GICEA
The Gujarat Institute Of Civil Engineers & Architects (GICEA)
ESTD. : 1947

NIRMAN

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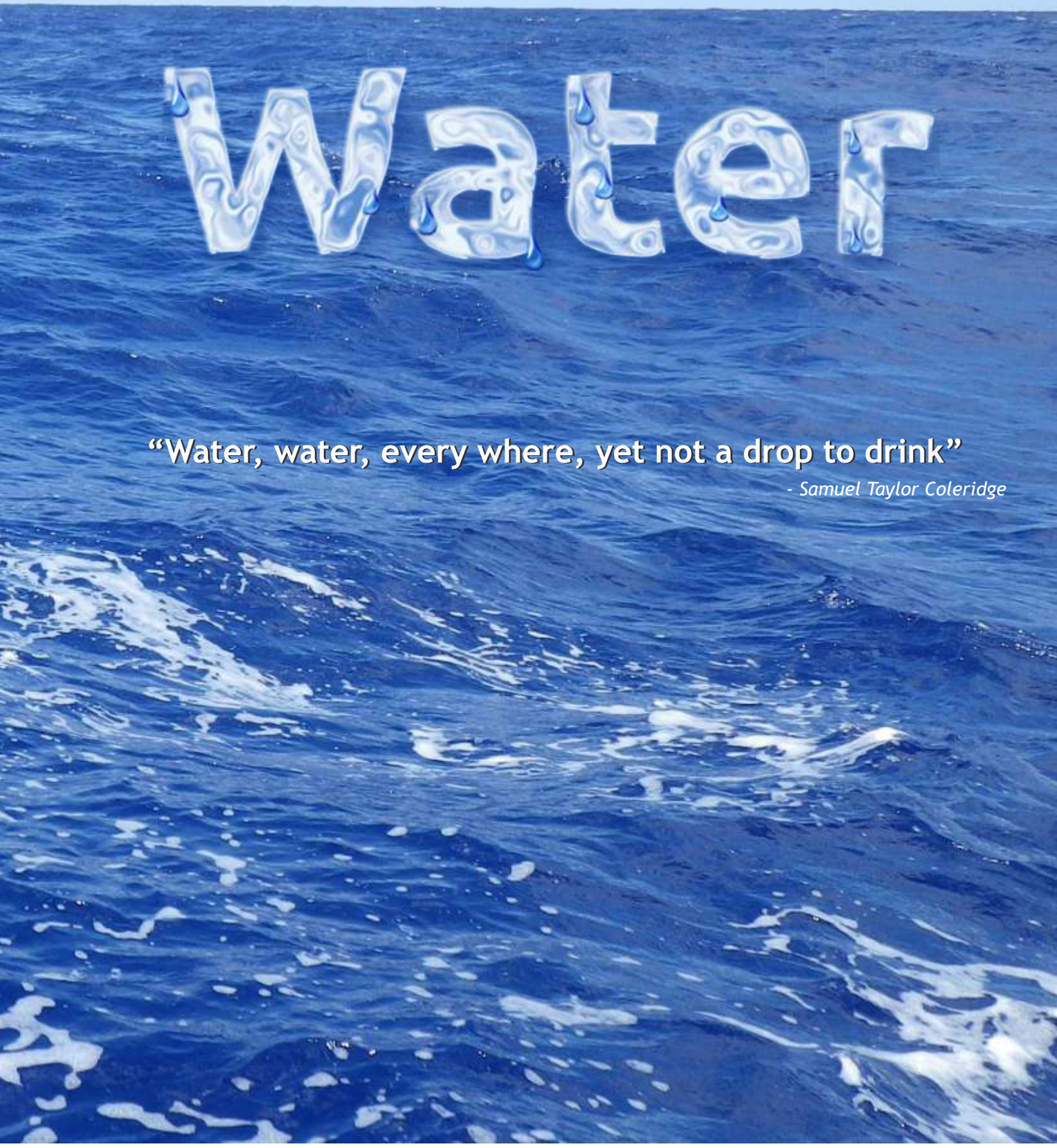

"Water, water, every where, yet not a drop to drink"

- Samuel Taylor Coleridge

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Water

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The **GICEA** Nirman magazine Committee
puts on record their vote of thanks to
P. C. Snehal Engineers Pvt. Ltd., Varun Raditors Pvt. Ltd.,
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Index

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PRESIDENT'S MESSAGE

Welcome to our first issue for the year 2014-2015.

I begin this address by thanking all of you in reposing faith in re-electing me for a second term as your President. I promise that I shall work assiduously to live up to the expectation of this August body.

The year gone by has been one of shared achievements. I thank everyone for their support and their forbearance. I also thank all members for giving us this marvelous opportunity to be of service to the GICEA. I am sure that I speak on behalf of all committee members when I say that to have received this honor from people we admire so much humbles us and we shall remain ever grateful for this opportunity.

I hinted at a road map of our agenda for this year's at the AGM. I mention below couple of important initiatives I – along with my team - propose to take up.

I hope that we move to embracing applications that facilitate delivery on the mobile. Let us think about sending all our circulars, notices etc. by mobile; no need spending lakhs on printing and distribution. In this connection, I hope setting up a committee that will devise ways of using the mobile and the net to reduce printing/distribution costs and save paper as well.

. As , much of our space at Gajjar Hall has been taken away and what is left is at the mercy of traffic congestion and holiday revelries at the Law Garden, I request all to work towards getting a fresh additional plot for construction of new building for GICEA

GICEA Nirman

GICEA Nirman has been an experiment that has transformed our erstwhile GICEA News magazine. The superior production values and the high caliber of contributors has been well received not just by us at GICEA but elsewhere as well.

To carry this magazine to the next step I want GICEA to take the lead in propagating responsible awareness of the masses. To provoke thinking not to provide instruction. To inculcate scientific and common sense approach to ecological issues and deliver these ideologies to the doorstep of our younger generation. The current issue on "Water" is the first in this series. We will follow this with issues on Going Green and on our Heritage Sites. If possible - we propose to publish an informative booklet on each of these subjects as well. A companion PowerPoint presentation shall be prepared and put on the internet for free download. Also, a serious high-level seminar on each subject is being planned wherein

Continued on page 3

PRESIDENT'S MESSAGE

participation has been invited by experts on the subject.

This issue on WATER

Mahatma Gandhi said, *"Don't use money like water but use water like money"* Today more than ever before his words ring their warning loud and clear

It is ironic that the Indian sub-continent can have severe flooding in J&K, Bihar and Assam and yet have extreme water scarcity issues at the same time.

The idea behind this issue is to make people think twice about how much water they waste. People who have plentiful access to water are encouraged to try not turning on their taps all day.

The near absence of fresh water for the human population is already beginning to impact the current situation in India. According to data from the World Bank, by the year 2020, many Indian cities are projected to run dry. Severe water shortage has already led to a growing conflicts across the country. India's supply of water is rapidly dwindling primarily due to mismanagement of water resources, although over-pumping and pollution are also significant contributors. Climate change is expected to worsen the situation by causing erratic and unpredictable weather, which could drastically diminish the supply of water coming from rainfall and glaciers.

Mahatma Gandhi said,
"Don't use money like water but use water like money"

Water.org provides statistics on the global water crisis that are alarming: Less than 1% of the world's fresh water is readily accessible for direct human use. About 98% of water-related deaths occur in the developing world. The water and sanitation crisis claims more lives through disease than any war claims through guns.

It is ironic that the Indian sub-continent can have severe flooding in J&K, Bihar and Assam and yet have extreme water scarcity issues at the same time. While flooding is exacerbated by human disruption of ecosystems, it may also ultimately be linked to climate change induced by humans too. Our Water resources are under threat, not only because of lack of funding but also due to unwise use of municipality funds. Water mismanagement is rife. Ignorance also plays a part in water mismanagement; many officials and local government employees are hopelessly under-educated and/or placed in positions of authority with no relevant experience.

Finally, I shall be failing in my duty if I do not thank our guest editor Shri V. B. Patel who has gone far out of his way to single handedly steer this issue through.

AR. ANAND TATU
President, GICEA

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GICEA CONGRATULATES

Shri Vijay N Shah — PM 20

Our Past President **Shri Vijay N Shah** has been unanimously chosen **as Treasure of Gujarat Chamber Of Commerce & Industry (GCCI) Ahmedabad, India.**

Shri N.K. Patel — FLM 225

Our Past president **Shri N K Patel** has been unanimously chosen as the **Chairman Institute of Town Planning Indian (ITPI)Gujarat Chapter for 2014-15.**

Shri Bharat R Modi — FLM 170

Our immediate Past President **Shri Bharat R Modi** has been appointed as **Special Invitee Board member in Gujarat Chamber of Commerce and President of Samast Vaishanav Vanik Parivar** Ahmedabad-Gandhinagar City.

Shri Prashant J Shah — FLM 485

Our Past President **Shri Prashant J Shah** has been unanimously elected as **Chairman of Progressive Mercantile Cooperative Bank Ltd.**

Dr. Vatsal S Patel — FLM 279

Our Past Hon. Secretary **Dr. Vatsal S Patel** Completed his **Doctorate of Philosophy in Municipal Solid Waste Management** for Medium Scale Town in developing Countries.

Shri Chiranjiv C Patel — ASLM150

Our Invitee board Member and Young Members forum committee Chairman **Shri Chiranjiv C Patel** has been unanimously chosen as the area **Director for Entire South Asia** for the prestigious **"Entrepreneurs Organisation (EO).** He is the youngest ever to have been chosen for this post and lead the top most Industry Leaders of South Asia.

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Editorial Team

Water, water, every where, yet no drop to drink.

Guest Editor: **Mr V. B. Patel**

Vithalbhai Becharbhai Patel, a NAVRATNA of GICEA and recipient of three National Awards, born on 28th July 1933, joined Irrigation Department of Govt. after securing first rank in L.D. College of Engineering in 1954 and rose to the highest technical position in water resources in India as Chairman, Central Water Commission and Ex-Officio Secretary to Government of India 1990-91.

Popularly known as trouble shooter in the profession successfully handled following challenging assignments.

(I) Drinking water problem of Gujarat State during failure of three consecutive monsoons during 1985-88, handling three top positions in water sector - Secretary Water Resources, Secretary Water Supply & Chairman Water Board.

(ii) Dewatering of flooded Porbundar town.

(iii) Departmentally constructing Kadana Dam 1972-76, Rs. 2000 Crore at current prices

(iv) Developed & executed dead water pumping scheme for Ukai to avoid power crisis in the state.

(v) Conceptualized and designed world's largest Emergency Water Supply Scheme of 700 mgd from Sardar Sarovar in year 2000

During active service and after retirement Mr V.B.Patel has:

(I) Chaired over 100 committees including Ganga action plan.

(ii) Chairman on committees of Bureau of Indian Standards for 40 years.

(iii) Planning Commission groups for developing Five Year Plans.

(iv) Associated with Task Force on Interlinking of rivers.

(v) Member on Committee on WAR FOR WATER appointed by G.O.I under directives of Supreme Court.

(vi) Founder Managing Director of Gujarat State Construction Corporation.

(vii) Founder Chairman of Water Management Forum of Institution of Engineers (I).

(viii) Founder Chairman DSC-Foundation & NGO in Natural Resources Management.

He has contributed over 100 technical papers, key note address, at National & International Conferences.

For his valued contribution to the Energy Sector Mr. Patel has been recently presented with the leading Energy Personality by the Council of Power Utilities

Water gives Life but if not Handled with Discretion can take Life as Well

-Granth Sahab

My many years spent working with water resources both with the Gujarat government and then with the Central government have brought home to me that the first step towards working for a solution of the impending water catastrophe is to increase public awareness. It is indeed laudable that the GICEA, under the leadership of its President Mr. Anand Tatu has taken the initiative to have an issue on Water. I take this opportunity to thank him and the GICEA for having provided me with this opportunity of helming this issue. The total water available in the world is enough to meet the requirements of every individual if evenly distributed, wisely used and equally shared. Unfortunately, this does not happen and there are wide disparities. The international standard for water requirement for comfortable living is 1700 cubic meter per annum. When this falls below 1000 cubic meter per annum, the condition is of serious stress. The situation of any country and for that matter any region has to be viewed and measured with this yardstick. Due to uneven availability of water, (which contributes to over 60% water resource of the country) many countries of the world including India are expected to be in a difficult situation. Currently, the average availability of water in India is about 1500 cubic meter per annum. However, this is expected to drop to 1100 cubic meter by 2050. While some regions of India falling in the GBM region (Ganga Brahmaputra , Megna) are rich in water availability, the others are not so comfortably placed and many are extremely poor in

People gather to get water from a well in the village of Natwarghad in the western Indian state of Gujarat

water resources. The western and southern parts of India are expected to face an extremely difficult situation. When we think of Gujarat, the situation is even more deplorable. The picture as of now and what it would be is presented in the table below:-

AREA , POPULATION & WATER RESOURCES			
Sr.No.	Particulars	All India	Gujarat
1	Population - Year 2000 (Millions)	1000	54
2	Land Area (M. Sq. Kms)	328.7	19.6
3	Density of population (per sq. km)	3.04	2.75
4	Average Precipitation (mm)	1200	800
5	Per Capita precipitation (M3)	3950	2900
6	Water resource per unit of land (m3/year)	3042	1876
7	Water resource per capita for the year		
	2014 (m3/year)	1500	900
8	Population for the year 2050 (millions)	1600	80
9	Water resource per capita for the year		
	2050 (m3/year)	1100	600

As the above table indicates, the water availability of India will drop to about 1100 cubic meters per person per year by 2050. However, as far as Gujarat is concerned, present availability of 900 cubic meters will go down to 600 cubic meters by 2050. In Saurashtra and North Gujarat, it is expected to go down to a mere 450 cubic meter. Gujarat therefore needs to have a determined effort to tide over the situation. It is very difficult to avert the impending crisis, without meticulous planning and timely and speedy implementation of large-scale programs.

