

# CHAPTER - 1

## Introduction:

### **Supreme Court of India warns of unrest over scarcity<sup>1</sup>**

“Water shortage could cause great suffering and social unrest, the Supreme Court has said and directed the Centre to immediately constitute a high-powered committee of scientists to evolve ways to overcome any crisis.”

Our planet earth over the years has been observed to be fairly stressed on many accounts like natural resources and elements constituting the environment .Water is one of most basic need for most of living things and vegetation on the planet earth and also for sustaining balanced environment on this planet along with 'Pran-Vayu' the Oxygen.

We are exposed these days to ecologically straining conditions and presently the planet's future can not be predicted with certainty even for next fifty years or so, what to talk of centuries. The outcome and direction for future will depend on the prevalence of forces exploiting the natural environment without bothering for its likely adverse impacts or the forces contriving to protect the environment.

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<sup>1</sup> Times of India New Delhi dated Feb. 09, 2009.

We all have inherited this beautiful world to live in, and to develop the same to make our living experiences more satisfying at least from creature comforts and materialistic indulgences point of view, if not on higher planes of spiritualism, as such we all are indebted to our previous generations for leaving relatively unexploited natural resources and in principal duty bound to leave this inheritance at least at its principal value, if not with value addition for our successor generations, for this we all have to appreciate the fragility and importance of delicate membrane of life covering this planet and the Biosphere and take vow not to damage these permanently for our benefits and in name of development.

Though the available Overall and specially the water suitable for human needs be it for drinking, washing, cooking i.e. for human consumption is practically limited in nature or can vary at a very small pace but our total requirements in addition to becoming eccentric are galloping very fast primarily due to increase in population. The rapid industrialization also is contributing these demands to go higher and higher for industrial, irrigation and water based waste management systems.

One of the interesting but at times disturbing feature affecting the water resource is the avalanching changes in the demographic profile in terms of increase of practically unplanned and unmanageable urban habitats. These urban habitats are concentrated putting serious strains on the available natural sources like water, air and soil change over to impermeable surfaces makes such strains critical specially for water which normally has adverse consequences on functioning of hydrological cycle.

To attain these objectives we have to be very judiciously selective in our approach to harness the scarce natural resources and be very cautious about any adverse impact of human actions which may be considered inescapable in exploring

new frontiers being God bestowed tendency of human intellect or such actions forming part of development for well being of mankind. Alongside such uses, the aspect of their conservation and if possible their renewal and replenishment of at least visible & perceivable natural resources is also ensured. This may require multi pronged approach.

World oceans cover about three fourth of earth's surface. According to the UN estimates, the total amount of water on earth is about 1400 million cubic kilometer which is enough to cover the earth with a layer of 3000 meters depth. However the fresh water constitutes a very small proportion of this enormous quantity. About 2.7 per cent of the total water available on the earth is fresh water of which about 75.2 per cent lies frozen in Polar Regions and another 22.6 per cent is present as ground water. The rest is available in lakes, rivers, atmosphere, moisture, soil and vegetation. What is effectively available for consumption and other uses is a small proportion of the quantity available in rivers, lakes and ground water. (Fig 1.1 & Fig 1.2)

