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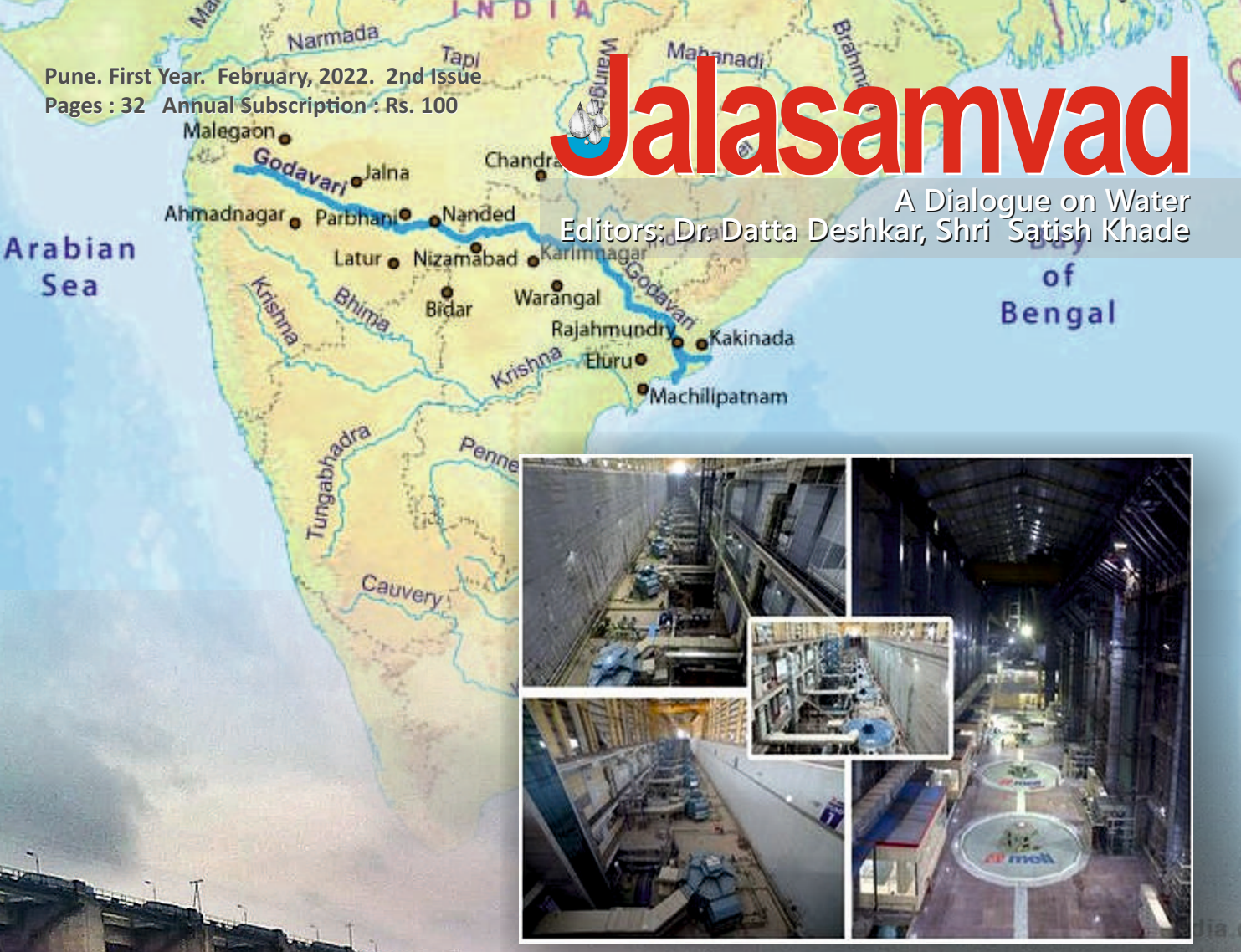
Jalasamvad

A Dialogue on Water

Editors: Dr. Datta Deshkar, Shri Satish Khade



Cover Story:

World's Second Largest Lift Irrigation Project on Godavari River – Ravindra Ulangwar

Urban Water Supply :

- Getting clean water for drinking is recognized as the basic right of every citizen. But unfortunately, nearly one fourth of the population of the world is denied this basic right. If polluted water is consumed, the community is required to face a number of water borne diseases. In most of the cases small children are the victims of such diseases.
- To supply clean and potable water to the community is the primary responsibility of the civic bodies like municipality or gram panchayat. There are some standard norms as to how much water is required by each person per day. These norms are separate for urban and rural population. It is said that in urban area 135 liters of water is required per person per day whereas in rural area it is 60 liters.
- In urban area, the details of 135 liters are as follows: for cooking and drinking: 15 liters. For bathing: 20 liters. For washing clothes: 20 liters. For washing utensils: 20 liters. For sundry use: 15 liters and for flushing toilets: 45 liters. Out of these, major requirement is for toilet flushing. If locality wise sewage treatment plants are erected this water requirement can be sufficiently reduced.
- If every person reduces his water consumption by 35 liters per day, huge saving of water would be possible. Such reduction, all of a sudden, may not be possible but if sincere efforts are made lot of water in the area can be saved.
- One more thing would be possible because of this saving. Creation of waste water would be reduced significantly. Every municipal body is required to spend huge money to treat this waste water. That amount can be used by this body for any other better purpose.
- In most of the towns and cities there is a huge leakage in the pipelines used for distribution of water. In some cases, this leakage is more than 30 to 40 percent. This is, in fact, a huge loss. The normal loss in this case is estimated to be 8 to 10 percent. If this water is saved, stress on the municipal bodies can be sizably reduced.
- In every house, there are at least 5 taps. One is in the bathroom, second is in the toilet, third is in the kitchen, fourth is provided for cleaning the utensils and the fifth is in the garden for watering plants. If we carefully observe them, we find that every tap is leaking. Total leakage per house can easily be more than 5 to 10 liters per tap. Stopping this leakage is a very easy job. But we are so careless that we do not take the trouble to repair these leaking taps.
- For use of electricity, every house has a meter. That tells us how much electricity we are consuming. Like electricity, water also is equally precious. Then why cannot we have a meter for measurement of water? If the municipal body decides to install such a meter, it has to face the public outrage.
- In Singapore, the civic body shows in the water bill how much water you are using, how much water usage is there in your colony and what is the national average. It provides you any opportunity to compare these three figures. There is a proverb in English, A nod for the wise and a rod for the fool. If you do not reduce your water consumption some strict action is taken against you.

Jalsamvad

Mouth Piece of Bharatiya Jala Sanskriti Mandal

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Contents

Editorial .....

Power generation from coal - A major crisis for the environment:

Coal-fired thermal power plants add more than 50 per cent of the total sulfur dioxide in the atmosphere, as well as 30 per cent of nitrogen oxides. Also 20% of dust is released into the atmosphere. In 2015, the Union Environment Ministry had imposed tough emission conditions for such power plants. It had forced them to complete the precautionary measures by 2017. However, these power plants were constantly trying to postpone the 2017 deadline. They were urging that this date be extended till 2024. In the Supreme Court, it was strongly argued that these power plants should abide by these conditions and bring in place, the necessary precautionary measures before 2022. However, the extension to 11 factories in Delhi NCR was granted only till 2020.

But these power plants could not meet that requirement. So, was again reconsidered and some conditions were relaxed. For the factories set up after 2017, the standard requirement of 2.5 cubic meters of water for generation of one megawatt of electricity was increased to 3 cubic meters. At the same time, for the power plants started between 2014 and 2016, the dust content permeability was increased from 300 mg to 450 mg.

There was a lot of criticism in the country about this relaxation. In this regard, the Central Electricity Authority has submitted a new proposal. This led the ministry to relax the terms for the third time. According to the new policy, power plants were divided into three types.

(1) Power generation stations within a radius of 10 km of the country's capital.

(2) Power generation stations within 10 km diameter of highly polluted areas.

(3) Other centers.

On April 16, 2021, the Central Pollution Control Board appointed a task force to divide 596 centers in the country. They divided them in three groups of 11 per cent, 11 per cent and 78 per cent respectively. This list was published on September 10, 2021 for the information of all the centers. Accordingly, the study done in this regard show that only 10 per cent of the centers in the first group have complied with the conditions, but the actions of the rest of the centers is not satisfactory. They will not be able to meet the set target of 2022. The situation of the centers coming under the control of the Central Government is a bit better, but the situation of the centers coming under the control of the State Government was found to be unsatisfactory.

In short, the conditions set by the Ministry of Environment have been ridiculed by these power plants. In some places the conditions have been relaxed, while in others, the deadlines were not followed. From this, it seems that the Ministry of Environment and the Central Pollution Control Board are not serious about this.

The government needs to focus on three things - power generation from water, power generation from wind and power generation from solar energy. If the power generation in these types increases, then only we will be able to shut down the existing coal-fired power plants.

We would like to insist that, just as the water saving movement has started in the society in the context of water, we should start the same in the case of electricity also. One of today's contradictions is ridiculous. Large offices are being set up, glass is being used on all sides to make it look beautiful, curtains are being installed as more light comes through the glass and then again lights are put on as the light is dimmed because of the curtains. This scene is common everywhere today while walking at night in big cities. I don't know whether to laugh or cry when I see it. At night, all the offices are closed but the lights are on everywhere. The wisdom, first packing the room from all sides and thereafter airing all the rooms by installing fans for air circulation, is incomprehensible. Are we going to think about this?

Why should not the railway stations, bus stands, schools, colleges, hospitals, malls, housing societies be compelled to use electricity through solar energy? Meanwhile, a big industrialist from Pune city had promised to help run the Pune railway station fully on solar power. In this way, there can be at least one industrialist in every city who can take on such a responsibility. We just need to find him out.

In fact, it would not be an exaggeration to say that there is a shortage of planners.

Dr. Datta Deshkar
Editor

J Chokkarao Lift Irrigation Scheme in Telangana

Cover Story

Shri Ravindra P. Ulangwar, (M) : 9075006509

The World's Second Largest Lift Irrigation Project on River Godavari.

Synopsis :

The Godavari River is the third largest river in the Indian River system having one of the largest and longest basin. Every year this river throws approx. 3000 TMC water in to the sea. On the other hand, most of the region on both the banks is drought prone area facing severe shortage of water even for basic requirement of drinking water. However the challenge is that the river is flowing at low level and command areas are situated at very high elevation. This calls for constructing the large pumping system which can lift water from the river and pump it to higher elevation in the command area.

J Chokkarao Lift irrigation scheme is one such ambitious project which was designed and built to lift 38 TMC water to provide irrigation and drinking water to 5.40 Lakhs acres of farm lands in draught prone region of Warangal and Karimnagar districts of Telengana state. The water is lifted by large size pumps from the river and transported to fill up various tanks en-route by large diameter steel pipelines. Considering the size and complexity this project is termed as one of the engineering marvels in the country.

History of Irrigation in Telangana state :

Telangana region has a rich heritage of cultivation and irrigation dating back to several centuries. In the past, rulers paid a good deal of attention to the development of irrigation in their kingdoms for the benefit of their citizens. Big lakes like Ramappa, Pakhal, Laknavaram and many other irrigation works of Kakatiya period have become names to remember.

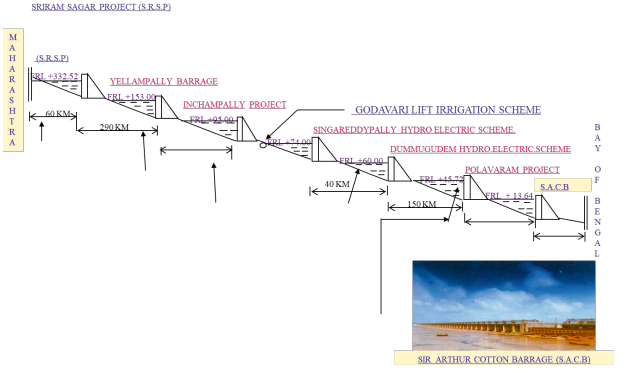
The Mir Alam Tank is the finest example for arched dams. Hussain Sagar, Ghanapur Anicut across the Manjira with two canals called Fathenahar and Mahaboobnahar Projects, Pocharam lake, Osmansagar, Himayatsagar, Nizamsagar Project, Mannair Project, Dindi Project, Palair Project, Wyra Project and Sarlasagar Projects are some of the magnificent contributions of the eminent Engineers of Hyderabad State under Nawab Ali Nawaz Jung Bahadur during the Nizam's kingdom in the Telangana Region.