Within Gujarat, there is great distortion with some regions being extremely poorly placed. This can be seen from the water table data presented in the table below:-

Indian scenario

in 1947 there were 300 dams, in 2000 the number rose to 4300 and the same is likely to be 10,000 by 2050. In India 56.5% of total land that is 186 million hectare are arable

There are rains for 100 hours on an average per year during monsoon.

Due to floods, on an average annually 1529 persons and 98000 cattle heads die and forest, agri-crops Birds and vegetations are destroyed.

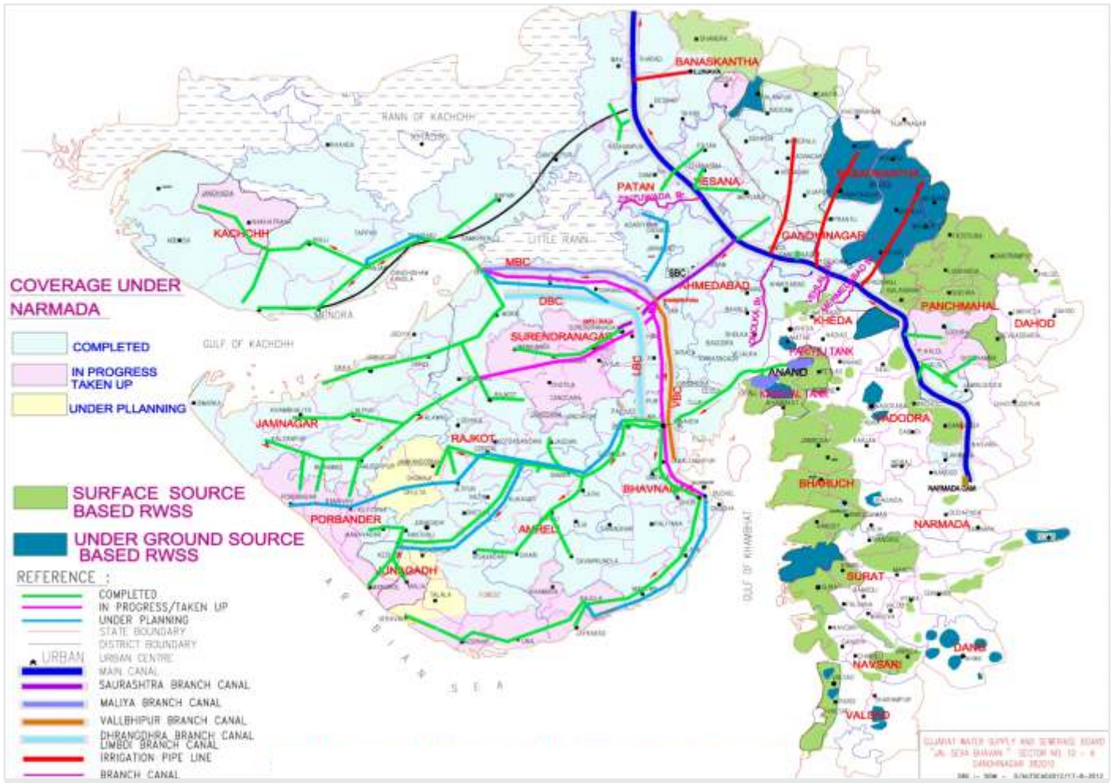
A man climbs out of a well with a seven-litre rubber pouch strapped on his back to fetch a day's supply of drinking water in the village of Chuda Chokad west of Ahmedabad in Gujarat

A woman fills a pitcher with drinking water from a pit made in the dried-up Banas river bed near Sukhpur village, north of the western Indian city of Ahmedabad. Villagers walk two and a half kilometres to draw drinking water from them, and they say it takes 30-40 minutes to fill a five-litre jar.

TOTAL WATER AVAILABILTY IN MILLION CUBIC METERS (MCM)						
Sr.No	Description	South & Central Region	North Region	Saurashtra Region	Kachchh Region	Total
1	Surface Water	31750	2000	3600	650	38000
2	Utilizable Ground Water	3950	3300	4300	450	12000
	Total	**35700**	**5300**	**7900**	**1100**	**50000**

PER CAPITA WATER AVAILIBILTY					
Description	Total of State	South & Central Region	North Region	Saurashtra Region	Kachchh Region
Total Water (MCM)	50000	35700	5300	7900	1100
Population (2001)	5596992	2.8E+07	8940627	11919201	1526321
Availability 2014 cm/person/year	900	1140	540	600	660
Population 2050 (crores)	8	5	1.2	1.6	0.2
Availability 2050 cm/person/year	600	700	450	450	550

Surface water storage is going to be the main contribution to the solution of the water crisis. Against an ultimate of 38000 MCM of surface storage potential at present only 15000 MCM is stored. Sardar Sarovar will add another 11000 MCM. Thereafter a balance of 12000 MCM will still be left to be stored. This calls for a major and intensified effort for creation of surface storage. The submergence of land and evaporation per million cubic meters of storage decreases as the size of the storage increases. Therefore, attempt should be to build as large



State Wide Drinking Water Supply Grid

storage as possible.

On the ground water front, some areas like North Gujarat are over exploited, whereas others like South Gujarat are yet left with surplus exploitable ground water. This surplus is unlikely to be developed fully as the South Gujarat region is otherwise comfortable in surface water.

The analysis reveals that as of today the entire state is in distress. If viewed region-wise, South Gujarat is not in a bad shape whereas North Gujarat, Saurashtra, and Kachchh regions are already in a crisis.

For the purpose of this issue, there could be many angles to study the water crisis of India in general and Gujarat in particular. However, What I have done here is to ask my friends and colleagues in government or otherwise to outline and delve at some length on the herculean mega-projects that will make a dent in solving the water crisis.

The twin criticisms of high costs and environmental degradation have tied down our mega-projects. To these criticisms, I have only this answer: No cost is too high when it is a question of survival itself. ■

International standards for scarcity and scarcity prone area/country

At international level following standards have been fixed to classify an area, a region or a country for availability of fresh water as under:

- If annual availability fo fresh water is 1700 cum per capital or more the situation is considered satisfactory.
- In annual availability of fresh water is less than 1700 sum per capital but more that 1000 cum, the area is considered scarcity prone.
- If annual availability of fresh water is less than 1000 cum per capita, the area, region or country is considered water stressed.

Mr B. N. Navalawala

Shri B. N. Navalawala, Former Secretary to Govt. of India, Ministry of Water Resources, New Delhi, is an internationally renowned water-resources expert and he is the first Asian to have been elected in September, 2001 as the Chairman of the Working Group of International Commission on Irrigation and Drainage for Research and Development for Water Resources. Also, he is the first water resource official in the country to achieve the honour of being the recipient of an "Award of Excellence" in recognition of his "exceptional" contribution to ICID and World Food Security in July, 2002. Shri Navalawala has to his credit more than 100 papers as published at international and national level on crucial issues like Inter-State river-water disputes, Water Pricing, Irrigation Management, Flood Insurance, Rehabilitation & Resettlement etc.

Currently Shri B. N. Navalawala, acts as Advisor water resources to the Chief Minister, Gujarat and Senior Advisor to the Minister Water Resources, Govt. of India

Kalpasar Project — A Boost to water scarce Gujarat State

Gujarat, despite being a water deficient State, has been able to develop only 54 % of its available surface water resource, since no suitable inland site is available for storage of 46 % untapped surface water resource. Presently, the Gulf of Khambhat bound rivers such as Narmada, Sabarmati, Mahi, Dhadhar and some of the rivers from Saurashtra area discharge their fresh water inflows into the Gulf, which on becoming a part of sea water turns to be a non-value water resource commodity. This water, which is estimated to be about 10,000 Mm3 is proposed to be stored in the Gulf-based reservoir to be created by constructing a dam enclosing about 9 % the Gulf since there can be no other storage site for this water. The Gulf stored water is proposed to be supplied to water-starved Saurashtra region having per capita water availability of 510 m3/annum against the requirement of 1700 m3/annum.

By supplying water to the coastal belt of Saurashtra, not only the problem of water scarcity but also the menace of steadily increasing salinity ingress will be tackled. It will also ameliorate the ground water of coastal Saurashtra which is under threat of deterioration due to increasing salinity and content of chemicals like nitrate and fluoride. Convenient connectivity between Saurashtra and South Gujarat has been a long-felt requirement. Construction of dam road across the Gulf will fulfill that requirement, giving advantage of distance reduction of 145 km which has implications of saving in travel cost and fuel consumption ultimately impacting favorably environmental parameters of reduced green house gas emissions.

The need of the project is summarized below:

- Gujarat is a water scarce state, with 6.39 % geographical area and 5 % population it has only 2% water resources.
- Central and South Gujarat, having 25% geographical area, accounts for 71% available water resources
- Gujarat has water availability of 830 cubic meter per annum per person. According to Swedish hydrologist Dr. M Falkanmark, water availability below 1700 cubic meter, hampers economic development and human health.
- The water storage capacity of Gujarat state is 20480 MCM through 196 major and medium reservoirs, against the total rainwater availability of 38000 MCM per annum.
- Saurashtra, with geographical area of 64 lakh ha, has 42 lakh ha agricultural land area of which only 15 lakh ha area is covered under irrigation (including Sardar Sarovar Project), while 27 lakh ha agricultural land area still remains non-irrigated.
- Agriculture in Saurashtra largely thrives on extraction of ground water. Excessive pumping of ground water has resulted in saline water intrusion extending to 10 km upslope land in the Saurashtra coastal belt.
- In view of non availability of suitable site for construction of new dam in the state, the 'Gulf of Khambhat Development" is the only option available with the state to store 10000 MCM fresh water.

There has been a long-standing thinking that by constructing an embankment dam holding the Gulf-bound river water inflows into a suitably created reservoir, the above mentioned problems could be solved on the long-term basis. The project proposal, with respect to its form and features, has evolved through an interplay of ideas and concepts initiated since 1955, which have been concretized by numerous studies and investigations carried out since 1986. The Project History is stated in brief as under:

- Year 1969, Gujarat State Gazette (Bhavnagar District) mentions for construction of 25 mile long earthen dam and ten thousand feet long waste weir to prevent sea tide water ingress and store rain water.
- In 1975, Prof. E. M. Wilson of United Nation Mission, presented report to Central Electricity Authority for construction of dam between Ghogha and Dahej, with and without tidal power generation.
- In September 1986, the Central Design Organization (CDO) of
- Irrigation Department of Government of Gujarat prepared the design & estimate for constructing 46 km long dam to store 3377 MCM of water.
- In August 1988, the Central Electricity Authority suggested to Government of Gujarat to construct two separate basins for tidal power and fresh water storage.
- In year 1988-89, M/s Haskoning of the Netherlands prepared a Reconnaissance Report of the Gulf of Khambhat Development Project with different dam alternatives.
- In year 1996, after 8 years of the Reconnaissance Report, Government of Gujarat entrusted the work of preparing a Pre-feasibility report to M/s Haskoning. The report, submitted in the year 1998, recommended to carry out Six Specific Studies before full feasibility report.
- In year 1999, Six Specific Studies confirmed the technical feasibility of the project, along with suggestion to carry out additional studies on some important technical and economic aspects.
- The Expert Advisory Group of international experts for the
- project recommended to carry out more studies related to technical and other related aspects for Narmada diversion canal and barrage near Bhadbhut, along with that for Kalatalav-Aladar dam alignment, delink tidal power component and to take ports downstream, which have been accepted by Government of Gujarat in September 2009.