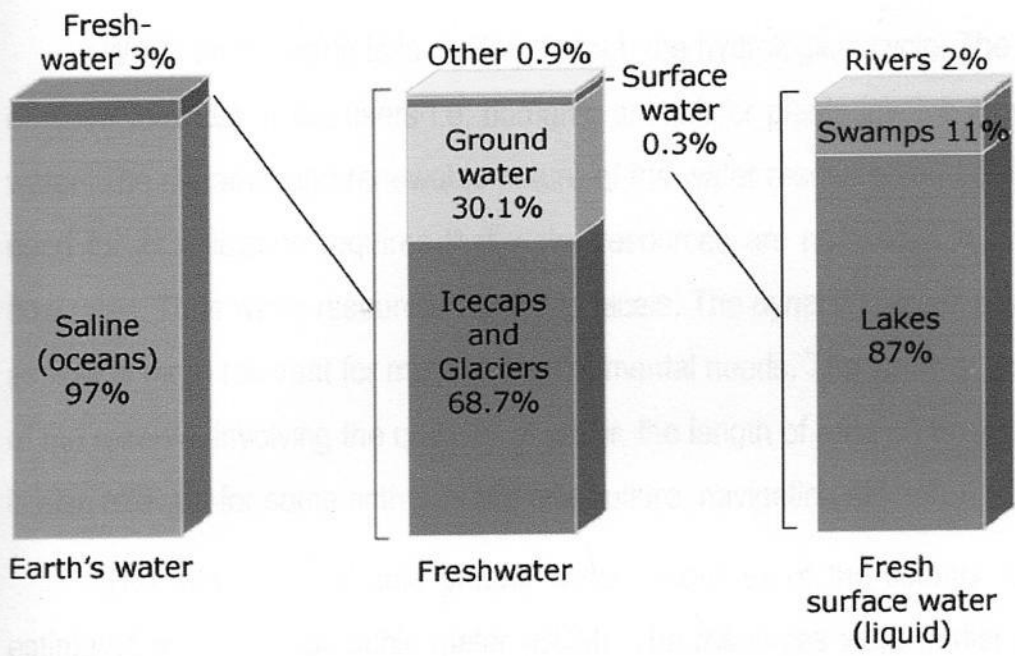


Fig 1.1 - Water availability on Earth

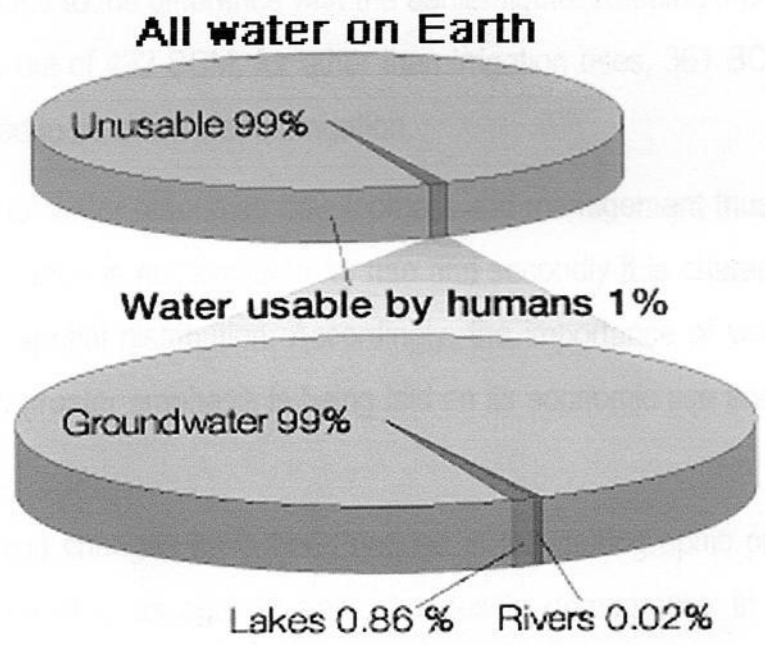


Fig 1.2 - Water for Human Consumption

Water on the earth is in motion through the hydrological cycle. The utilization of water for most of the users i.e. humans, animals or plants involve movement of water. The dynamic and renewable nature of the water resources and the recurrent need for its utilization requires that water resources are measured in terms of its flow rates. Thus water resources have two facets. The dynamic resource, measured as flow is more relevant for most of developmental needs. The static or fixed nature of the reserve, involving the quantity of water, the length of area of the water bodies is also relevant for some activities like pisciculture, navigation etc.

The total replenishable ground water resources of the country have been estimated as 434 billion cubic meter (BCM). The resources were earlier estimated as 432 BCM when ground water resources of the states of Mizoram and Sikkim and UT of Andaman & Nicobar were not assessed. Addition of the resources of these three States/ UT has led to the difference with the earlier figure. Keeping a provision of about 71 BCM/ yr out of 432 BCM, for other than irrigation uses, 361 BCM/yr of resources is estimated to be available for irrigation.

The crisis about water resources development and management thus arises because most of the water is not available for use and secondly it is characterized by its highly uneven spatial distribution. Accordingly, the importance of water has been recognized and greater emphasis is being laid on its economic use and better management.