The Godavari River :

The Godavari river is India's second longest river after the Ganga and third largest in India. River drains about 10% of India's total geographical area and originates from Trimbakeshwar, Nashik, Maharashtra. It flows east for 1,465 kilometres draining Maharashtra (48.6%), Telangana (18.8%), Andhra Pradesh (4.5%), Chhattisgarh (10.9%) and Odisha (5.7%). The river ultimately empties into the Bay of Bengal through an extensive network of tributaries measuring up to 312,812 sq. km. It forms one of the largest river basins in the Indian subcontinent, with only the Ganga and Indus rivers having a larger drainage basin. In terms of length, catchment area and discharge, the Godavari is the

largest in peninsular India, and had been dubbed as the Dakshina Ganga.

The river has been revered in Hindu scriptures for many millennia and continues to harbour and nourish a rich cultural heritage. In the past few decades, the river has been barricaded by several barrages and dams.



Location of various dam projects along the River Godavari

The Dowleswaram Barrage was an irrigation structure originally built in 1852 on the lower stretch of the Godavari River near Rajahmundry in AP before it empties into the Bay of Bengal. It was rebuilt in 1970 when it was officially renamed as Sir Arthur Cotton Barrage or Godavari Barrage. In 1970, the barrage was heightened to 10.6 m. The reservoir has 3.12 TMCFT gross storage capacity and dead storage of 2.02 TMCFT at 12 m MSL.

Sir Arthur Cotton Barrage near Rajahmundry in Andhra Pradesh

The J. Chokka Rao Devadula lift irrigation scheme project :

The J. Chokka Rao Devadula lift irrigation scheme is a lift irrigation scheme in Telangana state of India. It is the second biggest of its kind in Asia. Devadula is the place in Mulugu District, Telangana, where the scheme's intake well is located on Godavari River. The project is specially designed to lift water from the River Godavari to irrigate more than 600,000 acres (2,400 km2) in the drought prone Telangana state. Later it was named after the politician J. Chokkarao as the 'J. Chokkarao Devadula lift irrigation scheme'. The total work was divided into three phases for executional convenience. The first phase of the scheme was begun in the year 2003.

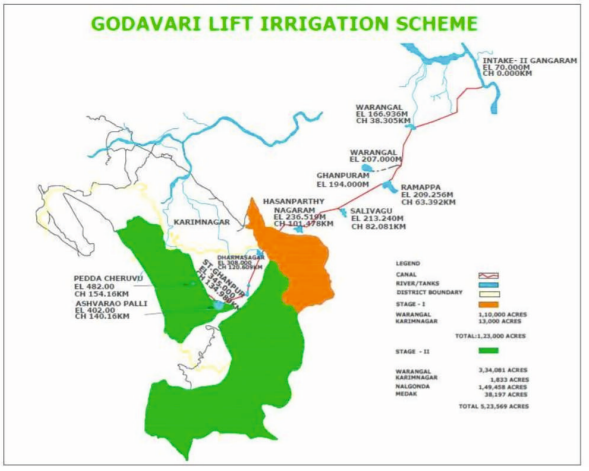
This Project irrigates an ayacut of 5,57 Lakh Acres in upland drought prone areas of Karimnagar, Warangal (U), Warangal (R), Jayashankar Bhupalpally, Siddipet, Yadadri, Jangaon and Suryapet Districts of Telengana.

Districts and Mandals benefited:

Sl. No.	Districts	Mandals
1	Jangaon	R.S.Ghanpur, Jaffegardh, Raghunathpally, Palakurthy, Devaruppala, Lingala Ghanpur, Gundala, Bachannapta, Kodakandla, Narmetta and Jangaon.
2	Warangal (Rural)	Wardhannapet, Geesukonda, Sangem, Nallabelly, Duggonda, Narsampet and Rayaparthi.
3	Warangal (Urban)	Khazipet, Hasanparthy, Bheemdevarapally, Elkathurthy, Dharmasagar, Khila Warangal and Inavole.
4	Siddipet	Maddur, Kondapaka, Komaravelly, Siddipet, Cherial and Maddur
5	Yadadri	Aleru and Mothkur

The maximum water lift is 510 meters to irrigate the command areas. The project operational requirement is 484 MW of power and 1.4 billion KWh of electrical energy annually for pumping 38 TMCFT of Godavari water. This project is an inter river basin transfer link by feeding Godavari River water to Krishna River basin in Warangal and Nalgonda districts.

The minimum river water level in the river to pump the water in the non-monsoon / lean season is below 71 m MSL. Across the Godavari river, Sammakka Barrage with FRL at 85 m MSL is built to make water available to the pump house in all seasons.



The scheme is designed to lift the total 38 TMC water in 170 days by construction of lift pumping stations in three different phases. The water is lifted by constructing the intake pumping station on River Godavari and transported to higher elevation using the large diameter mild steel pipeline. The alignment of pipeline is very innovatively designed in such a way that all the old tanks build by Nizams and Kakatiyas for storage of water were linked. This avoided the issue of fresh land acquisition for the project and also helped to recharge and rejunivate the already available tanks which were abandoned. The water is stored in these intermediate tanks and then again lifted by pumping station located on other end of the tank. Such 18 numbers of old and new tanks are connected to transfer tthe water from river Godavari for development command in upland areas of 5 districts and 35 talukas/ mandals in the state of Telangana. The pipeline Diameter is ranging from 2.5 M to 3.0 M

The phase wise details about the pumping schemes are provided in the below table.

Sl. No.	Description	Phases			Total
		Phase-I	Phase-II	Phase-III	
1	No., of Pump Houses	4	7	9	**20**
2	Length of Pumping Main (Km)	138.5	196.40	145.19	**480.09**
3	Length of Tunnel (Km)	-	-	57.16	**57.16**
4	Formation / Improvements to the Tanks	2	8	8	**18**
5	Proposed Ayacut (Acres)	122700	193164	241790	**557654**

Sl. No.	Description	Phases			Total
		Phase-I	Phase-II	Phase-III	
1	Water to be lifted (TMC) 170 Days	5.18	7.25	25.75	38.18
2	Discharge (No of Pumps x Cumecs)	2 x 5 = 10 353 Cusecs	2 x 7 = 14 495 Cusecs	6 x 8.27 = 49.6 1752 Cusecs	73.6 2600 Cusecs
3	No., of Lifts	4 Nos	7 Nos	9 Nos	20 Nos
4	Static Head	268 m	470 m	510 m	
5	Power Requirement	56 MW	123.6 MW	304.4 MW	484 MW

The scheme comprises one pipe line of 2.50 m. dia., with two pumps to carry 10 Cumecs of water to irrigate 1.23 lakh acres with Intake point at Gangaram (V) to Station Ghanpur tank connecting en-route existing tanks Bheemghanpur, artificial Tank Pulkurthy and Improvements to existing Dharmasagar Tanks with 4 stages Pumping, covering a distance of 138.50 Kms

Salient features of Phase-I:

No. of stages	4			
Pipe Line Length	138.50Kms			
Dia of Pipe Line	2.50 meters			
No.of Pumps (each Pump House)	2	2	2	2
Rating of Each Pump in (MW)	8.5	8.5	6	3
Height of total Lift in (M)	269			
Water to be Lifted in Cumecs	10	10	10	10
Total Power Requirement (MW)	17	17	12	6
No. of hours running per day	24	24	24	24
No. of minimum days running per annum (Pumping will be carried out for more days as per water availability)	170			

Phase II of the Project :

The Phase-II is to lift 14 Cumecs of water from river Godavari near Gangaram (V), Eturnagaram (M), Warangal District with 7 Nos. of pumping stations connecting Intake near Gangaram (V), Bheemghanpur, Salivagu, Dharmasagar, Gandiramaram, Bommakur and R.S. Ghanpur Tanks, covering a distance of 196.40 Km.

List of Pump houses and Formation /Improvements to the Tanks

Pump House Locations		Formation/ Improvements to the Tanks	
1	Intake at Gangaram	1	Narsingapur (Improvement)
2	Bheemghanpur	2	R.S.Ghanpur (Improvement)
3	Salivagu	3	Ashwaraopally (Improvement)
4	Dharmasagar	4	Chittakodur (New)
5	R.S.Ghanpur	5	Gandiramaram (Improvement)
6	Gandiramaram	6	Bommakur (New)
7	Bommakur	7	Veldanda (Improvement)
		8	Tapaspally (New)

Salient features of Phase-II:

No. of stages	7						
Pipeline Length	196.40 Kms						
Dia of Pipe Line	2.50 Meters						
No.of Pumps (each Pump House)	2	2	2	2	2	2	2
Rating of Each Pump in (MW)	12.8	11.75	12.5	13	3.5	4	3.5
Total Lift in (M)	469						
Water to be Lifted in Cumecs	14	14	14	14	14	14	14
Total Power Requirement (MW)	25.6	23.5	25	26	7	8	7
No. of hours running per day	24	24	24	24	24	24	24
No. of minimum days running per annum (Pumping will be carried out for more days as per water availability)	170						

Phase III of the Project :

Phase-III is proposed to create an Irrigation Potential of 2,41,790 Acres in draught prone

upland areas of Warangal and Nalgonda Districts, by lifting of 49.56 Cumecs of water from Godavari River near Gangaram (V), Eturunagaram (M), Warangal District with pipelines and Tunnels.

List of Pump houses and Formation /Improvements to the Tanks:

Pump House Locations		Formation/ Improvements to the Tanks	
1	Intake at Gangaram	1	Nashkal Tank (New)
2	Ramappa	2	Palakurthy Tank (Improvement)
3	Ramappa Tunnel PH	3	Chennur Tank (Improvement)
4	Dharmasagar Tunnel PH	4	Jaffergadh Tank (Strengthening)
5	Dharmasagar	5	Nawabpet Tank (New)
6	R.S.Ghanpur	6	Laddunur (New)
7	R.S.Ghanpur Tunnel PH	7	Kannaboinagudem (New)
8	Gandiramaram	8	Maareddy
9	Bommakur		

Salient features of Phase-III:

No. of stages	9								
Pipeline Length	196.40 Kms								
Dia of Pipe Line	2.50 Meters								
No.of Pumps (each Pump House)	6	6	3	2	2	2	2	2	2
Rating of Each Pump in (MW)	16	10.8	31.7	5.5	6	7.86	3.5	5	7.5
Total Lift in (M)	469								
Water to be Lifted in Cumecs	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56
Total Power Requirement (MW)	96	65	95	11	12	15.7	7	10	15
No. of hours running per day	24	24	24	24	24	24	24	24	24
No. of minimum days running per annum (Pumping will be carried out for more days as per water availability)	170								

The Metallic Volute Pumps :

Considering the requirement of High flow and high head requirements there was need of specially designed pumps. Before this project was announced need for such special requirements of pumps never arose in India.

The metallic volute type pumps were proposed to handle large flow rates at higher head. Such types of pumps were earlier used successfully for similar projects like Yellow River Diversion project in China and Pumping project from Hover Dam on Colorado River for supply of drinking water to California in USA.

he Godavri project was innovatively designed by using metallic volute type pumps for the first time in the country by Kirloskar Brother Limited. In case of metallic volute pumps the volute casing of the pump is built with high quality steel fabrication and then embedded in concrete. The water is drawn into casing by hydraulically designed suction draft tube. The pump is driven by high voltage electric motor. The pump is installed in such a way that even at lower water level it is able to pump the water to the pipeline. The electric motor is installed on the floor above the maximum water level so even during high flood level in rainy season the motor remains dry and safe. The motor transmits power to pump shaft through long specially designed cardon shaft which is hollow from inside to achieve the higher strength and rigidity. In case of Godavari project the height of Motor floor is almost 24 meters which is very large. Such battery of pump sets are installed at each pumping stations to lift the total quantity of water from the river and pump it in to pipelines.