After successful completion of Reconnaissance Study (1988-89), Pre-feasibility Study (1996-98) and Six Specific Studies (1999), the Government of Gujarat took the decision for preparing a feasibility report. While going ahead with the preparation of the Feasibility Report, attention was given on several concerns implicit in the observations and conclusions of the Pre-feasibility and Six Specific Studies reports particularly with respect to concrete structures of tidal power block using massive caissons on weak foundations, the apprehension for sustainability of fresh water status under the combination of saline water tidal basin and fresh water reservoir, the lack of marine construction capability using massive caissons, and the difficulty visualized in getting financial support for heavy capital cost requirement of tidal power component. For resolving these concerns and also the concern arising later from the proposal of establishing new ports inside the fresh water reservoir, the task of examining the issues of combination of tidal power basin with fresh water reservoir, dam alignment and establishment of ports inside the fresh water reservoir. Based on the recommendations of the EAG, the Government of Gujarat has approved in September, 2009 to carry out the feasibility studies on the basis of the following:

(i)Delinking tidal power component

MISSION STATEMENT - KALPASAR PROJECT

"A sustainable water-state" where there is "water for all, water for ever and more crop per drop"

Tentative Salient Features of Kalpasar Project

1	**Length of dam between two shores of Gulf**	**Approx. 30 km**
2	**Top of dam**	**100 m wide (with future expansion) 10 lane road + railway (Under palnning)**
3	**Reservoir features**	
	(i)Full Reservoir Level (FRL)	(+) 3.0 m
	(ii)Maximum Water Level (MWL)	(+) 4.0 m
	(iii)Minimum draw Down Level (MDDL)	(-) 4.0 m
	(iv)Live storage	10500 MCM
	(v)Storage between MWL & FRL	1900 MCM
	(vi)Reservoir area	2000 sq. km.
4	**Bhadbhut Barrage and Narmada Diversion Canal**	
	(i)Barrage including earthen dykes	10 to 12 km
	(ii)Narmada Diversion Canal	
	Discharge	100000 cusecs
	Length	32 km
5	**Irrigation Command**	
	(i)Water envisaged for irrigation	6558 MCM
	(ii)Irrigation	10.54 lakh ha
	(iii)Envisaged three garland canals	
	Discharge	4000 to 6000 cusecs
	Length	600 to 700 km
	Elevation	EL 50, EL70, EL100
6	**Life of Reservoir**	400 to 500 years
7	**Land Improvement**	700000 ha
8	**Extra land to be recovered**	150000 to 200000 ha
9	**Reduction in Distance**	
	Bhavnagar - Dahej	200 km
	Bhavnagar - South Gujarat	225 km
10	**Ports:** Bhavnagar port (will revived), Dahej port (to remain out of reseevoir), New ports are proposed at downstream of reservoir.	
11	**River debouching in the reservoir :** Sabarmati, Mahi, Dhadhar, Narmada (through diversion canal), Limbadi Bhogavo, Sukhbhadar, Utavali, Keri and Vagad	
12	**Construction Period : 5 to 6 years**	

from this project so as to develop it as a fresh water reservoir project;

(ii) Northward approximately 15 km shifting of dam alignment to be at Kalatalav-Aladar line as referred hitherto as Alignment No.-V, and diversion of Narmada river water into reservoir through diversion canal from the barrage on Narmada river;

(iii) Construction of a barrage across river Narmada near village Bhadbhut, District Bharuch as "Stand alone" project;

(iv) Proposed Dholera and Khambhat ports should be relocated on the downstream of Dam Alignment No.-V.

Full fledged techno-economic feasibility study for three alternative ports with their location on downstream of the dam alignment should be undertaken as a part of this project.

In accordance with the new project framework, the detailed (bankable) project report is under way. For establishing the key parameters on various aspects of the project, studies and investigations have been fielded involving premier subject-matter specific national institutes, such as SOI (Dehradun),NIOT (Chennai), NIO (Goa), IITs (Chennai, Delhi, Roorkee),

NIH (Roorkee), CWPRS (Pune), NGRI (Hyderabad), NEERI (Nagpur), CSMCRI (Bhavnagar), as well as state-level research institutes/organizations such as BISAG (Gandhinagar), GERI (Vadodara), GPCB (Gandhinagar) CEPT (Ahmedabad), WRI (Ahmedabad), GES (Vadodara), CDO (Gandhinagar). Besides, National Consultants (numbering 70) have been involved for examining subject-specific issues.

The preparation of full feasibility report of Kalpasar Project have been carried out mainly in six parts, out of which most of the studies have been completed or at the stage of completion, as under.

(1) Bhadbhut barrage on river Narmada, which includes: survey, investigation, preliminary design, preparation of plans and tender papers; environment and social impact through National Environmental & Engineering Research Institute (NEERI), Nagpur; physical model of Bhadbhut barrage through GERI, Vadodara; C.R.Z. clearance; legal issues with reference to Narmada Water by Gujarat National Law University etc;

(2) Technical activities related to Kalpasar dam and Narmada Diversion Canal, which includes: survey, investigation, preliminary design and preparation of Plans and Estimates; bathymetric survey work in southern and northern portion of the dam and for Dam corridor survey work by National Institute of Ocean Technology; study of sea level rise though National Institute of Oceanography, Goa; study of Tsunami effect through National Geophysical Research Institute, Hyderabad; study of impact on dam due to storm surges, wind waves through Indian Institute of Technology, New Delhi; impact assessment on existing and proposed ports in Gulf of Khambhat due to Kalpasar dam by National Institute of Oceanography, Goa; inflow water

study by National Institute of Hydrology, seismological studies by GERI; Vadodara & Indian Institute of Technology, Roorkee; study of construction material survey; mathematical model; study of geotechnical investigation; study of design flood and spillway capacity; Techno-Economic Feasibility Report of Kalpasar Project;

(3) Environmental and Social Impact Studies: Salt Pan Study by Central Salt & Marine Chemical Research Institute (C.S.M.C.R.I.), Bhavnagar; Mangroves Study by C.S.M.C.R.I., Bhavnagar; Base Line Data Collection along sea shore by C.S.M.C.R.I., Bhavnagar; Water Quality Monitoring by GPCB & WRI; central government clearance for scoping report for EIA & SIA study; Synopsis of studies by Gujarat Ecological Society; Fisheries study; CRZ Clearance; Environment clearance from central government; Diversion of Industrial Effluents from Rivers; impacts on ground water quality of command area due to the project; etc.

(4) Economical and financial aspects: Traffic survey by L & T- Ramboll, Chennai; study of development of peripheral land around the proposed Kalpasar reservoir by CEPT University, Ahmedabad; study of possibility of railway on top of dam by RITES(I) Ltd (under Ministry of Railway); activity of

planning for 10 m wide utility corridor on top of the dam; allotment of water for irrigation, drinking water supply and industries; feasibility report of wind energy development by Suzlon ltd; solar energy development; study of Bio fuel etc.

(5) Legal aspects: To know jurisdiction of Kalpasar Project, whether falls in international, national or state jurisdiction and for consent matters of interstate rivers Narmada, Mahi, Sabarmati etc through Gujarat National Law University, Gandhinagar.

(6) Kalpasar command area: Irrigation facility to be generated in 10.54 lac ha area; planning activity related to alignment for three different canal at 50 m, 80 m and 100 m elevation, discharge, canal design, land acquisition, pumping arrangement, water allocation etc.

VISION AND PLANNING - KALPASAR PROJECT

To store State's 25% average annual surface water resources by constructing 30 km long dam across the Gulf of Khambhat. This reservoir will store about 10,000 MCM of surface water and will be the the world's largest fresh water reservoir in sea.

Benefits of the Project

(a) 2000 sq.km of fresh water reservoir will be the largest man made reservoir in the sea and would store about 10,000 Mm3 of water at 50% dependability to be mainly utilized for irrigation purposes. It will irrigate 10.54 lac hectares of land in Saurashtra area.

(b) It is planned to have 10 lane road with a provision of railway track on the

top of the dam which will reduce about 200 km distance between Saurashtra and Surat/Mumbai. Consequently it would generate annual revenue to the tune of Rs.500 to 700 crore.

(c) Narmada water will be diverted through a link canal leading to the fresh water reservoir. The length of the link canal will be about 32 km. As the link canal is unlined, it would generate recharge of fresh water below the ground, thereby firming up the geo-hydrological conditions along its length.

(d) It is proposed to bring the area of Saurashtra region under irrigation which till date has remained bereft of this facility. It is proposed to irrigate 10.54 lac hectares of land in 39 talukas of 6 districts of Saurashtra region will get irrigation facility including rejuvenation of rivers. More than 60 existing dams will get permanently filled up with water.

(e) Salinity ingress problem in coastal Saurashtra tract is serious one. Salinity ingress has penetrated up to 10 km inland from the sea coast. Gujarat Government has taken a number of salinity ingress prevention measures to mitigate this problem and still various measures by constructing tidal regulators, bandharas, recharge wells/tanks, spreading channels etc. are being taken.

The proposed canal work of the Gulf of

Khambhat Development Project has taken into consideration of the salinity ingress problem along the Saurashtra Coast. The recharge canal proposed tentatively from R.L. 50 m traverses close to the salinity affected area. The proposed canal will supply fresh water to this area and would also help generate groundwater recharge. This would improve the geo-hydrologic scenario of the salinity affected area and alleviate this problem.

(f) Due to fresh water storage in the reservoir, peripheral area which otherwise is under the influence of saline water of the sea, will have the advantage to improve geo-hydrologically due to availability of fresh water.

(g) Due to availability of deeper water depth possibilities of locating ports d/s of the dam are quite bright.

(h) As there is no submergence of private land and resulting resettlement issues the project has several unique distinctions from environmental and interstate disputes considerations for its planning and implementation.

(i) Wind and solar energy will be generated which can also be used for lifting fresh water from the reservoir to the canal.

(j) Bhavnagar port will get revived which will result into speedy development of the region.

(k) Saline ground water of coastal area of Saurashtra & Central Gujarat will get converted into fresh water with reduction in soil salinity.

(l) About 2 lakh hectare land along the periphery of the reservoir will be opened up for development towards value-based land utilization.

(m) Enhanced benefit of world class industrial estate like Dahej and Dholera will be available to Bhavnagar/Saurashtra region. ■

|| Annant bhavanti bhutanee perjnyat annasmbhavah,
yagnnat bhavati perjniah yagnah karmsmudhvah ||

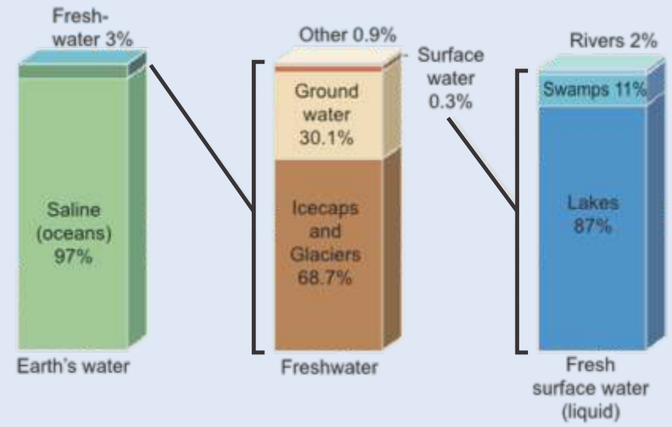
All creatures of the world depend on food and food is produced from water which is obtained from rain and rain is obtained from Yagna.

Shreemad Bhagvad Gita
Chapter:3 Shloka: 14

Facts about water you must know - 1

Distribution of Earth's Water

Total area of the planet eEarthis estimated as 510 million square kilometers (M.Sq. Kms). Oceans are occupying an area of about 360 M.Sq. Kms. (70%) and they contain about 97% of total water on Earth. This water beein saline is not suitable for human consumption. Only remaining 3% is fresh water. Out of this 2% is locked up as ice in the Arctic, the Antarctic and snow caps of mountains and is out of reach for beneficial use. Balance 1% exists as ground water, surface water, soil moisture, water vapourwhich can be useful to living beings in several ways.



Water and The Human Body

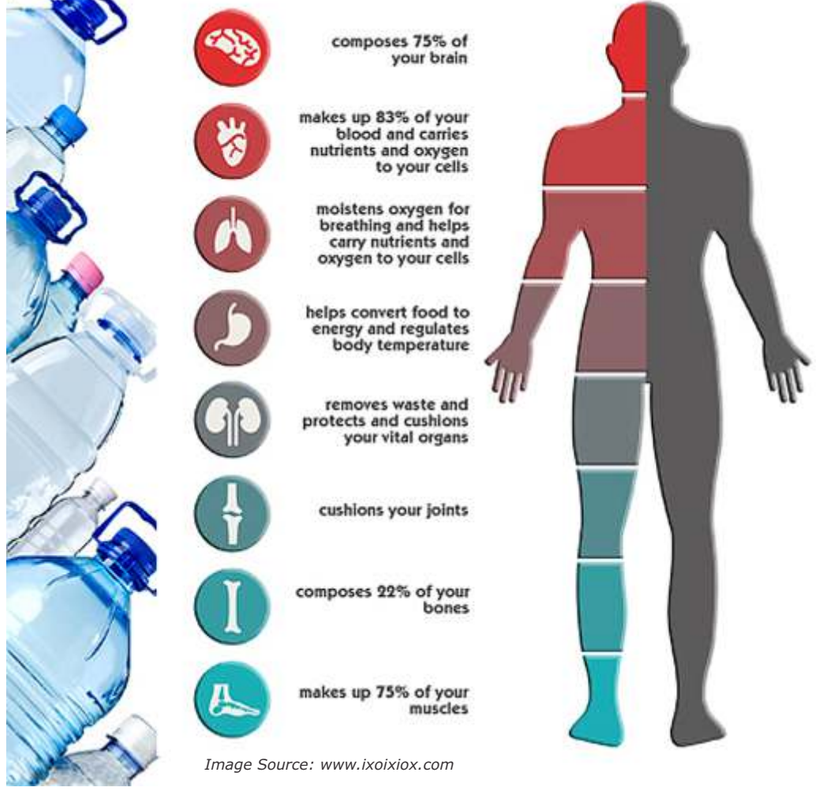


Image Source: www.ixoixiox.com

Quantity of water required for various purposes

The requirement of fresh water input for various purposes is generally as under and can change with location and technology.

- Drinking water need of an adult human being is between 2.5 to 3 litre per day. This comes to around 1000 litre per year. I.e. one tonne.
- An animal require 50 litre/day equivalents to 18 tonne per year.
- A tree needs 150 litres/day equivalent to 54 tonne per year.

