Moderator's note: We have received several interesting responses and are issuing a new Consolidated Reply as they have added to the discussion. We have also included comments from the query poser, Kurian Baby. The new material is marked NEW! Thank you for your participation, and the query is now closed.

Environment

Water Community

Solution Exchange for the Water Community
Consolidated Reply – Revised

Query: Participatory Well Recharge Programme – Mazhapolima - Experiences

Compiled by Nitya Jacob, Resource Person and Ramya Gopalan and Sunetra Lala, Research Associates

Issue Date: 21 October 2008

From V. Kurian Baby, Government of Kerala, Thrissur

Posted 8 August 2008

Dear members,

I am working as District Collector, Thrissur, Kerala. For the total 6-lakh households in the district, we have a total number of 4.5 lakh open/dug wells. As per 2001 census, 71% of the total population of the district depends on open wells for drinking. Estimates indicate that the aggregate household investment in open wells comes to about Rs. 1,800 crores and the wells have a combined capacity to yield 6.6 million m^3 per day. Though we have an average annual rainfall of about 3,000 mm, about 70% of these wells are non-perennial.

Additionally, because of heavy surface runoff, groundwater levels in several blocks have fallen sharply, and coupled with saline intrusion at an accelerated pace, have led to water quality problems.

In order to address the issues of quantity, quality and sustainability the District Administration in collaboration with the PRIs have launched a process driven, participatory well re-charge programme called *Mazhapolima* at an average cost of Rs. 1500 per open well. The total cost of about Rs. 920 million (Rs 92 crore) is envisaged to be financed largely by households themselves through demand generation, combined with ongoing decentralized programmes such as NREGP/GOK-GoI, and sponsorships. Informed decision-making, a menu of simple technical choices, strong IEC and awareness creation following social marketing tools for demand generation on a campaign mode, and process orientation are fundamental to the programme. The overall goal of the programme is to improve the health and welfare of communities through improved access to drinking water.

This is a new programme, and I would like to elicit views and suggestions from our sector partners and practitioners to help make it more effective. We would also like community members to share experiences and lessons from similar programmes in India and abroad that have made water available in an environmentally sustainable, cost-effective manner.

- Please suggest social marketing tools for demand generation based on hands-on experiences of similar nature
- Provide information on simple and/or traditional technology options, as well as inclusive and innovative financing options
- Experiences from existing M&E frameworks that will encompass the diversity of approaches, need based implementation arrangements and multiplicity of processes based on outcome

More details on the programme are available http://www.solutionexchange-un.net.in/environment/resource/res08080401.doc.

Responses were received, with thanks, from

1. **Uday Bhawalkar, Bhawalkar Vermitech Private Limited, Pune**
2. **P. S. Yadav, Haryana Institute of Rural Development and Department of Development and Panchayats, Haryana (Response 1; Response 2)**
3. **Biplav Paul, Lokvikas, Ahmedabad**
4. **Suneel Grover, The SDSG Foundation, Punjab**
5. **Tapan Ghosh, Kutch Nav Nirman Abhiyan, Gujarat**
6. **Megha Phansalkar, Development Professional, Pune**
7. **Abhishek Mendiratta, Consultant, New Delhi**
8. **Sharat Singh, Society for Promotion of Wasteland Development, Ranchi**
9. **M. M. Sharma, ICRISAT, Hyderabad (Response 1; Response 2)**
10. **Vijay Kumar, Chartered Environmental and Water Resources Exploration and Development Associates, New Delhi**
11. **Rajesh Shah, Peer Water Exchange, Bangalore**
12. **K. A. S. Mani, Andhra Pradesh Farmer Managed Groundwater System, Hyderabad**
13. **S. Vishwanath, Biome and Agrhyam, Bangalore**
14. **Tushar Shah, International Water Management Institute, Gujarat**
15. **Arunabha Majumder, All India Institute of Health and Public Hygiene (AIIH&PH), Kolkata**
16. **M. Dinesh Kumar, International Water Management Institute, Hyderabad (Response 1; Response 2)**
17. **David Foster, Administrative Staff College of India, Hyderabad**
18. **S. Janakarajan, Madras Institute of Development Studies, Chennai**
19. **Sachin Tendulkar, Mineral Foundation of Goa, Goa**
20. **R. Jagadiswara Rao, Sri Venkateswara University, Tirupati**
21. **Ajit Sheshadri, Vigyan Vijay Foundation, New Delhi**
22. **A. Latha, River Research Centre, Kerala**
23. **Mihir Maitra, Independent Consultant (formerly with India Canada Environment Facility, ICEF), New Delhi**
24. **George Thomas, Evangelical Social Action Forum (ESAF), Trichur**
25. **Apoorva Oza, Aga Khan Rural Support Programme in India, Ahmedabad**
26. **Avinash Zutshi, Feedback Ventures, Gurgaon**
27. **Biju Jacob George, Tsunami Reconstruction Project, Tamil Nadu**
28. **Terry Thomas, Wilbur Smith Associates, Bangalore**
29. **T. K. Gowrishankar, Remede, Andhra Pradesh**
30. **Murali Kochukrishnan, Action for Food Production, Bhubaneswar**
31. **Surekha Sule, Freelance Journalist, Pune**
32. **Latha Bhaskar, Ashoka Trust for Research in Ecology and Environment (ATREE), Kerala *NEW!***
33. **Isac John, Socio-Economic Unit Foundation, Calicut *NEW!***
34. **D. Chandrasekharam, Department of Earth Sciences, Indian Institute of Technology, Bombay *NEW!***

35. Subramanian K. S., National Remote Sensing Agency, Hyderabad *NEW!*
36. R. K. Rao, Samata, Hyderabad *NEW!*
37. V. Kurian Baby, Government of Kerala, Thrissur *NEW!*

Summary of Responses

The Thrissur district administration launched Mazhapolima because water levels in domestic wells in the district have fallen over the past few years owing to over-exploitation and shrinking areas for recharge and most run dry in the summer. The query sought inputs on social marketing, technology options, and M&E frameworks that would help take the scheme forward and make it more effective.

Wells remain the main source of water for domestic use in Kerala with an average of 250 wells per sq. km., and therefore, the Government has launched Mazhapolima to recharge wells and ensure water quality. This year, the core intervention is to recharge already-constructed wells to keep costs low, with the involvement of householders. This brings in a mix of traditional wisdom and proven practices, relegated to the background under a regime the promised free water at the doorstep. ***NEW!***

A secondary benefit will be groundwater recharge, and the scheme may even augment summer river flows. Alongside recharge, Mazhapolima will address the bacteriological and nitrate contamination of water caused by pit latrines, and we seek collaboration with the All India Institute of Health and Public Hygiene as well as others in this area. The Government of Kerala has launched community water quality surveillance and monitoring. ***NEW!***

The total outlay is Rs 92 crore of which Rs. 65 crore will come from the households, but the existing investment in construction of wells in the district is estimated at Rs 1800 crore. It is much cheaper than investments families make in PVC tanks at Rs 5-6 per litre. A small investment of Rs 500 is enough to modify rooftops, otherwise unsuitable for rainwater harvesting. ***NEW!***

Members they suggested rainwater harvesting for recharging wells as **Thrissur** gets an average of 3,000 mm of rain a year. A problem, noted a member, with such systems is the relatively high cost as wells are usually situated at the highest point in the field (to facilitate gravity irrigation). In **Rajasthan**, the cost would be around Rs 25,000 per well, much higher than the Rs 1,500 the Thrissur administration was providing under the scheme. In the State, the Khadin system collects rainwater in a trough that percolates into the ground, recharging wells. In **Goa**, with similar rainfall patterns and geo-morphology, a government-support micro-watershed restoration programme has been very successful. Another successful project is in Kothapally, **Andhra Pradesh**.

Members suggested tapping into a scheme launched in 2007, called the Dugwell Recharge Scheme, by the National Bank for Agriculture and Rural Development. Under this, the government provides Rs 4,000 per well for dugwell recharge. The National Rural Employment Guarantee Scheme can be used to pay those who contribute their labour.

Members suggested a basin-level approach to the well-recharge programme, working from the uplands down. The National Remote Sensing Centre, Indian Space Research Organization, Hyderabad, has carried

out the Ground Water Prospects for the entire state of Kerala using satellite imagery. The Centre for Science and Technology has a long list of successful case studies on the subject. ***NEW!***

In addition to recharging, members suggested the administration address the reason why the wells run dry in summer. Cultivation of water-intensive crops is a major factor, and governments provide free power to farmers that encourage them to pump ground water. The other is the aquifer simply does not have the storage capacity to hold the monsoon runoff, and most of the rain flows into the rivers as base flow. Watershed treatment by bunding with boulder dams may address this partially. The other solution is to check water use for agriculture during the dry season, as this is the largest single user of water. Modeling to determine rates of recharge and withdrawal will help to determine the efficacy of different methods. They quoted the examples of the bhungroos in Saurashtra, and Ralegaon Sidhi and Hiware Bazar in **Maharashtra.**

An issue with using groundwater runoff for recharging wells is contamination with fertilizers, pesticides, organic matter and, most importantly, human faeces. The latter also seeps into groundwater through latrines constructed under the Total Sanitation Campaign, raising nitrate levels. Members noted a study has indicated faecal material is present in most wells; people in **Kerala** got around this by boiling drinking water. RWS would circumvent this problem, and it is affordable. It is also possible to have community RWS to augment water flows into wells.

Effective community mobilization is important for the scheme's success, said members. In a village near Nashik, **Maharashtra** farmers have formed groups and contributed funds for an irrigation system; something is possible in Thrissur. They have also changed cropping patterns and put improved irrigations systems in place. It is necessary to emphasise groundwater is like a bank; people can only withdraw what they put in. This can happen only when the community is aware of the issues and involved in the programme.

Women, who have the onus of providing water, are central to any recharge scheme and have to be part of the information and education campaign. The campaign has to explain concepts such as aquifers, geo-morphology and underground water flows in simple language, members said. A door-to-door campaign is most effective. Kerala's powerful panchayats, NGO and the media have to be part of the process. Folk media and street plays are useful media for sharing information that must incorporate local knowledge.

Children, suggested members, are powerful change agents; nature walks can help them understand the link between surface and ground water flows. People from Thrissur can visit other parts of India to assess similar schemes. People have to be informed mining for sand along the rivers in the district and deep tubewells supplying water for commercial use are two main reasons why wells go dry during summers.

The information material has also to persuade people to participate in Mazhapolima for its success, said members. They have to participate in the planning process; there are ICT tools already available that are simple enough for people to use with minimal training. These can help inventorising small water bodies, wells, recharge canals and the topography of the region.

Respondents stressed the importance of community involvement in the project's M&E and recommended several networked ICT-based systems usable at the household level for monitoring water levels and quality, and for district-wide programme monitoring.

Comparative Experiences

Kerala

Injection of Rainwater into Open Wells for Enabling Water Quality Improvement *(from Terry Thomas, Wilbur Smith Associate, Bangalore)*
In partnership with the Kadalundi panchayat, the organization executed a programme where rainwater was fed directly into open wells to create a 'lens' of fresh water around the well. This arrested salt water intrusion and several households revived their wells for both drinking water and irrigation. After its success, the community has taken ownership of the programme. Read more

Revival of Wells, Kothapally (*from M. M. Sharma, ICRISAT, Hyderabad)*
ICRISAT has a Watershed Project in a village called Kothapally, about 45 km from Hyderabad under the leadership of Dr S P Wani for the last seven years. They have successfully revived 68 of the 72 wells in the village by rainwater recharging and the farmers grow flowers and vegetables even in summer.

Integrated Water Resources Management, Wayanad *(from Avinash Zutshi, Feedback Ventures, Gurgaon)*
In an IWRM initiative, the organization used a new approach based on community awareness to propagate sanitation. This supplemented the technically sound interventions in a phased manner and the community accepted this approach as it addressed both information and technical needs. However, the funding for the project ended prematurely when the Netherlands government withdrew bilateral funding.