The avalanching changes have been noticed in the demographic profile in some parts of this country, as against slow changes in demography in rest of country .These rapid changes have been forced due to unplanned growth of urban centers resulting in avoidable strains on available natural resources in such pockets, specially the water, vegetation and open spaces. Most devastating fallout of

urbanization where controlled environment is preferred over natural, is covering the earth surface with artificial surface by way of roads, pavements, aprons, footpaths etc, which are either of concrete, tiles or bituminous surfaces, all these make such coverage almost impermeable. This development is resulting in:

- 1 Reducing the penetration of water to underground aquifers directly under such surfaces.
- 2 The runoff % of rain water falling on such surfaces is practically 100%.
- 3 Because of very high %age of runoff with higher velocity on paved surfaces, the evaporation decreases drastically affecting the prevalent hydrological cycle.

### **Statement of Problem:**

The above situation has put a lot of pressure on all resources of water to cater for our present day demands. Rapid unplanned and unmanageable urban habitats in addition to affecting the hydrological cycle, also results in non / partial replenishment of under ground water, thus incrementally lowering the ground water table, tapping of which forms one of the major sources of water supply. These developments as a consequence, result in water availability problem in those areas, further the increase in population of world and increasing industrialization has already put pressure on water resources and this likely trend of the reduced availability of water will become more and more critically vital and it is said that next world war may be fought on this account only.

Indian railways is largest network in Asia , 2<sup>nd</sup> largest in world and the biggest employer in India and caters to water needs of almost 1.3 crore commuters daily in addition to about 1 crore of employees and their family members in various railway colonies primarily co existing with urban areas and in some case forming nucleus of developing cities. In addition railways have also to cater for lacs of railway dependent service provider and businessman like coolies, vendors ,stall holder etc in addition railway needs very large volume of practically potable water for its day to day operations in form of train watering, train washing, station cleaning etc in major station yards and workshops . Since Railways major yards and colonies are located in big urban areas they are dependent on common resources and face the similar problems as faced by those urban areas.

Northern Railways constitutes one of major zonal railway on Indian railways Spreading across the states of Jammu & Kashmir, Punjab, Haryana, Himachal Pradesh, Uttaranchal, Uttar Pradesh, Delhi and the Union Territory of Chandigarh. Northern Railway seems to have the vantage point of standing atop the peninsula and transposing its work rhythms to the rest of the country. Thus Northern Railways is an integral component of Northern Indian cities specially the NCR region and is facing similar problems related to availability of water as is being faced by any urban area in general as railways are also dependent on same local water sources.

This critical issue relating to water requirement and its availability is getting focused attention at world stage and adequate responsive measures are being initiated in different countries. In India the ministry of water resources informed Lok Sabha<sup>2</sup> that during 1982 -2001 under ground water level in country has declined by 4m to 6m and in few areas the decline noted was even more than 6M. The total no

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<sup>2</sup> DPS Nagal (2003-04) Rain water harvesting in the NCT of Delhi IIPA New Delhi

of affected union territories and states was 17. The situation in some areas had taken alarming proportions and needs to be ratified on an emergent basis.

The National Water Policy 2002<sup>3</sup> has recognized this problem and has laid down policy guidelines to be followed by central and state government to implement schemes to respond to this problem in effective manner, including measures for Ground Water Recharge to improve both the quality and availability of under ground water.

Indian Railways including Northern Railway is also aware of this problem and has started giving focused attention to effectively manage these problems in tune with national policies and guidelines in general and looking for special measures peculiar to Railways.

### **Objectives of Study:**

There are many pioneer studies and research literature available on this very important aspect of water resource availability and management; however I have not come across any study regarding management of water on Indian Rlys. Accordingly the focus of this study and resultant thesis paper is to make my small contribution neither from basic research point of view ,or from originality point of view , nor to leave any authoritative stamp in this very sophisticated and complex field of study , but basically to understand few of works already available & relevant to this theme , without resorting to any subjectivity or comparative grading of available literature , and also to know and evaluate the measures being adopted on my organization that is Indian Railways specifically on Northern Railways and

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<sup>3</sup> National Water policy Govt. Of India ,Ministry Of Water Resources ( April 2002 )



suggest improvements in such measures as possible , with in the small time available & within natural limitations of my knowledge and faculties and express the same in my own words , with unavoidable individualistic tinge ,and omissions or commissions even in simple repetition .