Information supplied by Water Management Forum, Ahmedabad

Dr. M. B. Joshi

Dr. M. B. Joshi, recipient of 'Young Engineer Award' from Central Board of Irrigation and Power for his significant contribution to the field of Water Resources Management, is working as General Manager (Technical & Coordination) in Sardar Sarovar Narmada Nigam Ltd. and has got vast experience in water management, planning & designing of canal network, quality control and procurement.

Dr. M. B. Joshi has been associated with the Sardar Sarovar (Narmada) Project since last 29 years and has contributed in various aspects of planning, designing and quality control of the canal network. He has also got more than 75 Technical papers published at national and international levels. Continuing his pursuit for excellence, Dr. Joshi has been contributing in training the fellow engineers as a visiting faculty, external examiner and Research Guide at various Universities and Institutes etc. He also peer reviews Articles/Technical Papers as an Invitee Reviewer for International Research Journals.

Sardar Sarovar Project : Vital for Inclusive Growth of Vibrant Gujarat

Sardar Sarovar Project : Designed for Water and Energy Security

Sardar Sarovar Project, one of the largest human endeavors of our times for sustainable development, is a Mission to harness the untapped waters of river Narmada for the survival of millions of people by providing them the essence of life i.e. water and energy. Borne out of deliberations of a constitutional body, following the principles of 'Equality of Right' and 'Equitable Utilization' of the whole course of an Inter-State River, this unique inter-state, multipurpose River Valley Project will provide assured Drinking Water to 9633 villages and 131 urban centres in Gujarat, irrigation to over 19 lakh hectares in Gujarat, Rajasthan and Maharashtra and would generate hydropower with an installed capacity of 1450 MW. Narmada is the first river basin in the country to have integrated development and Sardar Sarovar Dam is the terminal dam on the river Narmada along with 30 major dams, 135 medium dams and 3000 minor dams. It is one of the largest water resources projects of India benefitting four major states - Maharashtra, Madhya Pradesh, Gujarat and Rajasthan. Out of the 28 MAF water available as per hydrological assessment made by the Narmada Water Dispute Tribunal, the share of Madhyapradesh, Gujarat, Rajasthan and Maharashtra is 18.25 MAF, 9 MAF, 0.5 MAF and 0.25 MAF respectively. Hydropower is shared amongst Madhyapradesh, Maharshtra and Gujarat in the ratio of 57%:27%:16%.

SSP will also provide flood protection to riverine reaches measuring 30,000 ha. covering 210 villages and Bharuch city and a population of 4.0 lac in Gujarat. It is also proposed to develop wild life sanctuaries viz. "Shoolpaneshewar wild life sanctuary" on left Bank, Wild Ass Sanctuary in little Rann of Kachchh, Black Buck National Park at Velavadar, Great Indian Bustard Sanctuary in Kachchh, Nal Sarovar Bird Sanctuary and Alia Bet at the mouth of River. On completion, annual additional agricultural production would be Rs. 1600 crores, power generation Rs. 400 crores and water supply Rs. 175 crores, aggregating about Rs. 2175 crores every year equivalent to about Rs. 6.0 crores a day.

Salient features of the project

DAM

The Main Dam (Latitude 21o 87' 33" N, Longitude 73o 50' 22" E) is 1210 m long, 163 m high from deepest foundation (World's Second Largest Concrete Gravity Dam by Volume after Grand Coulee and India's Third Highest Dam after Bhakra in Himachal Pradesh (226 m), Lakwar in Uttar Pradesh (192 m)). Top R.L. of dam is at 146.50 m. Total catchment area of river above dam site is approximately 88,000 sq.km. The reservoir would occupy an area of 37,000 ha. and would have a linear stretch of 214 kilometer of water and an average width of 1.77 kilometer. Live storage capacity of the reservoir is 0.58M.Ha.m (4.7MAF). The total length of reservoir is 214 km. The maximum width of reservoir is 16.10 km and average width is 1.77 km. Dam's spillway discharging capacity (84949.25 cumecs - 30.7 lakhs cusecs) would be third highest in the world.

RESERVOIR

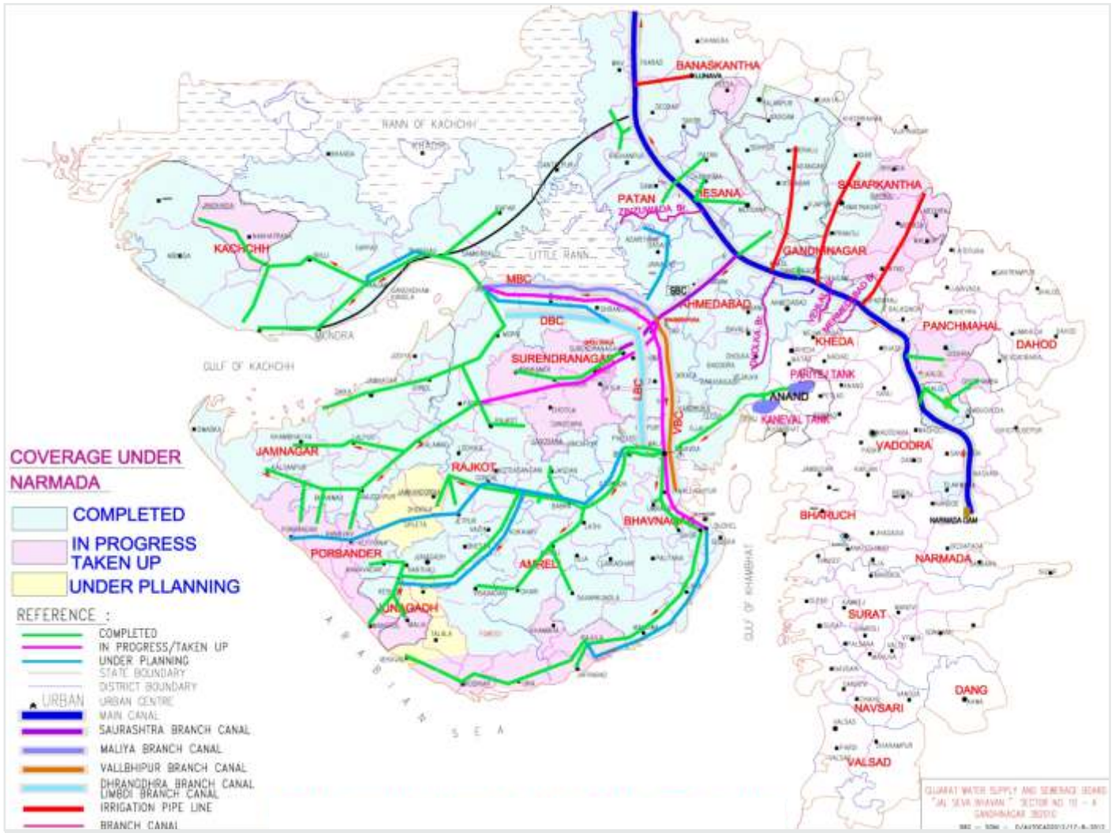
The gross storage capacity of the reservoir is 0.95 M. ha.m. (7.7 MAF) while live storage capacity is 0.58 M.ha.m. (4.75 MAF). The dead storage capacity below minimum draw down level is 0.37 M. ha. m. (2.97 MAF). The reservoir would occupy an area of 37,000 ha. and would have a linear stretch of 214 kilometer of water and an average width of 1.77 kilometer.

POWER HOUSE

There are two hydro power houses with a total installed capacity of 1450 MW i.e. River Bed Power House with 1200 MW capacity (six reversible Francis Turbines) & Canal Head Power House with 250 MW capacity (five Kaplan Turbines). The project will generate between 856 to 1007 million units per year of cheap and Eco-friendly, indigenous hydropower.

CANAL SYSTEM

With 1133 cumecs (40000 cusecs) capacity at the head regulator, and 532



Coverage by Narmada Network

km. length (458 km in Gujarat and further 74 km in Rajasthan), the Narmada Main Canal is the largest irrigation canal in the world. The water from dam is guided through four naturally built interconnected ponds and main Canal off-takes from fourth pond. The full supply level of main canal at H.R. is 91.44 m (300 ft) and its total length up to Gujarat-Rajasthan border is 458 km. The full supply level of canal at head is 7.60 m and bed width is 73.1 m. The design discharge capacity at head is 1133 cumecs(40000 cusecs) and at tail 71 cumecs (2500 cusecs). The total number of branches off –taking from main canal is 38 and total length of canal network is 75,000 km. The canal system is proposed to supply water to 18.45 lakh hectare culturable command area benefitting about 1 million farmers in 3117 villages in 74 Talukas of 17 Districts

Current status of the project

- Dam: Spillway Raised upto EL 121.92 m facilitating Live Storage of 1.27 MAF
- Canal Head Power House – All 5 units Commissioned (5 x 50 MW)
- River Bed Power House – All 6 Units Commissioned (6 x 200 MW)
- Energy generated: 33042 Million Units (upto 31/5/2014)
- Irrigation Bye-Pass Tunnel (IBPT): Completed.
- 68,000 MCM of water conveyed so far (upto distances over 500 km)
- Drinking Water to 7713 villages and 119 towns benefitting about 2.9 crores people
- Irrigation Potential developed upto Minors – 9.76 lakh hectare
- Rajasthan being supplied Narmada water since March 2008
- 37 Branch Canals out of total 38 Branch Canals are completed and flowing with water
- Saurashtra Branch Canal – the largest Branch with discharge carrying capacity of 424 cumecs (15,000 cusecs) completed in its entire length of 104 km including five Pumping Stations in a series facilitating aggregate lifting of water by 71 meter.

Revised Cost Estimate 2008-09 (Rupees in Crores)

1	Unit-I (Dam)	8384.85	21.4 %
2	Unit-II A (Main canal)	5798.28	14.8%
3	Unit-II B (Branch & Distribution System)	21600.76	55.0 %
4	Unit-III(Power-Generation)	2910.89	7.4%
5	Share of Narmada Sagar Debitable to Sardar Sarovar Project	545.68	1.4%
	Total	39240.45	100%

Project Cost Estimates

Planning Commission has given investment clearance to the revised cost estimate of Rs. 39,240.45 Crores at 2008-09 Price on 10th May,2010.

Expenditure already incurred Rs. 31,161 Crores including Rehabilitation & Resettlement and Land.

In addition to the equity support by Government of Gujarat in the form of budgetary provisions, and assistance from the Central Government under AIBP scheme, Nigam is raising resources through market borrowing by way of loans from banks and financial institutions private placement of bonds & fixed deposit from the Public.

Land Acquisition for SSP Canals through Consent - A path-breaking Approach

Today Sardar Sarovar Project has become one of the largest ongoing construction activities on the planet earth, with the award of 201 new construction contracts worth Rs. 9100 crores for canal network in last three financial years. This would facilitate irrigation potential upto Minors level to be increased by around 7 lakh hectares by constructing another 9,500 km length of canals. All these became possible because the prerequisite of Land Acquisition could be successfully and timely managed by Sardar Sarovar Narmada Nigam Limited, adopting a path breaking policy and practice..

Ministry of Statistics and Programme Implementation, Govt. of India has highlighted in almost all periodical Status Reports that almost 70% of the delayed infrastructure projects are on account of land acquisition problems. The process of land acquisition was identified as the most important structural constraint to the development of infrastructure (The first India Infrastructure Report (IIR 2001), published at the turn of the millennium, when the world was setting its Millennium Development Goals). Recognizing the fact that Land is the heart of infrastructure development and land acquisition is the most contentious aspect, in the year 2009 India infrastructure Report was devoted to "Land for Infrastructure", which emphasized that unless there is a sustainable resolution of the underlying issues, it will be a major obstacle to building new infrastructure. In this backdrop, it is interesting to note how Land Acquisition for SSP canals has emerged as Best Practice.

For the entire Sardar Sarovar Project canal network, total land required to be acquired is about 80,000 hectare (about 4.5% of the total land to be benefitted in terms of assured

Type of canal	Total Length in Km	Completed Length in Km
Main Canal	458	458
Branch Canal	2585	2322
Distributaries	5112	3103
Minors	18413	8979
Sub-minors	48058	10217
Total	74626	25079

The Sardar Sarovar Dam is a gravity dam on the Narmada River near Navagam, Gujarat in India. It is the largest dam and part of the Narmada Valley Project, a large hydraulic engineering project involving the construction of a series of large irrigation and hydroelectric multi-purpose dams on the Narmada River. The project took form in 1979 as part of a development scheme to increase irrigation and produce hydroelectricity.

One of the 30 dams planned on river Narmada, Sardar Sarovar Dam (SSD) is the largest structure to be built. It has a proposed final height of 163 m (535 ft) from foundation. The project will irrigate more than 18,000 km2 (6,900 sq mi), most of it in drought prone areas of Kutch and Saurashtra. The dam's main power plant houses six 200 MW Francis pump-turbines to generate electricity and afford a pumped-storage capability. Additionally, a power plant on the intake for the main canal contains five 50 MW Kaplan turbine-generators. The total installed capacity of the power facilities is 1,450 MW. It is the second largest concrete gravity dam (by volume) after Grand Coulee Dam in the US and has world's third largest spillway discharging capacity.

Project Affected People (PAP)

India's first Prime Minister Jawaharlal Nehru laid the foundation stone of the dam on April 5, 1961. The project, however, got embroiled in controversy over issues of displacement of thousands of project-affected people.