Qualitative Assessment of Dugwell Water *(from Arunabha Majumder, AIIH&PH, Kolkata)*
The All India Institute of Health and Public Hygiene surveyed dugwells in Kerala and found most had faecal contamination. This is due to run-off from fields and leaching from subsoil water. While this is easily addressed by boiling the water, it points to the need for better protection of water sources. Read more

Jalanidhi Project: 3,681 Schemes Completed *(from Biju Jacob George, Nagapattinam, Tamil Nadu)*
Under the Kerala state government's water supply programme, 3681 water supply systems, managed by 3891 beneficiary groups have been completed as on end June 2008. The beneficiary communities are operating and maintaining these schemes, demonstrating their willingness to participate in similar programmes. Read more

Sanitation in Cheru Panchayat Samiti, Thrissur *(from P. S. Yadav, Haryana Institute of Rural Development & Department of Development and Panchayats, Haryana; response 1)*
A team from Haryana visited the district with a group of 200 sarpanches to study the success of the Total Sanitation Campaign. The people of the district had contributed in large measure to the success, and this same community, when mobilised, could be an important factor in the success of Mazhapolima. It underscored the importance of community mobilisation and involvement.

National Remote Sensing Maps Provide Data on Groundwater *(from Subramanian K S, National Remote Sensing Centre, Hyderabad)* ***NEW!***
The National Remote Sensing Centre, Indian Space Research Organisation, has mapped the groundwater resources of the entire state on a scale of 1:50,000. These maps show the ground water prospect zones and the suitable sites for water harvesting structures using satellite images. The Central Ground Water Board was also involved in this project. It has helped develop a water map for Kerala.

Akasha Ganga Project Works to Recharge Wells, Kozhikode District *(from Isac John, Socio-Economic Unit Foundation, Calicut)* ***NEW!***
In 2000, the District Rural Development Authority launched a programme called Akasha Ganga. This recharge project aimed at developing a recharge system for wells and other water sources using other point recharge structures such as tube-wells, dug-wells, etc., by tapping rainwater. The project stressed successfully on mobilising communities.

Rajasthan

Cost of Well Revival *(from M. Dinesh Kumar, International Water Management Institute, Hyderabad, response 1)*
In Rajasthan, the cost of reviving field wells is estimated at Rs 25,000 per well. This is because the wells in the fields are located at the highest point to facilitate irrigation. The channels for reviving the wells also silt up rapidly. Water contamination by pesticides and fertilisers is another issue and is very difficult to treat.

Khadin System *(from M. M. Sharma, ICRISAT, Hyderabad)*
Khadin is a land-use system in Rajasthan in which runoff from a catchment is stored in fields at lower levels behind a bund. Fields immediately behind the bund typically remain submerged during the rainy season while those at higher levels within the khadin have assured moisture for a rainy season crop. A second crop is grown on stored moisture in areas that are submerged during the rainy season. Farmers manage to eke out a crop during the rainy season even in drought years.

Goa

Microwater/Watershed Programme *(from Sachin Tendulkar, Mineral Foundation of Goa, Goa)*
Goa has a similar monsoon pattern to Kerala and faces water shortages in summer. The NGO has partnered with the state government to implement a microwatershed programme in the highland areas with encouraging results. Water levels rose 40 cm in the lean season and there was better retentioin of moisture in fields.

Andhra Pradesh

Free Power to Farmers *(from David Foster, ASCI, Hyderabad)*
Many states encourage excessive groundwater pumping by providing free power to farmers. While this subsidized power is justified in the name of the poor, in practice few poor people benefit from it, as most have neither deep wells nor pumps to make use of free power. The shallow wells of the poor farmers are first to run dry when the groundwater falls.

Maharashtra

From P S Yadav, Haryana Institute of Rural Development & Department of Development and Panchayats, Haryana; response 2

Ralegaon Sidhi
Ralegaon Siddhi (aka Ralegan Shindi) is a village in Parner Taluka of Ahmednagar District, Maharashtra, India. Since 1975, led by Anna Hazare, the village has carried out programmes like tree planting, terracing to reduce soil erosion and digging canals to retain rainwater. It is an oasis of prosperity and a model for the country, and a model for environmental conservation and revival. Read more.

Hiware Bazar
From a den of vice, this village in Maharashtra has emerged as a model of water management. The sarpanch, Popat Panwar, has used several innovative measures to improve water availability. Villagers have voluntarily imposed checks on cattle grazing and growing water-intensive crops, and now it is a prosperous, educated village. Read more

Farmers' Cooperative for Irrigation, Nashik *(from Surekha Sule, Freelance journalist, Pune)*
Left to their own devices, 200 farmers in the Nashik district of Maharashtra formed a cooperative to harness water from a distant source and irrigate their fields. They have developed their own system to tap and store rainwater and use it during the dry months for agriculture. Alongside, they have changed cropping patterns to match the amount of water available. Read more

Punjab

Community Involvement in Drinking Water *(from Suneel Grover, The SDSG Foundation, Punjab)*
The Punjab state government and the World Bank are implementing a community-based drinking water scheme, assisted by several NGOs, across the state. The community's involvement is central in the scheme. It is partly supported by the World Bank, the Union Government and the state government. Read more

Gujarat

Bhungroos for Water, Banaskantha *(from Biplab K Paul, Lokvikas, Ahmedabad)*
The NGO has built several water harvesting structures called bhungroos in this extremely arid district that have enabled families improve their economic conditions. These meet their irrigation needs and have helped raise the water tables. With the improved water situation, families no longer have to migrate seasonally in search of work. These were the traditional water management systems of the region. Read more

Dug Well Programme, Saurashtra *(from Dinesh Kumar, Water Resources Management Specialist, Hyderabad; response 1)*
Farmers in Saurashtra went on well-digging spree in the 1960s and 1970s to irrigate crops. Initially, there was an abundance of water but this soon ended as they used the water to irrigate both kharif and rabi crops. Farmers then bored tubewells to reach deeper aquifers, compounding the problem. The result is now they are severely short of water. Read more

All India

Groundwater Recharge *(from Apoorva Oza, AKRSPI, Ahmedabad)*
AKRSPI has tried a range of well-recharge options, and while some have worked, others have not. They feel the costs, even at Rs 25,000, are not high because this includes a significant labour component, that farmers can contribute themselves. The project should go ahead based on a needs survey of the farmers rather than an extensive study of the entire area. Read more

NABARD's Scheme for Dugwells *(from Tushaar Shah, International Water Management Institute, Gujarat)*
NABARD provides a grant of up to Rs 4,000 for financing dugwells in hard rock areas under a special programme covering 100 districts of India. Individual farmers can now avail of the scheme and are required to contribute labour. Read more

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Related Resources

Recommended Documentation

From Tushar Shah, IWMI, Hyderabad

Mobilizing Social Energy Against Environmental Challenge: Understanding the Groundwater Movement in Western India
Article; by Tushar Shah; Natural Resources Forum, Vol. 24; September 2000; Permission Required: Yes, paid publication
Ordering information available at http://www3.interscience.wiley.com/journal/117987076/home

> *Explores the movement to abstract groundwater in Saurashtra, Gujarat, which is an extremely arid zone, and the movement's mixed results*

Every Drop Counts
Article; by Tushaar Shah; Times of India; 9 May 2006
Available at http://timesofindia.indiatimes.com/articleshow/1521055.cms

Emphasises the need for farmers to recharge their dug wells during the monsoons, instead of treating them only as a source of water

Ecorestoration of Ponds, Lakes and Rivers using Biosanitizer Ecotechnology (*from Uday Bhawalkar, Bhawalkar Vermitech Private Limited, Pune)*
Article; by Uday S. Bhawalkar and Sarita U. Bhawalkar; Bhawalkar Ecological Research Institute; Pune June 2008
Available at http://www.wastetohealth.com/ecorestoration.html

Discusses the theory behind 'Biosanitizer' and gives case studies based that show enhancement of both quantity and quality of water.

From Terry Thomas, Wilbur Smith Associates, Bangalore

"Backwashing" -Injection of Harvested Rainwater into Open Wells for Enabling Water Quality Improvement
Document; by Mr. M. J. Joseph; Planet Kerala; Kerala
Available at http://www.planetkerala.org/downloads/Backwashing_English.pdf (PDF, Size: 450 KB)

Details the technique of backwashing that involves channeling rainwater from rooftops into wells and other water storage structures by PLANET Kerala, an NGO

Pro-Poor Water and Wastewater Management in Small Towns
Article; by Dr. K. C. Bellarmine; PLANET Kerala; UNESCAP; 2004
Available at http://www.unescap.org/pdd/prs/ProjectActivities/Ongoing/Water/Kerala/Kerala_ES.pdf (PDF, Size 88 KB)

Discusses the relevance of rainwater harvesting in Kerala and provides details on different models and the costs of the various approaches

Rainwater Harvesting Procedure Booklet in Malyalam
Booklet; PLANET Kerala
Available at http://www.planetkerala.org/downloads/book.pdf (PDF, Size 830 KB) (in Malayalam)

Describes in detail different rainwater harvesting structures appropriate for Kerala and can be used by communities as it is in Malayalam

From P S Yadav, Haryana Institute of Rural Development & Department of Development and Panchayats, Haryana; response 1

Hiware Bazar - A Village with 54 Millionaires
Article; by Neha Sakhuja; Down to Earth; Centre for Science and Environment; New Delhi; January 2008; Permission Required: Yes, paid publication
Available at
http://www.downtoearth.org.in/cover.asp?foldername=20080131&filename=news&sid=42&sec_id=9

Hiware Bazar, a village in the Ahmednagar district of Maharashtra, is the new role model for community-based water management

Ralegon Sidhi
Article; Wikipedia; 7 August 2008
Available at http://en.wikipedia.org/wiki/Ralegaon_Siddhi

Describes how the village of Ralegaon Sidhi has set an example for watershed management, community-driven afforestation and overall rural development

From Surekha Sule, Freelance journalist, Pune

Water Management in Pimpalnare: The People Succeed Where Government Failed
Article; by Surekha Sule: InfoChange News and Features; March 2004
Available at http://infochangeindia.org/200403083359/Water-Resources/Stories-of-change/Water-management-in-Pimpalnare-The-people-succeed-where-government-failed.html
Describes how farmers in the Pimpalnare village, left to fend for themselves, set up and managed their own irrigation system

Not Only Money, Villagers Need Knowledge Too!
Article; by Surekha Sule; India Water Portal
Available at http://www.indiawaterportal.org/tt/dwm/case/PLC_Utthan.html
Utthan has set up a People's Learning Centre on water and sanitation, which has been raising grass root level awareness and also facilitating the lateral spread of information since 2006

Punjab CM Inaugurates Rs. 3.22 Crore Community Based Drinking Water Scheme *(from Suneel Grover, The SDSG Foundation, Punjab)*
Article; Punjab Newsline Network; February 2008
Available at http://www.punjabnewsline.com/content/view/8682/38/
Explains how the state government has inked an agreement worth Rs 1,280 crore for supplying water and sanitation with the World Bank

National Employment Guarantee Act (NREGA)- 2005 *(from P. S. Yadav, Haryana Institute of Rural Development & Department of Development and Panchayats, Haryana; response 2)*
Act; Ministry of Rural Development; Government of India; 2005
Available at http://www.nrega.nic.in/
NREGA is the Union Government's national scheme for guaranteeing 100 days of employment for each person from families living below the poverty line

Saving Water: From Field to Fork - Curbing Losses and Wastage in the Food Chain (*from R. K. Rao, Samata, Hyderabad)* ***NEW!***
Paper; by Jan Lundqvist, Charlotte de Fraiture and David Molden; Stockholm International Water Institute, Paper 13; May 2008
Available at http://www.siwi.org/documents/Resources/Papers/Paper_13_Field_to_Fork.pdf (PDF, Size: 616 KB)
Argues making the food chain more efficient means saving water used to produce food, & looks at reducing losses & wastage & how it can serve the interests of farmers, consumers & society