This shall provide one more opportunity to readers to think about one of the most critical and vital problem, manifesting over a period and staring in face of human society, with deadly potential of wiping off the life from face of this planet, and may contribute to mitigate this problem by contributing in one's own way. It is also hoped that suggestions in this paper on acceptance will also result in small contribution in process to mitigate this gigantic problem. The only objective being to offer my contributory 'AHUTI' in this 'VIRAT YAGNA' for welfare of mankind.

## **RESEARCH QUESTIONS**

- Some of the relevant questions which this study in concerned about are :
- Is Northern Railway having areas where rate of depletion of water table is so alarming to warrant emergent rectifications?
- Is Northern Railway complying with all Rules and bye Laws as applicable?
- Are measures taken by Northern Railway adequate?
- What other measures can help railways in tackling this problem?

## **LIMITATIONS / DELIMITATIONS**

Since time is limited and Northern Railway is spread over large area covering seven states of Jammu & Kashmir, Punjab, Haryana, Himachal Pradesh, Uttaranchal, Uttar Pradesh, Delhi and the Union Territory of Chandigarh. It was not practically possible to cover the entire Northern Railway through field visits or to get timely responses from large no of concerned railway officials and offices keeping records. Accordingly the study and evaluation is primarily based on literature readily available and interaction with locally accessible officer and sites mostly in Delhi region , however it is felt that since large No. of Northern Railway facilities are located in Delhi region only and water availability problem is also most acute in this urbanized area as such these studies can be taken as reflective of conditions over NR and results can be applied to not only Northern Railway but over IR in general .

## **Scope and Methodology:**

The methodology adopted was to first look for written literature available in form of printed material or on internet or as advised by the guide ,faculty ,co participants and concerned authorities and study the same to gain insight in to this subject . Efforts have also been made to go through related articles appearing in environment related journal and periodicals. Articles appearing in news papers have also been scanned in addition to going through typical reports on special projects being formulated, papers read out in various seminars on related topics organized by various authorities .The relevant policy papers including basic 'National Water Policy' documents and policy implementation , and progress status of northern railway relevant to water problem have also been gone through and understood .

Literature churning efforts have also been supplemented by personal discussions and interviews with concerned authorities ,NGOs specially with Railway authorities from Ex Dir /L& A/ Railway Board ,Ministry of Railways formulating relevant policies on this subject for all Zonal railways and PSU with railways ,special emphasis was on concerned executives of Northern Railway H.Q headed by Principle Chief Engineer ,Chief Engineer Works assisted by Exen / works ,Chief Engineer Construction / N Rly K. Gate and Senior Divisional Officers of Delhi Division . The Learning and Consulting procedure extended to field officer and staff responsible for maintenance and owning such projects to have grass root feel of things, their commitment, information level and perception through Interviews. Since some of field data and required information's were not readily available dependence on questionnaire became un-avoidable, as such replies received against questionnaire have also been relied in appraisal and report writing.

### **Over-view of Literature:**

The subject being of critical importance for survival of life had invited attention of various organizations , world bodies , National Policy makers of countries ,and individuals , private bodies , NGOs etc as such detailed & extensive information is available in documented form in addition to vast literature on these issues . In India the main authorities i.e. Central Ground Water Board ,Ministry of Water Resources and Centre for Science and Environment have Published policy ,books manuals ,newsletters for directions ,guidance & public information covering all aspects of the issue.' The Delhi Jal Board and the Ministry of Environment and forest have also brought out a number of informative documents in this regard <sup>4</sup> In

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<sup>4</sup> DPS Nagal (2003-04) Rain water harvesting in the NCT of Delhi IIPA New Delhi

addition for Railways , Ministry Of Railways and Northern Railway have also reiterated basic Govt. policy and have come out with required instructions and informative literature to guide Railway men.