The unique fact which may not be known to many is that the rehabilitation and resettlement (R & R) package is the best ever adopted in the country and has successfully shifted the project affected people (PAP) of Gujarat and those willing, from the states of Madhya Pradesh and Maharashtra. However, strangely, the project had been criticized and held up on this account.

Fortunately, with the recent clearance from the Government of India to raise the height to its planned final height of 163 m (535 ft) from foundation and install the gates the project is now slated to be completed shortly.

– Guest Editor

irrigation). Land acquisition for SSP canal network began in early 1980's and continuous efforts of almost three decades facilitated construction of about one fourth length of this vast canal network.

However, during the process it was experienced that average time taken in each land acquisition proposal was significantly more than the stipulated limit of three years defined under the Act. In the past, for SSP canal network, 38,000 hectare land was acquired under the Land Acquisition Act without consent which had generated more than 60,000 land reference cases filed in different courts. Invariably, SSNNL ends up in paying more than the market rate after prolonged litigation, delaying the project implementation.

This had also necessitated time limit extension of many construction contracts with associated cost overrun (escalation) and delayed benefits. Government being determined to overcome all the hurdles in implementation of SSP canal network, a path breaking policy approach was evolved in May 2010 to acquire private land through 'consent awards' by paying compensation at 100% of the market rate (Jantri).

As a result of concerted efforts, total 21,726 hectare of land could be acquired since 2010-11, out of which 14,143 hectare private land could be acquired through consent awards. Strong political will, reasonable compensation and timely payment, creating awareness on the benefits of project, flexible approach in minor adjustments of canal alignment and increased facilities like cross drainage system and bridges for canal crossings etc., constant monitoring at the highest level and creating a positive working environment for the land acquisition administrative machinery are key to the success of this new practice.

Canal Top Solar Power Projects – An Initiative to save Land & Water

SSP is the pioneer in the entire country to install Solar Photo-Voltaic Panels on flowing canals – an initiative that saves precious natural resources – land and water besides generating eco-friendly solar power. The success of 1 MW Pilot Project on Sanand Branch Canal has not only led to another 10 MW solar PV installation on Vadodara Branch Canal, but other canal projects elsewhere in the country and abroad have also desired to replicate this idea. Even with the present stage of construction, SSP has a potential of about 2,000 MW solar PV installations.

Socio Economic Impacts – Assessment of Initial Trends

An Independent Study by Institute for Resource Analysis and Policy, Hyderabad in 74 villages of SSP Command Area in 23 Talukas of 7 Districts, has revealed that Narmada water has led to –

- Substantial increase in Gross Cropped Area per farmer (Gravity - 18%, Lift – 229%) and Area under Irrigation (Gravity - 302%, Lift – 248%)
- Dependence on other sources (wells/purchase) declined
- Shift in cropping pattern towards remunerative crops
- Remarkable increase in
  - Crop Yield (Cotton 122%, Maize 118%, Castor 172%)
  - Net Income from Farming (Rs. 50,000 to 70,000/Ha)
  - Net Income from Dairy (Rs. 5,000 to 20,000/Year)
  - Demand for farm labour and wages (Rs. 34-37 per day)
  - Total household expenditure (almost double)
- Saving in time consumed for fetching water
- Rise in groundwater levels, reduced depth of pumping
- Reduced economic cost of energy to pump groundwater
- Reduced expenditure on health, lower incidence of water borne diseases

The Way Forward

After permission of Narmada Control Authority, SSNNL is fully prepared to take up the work immediately. Works to be undertaken include Raising of Piers and Installation of Gates. 1,20,000 cubic meter of concrete work 30 Radial Gates already fabricated and kept ready for installation. Work will be completed in 30 operational months.

The works of Canal Network are going on in full swing and it is planned to complete the canal network upto Minors by 2015-16 and upto Sub-Minors by 2016-17. As far as irrigation benefits are concerned, it has been the policy of Sardar Sarovar Project not to supply water to any individual farmers but only to the Water Users' Association (WUA) – farmers' cooperative societies. In the implementation stage of the Project, EPC (Engineering-Procurement-Construction) mode of contracts encourages private participation in turnkey solution. Unprecedented size and complexity of this Project offer unique opportunities for Public-Private partnership in various domains – be it small hydro/ micro-hydel power generation or micro irrigation or command area development.

Any asset created is a liability too. In this context, the Project also promises increasing role of private sector during its Operation & Maintenance phases. Technology based projects (e.g. SCADA based Remote Monitoring and Control System for the Canal Network) also provide unique opportunities for the private sector to participate. Thus the Project promises to provide more than what it has promised, being a real transformer enabling inclusive growth.■

SSP is the pioneer in the entire country to install Solar Photo-Voltaic Panels on flowing canals – an initiative that saves precious natural resources – land and water besides generating eco-friendly solar power.

Dr. Guruprasad Mohapatra (I.A.S.)

Dr. Guruprasad Mohapatra is the Ex. Municipal Commissioner of Ahmedabad. He is a senior IAS Officer (of 1986 batch) in the rank of the Principal Secretary to the Government of Gujarat.

He had a long stint in development and regulatory administration as District Development Officer in Surendranagar and as the District Magistrate and Collector at Junagadh and Rajkot districts. Some of the major assignments handled by him have been with Gujarat Industrial Development Corporation (GIDC) as Joint MD, with Sales Tax Department as Special Commissioner (Enforcement), and Commissioner of Commercial Taxes and as the Commissioner of Transport.

He had a long stint in the power sector, where he was involved in the comprehensive reforms in the power sector and restructuring of the erstwhile Gujarat Electricity Board into several commercial entities. He started in the State Electricity Sector with the erstwhile Gujarat Electricity Board in 2002 and worked with various Electricity Companies such as GSEC (generation company) and the Distribution Companies such as PGVCL, DGVCL & UGVCL. He has rich and varied experience in the chemicals & fertilizers sector as he has worked as the Managing Director of Gujarat Alkalies and Chemicals Ltd. (GACL) and Managing Director of Gujarat Narmada Valley Fertilizers Company Limited (GNFC).

He worked as a Municipal Commissioner in Surat Municipal Corporation from 1999 to 2002, during which he was actively involved in the process of converting Surat into one of the models of urban governance in the country with its thrust on Solid Waste Management practices, quality infrastructure and financial management.

Currently he is appointed as Joint Secretary, Department of Commerce, Ministry of Commerce and Industry in Govt. of India

Ahmedabad Municipal Corporation, From Ground Water to Surface Water

PREAMBLE

The city of Ahmedabad was founded in 1411 AD as a walled city on the eastern bank of the river Sabarmati, now it is the seventh largest metropolis in India and the largest in the state of Gujarat. It is situated on 230 01' North Latitude and 700 37' East Longitude, at an average altitude of 49 m above Mean Sea Level (MSL).

Historically Ahmedabad has been one of the most important centers of trade and commerce in Western India. The city was once famous as the 'Manchester of India' on account of its textile industry. It is a major industrial and financial city contributing about 14% of the total investments in all stock exchanges in India and 60% of the total productivity of the state.

Several scientific and educational institutions of national, regional and global importance are situated in the city. The city has a great architectural tradition reflected in many exquisite monuments, temples and modern buildings.

The area of Ahmedabad city was 5.72 sq. km. in year 1817 to 1857 with status of non statutory committee. In 1950 Municipal Corporation has been established with city area of 52.47 sq.km. As on today the area of Ahmedabad city is 466 sq.km. & population of city is about 60 lacs.

WATER QUALITY

Sr. No.	Parameters	W.H.O. standards	Actual
1	pH	6.50 – 8.50	7.20 – 7.80
2	Turbidity, NTU	5	0.00 – 3.00
3	Alkalinity, mg/L	600	80 – 280
4	Total Hardness, mg/L	600	190 – 320
5	Calcium as (Ca++), mg/L	200	20 – 60
6	Magnesium (Mg++),mg/L	100	20 – 60
7	Chloride Cl-, mg/L	1000	65 – 370
8	Sulphates (SO4), mg/L	400	12 – 35
9	TDS, mg/L	2000	120 – 900

SOURCE OF WATER

Sr. No.	Parameters	At Present Capacity	At Present Utilization
A	Kotarpur WTP		
1	Narmada main canal - HR(Gravity-I)	330 MLD	370 MLD
2	Intakewell I at Kotarpur	165 MLD	110 MLD
3	Intakewell II at Kotarpur	330 MLD	150 MLD
B	Jaspur WTP		
4	Dholka branch canal	275 MLD	210 MLD
C	Dudheswar WTP		
5	Sabarmati river	70 MLD	00
6	Raska WTP		
D	Shedhi branch canal	200 MLD	120 MLD
7	Frenchwells- 7Nos	170 MLD	120 MLD
8	Borewells	300 MLD	120 MLD
	Total	1840 MLD	1200 MLD

TREATMENT FACILITY

Sr. No.	Parameters	At Present Capacity	At Present utilization
1	Kotarpur Water treatment plant	650 MLD	630 MLD
2	Jaspur water treatment plant	275 MLD	210 MLD
3	Santram(Raska) water treatment plant	200 MLD	120 MLD
4	Dudheswar water treatment plant	75 MLD	00

GENERAL ABOUT WATER SUPPLY

Water Supply

As per CPHEEO norms the water supply in urban areas is 140 lpcd (litre per capita per day). But Ahmedabad Municipal corporation is supplying total water supply of 1150 MLD to 1200 MLD at the rate of 190 to 200 lpcd. NRW in AMC is 25% to 30%. Out of total population & area, 92% of population & 87% of area is covered with piped surface water supply. Only isolated scattered areas are covered with bore well water supply. As on date total coverage of population is 95% and area coverage is 90%.

Water Quality

Ahmedabad Municipal corporation follow the IS 10500:2012. For water quality monitoring the engineering & health department of AMC taking daily 10000 water samples for analysis. The achieved quality parameters is published quarterly in local newspapers as well as updating the data of water quality on AMC website fortnightly. Detail quality parameters are as under.

Thus in terms of source & treatment plant facility, Ahmedabad Municipal Corporation has achieved the requirement of year 2021.

INFRASTRUCTURE AVAILABILITY		
1	Trunk main facility	250 Km
	MD/CI/DI water pipeline - Total length	
2	**Storage capacity** Under ground tank with pump house(155 Nos)	995.47 ML
3	**Distribution Network facility**	3600 Km
	CI/DI water pipeline - Total length	

CHALLENGES FOR WATER SUPPLY

Ahmedabad is located in the arid region. Average rainfall is about 740 mm per year. The main source of water for the Ahmedabad city is Sabarmati River which is not perennial and other source is ground water.

The generic complaints in water supply system is low pressure at tail end, contamination in dense area of city, interrupted water supply, theft of water, illegal water connection & no specified command area of water distribution station. To redress above complaints AMC had worked very hard on it to achieve

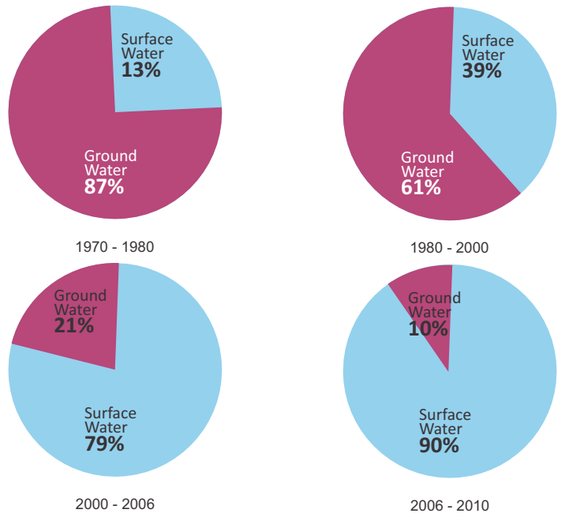
(1) 100% area & population coverage

(2) Whole city water supply is based on surface water supply.

(3) Stoppage of utilization of ground water

The following table shows the scenario of water supply in Ahmedabad city transferred from ground water to surface water.

Sr. No.	Time Period	Use of Ground Water	Use of Surface Wate
1	1970-1980	87 %	13 %
2	1981-2000	61 %	39 %
3	2001-2005	21 %	79 %
4	2006-2013	10 %	90 %



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CHALLENGES FOR WATER SUPPLY

At present cost of water supply which includes raw water charge, water pumping cost & water distribution cost is Rs. 6.25 / kilo letres (1000 litrs).Detail calculation is as under.

Sr. No.	Parameters	Cost of water per kilo litre	Remarks
1	**Raw water cost**	**Rs. 2.15**	**10% increase at every fin. year**
2	**Water Production Cost** (incl. Energy charges, O & M , Spares, Staff Salary, Alum, Clorine etc.)	**Rs. 1.01**	
3	**Water Distribution Cost** (incl. Pumping charge Expenditure, Borewell charges, Electricity charges, Salary, Spares, O & M Contract charges etc.)	**Rs. 2.66**	
	Water Cess 0.5 % of Cost .(0.5% of Rs. 5.82) **Rs. 44 Crorers for Zonal Water Works** (30% cost for O & M for Water Supply Distribution from Water Dist. Station to Consumer End.) Basis of Actual Supply 900 ML.	**Rs. 5.82** **Rs. 0.03** **Rs. 0.40**	
	Total	**Rs. 6.25**	

As on date the water tax to the citizens of Ahmedabad city is not on volumetric base but it is flat – 30% of property tax. So ultimately AMC demands Rs. 125.31 crores water tax against expenditure of Rs. 213.00 crores.