The Water Catchers of Saurashtra *(from Nitya Jacob, Resource Person)*
Book; by Ambrish Mehta; Permission Required: Yes, paid publication
Available at http://www.sdnetwork.net/files/pdf/chapter5-mehta.pdf (PDF Size: 70 KB)
Describes how the movement to catch water in the Saurashtra region is still going strong, and argues it is everybody's business to catch and store all available rainwater

From Sunetra Lala , Research Associate

Role of Aquifer Storage in Water Reuse ***NEW!***
Article; by Peter Dillona, Paul Pavelica, Simon Tozea, Stephanie Rinck-Pfeifferb, Russell Martinc, Anthony Knaptond and Don Pidsley; Science Direct; Vol. 188, Issues 1-3; 5 February 2006; Permission Required: Yes, subscription required
Available at http://www.sciencedirect.com

Describes two cases studies, which explain the role, value, limitations and policy requirements for storing reclaimed water in aquifers for indirect reuse

Augmentation of Groundwater Resources through Aquifer Storage and Recovery (ASR) Method ***NEW!***
Book; by C. Barber; Center for Groundwater Studies, Flinders University, Adelaide, South Australia; Springer; Netherlands; 2007
Available for purchase at http://www.springerlink.com/content/k4711014516h8208/

Presents approaches involving geo-chemical modelling and assessment of likely impacts of injection of potable water in confined aquifers in less arid southern Australia

Groundwater Recharge and Wells: A Guide to Aquifer Storage Recovery ***NEW!***
Book; by R. David and G. Pyne; CRC Press, Taylor and Francis Group; 2005; Permission Required: Yes, paid publication
Available for purchase at http://www.amazon.com/Groundwater-Recharge-Wells-Aquifer-Recovery/dp/1566700973

Book presents aquifer storage recovery (ASR) technology procedures for groundwater recharge and includes selected case studies

Water Well Rehabilitation and Reconstruction ***NEW!***
Book; by Georg Houben and Christoph Treskatis; McGraw-Hill; 2007; Permission Required: Yes, paid publication
Available for purchase at http://www.amazon.com/

It offers water resource professionals a comprehensive guide to the mechanical, chemical, and microbiological ageing processes of water wells

Water Well Rehabilitation: A Practical Guide to Understanding Well Problems and Solutions ***NEW!***
Book; by Neil Mansuy; CRC Press, Taylor and Francis Group; 1998; Permission Required: Yes, paid publication
Available for purchase at http://www.amazon.com/

Written from a microbiological viewpoint, with a focus on well rehabilitation, it outlines proven solutions to addressing production problems in all types of wells

Recommended Organizations and Programmes

From A. Latha, River Research Centre, Thrissur

Western Ghat Development Programme (WGDP), Kerala
Kerala State Planning Board, Pattom, Thiruvanathapuram, Kerala; Tel: 91-471-2540707; Fax: 91-471 2541765; spb@keralaplanningboard.org; http://www.keralaplanningboard.org/
http://www.kerala.gov.in/dept_planning/ann10.pdf (PDF, Size: 30 KB)

Has been in existence for over 30 years in Tamil Nadu, Karnataka, Kerala, Maharashtra and Goa for managing the sustainable development of the Ghats

Thrissur Corporation, Kerala
Thrissur, Kerala; Tel: 91-487-2424864; piutsrksudp@gmail.com; http://www.corporationofthrissur.net/

Urban local body responsible for providing civic services to the municipal area, including water supply and sanitation

Lokvikas, Gujarat *(from Biplav Paul)*
Saket House, 1, Panchsheel Society, Usmanpura, Ahmedabad 380013, Gujarat; Tel: 91-79-7551931; teamleader@lokvikas.org; http://lokvikas.org/

Public charitable trust with the main objective of developing and promoting of sustainable educational, economical, health, social and cultural values

Aga Khan Rural Support Programme (AKRSP), Gujarat *(from Apoorva Oza)*
Swastik Cross Road, Navrangpura, Ahmedabad 380009 Gujarat; Tel: 91-79-6427029; apoorva@akrspi.org
Works on water, sanitation and related issues in the several state of India, with a strong focus on community participation, among the rural poor

From Dinesh Kumar, IWMI, Hyderabad; response 1

Ministry of Water Resources, Government of India, New Delhi
New Delhi; http://wrmin.nic.in/; Contact U. N. Panjiar; Secretary; Tel: 91-11-23710305; us.panjiar@nic.in
Responsible for laying down policy guidelines and programmes for the development and regulation of country's water resources

Central Ground Water Board (CGWB), Haryana
NH-IV, Bhujal Bhawan, Faridabad 121001 Haryana; Tel: 91-129-2419075; Fax: 91-129-2412524; chmn-cgwb@nic.in; http://www.cgwb.gov.in/
Apex national level agency responsible for monitoring ground water levels, quality and hydrology across the country, has a network of 18 regional offices

International Water Management Institute (IWMI), Andhra Pradesh
Patancheru, Hyderabad 502324, Andhra Pradesh; Tel: 91-40-30713071; Fax: 977-1-5535743 d.pant@cgiar.org; http://www.iwmi.cgiar.org/Offices/Asia/South_Asia/
Researches increasing productivity from water, taking the needs of the environment and the poor into account from a holistic perspective

From Avinash Zutshi, Feedback Ventures, Gurgaon

Commissionerate of Rural Development, Kerala
L. M. S. Compound, Vikas Bhavan P.O., Thiruvananthapuram, Kerala 695033; Tel: 91-471-2316095; Fax: 91-471-2317214; rdkerala@eth.net; http://www.crd.kerala.gov.in/
Oversees all rural development programmes in the state, including the Total Sanitation Campaign and provision of drinking water

Social Economic Unit Foundation (SEUF), Kerala
Socio Economic Unit Foundation, A1, Belhaven Gardens, Kowdiar P.O., Thiruvananthapuram 695003 Kerala; Tel: 91-471-2315907; seufhq@sify.com; http://www.seuf.org.in/
Kerala state government's leading institute for research and implementation of all the social sector programmes

All India Institute of Hygiene and Public Health (AIIHPH), West Bengal
110 Chittranjan Avenue, Kolkata 700073 West Bengal; Tel: 91-33-2241-3831
Human resources development agency in the field of public health and hygiene, under the Ministry of Health and Family Welfare

From Mihir Maitra, Consultant, New Delhi

Centre for Water Resources Development and Management (CWRDM), Kerala
Kunnamangalam, Kozhikode 673571 Kerala; Tel: 91-495-2351802; Fax: 91-4952351808; edcwrdm@satyam.net.in; http://www.cwrdm.org/
State-level centre of excellence catering to the needs of research and development in all spheres of water management

Malanadu Development Society, Kerala
Kanjirapally P.O, Kottayam District, Kerala 686507; Tel: 91-4828-271646; Fax: 91-4828-270656; mds02@sify.com; http://www.malanad.org/

Official organization of the Diocese of Kanjirappally for social and development interventions, with a focus on education and water

Evangelical Social Action Forum (ESAF), Kerala *(from George Thomas)*
12, Hephzibah Complex, Mannuthy, Trichur, Kerala 680651; Tel: 91-487-2371472; Fax: 91-487-2371472 esaf@sancharnet.in; http://www.esafindia.org/

Works to provide the poor opportunities for enterprise development, jobs and ownership of resources to ensure their welfare and development

Kerala Rural Water Supply and Sanitation Project, **Kerala** *(from P. S. Yadav, Haryana Institute of Rural Development & Department of Development and Panchayats; response 1)*
PTC Towers, SS Kovil Road, Thampanoor, Thiruvanthanpuram, Kerala 695001; Tel: 91-471-233700; Fax: 91-471-2337004; mis@jalanidhi.com; http://jalanidhi.com/

This is the state-level project, assisted by the World Bank, and implemented jointly with the state government to provide water and sanitation services

National Bank for Agriculture and Rural Development (NABARD), Maharashtra *(from Tushar Shah, IWMI, Gujarat)*
Plot No C 24, G Block, Bandra-Kurla Complex, Bandra (E), Mumbai 400051 Maharashtra; contact@nabard.org; http://www.nabard.org

Has a national scheme for the rehabilitation of dug-wells across India for individual farmers where it provides financial assistance

Integrated Water Resources Management Organization (IWRMO), Switzerland *(from Latha Bhaskar, Ashoka Trust for Research in Ecology and the Environment, Kerala)* ***NEW!***
ch des Eschaux, 1274 Signy, Switzerland; Tel: 41-22-3621654; iwrm@iwrm.org; http://www.iwrm.org

Promotes IWRM concepts for equitable sharing of land and water resources, promoting an understanding of human being's dependence on ecology and dispute resolution

Kerala Rural Water Supply and Sanitation Agency (KRWSA), **Kerala** (*from Isac John, Socio Economic Unit Foundation, Calicut)* ***NEW!***
PTC Towers, S S Kovil Road, Thampanoor, Thiruvananthapuram 695001, Kerala; Tel: 91-471-2337002; Fax: 91-471-2337004; mis@jalanidhi.com; http://jalanidhi.com

Autonomous institution, whose development objective is to improve the quality of rural water supply and environmental sanitation, including through well recharging programmes

From Subramanian K S, National Remote Sensing Agency, Hyderabad

National Remote Sensing Centre (NRSC), **Andhra Pradesh** ***NEW!***
Balanagar, Hyderabad 500625, Andhra Pradesh; Tel: 91-40-23879572-76; Fax: 91-40-23878648; feedback@nrsa.gov.in; http://www.nrsa.gov.in/

Responsible for the acquisition, processing, supply of aerial and satellite remote sensing data and continuously exploring the practical uses of remote sensing technology

Department of Drinking Water Supply, **New Delhi** ***NEW!***
Ministry of Rural Development, Government of India, 9th Floor, Paryavarn Bhawan, CGO Complex, Lodhi Road, New Delhi 110003; Tel 91-11-24361043; Fax: 91-11-24364113; jstm@water.nic.in; http://ddws.nic.in/

Union Government agency responsible for providing drinking water and sanitation services to rural areas across India

Recommended Portals and Information Bases

3rd Census of Minor Irrigation Schemes, Ministry of Water Resources, Government of India, New Delhi *(from R. Jagadiswara Rao, Sri Venkateswara University, Tirupati)*
http://mowr.gov.in/micensus/mi3census/index.htm

Portal contains information on all the irrigation schemes in India with a command area of less than 2,000 hectares that are categorised as minor irrigation schemes.

From Sunetra Lala, Research Associate

rainwaterharvesting.org, Centre for Science and Environment, India ***NEW!***
http://www.rainwaterharvesting.org/; Tel: 91-11-26066854, 26059810, 29955410, 29955781, 29956394

Provides information on water recharging experiences, both rural and urban across India, along with several case studies

India Environmental Portal: Knowledge for Change, Centre for Science and Environment, India ***NEW!***
http://indiaenvironmentportal.org.in/; Tel: 91-11-26066854, 26059810, 29955410, 29955781, 29956394

Promoted by the National Knowledge Commission, the portal provides extensive information about various environmental issues, including water recharge in India

International Groundwater Resources Assessment Centre, The Netherlands ***NEW!***
http://www.igrac.nl/publications/104 ; Tel: 31-30-2564270; info@igrac.nl

It is an interactive and transparent portal containing information on groundwater for both professionals and the general public

Recommended Training Courses

From Sunetra Lala, Research Associate

Artificial Recharge, **BOSS International**, **USA** ***NEW!***
Information available at http://training.bossintl.com/html/artificial-recharge-training.html; For details contact Tel: 001-800-488-4775

The course will deal with the planning, designing, operating and management phases of systems for artificial recharge (including wells) and training with practical examples

Artificial Recharge of Groundwater, **National Ground Water Association (NGWA)**, **USA** ***NEW!***
1 to 2 December 2008. Information available at www.ngwa.org, For details contact Tel: 001-800-551-7379

Course will cover water recharge options inducing types, objectives, sources of water, design of wellheads and well fields, and functioning of aquifer storage recovery systems

Recommended Upcoming Events

An International Perspective on Environmental and Water Resources, Bangkok, Thailand, 5-7 January 2009 (*from Sunetra Lala, Research Associate)* ***NEW!***

Sponsored by Asian Institute of Technology, Information available at content.asce.org/conference/thailand09/conference_overview.html-11k

Conference focuses on aquifer-storage-recovery and artificial recharge of aquifers, watershed management, well restoration, etc

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Responses in Full

Uday Bhawalkar, Bhawalkar Vermitech Private Limited, Pune

Please see http://www.wastetohealth.com/ecorestoration.html, my recent paper that discusses diverse aspects of enhancement of water quality and availability.