Due to use of such high technology pump in this project the total numbers of pumps were reduced considerably making this project more energy efficient and cost effective resulting in saving of huge cost on account of electricity consumption over many years. The operation of pumping system is also simple and reliable with need of almost zero spare parts.

The view of Metallic volute pump of 5 Cumecs flow with 130 M Head and driven by 8500 KW electric motor.

Development of Command Area :

After commissioning of this unique project in the year 2008 every year good amount of water is lifted from river Godavari which otherwise used to go to sea unitized. The year wise water lifted by this project from the Godavari river is shown in the following table.

Achievements :

Year wise quantum of water lifted (in TMC) from river Godavari	
Year	**Water in TMC**
2008	0.976
2009	1.054
2010	1.388
2011	1.904
2012	2.76
2013	1.52
2014	4.98
2015	7.30
2016	6.85
2017	7.93
2018 (Rabi)	3.17

Using the pumping stations and pipeline network the water is stored in various tanks and reservoirs in the command areas and this water is utilised for irrigation purpose during Khariff and Rabi seasons. From the following table it can be seen that during last few years the more and more Minor Irrigation tanks are being fed.

This project has benefitted immensely to provide necessary irrigation to this drought prone area which receives very scanty rainfall. The water table has been significantly increased benefiting to recharge various aquifers in the regions. The fertility of the soil has increased which has benefitted the farmers for higher yields of Khariff and rabbi crops. This projects has also the fulfilled the requirement of drinking water for the region which has improved the health of the citizens in the region.

Details of M.I. Tanks filled:

Sl.No.	Constituency	No.of Tanks			
		2014-15	2015-16	2016-17	2017-18
1	Husnabad	12	24	17	23
2	Huzurabad	1	2	3	3
3	R.S.Ghanpur	4	79	47	87
4	Wardhannapet	26	60	31	39
5	Palakurthy	0	19	26	39
7	Jangaon	0	40	46	94
8	Aleru	0	0	0	8
9	Gajwel	0	0	0	7
10	Warangal East	0	0	0	8
11	Warangal West	0	0	0	11
Total		**43**	**224**	**170**	**319**

Summary:

Considering its size and the engineering challenges involved in this project it can be considered as an engineering marvel. This is also one of the second highest lift irrigation project lifting Godavari water to almost 530 m height involving approx.500 MW of electricity. The project also involves laying of 480 kms long large 2.5 m diameter steel pipeline and 58 kms of tunnel to transport the irrigation water to upland command areas.

This unique project has helped to provide much needed irrigation water to 540,000 acres of drought prone area of Jangaon, Warangal, Karimnagar and Siddipet districts of Telengana. This project is also satisfying the requirement of safe and clean drinking water of this region which was otherwise suffering from very high fluoride content in the ground water.

After commissioning of the first phase in the year 2009 over the year more and more farmland were brought under irrigation. The project has played significant role in transforming the economy of the region by empowering thousands of farmers and making them Atmanirbahar.

There is need to build many such projects on river Godavari river so that thousands of liters of water flowing to sea is unitized to provide irrigation and drinking water to various parts of the states from which the river is flowing.

*****

Aao Nadi Ko Jaane - Report 03

Shri Vinod Bodhankar

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The Context to Frame the Study :

Aao Nadi Ko Jaane, come let us study our rivers, know our rivers, understand our rivers, resonate to our rivers, respect our rivers and protect them. Where they have been exploited, polluted and encroached upon by us, let us rejuvenate them. Let us plan this in great detail and build the people's movements and the institutions to accomplish this. In this team, let us count the participants and members of the team as ALL the population in the river basin. The people who hurt the river as well as the people who try to heal the river. Especially, the people who are indifferent to the river.

This is not a recent thought and feeling. Ever since we met Dr Vishwas Yevale, who started the Jala Dindi from Alandi to Pandharpur, in K1, K2 and K4 Kayaks, accompanied by CME Army Barges and Trucks to strengthen the land team, and the COEP students and boat-club life-guards and trainers in full measure; ever since we met Sandeep Joshi of SERI, Srushti Eco Research Institute, in the Jal Dindi Team; ever since we learned from Sandeep that the river is a multi-species intelligence, we have this vision and mission in the corner of our hearts and minds - that there will be Jana-Jagruti and Shrama-Jagruti at a massive scale, and that the people's will, the scientific guidance, the ecological sensitivity and the general populations's support would bring about a vast transformation in human attitudes towards the rivers and river basin ecological zones.

Dr Vishwas Yevale, our first river mentor. Jal Dindi is the Jal Wari - his inspiring gift to us

It has been a long journey, from Jala-Dindi to Ramnadi Swatchata Abhiyaan, to Vasundhara Swatchata Abhiyaan, with a stop over at the National Society for Clean Cities. The arrival into the national people's movement Jalbiradari was a natural evolution of deepening involvement with the rivers and the fate of the rivers, and the people and the water literacy of the people.

It was simultaneous, the deeper involvement with Jalbiradari under the mentorship of Dr Rajendrasingh and the involvement in Yashada and National Water Academy as an occasional speaker on People's Participation in River Protection.

As the years rolled by a deeper relationship with SERI took place. Fascinated by Sandeep's approach to the complexity of the River Basin - there were frequent brainstorming sessions on the field and at the SERI office. Foundational documents were generated which we now realize are ever so important to refer back to, even today. Vision and Mission Documents emerged - from Tisrey Swarajya, to the Bhikampura Declaration and from the Daula Declaration inclusive of the

Nadi Ki Paribhasha to the Citizens Paper on Concepts of Sustainable Development in a River Basin which I am going to refer to here. Today, after years of working on the field, from being on the team of Agrani River Rejuvenation to being co-founder and co-director of Sagarmitra, water has become more and more important to address. It is as though all the past were a preparation for the work of Aao Nadi Ko Jaane, within the wider mission of Indian Peninsular River Basin Council. At the same time Aao Nadi Ko jaane is also part of the wider mission of Bharat Punarnirman Abhiyan. All of this being a sub-set of Samanvayon ka Samanvay. This last is absolutely open-ended and embraces all.

In this rather long and meandering journey to relate to water and to embrace water and to protect water and river systems - some documents, as mentioned before, emerged from the natural urge to preserve the 'Research & Respond' type of studies and visualizations.

Today, through AAO NADI KO JAANE series of meetings online and offline, we have gathered the mentors, activists, experts, government officers, civil society organizations and networking specialists to forge together an all India river basins people's movement. This movement will compile and synergize the field-learning from robust ecological restoration Projects successfully undertaken and ongoing - in the Himalayan River Basins as well as the Peninsular River Basins regions.

The task of together merging and forging the Himalayan River Basin States and the Peninsular River Basin States with each other, especially around the actual field-work of protecting & rejuvenating the nearest river from source springs to confluence, ugam to sangam, is a challenging one. What could be the common theme which forges these states and river basin populations into river-protectors and river-rejuvenators - led by the highest minds in Science & Technology; Religion & Spirituality and also Administration, Politics & Governance ?

There are many threads, including livelihood issues, de-forestation; sand-mining; mono-culture crops and a hundred other aspects, situations, possibilities and problems within a river basin. In a way we realized, early on, that the river basin is a microcosm of planet earth, and that sustainability solutions for the planet earth could also be explored within the varied types of ecological zones, including the icebound and the desert ecologies. The river basin ecological zone took precedence, however, as a vast portion of the human population lives near rivers and coastlines. Under Sandeep Joshi's urgent invitations to the SERI office, three of us began to meet to study, for ourselves, the essentials of sustainable development with respect to a river basin. The resulting document is divided into 5 sections and I will be submitting a part of it in this month's report on Aao Nadi Ko Jaane. It is a core-document that has helped us to formulate our approaches, our awareness programs, our undertaken river rejuvenations and our initiatives in solid waste management with respect to keeping the rivers clean and resilient against an increasingly arbitrary and criminal assault of solid waste, on the river banks, river flow as well as the entire catchment area.

It is a document which is immensely relevant today and comprises of a 5 fold study of a river basin protection and rejuvenation approach. The document is "Citizens Paper on Concepts of Sustainable Development in River Basin". Between three introductory sections which place the context of the work before the reader, the Citizens Paper considers the River Rejuvenation in 5 aspects:

1. River Catchment Area Approach
2. Removal & Prevention of Encroachment
3. Controlling the Pollution of the Lakes and Rivers of India
4. Maintaining Ground Water Balance
5. River Culture and Society

In this month's ANKJ Report I will include only the 1st of the 5 aspects listed above. Every theme and concept, every hands on project learning is relevant to the entire work of the Indian

Peninsular and Himalayan River Basins Councils.

A Note of Remembrance and Gratitude:
(About my friend and river-ecology mentor - the Late Sandeep Joshi)
Sandeep Joshi. Ecologist extraordinaire. I met him during the second Jaladindi in 2003.

Preparation for the Jaldindi Pratishthan-COEP organized Mutha River Jal-Maitri Yatra 2009

Jaladindi is an annual Spiritual-Environmental Pilgrimage – an amazing journey of 450 km on kayaks through the Indrayani and Bhima Rivers. Linking itself with the ancient tradition of Waari – the annual 250 km long-walk by 10,00,000 Waarkaris, from Alandi (Center of Learning & Dnyanayoga) to Pandharpur (Center of Faith and Bhaktiyoga) – the Jaladindi has, since 2002, been spreading the message of Positive-Action in Health, Environment and Spirituality (Sakaaraatmak Swaasthya, Paryaavaran ani Adhyaatma) through its River-Rowing expeditions on Indrayani, Pavana, Bhima and several other rivers. I was a newcomer there.

Along with my first mentor in matters related to rivers, Dr.Vishwas Yevale, the founder of the Jaladindi, I met his friends and companions who included Babanrao Kachi, Dr. Vishram Dhole, Probir Sinha and Sandeep Joshi.

My first memory of Sandeep is seeing him knee deep in the waters of the Indrayani river taking a sample of the water and within a few minutes a mini labarotary water-testing was happening on the banks of the river, with juniors taking down results in structured formats and a ceaseless discussion on deep ecology, ecological consciousness and practical solutions to problems of water pollution ensued. I saw him speaking with equal passion and assertiveness with scientists, spiritual leaders, government officers, politicians, colleagues, peers, villagers and school students. My impression is of a new friend with feet firmly and practically on the ground, coming to grips with the rising threats of urbanization, industrialization, consumerism, ethical deterioration and the crisis of water pollution which is the inevitable and incremental result of all of these.

Volunteers during the Mutha Jal Maitri Yatra 2009.
Our 8th year with Dr Vishwas Yevale & Sandeep Joshi

It did not take long to recognize, in each other and friends from Vishwasanskruti Ashram like Narendra Chugh, fellow-travelers in the quest for innovative and powerful approaches to tackle the Individual and Global Environmental Crisis which looms locally and globally over our planet earth. In this company the confidence that solutions can be found, the readiness to put up Tan, Man, Dhan and Samay (Physical Presence & Effort, Involvement and Intellectual Investment, Wealth & Resources and Precious Personal Time) as investment in the exercise of one's personal and group duty to Mother Nature in Crisis – was ever present in thought, word and deed. My first river-mentor, Dr. Vishwas Yevale, taught me how a river

extends far far beyond the city we live in and is part of a much larger system of rivers – by simply taking us on a long rowing journey where we
could become an inextricable part of the life in and on the banks of the river – inclusive of flora and fauna and the people dependent on and interacting with the river.