As per current water tax the water rate for residential property is Rs. 0.68/ kilo litres & for non residential property Rs. 27.55/ kilo litres against total cost of water supply of Rs. 6.25/ kilo litres

FUTURE DIRECTION

Augmentation of Water treatment plant is as under

To achieve the target of 100% coverage of area & population with surface water supply, Ahmedabad Municipal Corporation has initiated

i. Expansion of Jaspur water treatment plant by 125 MLD at the cost of Rs. 46 crores & expansion of Kotarpur water treatment plant by 200 MLD at the cost of Rs. 62 crores

ii. More than 40 water distribution stations are under construction at the total cost of Rs. 563 crores. in newly merged areas & developed area of city.

Water Distribution Station Command Area

Identification of water command area for each water distribution station is prepared on map by zonal level & implementation of the same will be completed within one year; which will result in equal water distribution without any contamination.

Storage of water

In case of closure of Narmada Main Canal / Mahi canal for a limited period in case of routine maintenance or any breakdown in canal will result critical situation of water in the city of Ahmedabad.

After detail discussion & past experience it was decided to create a storage facility of minimum 15 days. For that detail feasibility report has been prepared & discussed with different Government agencies – SSNNL & irrigation department & concluded to implement in a phase manner the following projects.

(1) For losses of water from Sabarmati river it is decided to laying Gravity pipeline from Narmada main canal to Kotarpur water works at the cost of Rs. 100 crores.

(2) Construction of barrage in Sabarmati river on down stream of Kotarpur water treatment plant with intake well to cater for 15 days water supply for Kotarpur WTP & jaspur WTP. The estimated cost of this project is Rs. 300 crores

Transfer from intermittent water supply to continues water supply

(24 x 7 water supply)

As on date Ahmedabad Municipal Corporation is supplying water at the rate of 190 to 200 lpcd in the morning 2 hours & 30 minutes in evening for citizens of Ahmedabad.

But in recent past so many cities has initiated the continuous water supply

(24 x 7 water supply) in India. The major advantages of 24 x 7 water supply is as under.

- Minimize pollution
- Water audit and energy audit can be done
- Sustainable water supply with better accountability towards citizen
- Reduction in NRW
- Supervisory control and data acquisition
- Water supply with effective pressure & equal distribution

For the same Ahmedabad Municipal Corporation has initiated the implementation of 24 x 7 water supply scheme as a Pilot project in Part of Jodhpur ward in New West zone & Part of Navrangpura , Stadium & Old wadaj ward in West Zone at the total cost of Rs. 47 crores.

Simultaneously AMC initiated for the appointment of consultant for 24 x 7 water supply scheme in a whole city. Thus AMC targeted to cover a whole city with 24 x 7 water supply scheme within coming six years span at the cost of Rs. 1500 crores.

Water meter policy

As we know that average NRW(Non revenue water) of urban cities is nearly 30% in all over India. For reduction in NRW; AMC initiated to install water meter at each & every house connection as well as commercial connection. For the same water meter policy has been prepared and it is under approval. In future the water tax must be on a volumetric base instead of fix charges of water tax.

Implementation of SCADA

(Supervisory Control and Data Acquisition)

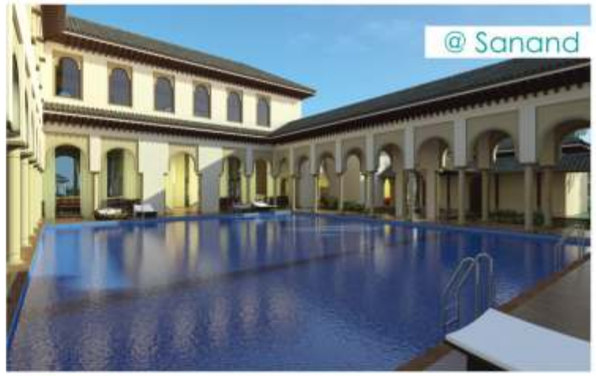
As on date all the infrastructure of water supply is monitored through human being with their personnel visit on site; So there is a chance of human error in each & every operation. To avoid such human error and for effective & economical monitoring of water supply from single point, AMC has initiated implementation of the SCADA (Supervisory Control and Data Acquisition) project at the cost of Rs. 35 crores in next two years. ■

Facts About Water You Must Know - 2

Disparities in Water Rates

	Water Usages		Rate for 1000 litre
1	**Irrigation**		
	a	By canals	5 paisa
	b	By tubewells	40-70 paisa
2	**For Residences**		
	a	Municipal supply	60-80 paisa
	b	In Rural area	Free
3.	**For Commercial /Shops**		20000 paisa
4.	**For industry**		
	a	State Govt corporation	325 paisa
	b	Other industrial area	650 paisa
5.	**Mineral Water**		
	a	From R.O. family size 6 Ltr/ hour	RS. 550/-
	b	20 Litre family pack (local)	RS.1250/-
	c	20 Litre family pack (standard)	RS.2250
	d	1 Litre bottle pack	RS.15000/-
6	**Soft Drinks (Cocacola/Thumsup/Pepsi)**		RS.20000/-

all prices are calculated for the year 2004. Information supplied by Water Management Forum, Ahmedabad



Information Sheet

Rivers Interlinking Project of India

This sheet presents data available in the public domain on the issue of Rivers Interlinking Project of India.

We are aware that there exists a vast body of material that expresses serious doubts and criticisms on this project. However, for want of space we have not been able to accommodate the same.
Executive Editor

The Indian Rivers Inter-link is a proposed large-scale civil engineering project that aims to link India's rivers by a network of reservoirs and canals and so reduce persistent floods in some parts and water shortages in other parts of India. The concept, which was first thought of by British irrigation expert Sir Arthur Cotton during the Raj and then propounded by KL Rao, power and irrigation minister in Indira Gandhi's government in 1972, envisages carrying the surplus water from northern rivers, which are in spate during the monsoon to the water-deficit rivers of peninsular India. The National Water Development Agency, set up in 1982, identified 30 river links on 37 rivers.

This would constitute the largest water development project in the world. In 2002, it was estimated to cost a staggering Rs. 5,60,000 crore. It would provide 173 billion cubic metres of water through 12,500 km of canals and irrigate 34 million hectares.

The Need

The average rainfall in India is about 4,000 billion cubic meter, but most of India's rainfall comes over a 4 month period - June through September. Further the rains across the nation are not uniform, the east and north gets most of the rains, while the west and south get less. India also sees years of excess monsoons and floods, followed by below average or late monsoons with droughts. This geographical and time variance in availability of natural water versus the year round demand for irrigation, drinking and industrial water creates a demand-supply gap, that has been worsening with India's rising population

Current reserves and loss in ground-water level

India currently stores only 30 days of rainfall, while developed nations strategically store 900 days worth of water demand in arid areas river basins and reservoirs. India's dam reservoirs store only 200 cubic meters per person. India also relies excessively on groundwater, which accounts for over 50 percent of irrigated area with 20 million tube wells installed. About 15 percent of India's food is being produced using rapidly depleting groundwater. The end of the era of massive expansion in groundwater use, is going to demand greater reliance on surface water supply systems. Proponents of the project suggest India's water situation is already critical, and it needs sustainable development and management of surface water and groundwater usage.

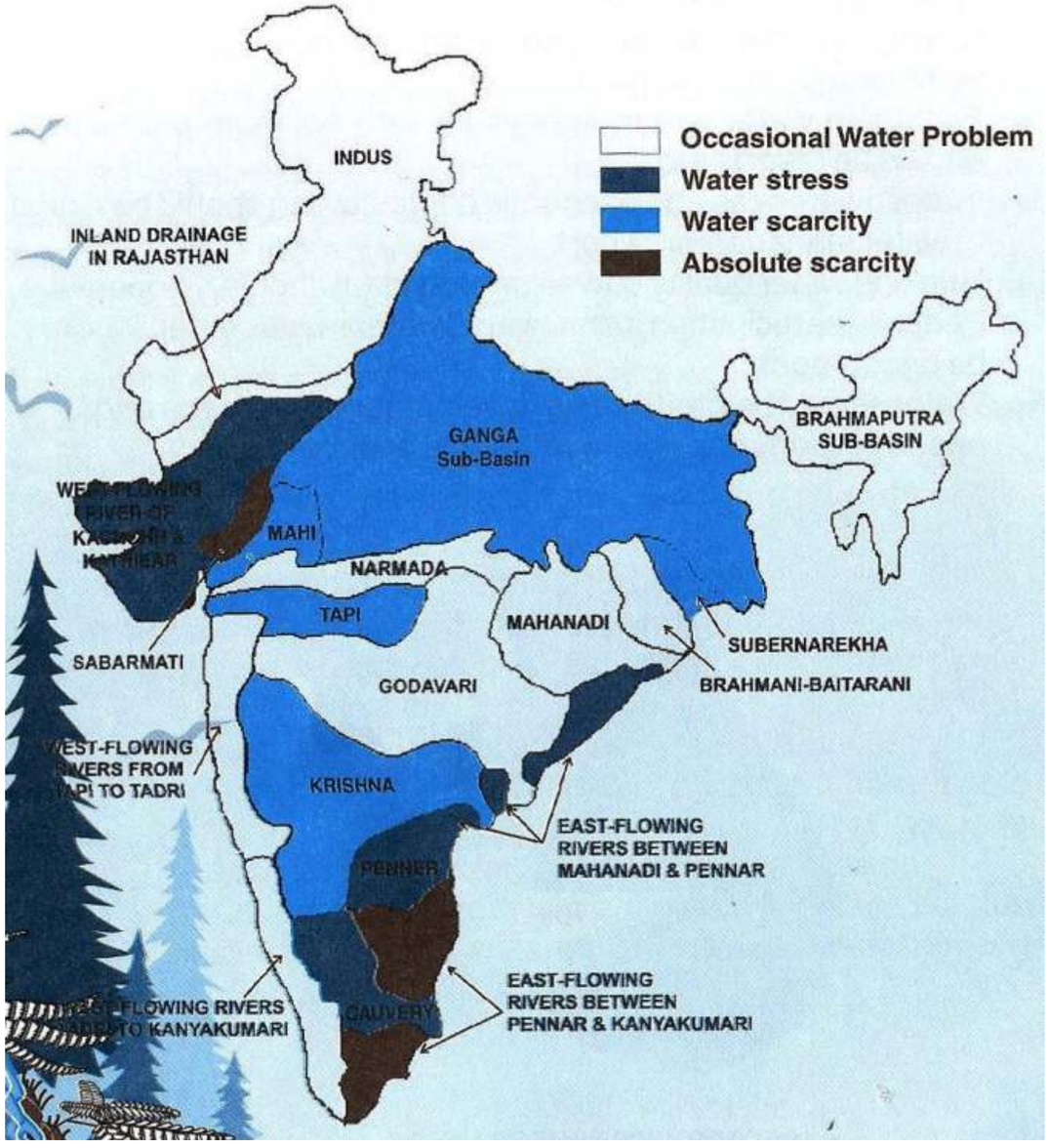
Proposed River Links

The interlinking river project is separated into two primary components the Himalayan and Peninsular Rivers Components . The Himalayan Component proposes fourteen canals and the Peninsular Component sixteen. In the Himalayan Component, many dams are slated for construction on tributaries of the Ganga and Brahmaputra in India, Nepal, and Bhutan. The project intends to link the Brahmaputra and its tributaries with the Ganga and the Ganga with the Mahanadi River to transfer surplus water from east to west. The scheme envisages flood control in the Ganga and Brahmaputra basins and a reduction in water deficits for many states.