P. S. Yadav, Haryana Institute of Rural Development & Department of Development and Panchayats, Haryana *(response 1)*

This is surprising that a district receiving 3,000 mm of rainfall on an average faces the problem of potable water and 70% of the wells have dried up.

Parts of Rajasthan receive very low rainfall usually. Traditionally, the Rajasthani people harvest rainwater through the system of *'Khadins'* and used this for drinking and household purposes.

For Kerala, I would advise that each and every rural household in Thrissur district be advised to resort to roof rainwater harvesting; large scale field bunding be practiced to arrest water run-off and conserve soil moisture; more village ponds be dug, existing ones be desilted and excess runoff be diverted to them under NREGA and; implement a system of rainwater filtration and transfer to wells directly to improve the system in the immediate term.

These measures can help improve the available of water in dug wells through the year.

Biplav Paul, Lokvikas, Ahmedabad

First, I am grateful to find this level of commitment from person of DM level. In Urdu there is a proverb that "good intention leads to job done - Inshallah".

I am from a NGO Lokvikas (www.lokvikas.org) working in grassroots development for last 14 years. We are also involved in dugwell rejuvenation programme in salinity-affected zones of North Gujarat.

My effort to answer your queries:

- **Social marketing tools for demand generation:** We had used financial terminology in the rejuvenation programme. In your case, it will be better to calculate the cost of drudgery of women in the village given the quantum of water accessibility in context of drying of the wells, and then campaign with the opportunity cost. The important factor is that it has to be village specific so detailed planning is needed. Secondly, we have worked with schoolchildren to share with their fathers information about the water problem they and their mothers face through the performing arts or print media. It works very well. It needs to be strategic, suitable to local needs.
- **Technology**: There are several technologies, which can be used to augment water supply. With an annual rainfall of 3,000 mm it will be not a tough task. The important factor is that we have to find the depth of the saline water table and how best we can use adversity as an advantage. We have developed a technology for reusing rainwater in saline zones. For that, we have been awarded by World Bank as one of the best socially innovative NGOs in India. This method can also be tried in Thrissur. We can study how to take this further and dovetail it with NREGA in Kerala as we are already trying it in our project areas.
- **Finance options**: It is one of the most critical factors and very few can claim success. There is no thumb rule for inclusive finance but I will suggest (a). To designate the well as a community asset

and ask people about their willingness to pay against the earlier transaction cost. (b). Try to secure community funds proportionate to the water collected per day (c). Develop a small ground level water tank based on the well and then develop a systematic pricing mechanism in keeping with consumption

- **Existing M&E:** Looking at your position as a policy maker and the volume of the task, I suggest that you may need to hire an expert team for the evaluation because the existing government system can do the monitoring only on a quantitative basis. For qualitative monitoring, you will need to develop case studies with a joint writer.

Suneel Grover, The SDSG Foundation, Punjab

It seems to be a very good project. It will need detailed and elaborative preparatory planning as well as post implementation follow-up to make community participation mandatory and successful.

We are working towards community involvement in drinking water in a World Bank assisted project with the Punjab government. There are many steps that should be really chalked out before hand for effective people's participation and sustainability of the project.

Tapan Ghosh, Kutch Nav Nirman Abhiyan, Gujarat

Tools which is use for awareness of utilization of ground water like, ground water is like a bank account, if you want to transaction through bank, then you can also deposit the same amount to the bank, if your bank have no amount then your transaction will not made. Therefore, if you want to continue made transaction through bank, then your responsibility is to deposit same amount to the bank. This is same process in ground water utilizations.

Ground water recharge process, which is a process in semi arid area is. Well made near to perennial line, where water would be follows, in between different type of treatment will be made like different type of checkdam, loose bolder, gabion structure, etc.

Megha Phansalkar, Development Professional, Pune

I would like to provide some insight on the need of community-based knowledge management in such community-driven projects. An array of participatory knowledge management tools which are user friendly and demand driven needs to be institutionalized. The data generated from these tools at regular interval can be an important piece of information for the traditional M & E system.

These community based knowledge management tools include:

- Community scorecards are regular intervals - which help improve the service delivery of the project like this.
- Process documentation tools, which can ensure that the non-negotiable principles are followed in the project and are documented.
- Transparency tools displaying the technical measures incorporated, regular display of expenditure and its heads.
- User-friendly community monitoring tools can be an handy tools for the stakeholders.
- A simple community-based monitoring system where limited but fixed – qualitative and quantitative data comes at regular interval and processed for analytical analysis.
- Self-addressed postcards at the community level become a regular source on feedback mechanism.
- Structured cross learning sessions amongst stakeholders are good source of important field information.

- Exposure visits to related project sites to understand the varied aspects of processes and technology.

Abhishek Mendiratta, Consultant, New Delhi

The following strategy should be adapted for groundwater recharge based on the assessment of area:

- Rejuvenation and rehabilitation of existing sources
- Augmentation of drinking water supply sources through conventional measures like percolation tank, check dams, weirs, Kolhapur Type weir, bandhara, recharge trenches etc., and unconventional measures like hydro-fracturing, bore hole blasting, fracture cement sealing, etc.
- Increase groundwater recharge to sustain the demand
- Rainwater harvesting and roof top rain water harnessing
- Create supplementary source
- Piloting of aquifer management groups and educate communities in total water resources management
- Regular monitoring of groundwater quality and quantity
- Provide drinking water from alternate sources
- Promote shallow open wells in areas where water quality is an issue
- Chlorination of drinking water at different points in the supply chain
- Mixing contaminated water with fresh water to lower the concentration of fluoride, nitrate, iron and salinity
- Provide limited quantity of fresh water for drinking and use poor quality water for other purposes
- Provide household or community treatment and water quality monitoring mechanism

Conventional and Unconventional Measures for groundwater recharge:

Type	Situation where applicable	Environmental Benefits
Conventional Measures		
Earthen Weirs	These are constructed across the streams to impound water, where the nala has a watershed area from 10 to 1000 Hectares, and width is less than 15 m.	Control on soil erosion Ensures groundwater availability in the wells located in the surrounding aquifer The silt from the drainage is used as fertilizer
Continuous Contour Trenching	These are suitable for hilly terrains and tribal areas, having low to medium rainfall. These works have to be implemented in a wider geographical area.	Stops soil erosion Increases groundwater storage due to percolation Forestation and biological fertility on the continuous contour trench Guaranteed clean environment and acceleration of environment cycle
Gabion Bandhara	Simple and less expensive where check dams/weirs are not possible. Height is about 1.2 m. Constructed using locally available material (boulders).	Recharges ground water on both banks of the stream
d) Vanrai Bandhara	For impounding water of post monsoon flow in small streams by keeping sand filled bags across	Recharges ground water on both banks of the stream. No silt accumulation as it

	small streams. Low cost structure.	collects post monsoon flows every year
e) Underground Bandhara	For arresting sub-surface flow from the aquifer having good transmissibility. Suitable for moderately sloping areas. Selected site must not create water logging in surrounding areas. Labour intensive.	Immediate and permanent benefits to the nearby wells by increased water availability Low evaporation losses unlike in other bandharas
f) Farm / Village ponds	Suitable in all areas. Beneficial in areas where artificial recharge to ground water by other methods is difficult. To be protected from human / animal activity in the vicinity.	Direct use of water is possible. Can be used for Pisci-culture for generating additional income
g) Percolation Tanks	In high relief areas where underground rock is permeable and large areas for water storage is available.	Most suitable for over extracted areas
Unconventional Measures		
a) Hydrofracturing	Suitable for areas where existing joint /fracture densities are low and also in areas where existing joints are chocked	Increases yield of wells and revamps dry or poor yielding wells
b) Fracture cement sealing	Suitable where available water from wells is lost to deeper aquifer through fractures	· Prevent leakages from well and guarantees availability
c) Bore Blasting Technique	Artificially creates fractures and improves infiltration in the source well storage capacity of source well. Suitable in assured and heavy rain fall areas and in low porous formation	Improves performance of low yielding wells Useful for small hamlets/tribal and hilly areas
d) Rain water harvesting	Captures rain water either in small tanks or direct recharging to well. Several types of design suitable for different situations are available Reliable method for drought prone and over extracted areas	Utilises available rain water, which is otherwise wasted

Funds can be mobilised through community participation with the involvement of all the stakeholders.

Sharat Singh, SPWD, Ranchi

The problem of water shortage that the Thrissur district is facing has led to many questions in my mind.

The district has more than 4.5 lakh wells – with an extraction capacity of more than 6.6 million m^3 per day.

Is this water used for drinking only or other purposes as well?

What is the area of influence normally associated with the wells? Are there wells lying very close to each other, i.e., impinging on each others' area of influence? If the dug wells are very close to each other and have a common area of influence, then we could think of using one well for direct recharge while withdrawing water from the other.

What is density of borewells or irrigation pumps? Is there a competing demand on groundwater between the borewell and dug well? Since the borewell draws water from the lower strata this might be creating conditions leading to drying of open wells. If there is high incidence of borewells, the problem has to be looked with this larger picture in mind and solutions will also have to be designed based upon these. Since then doing any amount of work for wells will only add up to better health of borewells and consequently leading to more borewells.

I am sorry that I did not come up with solutions but more questions, but probably this will help in designing an effective solution. Probably you must have already looked into these issues, then please share your thoughts.

M. M. Sharma, ICRISAT, Hyderabad *(response 1)*

My institute, ICRISAT, has a Watershed Project in a village called Kothapally, about 45 km from Hyderabad. Dr S P Wani is Leader of the team doing this project for 7 years now. In the village there were 72 dried wells. They attempted to revive 68 wells. All have been successfully revived by rain water recharging. The farmers even grow flowers and vegetables in summer months.

P. S. Yadav, Haryana Institute of Rural Development & Department of Development and Panchayats, Haryana *(response 2)*

I am happy to learn from you that Thrissur is one of the richest and most advanced districts of Kerala. I have visited Thrissur and also Cherpu Panchayat Samiti along with a team of 200 Sarpanches from Haryana to see the best practices on Sanitation. But I am equally of the opinion that being one of the richest districts does not mean that it has achieved the situation of full employment and people are not in need of work.

I would hope that at least 10 persons out of 1,000 rural population are definitely willing to do unskilled manual work. Let the NREGA authorities work on this hypothesis and take up digging of ponds for their own benefit. *Shramdan* is another option that can be done by even the rich. If this is also not possible then the rich people should make voluntary financial contributions for creating water-harvesting structures. At least, they can raise money creating these structures (which is in keeping with India's tradition). Somehow community has to be involved may be through contributions in kind, cash or labour. This is not the only area for collector to worry about. This is a big social problem to be tackled. Let the village communities be enlightened on this issue.

I hope the people of this rich district will come forward to solve their own problem. This will be real community empowerment. Because the empowered communities could create Ralegaon Siddhi and Hiware Bazaar in Maharashtra and there are numerous examples elsewhere in the country.

Vijay Kumar, Chartered Environmental & Water Resources Exploration and Development Associates, New Delhi

The falling water table is growing concern across the most of the places with all ranges of rainfall; Thrissur district is not exceptional as reported by Mr. Kurian Baby.

I had drawn a model for one of commercial venture group who thought of convincing GoK officials / authorities concerned. Till date-since I haven't got any feedback from that group. I feel, it can be modifies to suit to local condition by Mr. Kurian's team of experts. It might be similar what Mr. P S Yadav of Haryana IRD and Dept Dev. & Panchayats has proposed in one of his mails to water community. The situation is not so easy to understand for we people form far places. I had been to Thrissur once as part of WB team for assessment and mentoring team for Kerala Water Authority project on rural water supply in the yr 1990-91. Not the every roof is suitable for RWH; as well it is not easy to dig up ponds / wells for the purpose. But on neighborhood basis RWH [cluster having close roof tops] can be attempted to common storage system, which could a step towards solution that Mr. Kurian is looking for.