Sandeep is my second river-mentor. He gave me an intelligible format in which to internalize the Jaladindi River-Rowing Expedition. After meeting my two mentors I began to speak of upstream and downstream issues on a river and then on different rivers of the entire Upper Bhima River Basin. I began to experience the 'mother-essence' of the river which Dr Vishwas spoke of and the 'multi-species intelligence' which gives resilience to the river eco-system which Sandeep spoke of. Jaladindi got us all together.

As the years progressed we all found our personal journeys and yet remained committed to the mother river and to Water in Her infinite and resilient giving-ness and in Her equally mysterious fragility. My third river-mentor is Narendra Chugh. From him I am still trying to learn how to do so much that one becomes a pillar in any team but to stay subtly far far away from even the shadow of taking credit for the team efforts.

In such wonderful river-company one comes across endless examples of projects which are explorations into solving the various aspects of water-pollution. Broadly categorized under Scientific-Engineering and Social-Engineering these explorations are bold initiatives which require out-of-the-box designing and implementation. It would take several volumes to write of all the innovations and projects encountered during the last dozen years in this river-companionship. One of the most, to me, astounding innovations I came across is the Green Bridge. How can I sum up the nature of this innovative technology? I try to recall Sandeep's words.

'Grafting a healthy and compatible eco-system to an unhealthy one'.

'Encouraging the remaining healthy cells in an organism to revive and revitalize – to create self-sufficient resilience'

'Reviving the multi-species intelligence of the water body'.

Contd.....

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जलसंवाद हे मासिक मालक व प्रकाशक डॉ. दत्ता देशकर यांनी
ऐ – २०१, व्यंकटेश मीराबेल अपार्टमेंटस,
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Know the Cost of Water

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Water Scarcity :

Humans for all their activities pump and consume Ground Water. In our country, this consumption is faster than the rate of natural replenishment of the aquifers (Aquifers means underground storage places of ground water) Groundwater consumption in India is not only the highest in the world, but it is also one of the fastest one. and hence Groundwater levels have been declining very speedily i.e. by an average of one meter per every three years. More than 100 cubic km of groundwater being disappearing for every 10 years. Recent Niti Ayog reports says that aquifers of all major cities of the country will dry within 05 years. CGWA is the regulatory authority for the ground water resources. It has divided India's 'water blocks' into four categories - safe, semi critical, critical, and over exploited - the last being those where annual replenishment is proving inadequate. Out of the 6,607 assessment units in the country, 1500 units have been categorized as 'over-exploited' resulting in falling Water levels in wells. A CGWA study of 14,346 wells showed 46 percent had lower levels of water than five years ago. If we see statewise, according to CGWA estimate, Apart from UP, the worst off states are Punjab, Haryana, Rajasthan, Delhi, Karnataka, Tamil Nadu, Andhra Pradesh and Telangana.

Similarly surface water levels are also falling, almost all the major rivers now have deficient basins. Reservoirs are similarly depleting, with water levels in 91 major ones currently at their lowest in a decade, barring current situation of heavy rainfall. The problem arises out of a combination of factors. "On the supply side, there is inadequate capacity of our water storage system, and on the other hand there is growth in demand due to increased population and industrialization." Even when it rains, the storage capacity isn't enough to capture it. According to an estimate by FAO, India's per capita water storage capacity is 200 kl, which is well below the world average of 900 kl per capita."

Adding to the problem is the pollution of water bodies - a 2014 Central Pollution Control Board (CPCB) report says 302 stretches across 275 rivers in India are polluted. Traditional water bodies such as ponds, tanks and lakes are in an abysmal state. According to a study by the National Water Resources Framework (NWRF), India's usable supply of water could fall short by 50 percent by 2030. Rains are increasingly proving insufficient in refurbishing water sources. India's total annual precipitation is around 4,000 BCM, of which only 1,123 BCM is being utilised: 690 BCM being added to surface water and 433 BCM to groundwater. Barring a couple of years, there has been deficient rainfall in ten years. Water is finite and we have to be careful, Also most of the water comes down as heavy downpour of a few hours rather than steady and continuous rainfall continuing for days, as a result, water leads to runoff or water logging only, rather than percolation into the aquifers or maintaining soil moisture. Unaccounted for Water (UFW) in most cities ranges from 30-50 per cent, whereas in developed countries UFW typically ranges from 5-15 per cent. "Absence of adequate metering, network mapping, scientific monitoring system and lack of consciousness have resulted in large scale water wastage and theft.

Whom to Blame?

The blame lies with both agriculture and

industry - as well as with government policies that encourage reckless water consumption. Between 1951 and 2009, the number of electric pumpsets in use rose from 26,000 to 16.2 million, and diesel pump sets from 83,000 to 9.2 million. States like Andhra Pradesh, Karnataka, Punjab and Tamil Nadu - all groundwater stressed - are known to provide free power to farmers. "Farmers being an important vote bank, politicians shy away from discussing the subsidies they are being given," Rs 24,000 crore is the subsidy given to agricultural power."Agriculture should get subsidies, but these should be properly targeted." Even states that charge farmers do so on a pro rata basis (the HP of the installed pump set) and not on the basis of actual power consumption. "Those farming land where groundwater can be easily tapped extract as much water as possible," "Those who have to install powerful pump sets because the groundwater on their land lies much deeper, pay more for power, while they may not be drawing that much water." Also a new threat is the growing popularity of solar pumps in states like Gujarat, which need no grid power at all.

The problem is that water is seen largely as a free or low-cost resource - with little effort being made by either the Central or state governments to capture its cost or price it correctly. Besides, water is largely under the control of states - and few states believe water is a finite resource that needs to be carefully managed. But if governments have been callous about the economics and usage of water, so have the consumers - in every sector. And that is leading to a rapid depletion of water resources in the country. With increased urbanization and industrialization, more and more water would go into cities, power and industries, and this will make water a more stretched resource. Mis-management of water resources in India will lead to many more conflicts.

A major reason for the rampant misuse of water is that it comes cheap. The price varies widely between states - water being a state subject. Charges range from Rs 10 per cu m in Gujarat and Rs 15-60 per cu m in Tamil Nadu to as little as 33 paise per cu m in Andhra Pradesh, if taken from natural sources, and a little more if it comes from reservoirs or canals. With high capital and running expenses of major and minor irrigation projects, the government is barely making any money through water tariffs. It is necessary for state governments to evolve a policy for periodic rationalization and revision of water rates so that the revenue generated by the irrigation sector is able to meet the cost of operation and maintenance. In many States/UTs, no revisions in the water rates have been carried out over several decades. As per CWC's 2010 findings, Goa had not revised its rates in 22 Years, Tamil Nadu in 23 years; Kerala in 36 years; West Bengal in 33 years and Daman & Diu in 30 years. Even in case of the States which had revised their water rates during the decades (1991-2000), the gap between current and previous revisions had been prominently large. Andhra Pradesh in 14 years; Assam in 10 years; Haryana in 10 years; Karnataka in 10 years; Rajasthan in 11 years; Uttarakhand in 15 Years and Uttar Pradesh in 15 years. The results are evident. While the capital expenditure on the irrigation projects have gradually increased year on year, the gap between gross receipts on account of water charges and working expenses is gradually widening across the country. "Water tariff collected from users goes to general treasury or consolidated funds. Funds for operation and management come from general budget. There is no structural link between the two.

Let us see, on what cost water depends upon? What is involved in costing of Water?

The principle of water pricing and its various payment systems raise numerous questions and are of great importance for all water users, especially since prices are generally on the increase and becoming a significant part of household budgets, given the relative scarcity of the resource and its frequent pollution. Before we examine the various water pricing and invoicing systems, and in particular the various types of social and solidarity pricing policies, or aid for the most deprived, we need to have a closer look at the

justification and components of the price of water, i.e. what users are billed for, who decides it and what is meant by affordable water price.

Water is invoiced to users in a variety of ways but practically everywhere and at extremely variable prices, some being very low, especially in certain rural or poor areas, while others are very high, in particular where complex treatments or facilities are required. To an increasing extent, the price of wastewater treatment, where this is done by the municipalities, is added to the previous price and is often similar. But water hasn't always been charged for everywhere. At an earlier period, especially when the water of lakes and rivers was relatively pure and required practically no treatment, water was often totally or almost free, except in cities where water collection and distribution networks had to be built. Moreover, a few rare countries such as Ireland and South Africa supply all or part of the water free of charge, as it is financed by the state through taxation.

Why invoice water ?

Water, as a natural resource which is indispensable to everyone's life, is of course a free commodity. However, its collection, treatment and distribution, as well as the treatment of wastewater before it is returned to nature, require more or less significant technical, financial and human resources which are sometimes complex and have a cost which needs to be paid for one way or another. Thus, we must not mix up water resources (rivers, groundwater, etc.), which are free public resources, with public water services, which consist in collecting this drinking water and supplying it to households (individual connection), or as close as possible to everyone (community wells, public standpipes, etc.), and have a cost. Though primarily we can say almost everyone is concerned with water pricing. However, this pricing and invoicing systems must be well-suited and affordable, especially for the most deprived. There are numerous such systems, as we will see. Consumers in India are divided into two categories – domestic and non-domestic consumers. Industries and businesses fall in the latter category; they also pay higher charges than government and semi-government institutions.

What does the price of water depend on? Who sets it? How is it invoiced and collected?

The price of water varies significantly from one country to the next, and even from one region or municipality to the next. This variation depends to a minor extent on the public, private, mixed or community nature of the service, but mainly on the conditions involved in providing the resource (water collection, quality, distance, cost and age of the facilities, etc.) and complexity of treatment and distribution systems (simple or non-existent network, service provided to users, simplified invoicing, etc.). Thus, the cost of water pulled up in a bucket from a well will be totally different from that of water produced in a modern treatment plant using surface water which is more or less polluted by agricultural and industrial activities. Likewise, as water is a local commodity whose long-distance transport is costly, its price essentially depends on the geographical, geological and economic conditions prevailing in the communities where it is produced and which set its price.The price of water can thus range from a few cents to €5 per cubic metre, or even more in rare cases.

It is necessary to distinguish between the cost of water, which corresponds to the real cost of its production and distribution for the firm which produces it and the price of water which is the part of this cost invoiced to users, which is most often higher, but which is sometimes low or even insufficient to ensure the quality, maintenance and renewal of facilities. Some of the charges applicable to industries are listed below: Water connection charge (one-time-only); Sewerage connection charge (one-time-only); Security deposits for connection and sewerage separately (one-time-only); Fixed/minimum charges; Volumetric charges (according to the diameter of the pipeline); Meter charges; and, Sewerage charge (a percentage of the total water bill).Incentives for conservation and pollution control. Firms may receive discounts on fixed prices for implementing water conservation measures.

Tax rebates for early payment of water bills are also given. In the state of Maharashtra, for instance, a reduction of 20 percent demand by a firm guarantees it a 20 percent reduction in tariffs.

The real cost of water

It comprises construction costs, amortization expenses and provisions for the replacement of all water collection, treatment and distribution facilities, as well as the cost of treatment, operation and maintenance, including that of the pipe network, administrative and customer management services (when they exist), and resource preservation costs. On top of those costs, taxes of various kinds, of sometimes significant amounts, are most often charged by local authorities or the state.

In regions where there are also sanitation and wastewater treatment services, their cost are often added. Experts are often been divided between two schools of thought : according to international experts, that of "full cost recovery" and that of "sustainable cost recovery". Full cost recovery consists in getting users to pay for the total cost of water, as detailed above. This is what large international institutions such as BIRD used to advocate over the past decades, including in developing countries, which seemed to make sense to ensure the proper operation and sustainability of the facilities, but which led to several resounding failures. How can populations, which are often deprived, be asked to fully finance in the space of a few years, what the populations of most developed countries managed to achieve in nearly a hundred years with the help of significant external aid or financing? Therefore, the "sustainable cost recovery" model has imposed itself in most cases. While experts are divided on the components that need to be taken into consideration – which may vary according to situations – most of them agree that the price to be paid should at least be equal to the operating, treatment, and maintenance costs, while construction and amortization expenses, or at least the largest part of those costs, should be covered by grants and external financing from the state and/or international bodies.