Links Identified in Himalayan Component

1. Kosi - Mechi
2. Kosi - Ghagra
3. Gandak - Ganga
4. Ghagra - Yamuna
5. Sarda - Yamuna

INDIA - WATER STRESS & WATER SCARCITY



6. Yamuna - Rajasthan

7. Rajasthan - Sabarmati

8. Chunar - Sone barrage

9. Sone dam - Southern tributaries of Ganga

10. Brahmaputra - Ganga (Manas - Sankosh - Tista - Ganga

11. Brahmaputra - Ganga (Jogigopa - Tista - Farakka)

12. Farakka - Sunderbans

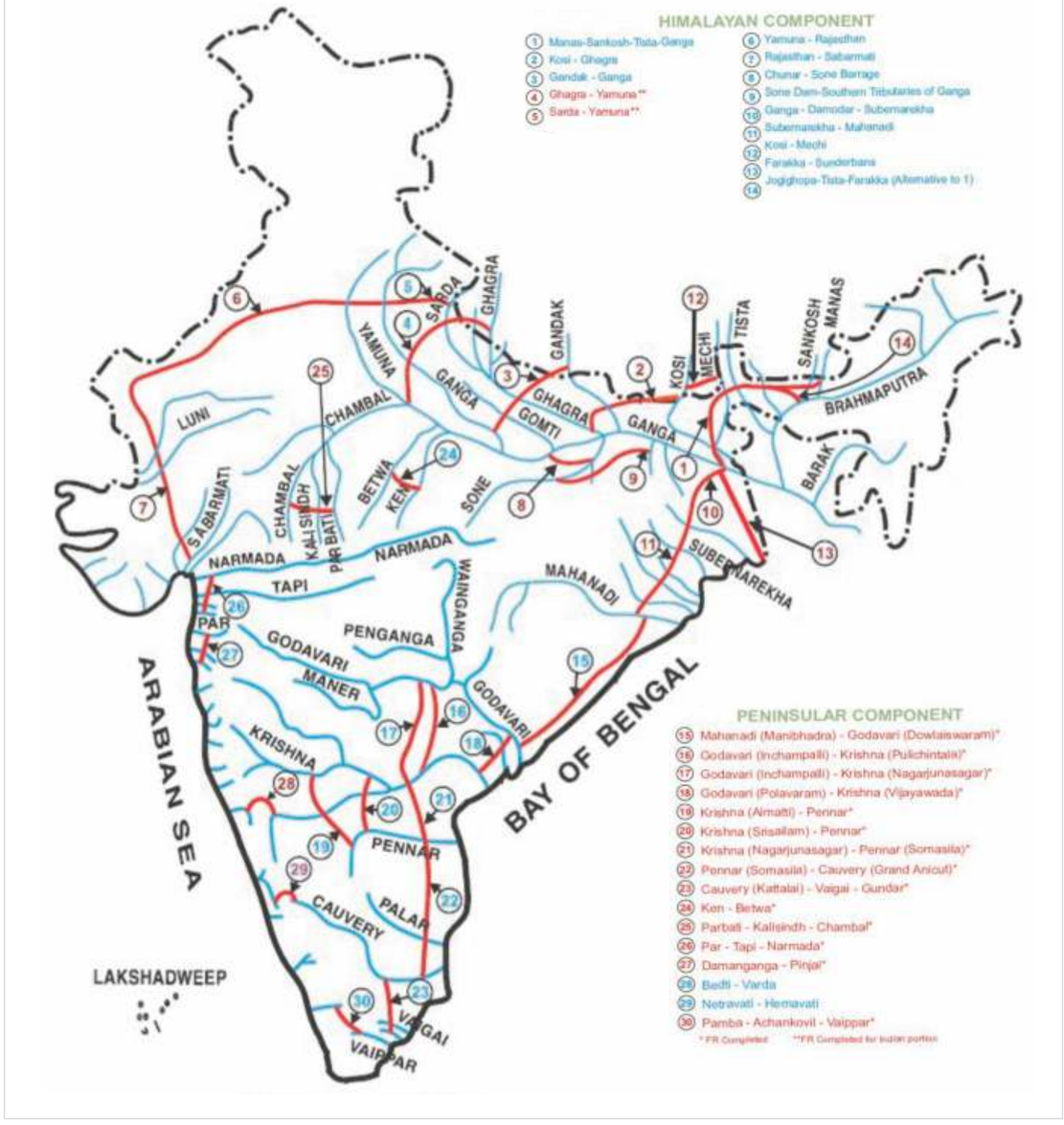
13. Farakka - Damodar - Subarnrkha

14. Subernarekha - Mahanadi

Source: "National Perspective Plan," NWDA (1980), and Goyal (2003)

In the Peninsular Component, river interlinks are envisaged to benefit the states of Orissa, Karnataka, Tamil Nadu, Gujarat, Pondicherry, and Maharashtra. The linkage of the Mahanadi and Godavari rivers is proposed to feed the Krishna, Pennar, Cauvery, and Vaigai rivers. Transfer of water from Godavari and Krishna entails pumping 1,200 cusecs of water over a crest of about 116 meters. Interlinking the Ken with the Betwa, Parbati, Kalisindh, and Chambal rivers is proposed to benefit Madhya Pradesh and Rajasthan.

PROPOSED INTER BASIN WATER TRANSFER LINKS



Links Identified in Peninsular Component

1. Mahanadi (Manibhadra) - Godavari (Dowlaiswaram)

2. Godavari (Inchampalii) - Krishna (Nagarjunasagar)

3. Godavari (Inchampalii Low dam) - Krishna (Nagarjuna Tail Pond)

4. Godavari (Polavaram) - Krishna (Vijayawada)

5. Krishna (Almatti) - Pennar

6. Krishna (Srisailam) - Pennar (Prodattur)

7. Krishna (Nagarjunasagar) - Pennar (Sornasila)

8. Pennar (Sornasila) - Cauvery (Grand Arnicut)

9. Cauvery (Kattaiai) - Vaigai - Gundur

10. Ken - Betwa - Link

11. Parbati - Kalisindh - Chambal

12. Par - Tapi Narmada

13. Damanganga - Pinjal

14. Bedti - Varda

15. Netravati - Hemavati

16. Pamba - Achankovil - Vappar

M.Gopalakrishnan

Memorandum sent by the Institution of Engineers (India) to the Parliamentary Committee Programme of Inter linking of Rivers under study by Government of India

M.Gopalakrishnan

Gopalakrishnan FNAE, Hon. Diplomate, American Academy of Water Resources (Hon.Dip._WRE), FIE (India), M E (Hons) (Roorkee), PG Dip (Hons) WRD {Univ of Roorkee and Dr. A.N. Khosla Gold Medalist}

President, New Delhi Centre of World Water Council, Former President of Indian Water Resources Society

Secretary General Hon., International Commission on Irrigation and Drainage,

Former Member Central Water Commission and Ex-Officio Addl. Secretary to Government of India

Member PAC, IUCN's E4L project (Bangladesh-India) programme;

Member GoI Committees {(Ilimate Change – Water (MoWR), Doabia Committee to provide approach to River Basin,(ii) Single Member Committee as the MoWR Consultant on CWC Restructuring and (iii) CSMRS Institutional Strengthening Expert Committee}, Supreme Court designated single member commission to study the Polavaram Dam Issues in the light of GWT award and Chair of the Committee involving CWC members' team on the same subject

Chair / Member/ Adviser of many TAC or PoEs on Hydro Power Projects of public as well as private developers in India/ Nepal,

INCOLD / CBIP's ' policy think tank for Water related programme of activities

Independent Senior Water Resources Expert

This is a paper on the subject matter which is exhaustive enough to lead a new thought provoking for all who are interested on ILR. Eventually it was sent to Government of India as a **Memorandum to the Parliamentary Committee constituted to review the Programme of Inter linking of Rivers under study by Government of India.**

India is one of the few countries considered to be well endowed with land and water resources. The only problem which was long recognized was the uneven distribution of water over time and space as most of the run off occurs during the 4 monsoon months of June to September. In fact the rainfall hours are just around one hundred on an average and the spells of severe rains caused floods and the long droughts caused distress in many parts witnessing worst famines. This was the reason for a concerted efforts in the initial plan periods after 1950s for us to steadily opt for water resources development. These actions taken during the early stages of our planned development after independence yielded positive results in making the Nation to become self sufficient to tide over crisis due to famines as a result of drought in the later parts of the last century. However with the rapidly growing population, increased urbanization and industrialization, more and more shortage of water has now begun to be felt all across the country; in some cases it is severe and nearly critical. Examples of severe water shortages are seen in cases like Cauvery basin which has resulted in progressive inter state disputes; more and more basins with severe water stress are foreseen not far of from now; water has already become a major issue for conflicts between States. Water Policies and future action in water sector have to keep this in view and take all desirable steps that can effectively contribute for National Integration.

India's population, which was less than 400 million in 1950, has now increased to over a 1.08 billion. Notwithstanding measures to control population explosion, it is expected to grow to 1.5 to 1.6 billion by 2050, by when it may probably stabilize. The per capita availability of water was 5.20 Th. cu. m per annum in 1950, which came down to 2.20 Th.cu.m in 1991. It was 1.80 Th.cu.m. in 2000 and is likely to reduce to 1.34 Th.cu.m. by 2025. It is believed as per norms that are International that when 'per capita per year' availability of water is less than 1 Th.cu.m., water scarcity occurs. We are marching slowly and steadily to this situation in a major part of our country. Clearly therefore, we need to take measures to avoid such an alarming situation that can cause severe conflicts within the country.

The present food grain production in India is slightly over 210 million tonnes per annum. To feed the anticipated population meeting with the desirable nutritional standards by 2050 we may need to have a food grain production in the order of 450-500 million tonnes per annum. The ultimate irrigation potential of the country is assessed at 140 million hectares – 76 million hectares from surface water and 64 million hectares from ground water. Steps are required to be taken to increase the existing irrigation potential of around 100 million hectares to achieve the full potential. However, even this may not be sufficient to achieve the required food grain production and it may therefore be necessary to look towards unconventional methods of increasing irrigation potential.

Not only to meet the additional food requirements but also to face the threatening future water crisis, there can be no further waiting in initiating all necessary action (which would span over decades). Non-action and 'business as usual' harms the environment much more than what one sometimes project as side effects of developments on environmental degradation. After all, one can factor the environmental concerns suitably with growing experience available from around the globe. Thus, we have to take steps to store the surplus water during the monsoon season, take all measures for conservation of water and its efficient use and improve managerial efficiency and better water Governance. All these actions are complimentary and are not mutually exclusive as sometimes people project.

The average annual rainfall in India is 1170 mm, which corresponds to an annual precipitation of 4000 BCM. Out of this, the average annual flow in the river system of India has been assessed as 1953 BCM. However, over 90 percent of the annual runoff in the Peninsular Rivers and over 80 percent of the annual runoff in the Himalayan Rivers occurs during the 4 monsoon months. The Ganga-Brahmaputra-Meghna system accounts for more than 60 percent of the runoff. Due to this spatial and temporal variation of runoff, most of the water cause immense flood losses and distress and misery. Clearly one of the answers to the water problem is to conserve the excess monsoon flows and wherever feasible use this water in areas which have inadequate rainfall and are drought prone. Storage in Himalayan rivers also help generation of eco friendly hydro power which is an asset to Electrical System because of its vital role in meeting peak power and stabilizing energy fluctuations. Nearly 30000 MW capacity plants have been identified in some of the Schemes planned in respect of Karnali, Pancheshwar, Kosi, Gandak, Sankosh and Manas, based on Feasibility studies which of course did not consider use of water optimally by inter basin transfer. Institution of Engineers (India) has evidence to understand that this aspect was independently investigated by National Water Development Agency (NWDA). NWDA was set up as a Society in 1982 to carry out surveys and investigations and to prepare feasibility reports of the links under the National Perspective Plan under the overall supervision of a body composed of all State Governments. NWDA has over the past two decades undertaken detailed water availability studies, identified 30 links. These links can be divided into two

Not only to meet the additional food requirements but also to face the threatening future water crisis, there can be no further waiting in initiating all necessary action (which would span over decades).

Non-action and 'business as usual' harms the environment much more than what one sometimes project as side effects of developments on environmental degradation.

groups namely the Himalayan links (14; as one link is an either / or this will become ultimately 13 only) besides the Peninsular links (16). We have to acknowledge that the Himalayan links require some consultations with neighboring countries because of international dimensions of the envisaged developments, Peninsular links are within our domain and could proceed with the co-operation of all participant States soon after reaching a political consensus.

Buildings of storage dams in India are inevitable for conservation of excess monsoon flows to meet the growing demand for water. Minor storages, watershed development through check dams and use of ground water are supplementary to major storages and not alternatives. Since the possible storage sites are limited and spatial and temporal variation considerable, the country needs to develop all possible storages; big as well as small, surface or ground. Starting with a pre-plan storage of a meager 15.63 BCM, till date, a total of about 176.73 BCM 'built up storage' has been created. Another 76 BCM of storage capacity will be available from projects under construction. If we add the 3 BCM capacities of small tanks a total capacity of 256 BCM will be available. There is yet another 108 BCM of identified capacity under consideration. A further augmentation which is essential will be possible only if inter basin transfer is undertaken as per the schemes investigated.

The interlinking programme is a major endeavor to create the additional storage facilities and transfer water from water surplus regions to more drought prone areas through inter-basin transfers. In the process it is expected to provide additional irrigation in about 35 million hectares and power generation capacity of 34000 MW.

Long distance inter-basin transfer of water is not a new concept and has been in practice in India for quite some time. The Periyar Project, the Parambikulam Aliyar Project, the Kurnool-Cudappah canal and the Telegu Ganga projects are good examples of interbasin water transfers executed in South India. In the north of the country we have the Beas-Sutluj link and the Rajasthan canal as example of inter basin transfers. Internationally also there are number of examples of interbasin transfers. The US transfers 45 BCM through interbasin transfers and has plans to add 376 BCM; China has a scheme under implementation, which will transfer about 48 BCM.

Some apprehensions have been expressed about the environmental and social impact of the link projects. Institution of Engineers(India) is aware of the fact that a Task Force that was constituted by Government of India in 2002 had organized the preparation of a very comprehensive terms of reference for detailed project reports. These terms of reference vetted by experts in different areas of technical, environmental, economic and social can yield a very comprehensive base line for future studies by Consultants and Experts from different spheres. I.E.(India) notices that this document is made available in the public domain already; one can provide comments and suggestions for their further improvement, if there is further scope.

Institution of Engineers (India) believes that the terms of reference on the social impact of the projects should also go beyond the land for land or cash compensation approach to an area development approach i.e., one that may permit in situ R&R of displaced persons, so as to avoid to the extent feasible the disruption of social kinship and cultural networks. Effort should be made to marry the R&R with the national imperatives of poverty alleviation and achievement of millennium goals and taking the opportunity of investment to far flung tribal areas for their upliftment and bringing them to the main stream.