Should Mr. Kurian Baby require a copy, which can be sent to him for the purpose directly, since it cannot be made public?

Rajesh Shah, Peer Water Exchange, Bangalore

The creation of a tool and its continued relevance is one of the challenges.

The other main challenge is how to manage 4.5 lakh dugwells for both quality and quantity.

Maybe the Peer Water Exchange can help. It is designed to handle applications, projects, status reports in large numbers transparently. Here all project data can be stored, not case study and summaries. So projects that do not work have a home here (which is a large fraction of all projects) and there are many learnings from them.

Megha's list is wonderful.

Most of these tools exist, but need to be integrated into processes, people, and organizations. How do we create the organizer of the data, the one that gets all the postcards and collects, assembles the data, and organizes the non-community work too?

Maybe some text to web application (such as Voxiva) is useful which can take an sms and post it directly into a database (better than a postcard).

K. A. S. Mani, APFAMGS, Hyderabad

Mazhapolima, a programme for recharging of several thousand open wells in Thrissur district is a welcome initiative. Your keen interest to put into operation this scheme should help in its timely implementation.

Kindly exercise some caution. In a district where 3,000 mm of rainfall is not able to ensure steep fall in groundwater levels, can a recharge programme that would capture only a fraction of the rainfall runoff improve the situation drastically. It has to be assessed whether the investment of Rs. 1,871 crores should be used differently.

To answer this question one needs to assess the current recharge rate and groundwater abstraction. This should be followed by a forward modeling (using the services of CGWB Trivandrum and CWRDM Kozhikode). All possible interventions including dug well recharge need to be input into the model and

the response assessed. Any intervention that can stabilize, if not reverse, the situation should only be considered.

Here it has to be kept in mind that bulk water users in Thrissur are not the domestic users but the deep tubewells supplying piped water for irrigation and commercial needs. Until the groundwater use efficiency and recycling of wastewater from such high demand users is not improved, no amount of additional recharge can reverse the declining trend of groundwater levels in the district.

While not appearing to be cynical, I believe one should not expect a turn-around in the situation through a simple solution to very serious and grave problem that is not confined to Thrissur, but large part of India.

I am sure an administrator such as you can seriously look at the demand-side management approach that calls for improving water use efficiency. This could be achieved through behaviour change. Kindly visit the website www.apfamgs.org for understanding more about this concept.

S. Vishwanath, Biome and Agrhyam, Bangalore

A wonderful idea and a comprehensive approach has already been adopted under the programme.
I have but a few suggestions:

- A quick explanation of the hydrogeology of the area to people in simple language with illustrations. This should be targeted so that children understand what groundwater is, what a shallow aquifer is, what its capacity is, why a problem is occurring, what the quantity threats are, and what should be done to maintain the nature of the aquifers.
- A series of neighbourhood walks organized for the community again centred around children to explain this above information in a visual manner appropriate to the local context.
- The main threat to the wells seems to come from nitrate contamination from the tremendously successful Total Sanitation Campaign in Kerala. Is that the case in Thrissur? Is it possible to find ecosan solutions in as many places as possible to ensure the quality of water in the groundwater wells?
- The necessity of appropriate solid waste management and catchment management to ensure again the quality of well water.
- If recharge is to be done in places where there is a quantity issue, I would suggest picking rooftop rainwater into recharge pits which would definitely cost less and would be within your budget. Any other water except rooftop rainwater should be allowed to recharge with caution to avoid pollution problems.
- To map clear recharge and discharge zones and then take recharge steps only in the places where recharge potential exists.
- I really do not see the need for too much finance but a simple system of rewarding the better performing units at the household level in each hamlet should go a long way. Other than that the availability of water in the wells throughout the year should be its own reward.
- For M & E would you consider using the India Water Portal and developing an appropriate tool to document success and failure stories, since this is in the nature of a peoples' movement and people are the best M & E developers.
- I do not think this advice is necessary but is given in a spirit of some experience at a much smaller scale working in Bangalore and villages of Karnataka.
- For those with broadband connection here is a small video clip:

http://www.youtube.com/watch?v=Dz_VGaPr610 and http://www.youtube.com/watch?v=cpINxY6F6t0

Tushar Shah, IWMI, Gujarat

I think you are about to launch a very powerful experiment which can have far-reaching impacts all over the country. Therefore, my suggestion is that it will be very good if you can have someone properly document the innovative ideas you try out.

The Saurashtra region in Gujarat has been witnessing a groundswell of groundwater recharge activity since 1990. Although the Gujarat government is focusing energy and resources on Narmada, Gujarat's agriculture has been witnessing unprecedented growth thanks to the groundwater recharge movement in Saurashtra. By a separate mail, I will share with you a study I carried out on the Saurashtra experience, which might give you some ideas about a social marketing strategy. However, the main lesson I derived was that recharge can succeed only if it becomes a people's movement; no government agency can implement it in a program mode although it can support it through incentives, effective IEC campaigns and providing technical support.

The most important roadblock is an unlearning barrier our well owners have to cross. We have been taught for centuries that the muddy floodwaters of rain must not be allowed anywhere near the wells; else, the wells will be silted. It is important to change this mindset by doing three things: [a] driving home the point that the rainwater run-off is a resource and not a nuisance; [b] promote simple techniques to reduce the silt load of flood water before directing it to the well; [c] train local barefoot technicians to efficiently desilt wells every 4-5 years at an affordable cost.

I wonder if you know that the government of India launched a Dugwell Recharge Scheme in 2007 with a total outlay of Rs 1,800 crore to be disbursed by NABARD as support to farmers for dugwell recharge. I think you should access this scheme. In my view, Rs 1,500 per well may not be sufficient to construct a good desilting chamber, for pipes, and other material needed. The Government of India scheme provides Rs 4,000/well.

I will be personally interested in staying in touch with you on how your intervention fares because, if you succeed, it will have profound effect on how we manage water elsewhere in India. Best regards and good luck with this noble idea.

Arunabha Majumder, All India Institute of Public Health and Hygiene, Kolkata

My comments are as follows:

As dug wells are very common in rural homes in Kerala, any rational effort to recharge ground water must be encouraged. Rural population love to use dug well water. In the 1990s, the All-India Institute of Hygiene & Public Health carried out qualitative analysis of dugwell water in different areas of Kerala.

We found people prefer to use dugwell water than street tap water (piped water supply), but almost all the dug wells were found to be faecally contaminated. People address this by boiling drinking water.

Recharging will depend on the underground soil strata. I think in many areas sub-surface recharging will help to get dugwell water throughout the year. Awareness and motivation programmes will help to sensitize people to practice rainwater harvesting. A door-to-door campaign will be effective. The role of the panchayats is very important and they must play a positive role. Students may conduct regular programmes to sensitize people such as street plays, magic show and cultural shows.

Regular surveillance is needed to avoid chances of contamination during recharging. Disinfection through drip-chlorination may help to keep dug well water bacteriologically safe.

M. Dinesh Kumar, International Water Management Institute, Hyderabad *(response 1)*

The dug-well recharge project may not solve a complex problem like groundwater depletion. This is something the people of Saurashtra did 20 years ago, but failed to achieve anything significant from it.

I fully agree with the points made by Dr. K. A. S Mani about the difference recharging can really make in an area, which receives 3,000 mm rainfall, but water levels are still falling. The real problem is the withdrawal of water, against what is available underground.

It is important to note that in many areas of Kerala, water levels are falling not only because the withdrawal is high, but because the aquifer does not have sufficient storage potential, especially in the midland and mountainous regions. A significant chunk of the monsoon recharge flows out of the aquifer and is available as base flow during both monsoon and non-monsoon periods. Increasing the recharge during monsoon by diverting the runoff into dug wells will not help, as the same would come out as base flows.

As Dr. K. A. S. Mani pointed out, the only solution is to reduce groundwater withdrawal during the non-monsoon period through demand management. There is no point in focusing on supply side solutions for drinking water supply, when the total water demand in domestic sector is just 1 per cent of the total agricultural water use.

If the recharge scheme is implemented in the semi-arid and over-exploited blocks of India (as is proposed now), it will reduce the volume of water in the rivers, which are already stressed, and eventually affect the reservoirs downstream. This in turn would adversely affect the prospects of farmers and millions of people living in the cities who depend on it for drinking water.

Most schemes for groundwater recharge simply ignore the water available on the surface. Almost all the river basins, in which have over-exploited blocks are falling, are "closed" basins, with no uncommitted flows.

In semi-arid areas, people depend heavily on groundwater and over-exploit it when surface water resources are scarce (with its demand far exceeding supply). In this context, there is no logic in appropriating the same surface water for recharging aquifers. It only helps divide the waters, but does not add even a drop at the basin level. If the dug well recharge scheme is implemented in peninsular India, semi-arid and arid parts of Gujarat and Rajasthan, it would only increase the environmental water stress of the rivers in these regions.

The last issue is of quality of water, which is used for recharging. There are no cheap techniques available for removing the fertilizer and pesticide residues in the water, which is used for recharging. The filters only remove the biological matter, sediment and silt load. Hence, from the point of view of managing drinking water supplies, this is dangerous.

In nutshell, these low cost technologies would prove to be costly for the society not only in the long run but also in the short run from the point of view of social costs and benefits.

In the light of these facts, the government's investment of Rs. 1,870 crore for recharging aquifers, when people are running out of water in those areas, will be misplaced. Also, it is unrealistic to expect 4 million farmers (in the 100 districts) to carry out recharge activities using just the subsidy of Rs. 4,000 each.

David Foster, Administrative Staff College of India, Hyderabad

I believe that Dinesh Kumar makes some very valid points. Sadly, in many areas of India, demand far exceeds supply and most government policies only exacerbate this problem.

Water intensive crops like sugar cane and paddy rice are being raised in areas poorly suited for them and consequently groundwater levels are falling precipitously. Furthermore, many states, like Andhra Pradesh, even encourage excessive groundwater pumping by providing free power to the farmers.

While this subsidized power is justified in the name of the poor, close observation will reveal that very few poor people actually benefit from it. Most of them have neither the deep wells nor the pumps to make use of free power and, predictably, it is the shallow wells of the poor farmers that are first to run dry when the groundwater falls.

S. Janakarajan, MIDS, Chennai

I appreciate your efforts. I am sure you are into a very important mission with a much larger vision. But first you need to take the inventory of small water bodies in the region where you are working and make sure that 3000 mm of annual rainfall is effectively used - at least to store a part of the rainfall - in these water bodies.

This would involve desiltation of these water bodies, catchment treatment, renovation of inlet channels etc. I am sure this measure will make a huge difference in recharging groundwater in the region. After all, these small water bodies are the age-old rainwater harvesting structures!! However, this does not mean that the individual efforts in recharging their wells should be stopped. Both can go on simultaneously.

Sachin Tendulkar, Mineral Foundation of Goa, Goa

The state of Goa with a similar monsoon pattern also face problem of water shortage in summer. We have collaborated with the Govt. of Goa to implement watershed programme on a microwatershed basis and results are encouraging. We have documented rise of 40 cm in well column in lean season and extension of moisture regime in the field. We have practiced this in the interior part of Goa, which are near to the foothills of the WG, and in the midland region. However, I do not have experiences in the coastal areas.

R. Jagadiswara Rao, Sri Venkateswara University, Tirupati

Let me first commend your proposal to take up a massive people's programme of recharging drinking-water open wells in Thrissur district essentially through roof water harvesting and thereby make adequate domestic water available to people round the year without resorting to water supply through tankers. As stated by you, 4.49 lakh households accounting for 72 per cent of the population of the district depend on 4.5 lakh open wells to meet their domestic water needs with one well providing water for one household. Although these wells can yield around 14.7 cubic metres a day per well on the average during monsoon, around 70 per cent of them dry up before the onset of monsoon. In view of the average annual rainfall of 3130 mm, artificial recharge of groundwater will no doubt further enhance the yield of these wells during monsoon while wells continue to remain dry during dry months.