A summarized review of some of main literature and documents consulted during this study is as under :

A . The NATIONAL WATER POLICY<sup>5</sup> has dealt the subject in its completeness bringing out the necessity of policy :

1.3 Water is part of a larger ecological system. Realising the importance and scarcity attached to the fresh water, it has to be treated as an essential environment for sustaining all life forms.

1.4 Water is a scarce and precious national resource to be planned, developed, conserved and managed as such, and on an integrated and environmentally sound basis, keeping in view the socio-economic aspects and needs of the States. It is one of the most crucial elements in developmental planning. As the country has entered the 21<sup>st</sup> century, efforts to develop, conserve, utilise and manage this important resource in a sustainable manner, have to be guided by the national perspective. The development, and overexploitation of groundwater resources in certain parts of the country have raised the concern and need for judicious and scientific resource management and conservation. All these concerns need to be addressed on the basis of common policies and strategies

The policy indicates the direction for Water Resource Planning as under :.

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<sup>5</sup> Government of India Ministry of Water Resources NATIONAL WATER POLICY New Delhi April, 2002

3.1 Water resources available to the country should be brought within the category of utilizable resources to the maximum possible extent.

3.2 Non-conventional methods for utilisation of water such as through inter-basin transfers, artificial recharge of ground water and desalination of brackish or sea water as well as traditional water conservation practices like rainwater harvesting, including roof-top rainwater harvesting, need to be practiced to further increase the utilisable water resources. Promotion of frontier research and development, in a focused manner, for these techniques is necessary.

The Water Allocation Priorities are clearly spelled out :

5. In the planning and operation of systems, water allocation priorities should be broadly as follows:

- Drinking water
- Irrigation

#### **Drinking Water**

8. Adequate safe drinking water facilities should be provided to the entire population both in urban and in rural areas. Irrigation and multipurpose projects should invariably include a drinking water component, wherever there is no alternative source of drinking water. Drinking water needs of human beings and animals should be the first charge on any available water.

The policy indicates methodology to be followed for Ground Water Development :

7.1 There should be a periodical reassessment of the ground water potential on a scientific basis, taking into consideration the quality of the water available and economic viability of its extraction.

7.2 Exploitation of ground water resources should be so regulated as not to exceed the recharging possibilities, as also to ensure social equity. The detrimental environmental consequences of over exploitation of ground water need to be effectively prevented by the Central and State Governments. Ground water recharge projects should be developed and

implemented for improving both the quality and availability of ground water resource.

7.3 Integrated and coordinated development of surface water and ground water resources and their conjunctive use, should be envisaged right from the project planning stage and should form an integral part of the project implementation.

7.4 Over exploitation of ground water should be avoided especially near the coast to prevent ingress of seawater into sweet water aquifers

Stress on Conservation of Water has been emphasized as under :

16.1 Efficiency of utilisation in all the diverse uses of water should be optimised and an awareness of water as a scarce resource should be fostered. Conservation consciousness should be promoted through

education, regulation, incentives and disincentives.

16.2 The resources should be conserved and the availability augmented by maximising retention, eliminating pollution and minimising losses. For this, measures like selective linings in the conveyance system, modernisation and rehabilitation of existing systems including tanks, recycling and re-use of treated effluents and adoption of traditional techniques like mulching or pitcher irrigation and new techniques like drip and sprinkler may be promoted, wherever feasible.

B. DPS Nagal<sup>6</sup> discusses the grave water problem facing the world. He discusses the reasons for receding reserves and rising requirements with special focus on Delhi. The author explores and establishes the necessity of rain water harvesting in national capital Delhi and also evaluates the work done in this field i.e. rain water harvesting giving few case studies .The author while bringing out the status of Govt. polices ,programs and initiatives highlights the important aspect of peoples awareness & response to such programs . The author finds that RWH has not received required degree of attention though RWH implementation results in

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<sup>6</sup> DPS Nagal (2003-04) Rain water harvesting in the NCT of Delhi IIPA New Delhi

augmenting the under ground water, he recommends use of dual pipe system to save upon wastage of drinking water for other uses.