Solution lies in water policy?

The availability of source, technology, institutional mechanism, commercial structure of the water utility, even terrain. "Srinagar has one of the lowest costs of water as the distribution system predominantly runs on gravity, whereas in Jammu, cost is very high as the distribution system heavily depends on ground water lifting." Bangalore, too, being at an elevated level from its main water source, the Kaveri river 100 km away, depends on pumping water against gravity for water supply, increasing the power requirement and cost manifold. Water being a state subject, there is also no umbrella agency to control its management. There is a National Water Policy - last updated in 2012 - but much of it remains unimplemented. "The biggest stress factor for water in India is the lack of governance,". "There is no democratic water allocation mechanism. It's all ad hoc and opaque." Each state has its own water policy. "Water allocation is done by the states,". "Each state has its own method of doing so, which is often not spelt out clearly."India needs to implement its National Water Policy, which grades water access.First there must be water for drinking and livestock, then for irrigation and thereafter for industries.There is a constant demand by neo-liberal economists to treat water as an economic good and price water in a way that the full capital investment (including certain return on investment) plus the operation and maintenance cost comes back to the system. Pricing should similarly be determined by quantity consumed. Graded tariff is more socially just. A certain amount of water required to sustain livelihood should be supplied at a minimum price or even given away free.In countries like South Africa, such lifeline water is not charged at all. But beyond that there should be what is called volumetric supply and pricing - the more consumed, the higher the charge."

This has been implemented successfully at a few places in India as well, notably at Ozar, in Maharashtra's Nashik district, at the tail end of Waghad Irrigation Project, by three water users' associations (WUAs), but needs to be replicated

nationally. The water policy should also remove all ambiguities about allocation. "Existing water laws focus more on regulating and managing use,". "Also, environmental laws focus on conservation of water. But allocation is currently something for users to negotiate as best they can."Agronomical practices and power subsidies have major repercussions on water use. Practices like drip irrigation should be encouraged." Equally, subsidies should be reconsidered. "Subsidies should be directed towards water efficient irrigation infrastructure, integrated water resources management interventions such as watershed management and energy efficient pumps,". The latest CGWA guidelines, would also make a major difference. They suggest making NOCs from the CGWA mandatory for all industries. And in over-exploited blocks, the guidelines further propose making all industries recycle and reuse their waste water, withdrawing of fresh water being allowed only if groundwater recharge has been sufficient. Funds to extend irrigation and augment groundwater recharge are available, but they have to be utilised with care.

However, irrigated area in the country has been decreasing rather than increasing, despite the crores allocated to building dams and canals in every Budget, Union and states. The task is indeed formidable, but not impossible. If a desert state like Israel can turn itself into a green oasis, with innovative policies (see Israel's Solutions), so can India.

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Jeevitnadi – A movement and Our learnings

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When there is a question thrown on me, – "what do you do?" I say, "I work for River revival!"There is a peculiar expression on a person's face, which indirectly asks, "What is that?" But openly they say, "oh! Is it? Wow! Really? Do you clean the rivers? Rivers are so dirty where we stay! Do you have any connection in this part of town that cleans the rivers? May be I can call him / her and ask her to visit our location. Or else, can you come here?

Initially these questions and queries really used to bother me, but not anymore! When we started working on rivers, we always thought that Urbans are totally disconnected with the river. But now our experience says something different.

I grew up in a small village on the banks of Krishna River. I learnt swimming at about an age of 7 in the river Krishna. My uncles taught me to swim. Virtually every body in our village knew how to swim. During summers, we used to go fetching drinking water from the water holes in the riverbed. (Just imagine water was swimmable and drinkable not many years ago) When I started working on rivers, I understood what these water holes mean in a river ecosystem. But it took me to reach 50 years of age to understand the meaning of these water holes. My Nani and her friends knew every water hole in the river bed and they used to dig them with small stick or something to get water. The water used to gush out and used to be so sweet and refreshing! The taste still lingers on my buds with all those lovely memories of river, Nani, her friends and my friends who used to be always on the river. Memories of Krishna River during summers and monsoons are still fresh in my mind where most of my day used to be spent other than school hours. We never used to have projects or homework like today. Nature around was our homework and our projects which not for submission but to feel and learn.

The life takes lot of twists and turns. I came to Pune for my college studies and left Pune city after marriage. I moved to different places within and outside India due to my husband's job. I was destined to come back to Pune after few years when my husband started a business. While he was busy looking for works, I joined my college friend to start an inclusive school for small children. The concept of an inclusive school around 1987-1988 was very new and people would not even understand meaning of inclusive schools. Gradually the school started growing and so did business of my husband. There was more need to give him a helping hand in his business, so I left going to school which I used to love so much and entered into a line which was very new to me. - Designing Interiors. I started liking it slowly, I also completed Interior Designer's course and before I realized I was into business doing Interiors. I used to love designing spaces. Especially the kitchens were my favourites than the office cubicles. I also used to love creating open spaces too. After running successful projects in Interiors over 14 years, I wanted to do something different but more in the field of environment. I came across a unique course run by Ecological Society Pune, an inclusive post grad diploma in" Sustainable Management of Natural Resources And Nature Conservation " This actually was an eye opener for me. In about 2 years, I wound up my business by completing ongoing projects. I knew now, my future is going to be working for the environment. This was a total 180

degree shift. In Interiors, there was always wastage of material, tiles, cement, fittings and what not. Somehow it was bothering me deep inside. Natural resource management actually gives a dimension of conserving everything and restoring back the disturbed ecosystem. This was something of a revelation to me. Ecological Society later gave me a good opportunity to manage a unique project funded by Global forest watch in catchment areas of rivers of Pune. This was like hands on experience for me on what I learnt. After every one finishes this course, we all literally become restless souls. Initial years go in trying to come over this restlessness and what we can or should do. While doing the project for Global Forest watch, this was constantly pricking me, after this, what next? Just before this project we also had lost our beloved Guru- Prakash Gole who had taught us and made us restless about surrounding environment. The situation of environment all through the world is really pathetic. You understand that lot of things are going wrong around you and you get a growing restlessness," The question keeps bothering you," What can I do?'

During same time one of our Alumna sent an email to all students of "Ecological Society". He wanted to celebrate his son's 1st birthday at " Mula Mutha Sanctuary" situated in Yerawada. Gole Sir always had special affinity for this place. About 20-25 of us jumped at the idea and reached the sanctuary. Niranjan with his low and steady voice simply announced, " I want to make a promise to my 1 year old in front of you all, that I will take " Prithvi" (his son's name) to swim in the same river when he becomes 15 years of age. " We all were stunned. We knew this is impossible. Swimming in those rivers is a suicide. But his sincerity touched us.

That probably was a triggering point for me too. River was always close to my heart from my childhood. After all my name also means River. Anyways, I knew this is what I wish to do henceforth. It was our initial meeting, mostly getting introduced to each other.

But we all decided to meet again next week. Venue was Sambhaji Park on J M Rd. This is one of our most important learning from our Guru! He always used to say, if you want to work with public and for public, gather in public places. Sitting in office will not work. So we started meeting in Sambhaji park, a centre of town and a public place. We started meeting regularly every Tuesday. Till today, we do not have office space. We meet on river stretches or a in a temple on the bank if it is too hot or raining.

Sometimes, we would also meet at our Parent Organization's office during Monsoons, - Ecological Society, Pune. The weekly meetings continued. Every week after meeting, I would collect all email Id's, keep MOM and share with all for next week. Every meeting some issue on river used to be raised. So, We started organizing different sessions with experts in the field. Every meeting and dialogue with experts opened new doors. Most of our meetings with experts would always happen on banks from the day we started.

When you are physically and mentally close to a problem, you start getting new insights. Meetings and learning with different experts – Ecological, Geography, Archaeology, Biotechnology, Green Chemistry, Hydro geology opened new dimensions and Tuesday's with River continued for over a year.

During all this, I had started realizing that river revival is not going to be an easy task. It is multi level, multidimensional and multi fold, in short very complex. We can not just do a face lift to a patient in ICU, but we need to find a cause why the patient has to be kept in ICU. I firmly believe, when we look at the river the site is depressing - the rivers are murky, there is a solid waste in rivers, when you go close you push back due to the foul smell. But these are all the symptoms of a dying rivers. Then it is like a doctor who wishes to cure the patient not bothering what the patient looks like or what he is wearing !

So what is the cause of our dying rivers? Its an open truth, that we urbanites are the biggest polluters, extractors of this beautiful planet for our greed's under the polished name of " My Life style". Slowly the journey was becoming clear to me. If we are the cause of dying rivers, then we better be responsible for rectifying our own mistakes. The road map was slowly opening in front of me. The journey forward was clear to me. One Vision- Revival of Rivers, One Mission – Revival of Rivers & One Goal- Revival of Rivers.

So,What is a River?

A German Poet, Novelist and Painter, Hermann Hesse, describes her so beautifully.

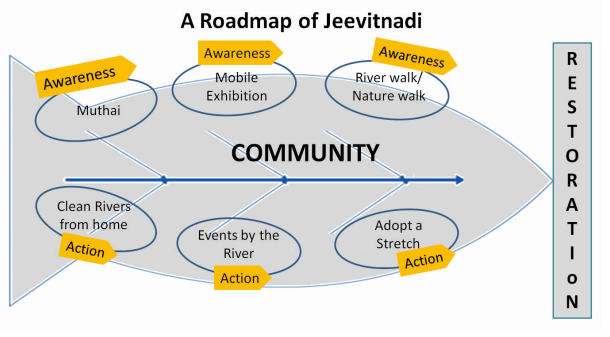
"Have you also learned that secret from the river; that there is no such thing as time?" That the river is everywhere at the same time, at the source and at the mouth, at the waterfall, at the ferry, at the current, in the ocean and in the mountains, everywhere and that the present only exists for it, not the shadow of the past nor the shadow of the future."

For all of us, "The river warriors", River is not just water flowing between two banks. She is a continuum of a flow, she is Eternal. History tells us that all civilizations flourished because there was a river there. Civilization doomed when rivers dried. The reality has not changed even today. We exist because she is there. She is a natural phenomena of Nature, supplying nutrients, minerals while she flows & taking the excess material forward, giving life, supporting life, producing life. She also balances salinity of seas and oceans which create our monsoons, an integral part of Hydrological cycle. On surface she flows by gravity and subsurface by water table. She is an enormous wealth of water. She creates a wind channel and controls temperature. An asset which cannot be ignored even for our selfish reasons. How many of us have thought through all those and many more unconditional services which she gives? Like our mother, we have always taken her for granted. This is the root cause why our rivers are in horrible state. We do not know our mother well. I realized that this understanding is totally missing in us. If River needs to be restored, one must understand her. Treat her with respect, with love. She is a "Living River"

So if you wish to restore her, one must consider the whole watershed of the River, which includes her tributaries, streams, springs, natural storm drains, her base flows and her flood plains, her wetlands and her riparian zones, her pools, riffles and cascades, her capacity to erode rocks to make them porous for ground water recharge. Her hyporheic zones and her recharge and discharge areas.

If this needs to be understood, we need to design programs in such a way that her ecosystem is understood in a short time. Most importantly a lost connection with our Rivers needs to be established.

So a Road Map towards Restoration was designed. Case-studies all around the world suggest that "River revival is not possible without participation of citizens". And decision was done to work with people for River.



Involving citizens in various activities to empathize with the river and its current situation

" Muthai River Walk" – Our 1st Signature program- Borrowing from the concept of Heritage Walk, this walk focuses on Mutha river of Pune. Mutha+ Aai = Muthai. Mutha is name of river, " Aai in Marathi is mother". The initial ice breaker happens when one understands" River does not flow through the city but Pune is settled because this River existed. The story of River is woven beautifully through Archeology, Historical evidences, ecology, and current transformations. This is a unique program which centers around River and trying to link the lost connection. Now it has become an integral part of schools & college curriculums. Corporates take River walk under CSR.