According to the Central Ground Water Board (CGWB), Thrissur district ranks seventh with a stage of groundwater development of 46.9%, with the districts Kollam, Pallakkad, Idukki, Kannur, Alappuzha, Pathanamthitta, Kottayam and Waynad alone showing a lower stage of groundwater development for the reference year 1998-99.

According to the 3rd Minor Irrigation Census (MIC) for the reference year 2000-01, the district has a gross area of 44,774 Ha irrigated by all sources, 23,285 Ha irrigated by minor surface bodies and 19,688 Ha irrigated by groundwater and is higher than any other district in Kerala. Despite that, 69 per cent of the net area sown in the district is rain-dependent. Compared with any other district in Kerala, Thrissur

district has maximum number of 45,216 wells in use accounting for over 21 per cent of the total wells in use in the state. While a well irrigates 0.44 Ha in the district, the corresponding figure for Kerala as a whole is 0.57 Ha and India as a whole is 2.7 Ha in on the average. This again indicates that design of irrigation wells in the district is in general inferior to those in the state as a whole; and those in the state are inferior to those in the country as a whole. What is true with irrigation wells must be also true with drinking water wells.

Dug wells, shallow tube wells and deep tube wells are the three types of irrigation wells recognised by the 3rd Minor Irrigation Census. In the district, the gross area irrigated is 0.44 Ha for a dug well, 1.0 Ha for a shallow tube well and 5.2 Ha for a deep tube well. The corresponding figures for Kerala as a whole are 0.54 Ha, 1.2 Ha and 4.2 Ha, while for India as a whole are 1.7 Ha, 3.4 Ha and 8.7 Ha.

As stage of groundwater development under 70 per cent is considered safe, more groundwater can be exploited in the district to meet the various water needs of the people. Making these wells perennial is possible only through construction of deep tube wells or high-yielding properly designed wells at right locations. By taking up a parallel programme of artificial recharge of groundwater as planned by you, it should be possible to keep the stage of groundwater development within safe limits despite excessive groundwater exploitation to meet the domestic and other needs of people on a sustainable basis.

Ajit Sheshadri, Vigyan Vijay Foundation, New Delhi

Based on our NGO's experience, give a few impressions on the "Participatory well recharge program" as below:

- Old dug wells which had helped sustain habitats get a chance to serve the communities in enhancing the ground water reserves.
- Earlier communities literally used to worship the village wells, over years have become cases of disgust with rubbish, wastes, even carcass of cattle being thrown in as a matter of convenience. Hence it will be a revival of village-wells, it is to be ensured that the wells are well-cleaned, de-silted, and if possible to dig a few feet deeper at the centre portion of the wells upto original depth.
- All wells near rain-water accumulations may be utilized for dug-well recharge, however to keep waste-water, sewage and solid-waste accumulations away, it would be good to make sign-boards sending social-messages to communities.
- Old wells which have their inners well plastered are very sound and intact, however some would be crumbling which need to be addressed by some minor or major repairs,
- Communities having discarded the usage of these sacred wells, need to re-enthused and made aware that such recharges will rejuvenate their very lives, in order they accept it. In our experience, the villagers who have seen the merits are taken to prospective areas for extended propagation & thro' appropriate community-communication methodologies.
- As regards recharge flow to lower aquifers, it has a good prospect upon flow measurement this can be commuted. In your case, each well has an investment of Rs. 1500/- and the recharge could be evaluated. Thus for a minimal cost, good quality drinking water is available to communities.
- This could well serve as an appropriate storm-water drainage mechanism in inundated areas in rural and also in urban areas. The wells need to be well- covered with a steel grating and some sign-boards affixed etc.

M. Dinesh Kumar, International Water Management Institute, Hyderabad *(response 2)*

I agree with Mr. David Foster on the issue of electricity pricing. The biggest culprit is the free power in the farm sector. Instead of addressing this economic issue, we seem to be spending all our energy in chasing the mirage, i.e., the surplus water.

While many (including politicians) believe that introducing consumption based (pro rata) pricing of electricity would reduce the net income from farming, the results from recent IWMI studies (which I had coordinated) shows just the opposite. Not only that the water use efficiency was higher under pro rata pricing of electricity but the net returns from farming (from every unit of irrigated land) were also higher. So, the socio-economic viability of pricing electricity is not the issue.

I recently happened to attend a meeting of the top officials of the government (from Ministry of Water Resources, including the Joint Secretary, Water Resources) and State heads of the CGWB, which discussed the implementation of dug well recharge programme. Officials from at least two states, which had already started it on an experimental basis, were highly sceptical about the scheme, while others did not know how to go about doing it.

Two concerns were raised in the meeting. First: the costs of recharging through dug well is much higher than estimates. The reason being that dug wells are located at the highest elevation in the field and runoff had to be collected from the lowest points in the slope. Therefore, water can be diverted to the wells only if deep channels are cut. This is highly expensive (often running into several hundred metres). In Rajasthan, the official estimated that it would be no way less than Rs. 25000. Fast silting up of the channel and filter was another issue in regions like Rajasthan. Second: groundwater contamination due to pesticide and fertilizer residues (raised by officials from Maharashtra), and also pointed out in my earlier response.

It was suggested in the meeting that government initiates some comprehensive studies to assess the physical and economic mpacts under different geological and hydrological regimes, before embarking on a massive programme of this kind in several states.

I sincerely hope, the members of the community would have serious discussions on this in the coming days.

I can share the recently published research papers based on studies of water harvesting/groundwater recharging, and the impacts of electricity pricing, if any member needs.

I would like to share some of the thoughts on some of the issue associated with estimating stage of groundwater development in the subsequent mails. That may perhaps help explain why water levels are falling when the development (as per official estimates) is only 50 per cent.

A. Latha, River Research Centre, Kerala

As a person aware of this program and a well-wisher, the single entry point intervention is a good starting and we are supporters of this challenging effort being an organization based in Thrissur. However, the larger background that has led to this situation can provide answers that can augment ad improve the results.

How come that 71 per cent of the open wells are non perennial?

The solution lies at the root cause of the problem itself.

To quote another similar instance, Thrissur corporation area alone had around 65 large ponds that were used by the people. Presently hardly 5 remain intact. All others have been reclaimed for urbanisation.

The Kerala landscape is dotted by hundreds of streams and rivers which are also rainfed and help summer recharge of wells. Most of them dry up after monsoons and most rivers fail to reach sea creating salinity intrusion.

The Kerala landscape was characterised by vast expanses of paddy fields, which also helped in recharging open wells. Rapid reclamation of paddy lands has also affected well recharging. Thrissur district is one of the worst affected in terms of paddy land reclamation.

Indiscriminate sand mining has plunged the riverbeds and surrounding water tables of open wells. Both Karuvannur and Chalakudy river basins in the district are heavily mined creating dried up wells even on the riverside!

Taking into account the fragile eco - geo - hydrology of the landscape, every land holding with an open well can contribute towards well recharge by simply improving land husbandry - shift to more soil cover and mulching, mixed multi-tier cropping which was once the traditional land use pattern helping in soil and water binding and in turn curbing heavy runoff and soil erosion.

In other words, we have been consistently reducing all the pre- conditions necessary for ensuring natural recharge. Hence, awareness creation on restoring the health of the land has also to be incorporated in the campaign for long-term effects of well recharge. It can be linked to NREG and watershed management.

In hilly areas open well recharge can be effectively tied up with watershed interventions. Many areas are already implementing WGDP. In coastal areas, clearing, cleaning up and vegetative restoration of channels draining the tidal flows can augment well recharge along with mangrove regeneration.

It is my humble opinion that such activities will have to be taken up along with the open well recharge either through NREG / plan fund for sustainable results. The communities have to be made responsible towards their natural resource base upkeep and nurturing.

That is all for the present.

Mihir Maitra, Independent Consultant (formerly with India Canada Environment Facility, ICEF), New Delhi

Your query assumes great importance since it contains both technical and programmatic (policy) concerns. Kerala, despite of more than 2000 mm rainfall is known to suffer from seasonal shortage of fresh water for drinking. General technical perception is that Kerala needs to apply large scale watershed treatments in the upper reaches to increase groundwater recharge and in the lower (coastal) reaches undertake roof water harvesting for storage where water is saline due to back water flow.

The main rock type of Kerala being latterite and due to pronounced slope from east to west, the aquifer system has low groundwater holding capacity. However, latterite and its derivative called lithomerge allow sufficient seepage to fill-in many dug wells in the mid- and upper reaches. If, it is found that many domestic dug wells that were having enough round the year drinking water earlier but are now getting dry during the summer months, the reason is obviously the over pumping in the lower-middle reaches perhaps by new users like Industries.

The apparent technical solution is to supplement the well water with water harvested from roof top for storage within the dug well. However, since, the programme deals with the individual source of drinking water, one has to tread carefully. One of the conditions recommended by many field practitioners is that the water to be stored in the well must be silt free to prevent clogging of the dug-well. Developing an on line effective silt-filter locally for storing silt free water in dug-wells would require some field trials in a pilot scale. You may consult, CWRDM, Kozhikode and Malanadu Development Society (MDS), Kanjirapally, who have adequate experience in roof water harvesting in Kerala.

In the policy level, my observation is that these days we have the benefit of many centrally sponsored programmes where emphasis is on timely fund disbursal and utilization. Certain development interventions are better done in project mode extending to 3 or more years. The PRIs would require time and understanding to undertake a project of this nature which has to mobilize funds and willingness from communities (unlike just giving subsidy) through social marketing and implement a process driven project to provide solution and capture lessons.

Therefore, in my view, the lessons of this critical intervention could be captured better if it is implemented in a project mode extending to say 3 years. It would be of advantage to collaborate with some local NGO partners for large scale awareness generation (IEC materials), monitoring of implementation, process documentation and contribute to some extent to the process of capacity building of the PRIs. The Socio Economic Unit (SEU), Thrissur, an offshoot of the Dutch-Dane funded drinking water project implemented in 1990s in seven districts including Thrissur, may be contacted for support as they are dealing with drinking water issues in Kerala since long.

George Thomas, Evangelical Social Action Forum (ESAF), Trichur

First of all I congratulate the Dr. V.K Baby who has initiated a people oriented Water Recharge Program in Thrissur Dist. My name is George Thomas, Director Operations, ESAF (One of the leading NGO in MF and WATSAN sector). I have been with Agricultural Dept., Govt. of Kerala for the last 13 years and in NGO sector for the last 7 yrs.

My experience with Farming Community and the WATSAN sector, I believe there is great link between Agricultural practices water conservation. Therefore, agronomic practices combined with Mechanical methods can minimise runoff and accelerate water recharge. Therefore let me share some of my experience

- Coconut palm's deep basin making before south west and south east monsoon
- Mulching in Coconut palm basins
- Deep ploughing of Paddy fields and application of Green Manures
- Composting of organic waste from agricultural land
- Plugging of common gullies by Panchayats (depends on the gravity and locations participation of grama, block and district Panchayats could be decied)to reduce runoff
- Micro Watershed approaches combining activities of departments.

Coordination among different government departments especially Agriculture, Soil Conservation, Irrigation, Water Authority, Ground Water, etc., are absolutely necessary

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Apoorva Oza, AKRSPI, Ahmedabad

I have been reading with interest the wide range of views. While Tushar has endorsed this, Dinesh Kumar finds that there is no benefit as it is at the cost of some water harvesting and use downstream.

We at AKRSPI have tried a range of options for groundwater recharge, and well recharge has worked in some places, though not all.

The costs, even when the wells are in the higher portion of the field are not too high if the farmers are convinced, because the material component is low and labour contribution for one's own field is easy. Over the year, despite my respect for research in the field, I would largely suggest that we should initially focus, and go ahead, based only on the farmers' response and not on some complex research study which looks at too many dimensions and has little space for the farmers' responses. During the pilot, if it works, expansion would make sense in a similar context.