C Neha Lalchandani <sup>7</sup> in an article 'Delhi water bodies battle for survival' brings out that though fast depleting water resources in the Capital have raised concerns in the corridors of power so much so that 629 such water bodies have been listed for revival and maintenance. However, several water bodies that are struggling to survive rapid urbanisation don't figure in this list. The 36,000 sq feet Mayapuri lake is one such water body that was reduced substantially when its 18,000 sq mt area was filled up for a common effluent treatment plant (CETP). However, the PWD, under which the lake was listed in 2002, says that its revenue records show that no such lake existed. In a reply to an RTI plea filed by NGO Tapas recently, the department has denied that the water body was ever under its jurisdiction.

"When the CETP was being made, the department was asked to create another water body of the same size in Bawana for which the Delhi Jal Board (DJB) had given an affidavit. PWD also claims to have paid the Municipal Corporation of Delhi Rs 1.5 crore for removing encroachment on the lake. Now they are saying that it doesn't exist," said Vinod Jain of Tapas.

The apathy of deptt is also brought by fact that In 2001, the MCD had identified 177 water bodies in the Capital but this figure was challenged since an earlier report had identified 355. The court formed another survey committee which, in 2002, came up with a list of 508 water bodies. However, there were several discrepancies in this list over the size of water bodies. Finally, an independent body

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<sup>7</sup> Neha Lalchandani 's Article titled 'Delhi water bodies battle for survival' in Times of India dt 8/9/08  
Delhi

was set up by the court which has identified 794. Of this, at present, 629 water bodies exist officially in Delhi which are being revived by various agencies.

D. Details of literature available from Northern Railways indicates that RLY is large organization with large water needs , not only for domestic & office requirements for its employees and their families but also for public using railway facilities in waiting halls/ platforms etc for drinking and other needs in addition to business needs of stall holders on Railways premises , water is also required for functional use of washing for its coaches and station areas , coach watering , construction activities etc .

Rly. establishment normally forms part of city area and is dependent either on public water supply available or its own tube wells , as such it is also experiencing the same problems due to depletion of underground water table as is being felt by country at large. Recognizing this problem Ministry of Railways has issued instructions to all Railways to go for rain water harvesting vide their letter dated 4/6/2001 as Water is one of the most essential requirement for existence of living beings. Surface water and ground water are two major sources of water. Due to over population and higher usages levels of water in urban areas, has gone down. In rural areas also Government policies on subsidized power supply for agricultural pumps and piped water supply through bore wells are resulting in to decline in ground water level. The solution to these problems to replenish ground water bodies with rain water by man made means.

Rain Water harvesting has been defined as the technique of collection and storage of rain water at surface or in sub-surface aquifer, before it is lost as surface run-off. The augmented resource can be harvested when needed. Thus it covers wide range of means of collecting and storing water but popularly this item is



becoming synonymous to artificial recharging of ground water aquifer. Advantages are as under:

- (a) Promotes adequacy of underground water.
- (b) Mitigates the effect of drought.
- (c) Reduces soil erosion as surface run-off is reduced.
- (d) Decreases load on storm water disposal system.
- (e) Reduces flood hazards.
- (f) Improves ground quality/decreases salinity (by dilution).
- (g) Prevents ingress of sea water in subsurface aquifers in coastal areas.
- (h) Affects rise in ground water table. Thus saving energy (to lift water).
- (i) The cost of recharging subsurface aquifer is lower than surface reservoirs.
- (j) The subsurface aquifer also serves as storage and distribution system.
- (k) No land is wasted for storage purpose and no population displacement is involved.
- (l) Storing water underground is environment friendly.

It is reiterated that under section 15 of Environment (Protection) Act 1986, Central ground Water Authority (Ministry of Water resources) has made it mandatory to adopt rain water harvesting system for certain types of building/institutions located in specified regions of National Capital territory. In Chennai, rain water harvesting has been made compulsory. In Delhi, Building bye-laws have been modified making rain water harvesting mandatory for new buildings erected on plots of more than 100 sq. mtrs.

Different mode and techniques to be followed are :

Through recharge pit

Recharge through abandoned hand pump

Recharge through abandoned dug well/open well.

Through recharge trench

Recharge through shafts

Recharge trench with bore

Other literatures surveyed and relied upon in form of books, articles, web sites etc has been referred to at appropriate places in this paper and bibliography.