"Mobile River Exhibition"- Our 2nd signature program. If Mohammad can not come to mountain, Mountain must go to Mohammad. "Story of a River" in picture formats and "You tube video is created. We go to schools, colleges, Corporates with this exhibition which is self explanatory. You tube videos are shared on social media.

" Muthai River Festival " The 3rd Signature Program. India is a festive country. So having a festival of River on India River Day, we started a week's celebration to celebrate River since 2015. It is one of its kind festival in India. This is an annual event. All the activities in this festival are designed to involve people of various ages and various walks of life. Every year a different theme is created. All activities planned are celebrated on the banks. Respect the Code Red (Awareness on HFL - red and blue lines) Flora Trails, bird count and Mutha bird watch trail, paint the River, Click the River, Trek to the source are some of the activities conducted so far. 'Conceptual Riverfront Design Competition' for architecture students was a hit where colleges from all over India participated.

Spread awareness amongst citizens about the river issues and remedies for river conservation

"Toxin free life style" our 4th Signature Program. During our exploration with different scientists, we came across a research done by a Sr. retired scientist Dr. Pramod Moghe at National Chemical laboratory about 30 years ago. The revelation was mind blogging. Every day, each person uses average 40gms of toxic chemicals through personal and household hygiene products.

So, If 70% sewage is from domestic sector in most of the rivers, then we can stop this at source by using biodegradable and natural products, and by having a transition in lifestyle. This proved to be a low hanging fruit. Specially more during COVID period. " Clean your rivers 60-70% from your own homes.

And, "Toxin free Life style" workshops started happening. We got immediate response from colleges, environment departments & Corporates for orientation. Faculties started taking these workshops. They have started undergoing "Train the Trainers" program. University like Symbiosis is creating new entrepreneurs by introducing this in curricula.

Our 5th Signature program – "Adopt A stretch" is an outcome of Muthai River Walks. After the River Walk, people started realizing that they themselves are equally to blame for state of

Take the Challenge - Clean 60-70 % River from your own homes

rivers. "What should I do? This question brought the next successful program "Adopt A stretch" This program is our attempt to bring people to the river, involve them in the work. Idea is to create a group, adopt a river stretch for a period of one year. " One hour for River" work there consistently, clean the river bank, check sources of pollution, assess measures for prevention, study human impacts, observe and document biodiversity, record changes and probable causes. Many such groups working on various stretches will have significant positive impact on the status of the river and our knowledge of the river.

This program lead us to create Citizen Science groups at stretches. Considering this need, Jeevitnadi has taken initiative in creating Citizen Science groups by training common citizens and engaging them in research related work in many areas. Once trained, the responsibility for different tasks is taken by group members based on their skill sets and they undertake activities such as identifying research questions, performing experiments, mapping of flora and fauna, collecting and analysing data, photo documentations, interpreting results etc..Most importantly, these activities are carried out through methodical observations and validating from experts in the field. With minimum involvement of professional scientists as they are required only for validation and guiding a right path. The data and documentations are verified by the experts in the respective fields from time to time and are going to be very useful during river restoration at different locations along the river.

The concept of Citizen Science groups revolves around inclusion, collaboration and community engagement. Jeevitnadi with the help of these Citizen Science groups play a very important role in creating this resource for restoration of rivers in Pune city.

Now Our next challenging requirement is designing of syllabus based on the river. Schools or Colleges have very little understanding of this subject as for knowing about, "Where my water comes from and where does my water go" River connects various ecosystems and its study is truly an interdisciplinary field. Jeevitnadi team is under process of designing a syllabus which will evolve gradually and students will learn various ecosystems, interconnections through river systems. Now "Yashada", an Institute which creates different training programs for Rural & Urban Govt officials has started taking sessions on River Ecosystem – Under Disaster Management & Sustainability.

Collaborate: Team-up with various other organizations including Schools, Charitable Trusts, Corporate Social Responsibility Trusts, Ecology Expert Organizations, education institutes, engineering colleges, design institutes, research institutes and Government bodies to achieve the objectives of this project.

Our learning during this whole journey:

People in urban areas

- Are not indifferent to their rivers
- They wish to do "something"

Only they do not know how and where to start. I think River warriors like me became the means to bring together good intentions in the society & convert it into meaningful action towards river conservation.

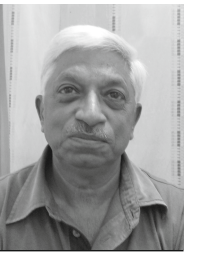
"We do not inherit earth from our ancestors,
We borrow it from our children"
Let's give our children what is rightfully theirs'
Let us join hands to revive our rivers for all living beings on our planet.

*****

Organization- WOTR

(Watershed Orgaization Trust)

Shri Vinod Hande - (M) : 9423677795



WOTR (Watershed Orgaization Trust) is established in 1993 with head quarter in Pune to support the Indo-German Watershed Development Program. It is non-profit organization. The principle of WOTR is to reduce rural poverty by organizing communities to generate the watershed, landscape and ecosystem. WOTR has supported and carried out development work in over 3754 villages across nine Indian states- Maharashtra, Telangana, Andhra Pradesh, Madhya Pradesh, Rajsathan, Jharkhand, Odisha, Chhattisgarh and Bihar with total beneficiaries over 4 million people till date.

building the community's resilience to climate change. It is a globally recognized organization dedicated to transforming lives of millions across India and support provided to projects in Somaliland, Kenya, Tanzania and Malawi. Sh. Prakash Keskar is Executive Director of WOTR.

To achieve goal WOTR works in following seven areas. They are,

- Ecosystems-Promoting conservation, regeneration and the judicious use of all the natural resources like land, water, vegetation and animals for sustainable human development.
- Climate- Building the resilience of rural

The goal of WOTR to ensure food, water, livelihood and income security together with a growing quality of life to vulnerable and disadvantaged communities on a sustainable equitable basis. WOTR tackles the key causes of rural poverty by rejuvenating ecosystem and communities to respond to the effects of climate change by adopting new and adaptive technologies.

- Water- Mobilizing communities for integrated water resource management and initiatives for improving efficiency of water use in

agriculture.

- Agriculture – promoting climate resilient agriculture practices to help farmers to reduce the risk of climate change, reduce the cost of cultivation, increase productivity.
- Livelihoods - Supporting rural livelihood by building skill about diversifying incomes to reduce dependence on agriculture.
- Gender- Equal participation of men and women by empowering women socially, financially and emotionally.
- Health, Nutrition and sanitation- Enabling good health and sanitation for the members of community through preventive medical care and nutritional food.

To talk about the impact or achievement since it's establishment in 1993 WOTR has restored 8913 sq.km. degraded land and it's schemes have directly or indirectly benefited 1.4 million people and over 4 million people across the country. From 63 countries 419116 people have participated in training program developed by organization.

Today WOTR is engaged in several sectors like,

- Integrated Watershed Development/Ecosystem Management.
- Integrated Water Resource Management(IWRM).
- Climate Change Adoption.
- Capacity Building and Training.
- Sustainable Agriculture and Integrated farming System.
- Agro Metrology.
- Biodiversity. Etc.

WOTR was the knowledge partner of "Satyameya Jayate Water Cup 2016". As knowledge partner WOTR was involved in designing and providing technical and leadership training for villagers. WOTR also played a crucial role in designing the assessment parameters and process for deciding the winner of the contest. 116 villages across three blocks–Koregaon, Ambejogai and Warud of Maharashtra competed for the first Satyameya Jayate Water Cup 2016 to make their village water sufficient. The total water storage created by the competing villages was 1368 crore liters. 2016 cup was awarded to five villages-Velu and Jaigaon of Koregaon-satara, Khapartone and Radi Tanda of Ambejogai –Beed and Wathoda of Warud- Amravati.

As mentioned earlier WOTR currently working in seven states in the country. Figures of Sept.2020 show that WOTR has worked in 3754 villages and has cumulatively impacted 3.8 million people since 1993. These figures covers areas of project implementation, training and capacity building.

Work in Maharashtra

WOTR started operating in 1993 from Maharashtra's Ahmednagar district. Today they are working in 12 districts- Ahmednagar, Aurangabad, Amaravati, Beed, Dhule, Jalna, Nasik, Pune, Raigarh, Satara, Wardha & Yevatmal. WOTR constructed a check dam in Tamabati village in Raigad dist.

Number of ongoing projects in Maharashtra

Ongoing Projects	Number
● Watershed Development Projects	12
● Community Development Projects	2
● Water Stewardship Initiative	1
● Climate-Resilient Agriculture Projects	4
● Water Management Projects	6
● Livelihoods Projects	4
● Health, Nutrition and Sanitation Projects	5
● Gender & Women Empowerment Projects	4
● Action Research Projects by WOTR Centre for Resilience Studies	6
● Action Research Projects by WOTR Centre for Resilience Studies	1

About one of such project farmer from Chincholi village of block Parner dist. Ahmednagar narrated story. He owns 2 acres and 10 gunthas of land. They were cultivating two crops a year such as millet, moong and fodder crops in the kharif season. Jowar and maize in rabi season. By January–February their well run dry and they could not cultivate any crop in summer. This condition continued till May 2017. He then excavated and constructed a farm pond in his field. cost of which was Rs.76000/-. Out of which grant of Rs.25000/- from WOTR helped him investment towards water harvesting structure. Water storage capacity of his farm pond is about 6.5 lakh liters which helped him to irrigate land to provide green fodder to his cross bred cows and became a dairy farmer.

Out come of projects in Maharashtra,

• Soil and water conservation works carried out on 4,911 ha of land.

• 496 drip irrigation units and 773 sprinkler units installed.

• 890 crop demos conducted in Maharashtra and 1,448 farmers adopted Systematic Crop Intensification (SCI).

• Under the agro-meteorology initiative to help climate-resilient agriculture, 10,13,721 advisories were sent to 13,455 farmers through mobile SMS.

• A total of 5,368 soil health cards were distributed.

• 27,340 people attended training and capacity building activities.

• 58 health camps benefitted 4,972 people etc.

Work in Madhya Pradesh

WOTR started work in Madhya Pradesh in 2006 and implemented projects pertaining to Watershed Development, Climate Change Adaption, Nutrition and Child Growth Monitoring and livelihoods. Organization currently active in nine districts and they are Damoh, mandla, Dindori, Seoni, Chhindwara, Anuppur, Hoshangabad, Betul and Sehor.

Ongoing Projects

• Integrated Watershed Management Program (IWMP) in Mandla district.

• Natural Resource Management and Improving Sustainable Livelihood Opportunities in 8 villages of Chhindwara district.

• Nutrition and Education Project for the children in the age group of 0-5 years in 11 villages of Anuppur district.

• Kanha Pench Corridor Climate Adaptation Project in 24 villages of Seoni .

• NABARD Watershed Development Project in Mukhas and Kinha villages of Mandla district.

• Watershed Management Programme in Chhindwara, Mandla and Anuppur districts.

Ground report-

Dumari Singh belongs to Banar village of Mandala dist. of Madhya Pradesh. Singh is one of those farmers who had migrated from village for livelihood despite having 2.5 acre of land. Prior to 2012 his earning was Rs.1000/- a month during kharif season due to poor soil quality in his farm. In 2012 WOTR took up watershed development project in Banar, after 2016 his average earning rose to Rs.3000/- per month during kharif and about Rs.2000/- in rabi. Dumari Singh is thankful to WOTR for their support . Now he can grow paddy, kodokutki and arhar in his field.

Out come of the projects in Madhya Pradesh –

• 1,416.03 ha of land treated under soil and water conservation.

• 124 minor and 30 major structures.

• 183 sprinkler units installed for efficient water use.

• 4,314 people trained in different skills to boost livelihood and reduce poverty.

• WOTR was the knowledge partner for the SLACC (Sustainable livelihood & Adaption to Climate Change) project, implemented in 100 villages of Sheopur and Mandla districts.

Work in Rajasthan

WOTR started its operation in Rajasthan in 2008. Since then they have covered 38 villages in the four districts of Barmer, Dungarpur, Pratapgarh and Udaipur.