I think this, and many other low cost ideas are the future of irrigation in India. India needs a large number of small recharge structures than a small number of large dams-which always have cost and time over-runs!!

Avinash Zutshi, Feedback Ventures, Gurgaon

The issues raised are, water quality, source contamination, bad sanitation and role of the state/ people/ external agencies in getting it right.

To the above concerns, the issues are interconnected and become a closed loop when looked into its totality. We, RNE supported SEUF intervention in Kerala (Dutch supported Kerala with FA and TA initiatives since 1990). During early 2005 RNE/ SEUF arranged AIIH&PH, Kolkata to demonstrate on the ground the applicative part of WQM and Institutionalize community based WQ Surveillance mechanism. We took this right to the doorsteps of people and arranged AIIH&PH to train PRIs in > 10 Panchayats (SEUF may correct the no.) with the help of Water quality field testing kits.

I am not aware as to the current state of affairs of this humble initiative and how much has it been internalized and taken forward by GOK functionaries (It did not cost the Dutch more than Rs 5 lakh). Is money the driving force- i may mostly like to differ but let me not take the discussion in a different direction.

We did try to make a start of an IWRM initiative in Wayanad, tried lay a broad framework. We had wished to take it forward with RNE funding, but for the untimely phasing out of Dutch from the Indian bilateral development scenario. However what was appreciated by all was, to follow an approach which is away from the conventional thought process and required preparedness to adopt to a paradigm shift- an approach which is based on community awareness/ consensus and technically sound interventions in a well planned phased manner- Latest status unknown to me on this also??

We did try sanitation (toilet) options based on climatic, social, cultural, economical and most importantly the Geo-morphological considerations, in terms of appropriateness to Alleppy situation (rampant water logging). Leachate from solid waste creates a mockery of mankind together with bacteriological contamination and Nitrate residues in water source/s is a result of actions by we all, we live there and the ones who work there. The broad framework of solutions is known to all now, but then a coordinated set-up to take it forward in a campaign mode is desired. A more scientific, people based and managed approach is required??

The pioneering initiative which started in Kottayam (2000), Kerala under its Community Led Clean Village program (as part of TSC) has been a remarkable effort- i am not aware as to the latest on this together with the RSMs/ PCs and Women mason society the "Jeevapoorna" initiated then and continued deliver under Dutch support until 2005.

Kerala's own decentralization under 173rd CAA is a landmark achievement in itself, am sure is continuing with the same vigor and commitment. There can be obstacles (leave politics away) off and on, but then the basics developed under stewardship of Mr. Vijayanand are strong.

I do believe that solutions lie in consultation processes, dialogs and a consensual approach but then the appropriateness hence developed has to take into cognizance the local knowledge, traditional practices and the local intrinsic values, they possess of there own environment. There has to be benefit of an outside support, which need be technically sound and managed scientifically.

The above discussion may lead us to think- is it the institutional reforms AVINASH is referring to. I do believe what is required most urgently is to plan a paradigm shift, an alternate way to do things.

There is urgent need for the re-structuring of the centrally located/ operative and dominating PSUs, conventionally responsible to develop policy- allot budget- plan schemes and implement them as per guidelines- and then they themselves evaluate performance. Reason why Nationally performance is at 43%, O&M budget is likely to surpass the capital cost development budget in next a few years, and increasingly the policy making institutions are fading away or being taken away by a new (innovative thought even for the Rural water and Sanitation also) the P-P-P models encouraging take-over by the Private sector.

Biju Jacob George, Tsunami Reconstruction Project, Tamil Nadu

I am Biju. I worked in Jalanidhi project, Vazhikadavu, Chungathara and Talavoor Grama Panchyahts, as Team Leader. I have been through your writeup and feel it will be very effective in well recharging. At present, I am working in Nagapattinam in the Tsunami reconstruction project.

M. M. Sharma, ICRISAT, Hyderabad *(response 2)*

Dr. Yadav has suggested just right solutions.

In Rajasthan, the *Khadin* system not only meets drinking and household needs for water but I have seen farmers growing wheat in areas, which get 250 mm rain with the system.

The key is water conservation. Those who get plenty of it, it seems do not have the culture to conserve such a precious but free resource.

In Hyderabad, in my house we conserve all rainwater from the roof of our house and use it for the full year for drinking, cooking, bath and washing clothes whole year. It is simple. We just have to forget the mentality that government alone is responsible to solve our water problem.

Terry Thomas, Wilbur Smith Associates, Bangalore

At the outset, it's great initiative in local level development implementation.

Freshwater services in homestead wells are to be considered as an ecosystem service. The only actor having pertinent role in maintaining this ancient water service is definitely the respective household possessing ownership of the well or pond. This message is vital for the success of "Mazhapolima".

Way back in 2004, we did initiate a participatory local action, in the coastal regions of Kerala, as an outcome of World Bank's Development Marketplace 2004 activity, towards arresting saline water intrusion open wells. The process adopted was titled "Backwashing": which necessarily involves collection of roof top rainwater and feeding directly into open wells and ponds. This enabled in loading and gradual development of larger fresh water lens surrounding the well, which enabled in arresting the saline water intrusion. More details concern the outcome and learning's with this process of direct recharge of wells using rainwater is available in the following web links.

"Backwashing" -Injection of Harvested Rainwater into Open Wells for Enabling Water Quality Improvement
http://www.planetkerala.org/downloads/Backwashing_English.pdf (Size: 450 KB)

Rain Harvesting In Kerala, India
http://www.unescap.org/pdd/prs/ProjectActivities/Ongoing/Water/Kerala/Kerala_ES.pdf (Size: 88 KB)

The procedure is also available for download in Malayalam at http://www.planetkerala.org/downloads/book.pdf (Size: 829 KB)

Here we partnered with problem clusters / households in selected coastal locations areas around Calicut (mainly Kadalundi panchayath). After explaining the background, these households willingly provided their own abandoned households to experiment the process. Monitoring and analysing the results, over the years, majority of the partnered households were able to revive their open wells, mainly in addressing salinity and other physical quality issues. Using this participatory localized approach, the owner household and the immediate neighbourhood could convincingly learned and understand the techniques (increasing the knowledge through participation), besides localizing the process for further replications. From 2006 onwards the facilitators took a back seat and now the local communities, including the Panchayath are taking initiatives for further replication.

"Backwashing" a term coined by partner communities emerged as a low cost solution to address the ever incrementing water crisis with practicality. The major shortfall of this process is its inability to address biological contamination; however, as the practice of boiling water prevails in most households, this aspect is addressed. The major impact of that process was towards enabling in reduction of drudgery towards bulk water collection, especially for women folks. The Dissolved Solids Level in water is brought down significantly through backwashing.

With reference to social marketing, I would like to share the learning's drawn which may find application in your mass drive. Three factors mainly drive the speed and effectiveness in replication-

The target community for rejuvenation of open wells should have the following features, which is found mandatory.

- Facing "acute" water crisis, with no other options and increased drudgery *(for making demand to adopt)*
- Access to right information and knowledge over open well revival process *(for demystification and gain confidence to act)*
- Technical options that are affordable to implement *(mainly cost concerns)*

The second factor is the more critical which "triggers" decision making towards addressing the homestead water crisis. Right information, knowledge and practical support in establishing the collection, "including clearing of minor doubts" is found to influence the level of adoption. The facilitators still receive numerous telephone enquires across the state, which proves a strong "unattended" demand exist among households.

The media should definitely get tied up with your initiative. Drawing from our experience the first level of information on various well rejuvenation processes can be best provided through news papers, which will enable communities to examine the options. In the second stage this is to be followed by "knowledge/ process support" over TV channel visuals (where the process of rainwater collection and diversion into well/pond is practically demonstrated). Finally in the third level, implementation support through local level trained facilitators/ local technicians. Financial support/ incentive for "hardware" come secondary with exception to most needy communities.

Please feel free to contact for further information in this matter.

T. K. Gowrishankar, Remede, Andhra Pradesh

It gave me immense pleasure to recognize your efforts to improve the wells both quantitatively and qualitatively.

Murali Kochukrishnan, AFPRO, Bhubaneswar

The project initiative on the participatory Well recharge programme- "Mazhapolima" is an excellent effort from your side. The aspect of participatory recharge to the ground water aquifer along the alluvium deposits and coastal alluvium will necessarily control the saline water intrusion by dilution of the concentrate and enhance the groundwater regime and quality of the area. However, the aspect of well recharge in the hard rock terrain and laterite need to be studied for its effectiveness. As the geomorphology of laterite formation and hard rock regions are undulating, the harvested water will drain out by gravity flow along the slopes similar to the run-off aspect (even though Thrissur District gets a 3228mm of Annual rainfall). That is why the open wells in hard rock terrain fail to yield required amount of water in summer.

In lateritic formation, the re-charge will certainly be effective up to the viscous lithomarge layer and the water will start flowing laterally above the contact between the laterite and the hard rock along the slopes until the water gets in to some fractures or fissures if available in the hard rock or may flow out with the slope.

With the rainwater harvesting schemes, various soil and water conservation measures like Contour Bunding, Marginal bunding, staggered trenches sub surface dykes etc. if taken up in the mid and upper reaches, this will necessarily conserve the water, recharge effectively and enhance the water regime of the area. As a whole, the programme is a excellent community based decentralized initiative worth appreciating.

The above points mentioned are the views of the individual and it never reflects on the organization where the undersigned works.

Surekha Sule, Freelance Journalist, Pune

I had written about participatory irrigation in a village near Nasik in Maharashtra. May be that is the way to unite even without any external assistance.

Besides there are many watershed development programmes with people's participation for well recharging. I will send one of my reports to you. (You can read the article http://infochangeindia.org/200403083359/Water-Resources/Stories-of-change/Water-management-in-Pimpalnare-The-people-succeed-where-government-failed.html

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Latha Bhaskar, Ashoka Trust for Research in Ecology and Environment (ATREE), Kerala ***NEW!***

It is nice to notice that a District Collector is paying so much attention to a specific and pertinent issue of conservation of our traditional wells and water sources. In this context I would like to invite your attention to the significance of preserving our available wetlands to facilitate the groundwater recharge and water quality maintenance.

"Wetlands" is the collective term for marshes, swamps, bogs and similar areas, and it is found in flat vegetated areas, in depressions in landscapes, and between water and dry land along the edges of streams, rivers, lakes and coastlines. Inland wetlands receive water from precipitation, surface water, tides and/or groundwater. Surface water sources include run off and storm water.

The hydrological and ecological functions of wetlands include

- Wetlands are important features in watershed management, as they regulate water levels within watersheds
- Improve water quality, *act as filters or traps for many of the toxins and pathogens*

- Reduce flood and storm damages
- Wetlands are significantly rich in biotic resources and diversity and support the sustenance of many riparian communities

But many of these wetlands are dying a slow death due to development pressures, namely annexation to agricultural fields, land filling for building housing colonies, water contamination from industries, factories and pesticides used in the cultivation of crops, etc. Most wetlands have been drained and converted to farmland, filled for housing developments and industrial facilities and used as receptacles for waste. Human activities continue to adversely affect wetland ecosystems.

Although these wetlands play a crucial hydrological role in storing and moderating flood flows in the rainy season and sustain water needs of thousands of people, there is no study available on the water regime and hydrology of these wetlands or economic valuation of their resources and services. Lack of baseline data and knowledge about our age-old wetlands is a constraint in the way of integrated planning for the conservation and utilisation of the water and other resources of these wetlands.

So we need to open our eyes to these significant issues and adopt more integrated water resource management (IWRM) approaches as against the ad hoc, piece-meal, short-term structural measures that are being adopted now. An integrated basin management approach, based on the principles of soil and water conservation as well as sustainable development, needs to be adopted sooner than later. The policies and practices for the utilisation of these resources in the future need to have a broader outlook and a changed paradigm and philosophy of development, akin to IWRM principles.

Hence it is high time for us to go beyond the confines of techno-centric management to broader notions of resource utilisation involving local wisdom as well as participation. Proper assessment and reduction of vulnerability, empowering local populations and strengthening existing institutions are essential for achieving the goals of sustainable development through IWRM.