The Institution of Engineers (India) believes that the 'Interlinking of Rivers' programme is a major one that India should embark upon in water sector to deal with our water problems. The scheme has ambitious goals of ensuring provision of drinking water, irrigation, water for industries, addition of sizeable hydropower to stabilize and contribute to the overall Grid, reduce distress and mitigates flood impacts, combat drought, enable navigational transport in ceratin reaches and enhance overall welfare of Indian public. The inter basin transfer is a process that helps to transfer water to areas chronically short of water. It helps to change the rural scene in such areas to tremendous extent which is not possible in any other manner.

During implementation, large-scale employment will be created and there would be a big fillip to the cement, steel and engineering equipment industries. The successful implementation of the programme is therefore of utmost importance for the development of the country and it is necessary that a supportive climate for the programme is created. Certainly the environmental concerns should be looked into very carefully with the provision for mitigating measures and proper rehabilitation steps taken for those likely to be adversely affected. Finally and most importantly, the pressure created by the support for the programme should be such as to persuade the reluctant State Governments. to rise above narrow interests and join the efforts to harness our river waters to the maximum extent in the most optimal manner. ■

Bhakra Nangal Dam

Dhimant B. Vyas

WATER FOOT PRINT -An Introduction

"As I travel around the world, people think the only place where there is potential conflict over water is the Middle East, but they are completely wrong. We have the problem all over the world. "

- Koffi Annan

Dhimant B. Vyas

Nitin D.Mehta

Mr Dhimant Vyas belong to 1997 batch of Gujarat service of Engineers. He is a Goldmedalist civil Engineering Graduate.He completed his M.Tech in Urban nd Regional Planning.He winning four awards from The CEPT Univerity.He Mastered in Business Administration with HRM.

He worked in different departments of Govt of Gujarat with special postings like Officer on Special Duty for Narmada planning Group, Officer on Special Duty for command Area Development for Sardar Sarover Project, Joint Director Agriculture and General Manager Coperative societies for SSP Command. He actively contributed in Disater Mangement as Technicl cordinator during scarcity,Cyclone and Earthquke in Katchchh .

Presently he is working as Superintending Engineer at GWRDC.with additional charge is Superintending Engineer at GWSSB.

Nitin D.Mehta is civil Engineering Graduate 1984 from Sardar Patel University V.V. Nager Gujarat. Presently he is working as Deputy Executive Engineer& Incharge Executive Engineer at GWSSB H.O Gandhinager.

Apart from providing this article he has also provided maps appearing on pages 9 and 18 of this issue.

Water scarcity, overexploitation of water resources and pollution are growing problems that constitute a risk for economic development and food security in several world regions.. The number of people living in severely water-stressed river basins is projected to increase from 1.6 billion in 2000 to 3.9 billion by 2050, or over 40% of the world population of 2050. The majority live in densely populated areas in countries with rapidly developing economies. Furthermore, at least 20% of the world's groundwater aquifers are considered to be overexploited. The quality of surface waters and groundwater is expected to deteriorate in the coming decades, due to micro-pollutants, pesticides and nutrient overloading These local problems have a global dimension because supply chains and trade link the 'virtual water' that is embedded in products to consumption in other parts of the world. The water footprint approach addresses this global dimension of water scarcity and pollution, as it assigns these 'virtual' freshwater volumes to products, consumers, producers and countries. The water footprint indicator has been effectively used as a wake-up call to raise awareness among the general public, businesses and governments about the global scale of water appropriation.

The water footprint concept was introduced by Hoekstra in 2002 (Hoekstra and Hung, 2002; Hoekstra, 2003) and has been gaining popularity, worldwide; when water footprint components are placed in their physical and socioeconomic context, unsustainable 'hot spots' can be traced.

The water footprint indicator refers to all water use and emissions to water, including leaching and run-off, associated with the processes to make a product or deliver a service. This includes both direct water use and emissions to water by the manufacturer and indirect water use and emissions to water along the supply chain of all ingredients including packaging. When viewed from a consumer perspective, the water footprint indicator for a product also includes the water use and emissions to water associated with its use. Water use is measured in terms of water volumes consumed, evaporated or incorporated into the product. Green water refers to rainwater used for growing crops, blue water to surface water and groundwater used for irrigation and industrial and domestic use. Grey water is a measure for the severity of emissions of

pollutants to water. Grey water is calculated as the volume of fresh water that would be required to assimilate the load of pollutants delivered to a freshwater resource given the natural background concentrations and existing water quality standards, whether or not this freshwater volume is actually available. Water footprint indicators are also defined for other things than products; for instance, for producers, sectors, consumers or nations. These water footprint indicators consist of the sum of the water footprint indicators for all products produced or consumed by them. In the case of nations a distinction is often made between the domestic or internal part of the water footprint and the foreign or external part, the latter is also referred to as 'virtual' water import.

The water footprint indicator, which assigns virtual water volumes to products, consumers, producers and countries, has been effectively applied as a communication instrument to make the general public, businesses and governments aware of the large volumes of water used in international supply chains for the production of goods. As a result, public and private parties have been stimulated into joining networks and partnerships, performing water footprint pilot studies and starting projects to reduce water use and pollution in production processes along supply chains. Also new methods and databases have been developed that are useful for water assessments. NGOs have played an important role in this process in communication, initiating networks, partnerships and pilot studies, and developing standards.

WATER FOOT PRINTS

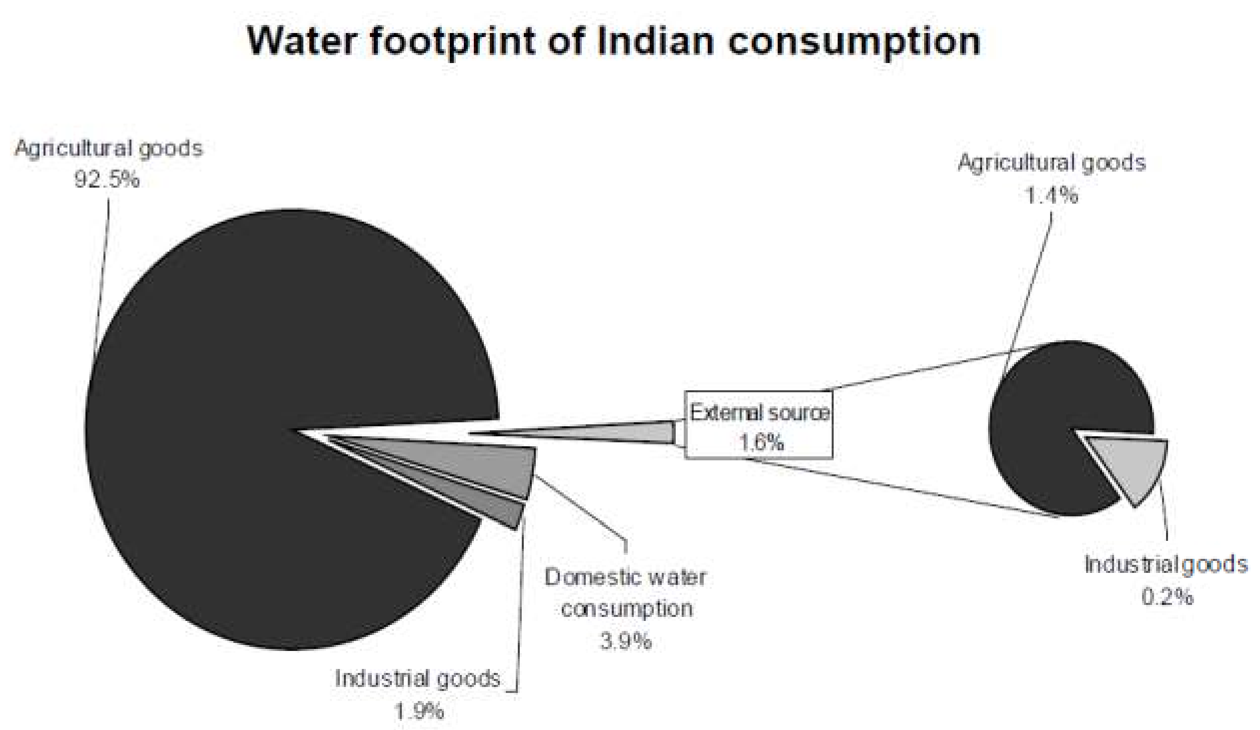
Individual water footprint – The water footprint of an individual is defined as the total water used for the production of the goods and services consumed by the individual. It can be estimated by multiplying all goods and services consumed by their respective virtual water content.

Nation's water footprint – The water footprint of a nation is defined as the total amount of water that is used to produce the goods and services consumed by the inhabitants of the nation. The footprint is generally expressed in terms of the volume of water use per year.

The national water footprint can be assessed in two ways.

The bottom-up approach is to consider the sum of all goods and services consumed multiplied with their respective virtual water content. It should be noted that the virtual water content of one particular consumption good can vary as a function of the place and conditions of production.

In the top-down approach, the water footprint of a nation can be calculated as the total use of domestic water resources plus the net virtual water import. ▪



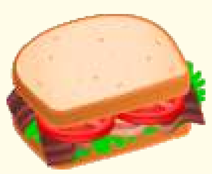
FACTS ABOUT WATER YOU MUST KNOW - 3

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible] water.
8. [illegible]
9. [illegible]ger pangs for almost 100% of the dieters studied in a University of Washington study.
10. [illegible]
11. [illegible]-10 glasses of water a day could significantly ease back and joint pain for up to 80% of sufferers.
12. [illegible]-term memory, trouble with basic math, and difficulty focusing on the computer screen or on a printed page.
13. [illegible]%, plus it can slash the risk of breast cancer by 79%, and one is 50% less likely to develop bladder cancer.

Water and your Food

How much water does it take to grow your food?

Pretty much everything we eat needs water to either grow or create. This water is either supplied by nature as precipitation or added by man during the growing/production process. You can't tell by the size or texture of a food how much water was actually used to produce the food item.



To grow that sandwich, for example, it takes water to grow the wheat, water to grow vegetables, water to grow tomato for sauce, water for preparation of sauce, water to wash vegetables, water to prepare breads. It all adds up.

Food item	Quantity	Liters of water
Sugar	1 table spoon	27
Tomato	1 small	30
Almonds	100 grams	150
Orange	1 medium	49
Lettuce	100 grams	12
Milk	100 ml	100
Rice	100 grams	500
Wheat	100 grams	110
Tomato Sauce	100 ml	49
Egg	1 number	250
Slice of bread	1 number	28
Tea	1 cup	35
Lemon	100 grams	100
Potato	100 grams	21
Potato chips	100 grams	93
Apple juice	1 glass(0.2 litres)	190
Banana	100 grams	200
Cheese Sandwich	1 piece	90
Chocolate	100 grams	225

Information supplied by
Water Management Forum, Ahmedabad

Seminar on "Save life Without being Doctor”

Felicitation of De. S. K Jain and Dr. M.N Patel

Presentation on Smart Cities

Quote Unquote

“If you don't read the newspaper you are uninformed, if you do read the newspaper you are misinformed.”

- Mark Twain

Presentation on Smart Cities

Participating in Run For Unity Event

Felicitation of De. S. K Jain and Dr. M.N Patel

Seminar on "Draft Local area Plan, Central Business District Ahmedabad"

Quote Unquote

“We are students of words: we are shut up in schools, and colleges, and recitation-rooms, for ten or fifteen years, and come out at last with a bag of wind, a memory of words, and do not know a thing.”

- Ralph Waldo Emerson

Seminar on Alternative Careers in Management Master of Habitat Management at CEPT University

Navaratri Mahotsav 2014 at Saptak Party Plot

Seminar on Water Foot Prints and Virtual Water Managent

Diwali Get-together 2014 at Surmaya Abode

Seminar on "Draft Local area Plan, Central Business District Ahmedabad"

Seminar-Advance Range of Concrete admixture for New Construction And Fiber Strengthening with repair Solution

Quote Unquote

"Education is an admirable thing, but it is well to remember from time to time that nothing that is worth knowing can be taught."

- Oscar Wilde

Quote Unquote

"Foreign aid might be defined as a transfer of money from poor people in rich countries to rich people in poor countries."

- Douglas Casey, Classmate of Bill Clinton at Georgetown University

Navaratri Mahotsav 2014 at Saptak Party Plot

Seminar on "Save life Without being Doctor"

Seminar on Alternative Careers in Management
Master of Habitat Management at CEPT University

Senior Citizen Meet 'Manranjan thi Manomanthan Sudhi"

Quote Unquote

"Take the first step in faith. You don't have to see the whole staircase. Just take the first step."

- Martin Luther King Jr.

PROFESSIONAL ACHIEVEMENT

Shri Narendra K. Patel
CMD, Sun Builders Group

This is to certify that Shri Narendra K. Patel (N. K. Patel) is elected as a Council Member for the year 2014-2015 of Institute of Town Planners, India in the month of September 2014, which is an apex body of professionals town planners of India having more than 4000 qualified town planners as a member.

He is an active Council Member of Institute of Town Planners, India, New Delhi since 2001 - 02. He has been successfully elected for thirteen years in Council. He represents Institute of Town Planners, Gujarat Regional Chapter. His professional contribution to our institute and in field of Town Planning is noteworthy. He was instrumental in organizing 61st National Town and Country Planners Congress 2013 held at Ahmedabad, which was a grand successs.

Dr. Najammuuddin
(Secretary General)

INSTITUTE OF TOWN PLANNERS, INDIA

WITH BEST COMPLIMENTS FROM:

Dr. R. N. Vakil
Eminent Academician & Technocrat

Dr. M. N. Patel
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