Ongoing Projects

• Participatory Natural Resource Management along with Watershed Development in the tribal belt of south Rajasthan.

• Livelihood project in Karauli.

In Rajasthan WOTR set up a solar drinking water system in the village of Modwa in Udaipur. Earlier main source of water was an old well with crumbling walls and steps for drawing water. The steps were small rock hanging from well walls and slippery and were leading to accidents. To reduce the risk of accidents WOTR solved this problem by setting up fully automatic solar operated motor pump in 2016. Now the water in the tank fills up during the day and is distributed through taps thus providing a safe and healthy source of drinking water without the risk accidents.

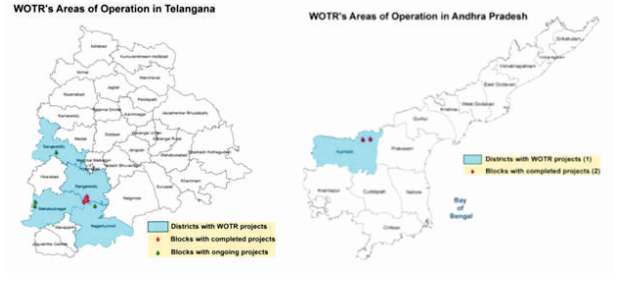
Out come of the projects in Rajasthan –

• 15 minor structures built and drip irrigation being promoted.

• 185 people benefitted from drinking water interventions.

• 2,875 days of labour days generated.

• 729 persons were provided training in areas such as making organic formulations, livestock management and livelihood activities like backyard poultry farming.



Work in Telangana and Andhra Pradesh –

WOTR started work in the undivided state of Andhra Pradesh in 2002. Since then it has covered 10 villages in Kurnool district and 28 villages in Sangareddy, Ranga Reddy, Nagarkurnool and Mahbubnagar of Telangana districts.

Out come of the work

• Soil and water conservation done in 7,344.64 ha.

• Under agro-meteorology initiative 3,556 advisories sent to 623 farmers.

• 431 minor and 3 major structures built.

• 1,300 soil health cards distributed to farmers.

• 163 farmers to adopt climate-resilient agriculture practices.

• 540 people trained in poultry, goat farming and general stores/kiranas

Odisha

WOTR works in 108 villages of Gunupur and Padampur block of Raighad dist., Digapohandi, Chikiti & Purshottam block of Ganjam dist. and Gumma block of Gajapati dist. In addition WOTR has supported NGO in implementing watershed projects in 118 villages of Gajapati district covering area of 25773 hectares impacting 29256 people.

Jharkhand –

WOTR is working in Jharkhand to reduce poverty through integrated watershed development and sustainable livelihood since 2010. As on date WOTR is giving it's services in 226 villages of Khunti, Gumla and Giridih dist.

Water budgeting -

It is estimated that many Indian cities will run out of water both surface and ground by 2040 owing to demand by rising population and mismanagement of water resources. India

accounts for around 4% of the world's water resources and 17% of the world population resulting in a huge imbalance.

Water budgeting is a unique approach towards ensuring optimum, equitable and most efficient use of water. This involves understanding of water availability, community's existing need and requirement of water, crop planning based on water availability, optimizing irrigation, equal sharing of water. WOTR appoints 'Jal Sevak' from village as representatives to supervise and implement water budgeting activities. 'Jal sevak's are trained to tackle various challenges in water management. Each 'jal Sevak' leads the project activities in his own and neighbouring 3-4 villages.

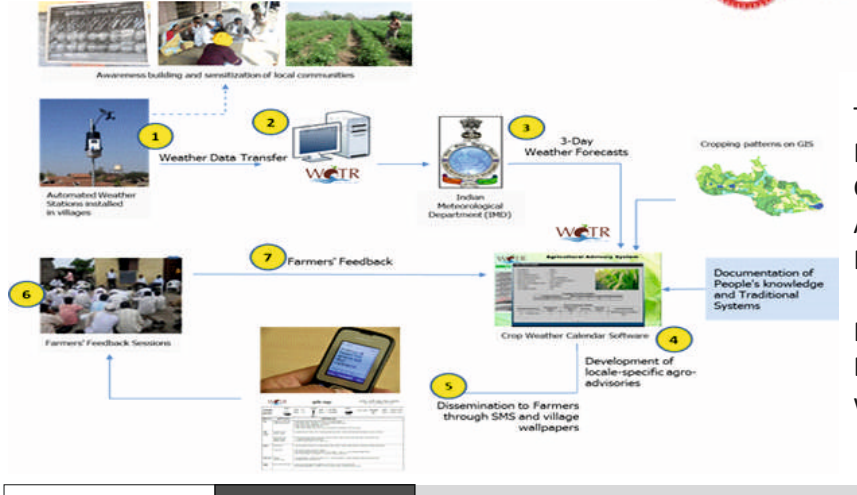
Water harvesting and conservation

Today in many places clean and safe drinking water is a distant dream either due to lack of availability or lack of access to a water source. Women and girls spend hours everyday to secure potable water. WOTR do best to provide safe drinking water and also to reduce labor of women. Under this new drinking water storage tanks are constructed. Bore wells have been dug in the village, new drinking water wells excavated and old drinking water wells repaired. Besides this submersible motor pumps have been installed in the bore well to pump the water to storage tanks.

WOTR's objective and development is aligned with UN's Sustainable Development Goals Agenda 2030. WOTR is working directly or indirectly and contributes in achieving 9 goals out of 17 SDGs. WOTR joined Indian Metrological Department where IMD guides WOTR in weather station installation and weather predictions.

Like other organizations WOTR too have partner to support them. They have two categories of partners – 1) Funding Partners and 2) Knowledge partners.

One can have more details from WOTR's contact details.



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How to Store and Protect Rain Water in Drought Prone Areas?

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The Concept of Water Storage Bins: Jal Pev / Jal Kumbh :

Storage of rain water, in an appropriate way, is the right solution to overcome shortage of water, in drought conditions. The storage of the running water or the storm water can be done in two ways –

1. Surface water storage.
2. Underground water storage.

There are some problems like submergence of farm land, forest, loss of migration corridors of wild animals, mines, roads, realignment of communication & transportation lines, human settlements, historical, monumental and heritage sites. Apart from this, there is a problem of rehabilitation of villages and villagers, associated with surface water storage on large scale. Though, a huge volume of water is stored in surface storage tanks , fifty percent of it is lost to atmosphere due to evaporation, a very small portion of the stored water remains as dead storage in reservoirs and about 30 -40 % part of stored water is available for actual use. Thus, with large investment, labour, material, energy and money a little is achieved. At present our irrigation policy is not helping us to sustain if there is no rain for two consecutive years. Even it is not producing electricity to the optimum level. After a huge amount of investment very meager benefits are obtained in comparison to exploitation and utilization of groundwater in the country . At present, after spending huge amount of money , losing a large chunk of the natural resources and engraving new social disparities , the percentage of total irrigated land by surface water is not more than 22 %. Whereas the percentage of irrigated land by ground water is 54 %, in the state and at national level.

Therefore the second method of storage of surface rain water into underground storages is more beneficial. The water that will be stored underground will be more safe and less contaminated by pollutants. It will be protected from sun and the rate and volume of evaporation can be brought almost to zero percent. Thus, here, the volume of water stored and available for use will be almost 90% of total volume stored. This storage system of running water will require very little land on the surface. Nothing will be submerged due to storage of water in underground reservoirs. No shifting of people or settlements are required. So there is no loss of property, society and culture. The biggest benefit of the method is that it can be decentralized and spread everywhere. It can be used in mountains, plains, coastal areas, areas with heavy rain, areas with moderate rain or even in areas permanently draught prone. The volume of water to be stored and size of storage bin to be dug in the area can be calculated on the basis of rainfall, slopes, lithology, rock structures, availability of water for storage and requirement of the local people.

The underground storage sites can be numerous. Their number will depend upon required volume of water to be stored and on availability of suitable sites in the catchment of stream. This method of storing water underground will help to augment groundwater on large scale. By this method we can store almost 90% run off from that region.

Prehistory of Underground Rainwater Harvesting :

There are following systems used to collect rain water and groundwater for drinking and irrigation purpose.

1. Qanat and shaft method of Egypt.
2. Surangum method. Malabar Coast.
3. Khajana well Method, Beed, Maharashtra
4. Old Step Wells, Baoli, Vav, Barav etc.
5. Kund from Rajasthan.

In all these methods an excavation and construction for tunnel and Baoli are undertaken to collect rain water and groundwater for utilization. None of these systems provide means for augmentation of groundwater. So, it seems that, for augmentation of groundwater, only, surface water storage ponds or bandharas were used.

The method of Kund from Rajasthan was the only method, that was designed and constructed for storage of surface water in underground Kunds and used year around and so.

The new method, that, I am going to suggest is quite different than these methods. In this new method the surface run off flowing through streams will be diverted to surface Purification Tanks and underground Water Storage Bins. Part of this stored water will infilter in the ground and augment ground water in the suitable porous and permeable rocks or aquifers. These aquifers can be exposed at various levels, vertically downwards, in the Bins. Second this store of water will be fully protected from the Sun and the evaporation and bacterial growths will be completely eliminated. A precaution is taken to protect the bin area from contamination. Thus, quality of the water will be maintained.

Geology and Geomorphology of the Area :

Marathwada is one of the five regions of Maharashtra. The region coincides with the Aurangabad Division of Maharashtra. Though the area comes under Deccan Plateau, due to erosion and denudation of the region, it has undulating topography. So there are valleys and ridges and hillocks, everywhere. Generally, the valley floors are mainly farm lands and are used for cultivation. The slopes of ridges and pediments are not used as agriculture areas; because of scarecity of water and poor quality of soil. In this area, the soil is mostly rocky and regolithic. They are mixture of talus, scree and clay . They are devoid of humus. But the valley floors have good black cotton soil.

The entire area is covered by the Deccan Traps lava flows of Upper Cretaceous to Lower Eocene age. The lava flows are overlain by thin alluvial deposits along the Kham and Sukhana River. The basaltic lava flows belonging to the Deccan Trap is the only major geological formation occurring in the area. The lava flows are horizontal to lowly dipping flows and each flow has two distinct units. The upper layers consist of vesicular and amygdaloidal zeolitic basalt; while the bottom layer consists of massive basalt. Most of the flows are pahoehoe type, 'aa' type and bit complex. Eastside of Nanded district shows some small exposures of Archaean and Dharwar Supergroup of rocks like Granites, Epidiorites, Quartz and pegmatite veins and Banded Heamatite Quartzites. Including Basalt all these rocks are crystalline, hard and compact rocks. They have good jointing. But the joints are open very near to surface where there is least pressure. These rocks are poorly porous and permeable and hold very little ground water naturally.

The lava flows are individually different in their ability to receive as well as hold water in storage and to transmit it. The difference in the productivity of groundwater in various flows arises as a result of their inherent physical properties such as porosity and permeability. The groundwater occurs in certain flows and is mainly controlled by the extent of its secondary porosity i.e. thickness of weathered rocks and openness and spacing of joints and fractures. The highly weathered vesicular trap and underlying weathered jointed and fractured massive trap constitutes the main water yielding zones. The soil is mostly formed from lavaflows and are black, medium black and calcareous types having different depths and profiles.

Again to be accurate, the detail study of geomorphology, geology and Geohydrology of

Individual catchments must be carried out. Slope analysis is also a must since major part of the run off of rain water flows over land as rain-wash over slopes. The slope analysis will, also, help to select locations of Water Bins and the streams that can be diverted to Water Bins. In one catchment there can be number of Water Bins of different capacities.