I wish you all success for the implementation of "mazha polima" in the district and request you to raise such issues too for the attention and consideration of the public/institutions.

Isac John, Socio-Economic Unit Foundation, Calicut ***NEW!***

It is encouraging to see that lots of people are taking steps to recharge water tables but we also need to look at the past experiments in the water sector in Kerala. The Calicut district authorities (Rural Development) also launched a similar programme, known as *Aksha Ganga* in the year 2000. Similarly, the Kerala Rural Water Supply and Sanitation Agency (KRWSA) also initiated an activity in their project *Point Recharge*.

Mr. Bhatathripad initiated the "Adi ana and Thada ana" and water literacy programme. All these initiatives are good and to be appreciated. We have to analyse why these initiatives are not sustained. At the same time total the literacy project and Nirmal 2000 of Kottayam district, all became successes because of their approaches and strategies. The IWRM concept is also worth looking at. The District Collector's initiatives of "Mazha Polima" is to be appreciated and I wish him all success.

D. Chandrasekharam, Department of Earth Sciences, Indian Institute of Technology Bombay ***NEW!***

Since I was associated with the Centre for Water Resource Development and Management (CWRDM) in the past, for seven years, I am quite aware of the problem you have posed. You may recall that entire Kerala can be divided in to three physiographic divisions – highland, mid and low land regions. The highlands consist of hard crystalline rocks, the midlands consist of laterites and the lowlands consist of

alluvium and form the coastal zone. The length of all the rivers are very short, hence more than 70-80 percent rainfall goes as surface run-off. The laterites is the potential aquifer and if my memory is correct, nearly 150 dugs wells are present (on an average) in one sq.km area in all the districts. In fact, we did carry out inventory of all the districts of Kerala and those reports should be with the Government.

Now the recharge concept has to be assessed on a "River basin" basis rather than "individual well" basis. If the infiltration rate is increased by an appropriate method, then one need not spend the kind on money envisaged in your message. Check dams at highlands can do wonders in this part of the country, taking in to account the physiographic advantage, which no other state has.

Once a mechanism of utilising the surface runoff is planned and executed, the problem of recharge into the wells will automatically be taken care of. So will the salt-water intrusion along the coastal aquifers. I think you need a good scientific response to solve this problem and not money. If you wish, you can take the opinion of the other scientific bodies across the world.

Subramanian K. S., National Remote Sensing Agency, Hyderabad ***NEW!***

The National Remote Sensing Centre (NRSC), Indian Space Research Organization, Hyderabad, has carried out the Groundwater Prospect mapping on 1:50,000 scale for the entire state of Kerala using satellite imagery. The project was sponsored by the Department of Drinking Water Supply (DDWS), Ministry of Rural Development, Government of India.

All the maps for entire Kerala have been submitted to the Secretary, Public Health Engineering Department (PHED) of Kerala. These maps show the groundwater prospects zones and the suitable sites for water harvesting structures using satellite images. The Central Ground Water Board (CGWB) was also involved in this project. Last year we trained a group of officials, exclusively, from the Groundwater Department of the state on usage of these maps in the field.

R. K. Rao, Samata, Hyderabad ***NEW!***

I agree with the observations of Professor Chandrasekaram – the best way to recharge wells is to take up a water conservation programme, not well by well but with the watershed as the unit. The Centre for Science and Technology (CST) has a long list of successful case studies on the subject. To recharge the wells in each town, you have to demarcate the watershed(s) that they fall in and take up conservation measures starting with the uplands at the top of the watershed and work downwards.

Measures include reforestation, bench-terracing, gully-plugging, check dams, harvesting ponds, rainwater conservation measures in households with the single objective of stopping the rainwater where it falls.

Gujarat too has several examples of successful recharge of tanks and wells; perhaps a study tour of some of the areas by the concerned staff will be very educative.

Less desires, more happiness. Conservation in a nutshell.

"More than enough food is produced to feed a healthy global population. Distribution and access to food is a problem – many are hungry, while at the same time many overeat. As much as half of the water used to grow food globally may be lost or wasted," says Dr. Charlotte de Fraiture, IWMI in his book titled, Saving Water: from Field to Fork - Curbing Losses and Wastage in the Food Chain. We are producing food to take care of not only our necessary consumption but also our wasteful habits.

Statistics show that producing to feed farmed animals requires vast amounts of water – it takes about 300 gallons of water per day to produce food for a vegan, and more than 4,000 gallons of water to

produce food for a meat eater. "If we're honest, less meat is also good for the health, and would also at the same time reduce emission of greenhouse gasses," noted Dr. Pachauri.

V. Kurian Baby, Government of Kerala, Thrissur ***NEW!***

Latha Bhaskar: Many thanks for the response. Great that you are doing significant work on wetlands. We are also working out programmes for the conservation and sustainable management of the wetland ecosystems. The Thrissur Kole lands, which is the major wetland in the district with an area of 13,500 ha., is a declared Ramsar site and unique for its bio-diversity, flora and fauna, environmental and other ecological functions in addition to the livelihood support and food security. We are working towards developing a GIS-based perspective plan and water balance study to have holistic policy and intervention support for scientific conservation. The idea is to move towards IWRM and river basin planning for the region.

Terry Thomas: We have taken many lessons from your initiative and have also conducted some rudimentary experiments with technical support from RNE. In coastal areas, we are mostly replicating the backwash programme, adopting a networked institutional design, demand generation and owner driven approaches. In fact we would be grateful if you could support us in any way possible.

Anurabha Majumder: You know Kerala much more than we are. Thanks for the suggestions and we are equally concerned about quality issues. Sometime back, we did some work with the London School of Hygiene and Tropical Medicine in quality improvement to quantify health outcomes of intervention programmes. However, on account of methodological issues and cost involved, it did not progress well. Also, we have tried community based water quality monitoring with the support of RNE. We look forward to guidance in any from the esteemed AIIHPH.

Dinesh Kumar (Response 1): First of all the programme is not to address ground water depletion per se but to ensure sustainable drinking water for households by recharging the households wells already constructed and not utilized. This is not something new for Kerala; we have excellent demonstrated evidence that minor interventions with little cost can make drinking water available. The problem is due to the shying away or substitution of community and household efforts under a regime where public programmes promise free water delivery at the doorstep. Traditional wisdom and proven practices have been relegated to the background.

Dinesh is absolutely right in observing the limitations of ground water aquifer capacity, but we are not focusing there. We are filling the storage capacity created, and the seepage from this capacity will definitely recharge the ground water as a secondary fall out. Moreover, this will never affect the flow in rivers but in fact will augment it during summer and support in ensuring minimum flow in rivers. For example, Bharathapuzha which is in crisis compounded by the depletion of vast paddy lands which are functionally great wetland ecosystems.

Here, the focus is in addressing supply side solutions, not in the context of total water demand, but to augment supply for the meet the demand of drinking water. As the domestic demands are relatively/comparatively inelastic, supply side solutions are most effective. During the process there will be secondary benefits to the larger basin.

Traditional techniques are cost effective and more sustainable from our own experiences. The total cost is Rs. 92 crores and Rs. 1800 cores is the investment already made but lying idle and not utilized.

(Response 2): Thanks for the very useful response. While agreeing to the fact that rationalized water pricing imputing even a depletion premium shall be an integral part of sustainable and equitable water resource management, the instrument in itself will not be sufficient. Demand and supply side factors are to be synergized to maximize welfare and intergenerational issues. Effective pricing will not only support

water use efficiency but also ensure equity, reduce poverty and marginalization. Most often, we use pricing to support the rich.

The cost concern of well re-charge is contextual as in the case of other options. We are not constructing new structures and then recharging. What we drive at is utilizing existing structures. When programmes are implemented with built-in incentives for over design and high volume investment, as we do normally, it is a real threat. In general, the programme cost involves huge transaction costs, most of which is absorbed by institutional arrangements. This is how simple options are defeated.

By recharging, we mean to divert surface runoff or roof water just to fill the wells already constructed through simple least cost /effective intervention programmes, by owners themselves, through generation of demand. The situation in Kerala is different in terms of spread of wells /well intensity in midland, high land and coastal regions, and so is the rainfall spread and intensity. In Rajasthan *tankas* are being re-charged through sand dunes virtually at no cost by adopting traditional methods.

Abhishek Mendiratta: We are just focusing on a single core intervention this year in terms of filling the structures/capacities already created, augmenting quantity in wells and aquifers followed by addressing quality issues. This is virtually the least cost intervention immediately feasible for Kerala to address drinking water and environmental sustainability.

Murli Kochukrishnan: This is a great model to emulate. Ultimately the key is self help.

Sharat Singh: First of all, these wells are mainly used for drinking and other domestic purposes. They are household wells in homesteads, with an average of 250 wells per sq. km. We do not have large number of bore wells as in the north, and dependence on ground water for irrigation is increasingly significant, but has not yet assumed a serious threat, except in over-exploited blocks.

S. Vishwanath: Great many thanks for the most valuable observations. Yes, we have the problem not only of nitrate but also of bacteriological contamination. We are addressing second generation sanitation issues, in terms of conversion of deep pit latrines into shallow twin pit. We are dealing with SWM issues more scientifically, moving towards decentralized composting and regional engineered landfills.

K. A. S. Mani: I absolutely agree with the concerns and take the advice in full spirit. Though we have 3,000 mm of rainfall, as the open wells unlike ponds are small structures and most of the wells may not even fill during the monsoon itself. Secondly, our advantage is in having an excellent spread throughout the year, which will keep the structures recharged. Thirdly, as we have a heavy surface runoff (average time is 1.5 to 2 hours for the runoff to reach the sea), the effort in also intended to delay the runoff and recharging aquifers.

Fourthly, and more importantly, the cost is not 1,871 crores, but 92 crores, Rs. 1,500 on an average per open well. This Rs. 1,800 crores is the dead investment in open wells by households already made but not used productively. The small leverage fund of Rs. 1,500 mostly by owners themselves would be the most cost-effective means in the world given the circumstances. Paradoxically, households with unused open wells spend on PVC tanks at Rs. 5-6 per litre and many times more as coping cost.

I know that ultimate solution is moving towards water budgeting, river basin planning and IWRM. This is only to support households to meet their own requirements, in the most cost effective way. The behaviour change that we envisage is a slow process and I believe it can be achieved when water is made everybody's business, as every drop counts.

P.S. Yadav: We are using NREGS as one of our flagship programmes in employment creation for rural areas and the focus is on land-water and environment for this year. The responses are promising; however, as our market wage rate ranges from Rs. 250-300, the tradeoff in favour of NREGS is very

weak. We are compensating through community PRI involvement in collective action. In terms of financing the total cost of Rs. 92 crores, about 65 crores shall come from the households themselves by generating demand, and APL households will share 100% cost.

Vijay Kumar: Thanks for the great remarks. I know that groundwater depletion is a common problem for the country and for most part of the globe. The query just highlighted our specific issues. As you understand the programme does not envisage any additional construction of ponds for roofs, it only harvests for existing ponds, wells and structures just utilizing the capacity created already at a nominal cost of Rs. 1500 on an average. We had a great tradition of rainwater harvesting from roofs and even trees. Admittedly every roof is directly not amenable for harvesting; we can make it suitable with less than Rs. 500 as shown in the document. Moreover, thatched huts are now increasingly being replaced. I request Vijay to send me a copy of his report.

Rajesh Shah: Thanks for the offer. More details would be worthwhile for us to pursue further. As suggested the major challenge would be to ensure quality. Traditionally Keralites used open wells for drinking and invariably boiled water. This may not be sufficient, so the GoK with the support of CCDU has already launched community water quality surveillance and monitoring. Additionally, once we are moving ahead the well centric approach, sanitization of open wells shall be an invariable component.

Many thanks to all who contributed to this query!

If you have further information to share on this topic, please send it to Solution Exchange for the Water Community in India at se-wes@solutionexchange-un.net.in with the subject heading "Re: [se-watr] Query: Participatory Well Recharge Programme - Mazhapolima - Experiences. Additional Reply."