Objectives of Underground Water Storage Bins :

1. To augment ground water in scarecity areas.
2. To store water for emergency purposes, even in normal water supply regions.
3. To avoid loss of water due to evaporation, from stored water and get maximum water.
4. To avoid pollution of stored water.
5. To use minimum land surface for storage water and avoid submergence of resources.
6. To avoid migration and rehabilitation expenses. Protect the culture of the region.
7. To minimize expenses on maintenance and management of the water bins.
8. To make available water to wells and bore wells in the draught prone areas.
9. To control floods due to excess water poured due to cloudburst and sudden stormy rains

Methodology :

1. Calculate the volume of water received by the area from the rain for last 10 years.
2. Calculate annual total run off from each stream in the catchment area.
3. Earmark suitable sites for construction of water storage bins.
4. Decide the circle of influence of each water storage bins
5. Make well inventory, in detail, with proper preparation of Geological maps and sections of each well in the area of influence of the water storage bins
6. Study major and minor geological structures like porosity & Permeability , dip and strike , faults, joint systems of formation and dykes, in the area.
6. Mark the movement of groundwater in the well. Is it in the form of small stream or in the form of seepage from a rock face in a well ? Note it down with proper sketches.
7. Find out physical, chemical and engineering properties of rocks at storage bin sites.
8. Prepare plan and section drawings of the storage bins.
9. Select methods of excavation and construction of storage bins.
10. Prepare an Environment Management and Maintenance Plan (EMMP) for storage bins.

Calculations of the Volume of Water Received by the Area

A rainfall of 01mm supplies 0.001 M3 or 1 liter of rain water to each square meter of the field. Thus 1 ha of land receives 10,000 liters of rain water.(1ha = 10,000M2).

As per Kyle's Converter volume TMC to cubic Meter –
1 TMC water is equal to - 2,83,16,846.59 M3 i.e.28316846589.9999 liters.

Depending upon the rainfall and area of the catchment the annual water received can be calculated. Then the runoff of various Gullies, rills, Nallahs, and streams can be assessed. This will give you the volume of water available for storage in Water Bins. Of course, the volume of water available at different levels in the catchment will be different. So, these calculations should be done with the help of Topo sheets of Survey of India which shows contours of the region.

Structure of a Typical Water Storage Bin:

The shape of storage bin on the surface can be circular or square or octane. That depends on the land area available, geomorphology and geology of the area. This will be like a mine shaft piercing down in the ground. It can be vertical or inclined. The diameter of the shaft can be 05m or 10 m The depth can vary from 10m,20m, 30 m, again depending upon the volume of water available , volume of water needed to be stored , the height of bottom of Water Bin and slope of ground, level of beneficiary land.

Then if necessary to store more volume of water then horizontal tunnels (levels) will be driven from the intake shaft. These will be driven in ground at different levels of depth and in almost, different directions and to various lengths, with a diameter of 1.5 m to 2.5 m. . This will help to take the water to different areas in underground pathways where Water Table needs to be raised; to supply perennial water, to existing dug wells or bore wells, The diameter of the storage bin will be expanded by forming a bulge, at the lower depth (e.g. 10 m depth) which can help to store more water. If still more space is required to store water then at various depth levels horizontal tunnels (levels), can be driven.. This type of arrangement of underground water storage bin will have a scope for expansion, without damaging natural or manmade environment, on the surface. This is also safer and economical.

These water storage bins can be filled by water by diverting running water or storm water from small streams flowing in the watershed. The water bins should be planned to arrest and store the flowing water during raining, in the area. The required rainfall data can be made available from Meteorological Department. The data related to the dimensions of water bins and volume of water to be stored in it is given in following table.

Shape and Dimensions of Water Bins :

The shape and dimensions of water bins will depend upon availability of water to store and also, requirement of water. It can range from 1.5 M to 25 M in diameter and 5M to 40 M in depth, in the form of storage tank and 100M to 1 Km in tunnel form, The shape of the tank may be circular or square or rectangular or hexagonal or octagonal, depending upon the geology, geomorphology and required storage capacity of the tank.

Augmentation of Ground water :

The water stored in water storage bins will increase rate of infiltration of water in the ground. This is mainly because of the additional pressure of the water column itself. This hydrostatic pressure will try to allow the water to enter in cracks, joints and fissures and pores, voids, lava tunnels in lava flows and contacts between the flows. If the farm area is at lower level than water storage bins, then artesian conditions will also be created. At least, the peizometric pressure will increase and water table and subsurface water levels can be raised. This will help the existing dry wells to become perennial. This will drive away the draught conditions permanently from the region. This underground storage system will reduce evaporation of water to 1 or 2 % only and make 98% water available to utilization for our purposes. Hope more discussion will be carried out by Geologists and Engineers on this topic of Underground Bins for Storage of Rain water and positive moves will be taken to make it a reality.

*****

World Water Day-1999

Everyone lives downstream

Shri. Gajanan Deshpande
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(A new series of articles has been launched from August 2021 to learn more about the importance of World Water Day and the various water awareness programs implemented every year.)

On the occasion of World Water Day-1999, the guideline " Everyone lives downstream " was specially implemented by pointing out the following shortcomings in water management. With half the world's population dependent on groundwater, it sought to draw the world's attention to these issues. The coordinating UN agency for the theme this year was UN Environment.

In water management, two terms are prevalent, upstream and downstream. Both of these terms are relative. The lower side of the stream becomes the upper side of the stream as the stream moves forward. The upstream and downstream side is important when the sewage from each village is discharged into the stream. The

water coming from the upper reaches of the stream is polluted and it becomes more polluted by mixing the sewage from our village. Thus, as the stream moves forward, it becomes more and more polluted.

This means that the quality of water available to you is determined by your neighbors living in the upper reaches of the stream. For that, we need to work as an environmentally conscious partner in our watershed; so that, this will reduce the flow of polluted water and ensure proper protection of water quality.

Due to our improper social habits, water sources, rivers, streams, reservoirs are getting polluted on a large scale. Municipalities and factories discharge their effluents into these sources without any treatment, and this greatly pollutes the rivers and streams. This leads to constant health problems. Now we have to make special efforts to maintain this declining quality of water. Improper human activities, excessive use of chemical fertilizers, improper disposal of plastic waste are also increasing adverse effects on aquatic life in rivers, reservoirs and seas. There has been an era of total neglect or over-exploitation instead of conservation and protection. It is now imperative to stop this.

The direct adverse effects of various human activities taking place in the modern lifestyle are on the environment and it has a negative impact on the environment. Water pollution is one of them. In today's fast paced life people are just engrossed in their work and keep themselves away from the environment. This is a sign that our overall social and mental sensibilities are rapidly declining. The overall depression in the society needs to be addressed immediately.

As a part of the society we are fully responsible for this environmental catastrophe, so it is our ultimate duty to take care of the protection of the environment and to rectify the mistakes that are being made in this practice. Something must be done first to change that. For this, we have to pay special attention to our natural resources like water, disposal of substances like plastic waste as well as cleanliness in the area, tree planting. It has become essential for the health of the society.

The happy future of the country will depend on the utilization of this water while taking care of how our water resources remain clean, potable and useful for various purposes. What is needed is direct social action through public participation. In order to create such public participation, it is necessary to create a feeling of faith and sincerity in the society regarding water issue. The movement can only be strengthened by embracing the responsibility of frugality while understanding the importance of water and the value of scarce water.

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Stockholm Water Prize 1997

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(An article series has been launched in August 2020 to learn more about the World Water Prize winners and their work.)

Professor Peter S. Eagleson, an American Hydrologist, was the recipient of the 1997 World Water Prize. Eagleson's characteristic is that he was not traditionally a traditional hydrologist; but he has a great knowledge of Darwin's ecology and mathematics.

Eagleson reveals in his study the various evolving shapes of forests, their characteristics and functions, and the role that climate plays in this process. Eagleson came up with a number of exciting findings from his seasonal water forecasting equations on how to control plant types due to soil water limitations.

Even before joining Darwin's study, Eagleson made great strides in his research, although hydrology was an established science. E.g. When he first published the book Dynamic

Hydrology in 1970, it gave a new modern impetus to the entire branch. Peter Eagleson has worked at the Massachusetts Institute of Technology (MIT) in Cambridge, Boston since 1952. Eagleson, who has been a water expert since 1965, has been working as a professor in the multidisciplinary branch of Civil and Environmental Engineering.

Considering the integrated effects of physics, biology and chemistry on the Earth's ecosystems, he has been working tirelessly for decades to develop new models of dynamic hydrology. Among other achievements, he was honored with the Stockholm Water Award in 1997 for this special work.

Eagleson says, "Given the complexity of the interconnectedness of geography and the environment, we can better predict long-term rainfall if we work extensively on hydrology. We must move away from our view that hydrology is purely physics. In particular, I consider the inseparable relationship between plants and the environment, both locally and globally. When trying to get a complete picture of the weather, we should not forget to mention the role of plants in our mathematical equations. Because unless we can successfully assess the behavior of a plant - for example, the relationship between productivity and the environment - it will not be possible to make reliable statements about the water balance in the climate. "

Peter Eagleson is such a scientist who has combined ecology and hydrology - what Europeans call ecohydrology - and which he considers to be a new science. Eagleson defines hydrology as a multidimensional global ecological geology from the field of contemporary engineering, in which green as well as biological factors play an important role in ecosystems.

Prof. Peter Eagleson created a new platform for long-term and more reliable weather forecasting at MIT. In which mathematical computer models are created to build a large number of weather forecasts by combining hydrological processes from the combined studies of different science disciplines on weather, water availability or potential water hazards or potential floods.

Professor Eagleson has been researching Darwin's theories on the relationship between plants and climate since 1997. Its practical purpose is to predict the biological changes that will occur due to climate change. His book, Ecohydrology: Darwinian Expression of Vegetation Forms and Functions, was published in 2002. This book is a link between the fields of hydrology and ecology and introduces new integrated principles based on the concept of natural selection. It also has the ability to determine how plants respond to climate change. He is currently writing another book on geographical expansion and diversity of tree species.

Storage of water at home :

- You must have heard about the old story of storing the rain water in the building itself in Rajasthan. While constructing the building a huge water storage tank was constructed in the basement itself. On that tank, the whole building was erected. Suitable arrangements were made to deposit the entire rainwater in this tank. That stored water was kept under lock and key. The head of the family used to retain that key with him. Unless there was any urgent need, he was not allowing anybody to withdraw water from that storage tank. Thus the stored water was used by the family for the entire year. If water is stored in this fashion, quality of water does not deteriorate.
- In Konkan area storage of water is a very peculiar problem. It is an area of heavy rainfall. But due to heavy slope there, water slips away to the sea and in summer there is a severe problem of water even for drinking. One voluntary organization has found out a solution for that. It has developed a technique of ferrocement tanks which can be constructed with minimum of cost and water can be stored for use round the year. This agency gives training to masons where they can construct such tanks at very many places. This technique is so simple that it can be very easily mastered by the masons.
- In every house water for drinking is stored in brass vessels, earthen pots of different sizes depending upon how much water is needed by the family. Since storage of water is directly related to the health of the family, utmost care and precaution should be taken while storing water. These utensils need regular cleaning. It should be seen that your hand does not touch the water as some pollutants may affect the quality of water stored.
- In rural areas, women fetch water from nearby ponds, wells, Bore wells, streams etc. There is no guarantee that the water there is clean. If such polluted water is brought at home, that may cause various health hazards. To improve the quality of such water, efforts should be made to purify it by using alum, liquid chlorine or other available methods. Even in cities, there is no guarantee that the water supplied by the local bodies is neat and clean. Various simple gadgets are available in the market which can help you to purify available water.
- Now a days the term 24 X 7 is becoming very popular in distribution of water. All the taps in the city would get water round the clock. This system has been tried in some of the small cities and is working very satisfactorily. It has its own advantages and disadvantages. If this system is tried, there would be no necessity to store water in the house. The pipeline in the city will always be full giving no scope to soiled water to enter into the pipeline. But at the same time it is said that this system would lead to wastage of water. It can be very well said that if the society is fully water literate it may work well.
- There is a human tendency to pour earlier day's water assuming that it is stale. Stale and fresh, both are relative terms. Rains give us water for three four months and we use it round the year. Water which we get today in the taps is that water which the rain gods have given four to five months earlier. If that is so, how can water filled in yesterday become stale today?

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