



Environment

Water Community



## Solution Exchange for the Water Community Consolidated Reply

*Query: Use of Rainwater and Wise Water Management in Schools - Experiences; Advice*

Compiled by [Nitya Jacob](#), Resource Person and [Sunetra Lala](#), Research Associate  
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From [Dipak Roy](#), United Nations Children's Fund (UNICEF), New Delhi  
Posted 13 April 2009

I work as the Hygiene Specialist with the United Nations Children Fund (UNICEF), New Delhi, with a specific focus on Water Sanitation and Hygiene (WASH) in Schools.

I have seen and read about different options for rainwater harvesting and wise water management (broadly referring to re-use of grey water and recycling of waste water in general) in schools in different states. Most of them have been supported by multi-lateral, bilateral and NGO-funded projects. The harvested rainwater is also used for different purposes – drinking after basic treatment, gardening, flushing toilets and washing, etc., depending on how the water is harvested and stored. These uses also vary depending on whether the school is residential or for day scholars.

I am requesting state-specific experiences from members of the Water Community on the following points:

1. Please give experiences that demonstrate the extent to which these options recognized and included in the various state government budgets for rural water supply, education, and tribal welfare departments?
2. What is the scale at which initiatives such as rainwater harvesting and grey water re-use have been applied in schools in different states?
3. Please give experiences of how the harvested rainwater or re-recycled water is used in schools?

I will use this information to prepare a status paper and package it as an advocacy document, which can inform the process of mainstreaming rainwater harvesting and wise water management in schools within national programmes.

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Responses were received, with thanks, from

1. [Arjun Kant Jha](#), Narisantha, Jaipur
2. [C. P. Kumar](#), National Institute of Hydrology, Roorkee

3. [Shailja Kishore](#), Aga Khan Rural Support Programme (India), Ahmedabad
4. [Digu Aruchamy](#), Independent Consultant, Coimbatore
5. [Ajit Seshadri](#), The Vigyan Vijay Foundation, New Delhi ([Response 1](#)) ([Response 2](#)) ([Response 3](#))
6. [Vijay Malik](#), Medentech Ltd, New Delhi
7. [Surekha Sule](#), Independent Journalist, Pune
8. [K. D. Bhatt](#), GSFC Science Foundation, Vadodara
9. [Dinesh Kumar](#), Institute for Resource Analysis and Policy, Hyderabad
10. [Tapan Saha](#), Institute of Environmental Studies and Wetland Management, Kolkata
11. [Chandra Shekhar Sharma](#), Sarva Shiksha Abhiyan, Bundi
12. [Somnath Sen](#), IIT Kharagpur, Kharagpur
13. [Vishwanath Srikantaiah](#), BIOME, Bangalore ([Response 1](#)) ([Response 2](#))
14. [Nitya Jacob](#), United Nations Children's Fund (UNICEF), New Delhi ([Response 1](#)) ([Response 2](#))
15. [Vijayan Janardhanan](#), Corps of Engineers, Hyderabad ([Response 1](#)) ([Response 2](#))
16. [N.C.S. Seema](#), WaterHealth India Pvt. Ltd., Secunderabad
17. [Latha Bhaskar](#), Ashoka Trust for Research in Ecology and the Environment (ATREE), Thiruvananthapuram
18. [Muhammad Mukhtar Alam](#), Centre For Ecological Audit, Social Inclusion and Governance, New Delhi
19. [Alpana Jain](#), Development Facilitator, Udaipur
20. [Arun Jindal](#), Society for Sustainable Development, Karauli, Rajasthan
21. [Joe Madiath](#), Gram Vikas, Behrampur, Orissa
22. [Seema Raghunathan](#), WaterHealth India Pvt. Ltd., Secunderabad ([Response 1](#)) ([Response 2](#))
23. [Richard Parmar](#), Cohesion Foundation Trust, Ahmedabad
24. [Shree Padre](#), Water Journalist, Vaninagar, Kerala

*Further contributions are welcome!*

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[Summary of Responses](#)  
[Comparative Experiences](#)  
[Related Resources](#)  
[Responses in Full](#)

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## Summary of Responses

Rainwater harvesting (RWH) is fast catching on as an alternative to groundwater or municipal water supply in many parts of the country. RWH systems have been installed in schools in many parts of India to provide water for toilets and occasionally, watering the grounds. However, there are very few reported instances of schools reusing the grey water for watering plants; this usually finds its way into the nearest drain or water body.

The [Karnataka](#) State Government implemented the largest school RWH programme in the country called Suvarnajala. It covered 23,682 schools, that is, nearly every other government school in the state, and cost Rs. 74 crores. The programme succeeded in putting in the hardware in most of the schools. However, an analysis of the programme showed nearly 95 per cent of the systems were never used because of a variety of factors – poor design, sub-standard material, missing taps on the tanks, leaking tanks, dirty roofs and theft of components. The last point is in

fact the main reason why many of these well-intentioned programmes fail. The only way to counter it is to involve the schoolchildren, teachers, principals and village education committees in designing and maintaining the systems.

In Udaipur district, [Rajasthan](#), the panchayat samities have constructed RWH structures in 1,500 schools. A recent survey indicated only a third of these are in working condition. Most of the schools in urban areas have working RWH systems because they have boundary walls and a guard. Those in rural areas have fared worse because of poor quality of construction and damaged pipes. There is no money for maintenance in the school budgets.

The Barefoot College, Tilonia, [Ajmer district](#), has set up RWH systems in 1187 schools. In Chirawa town, [Shekhawati](#), the Dalmia trust has constructed these systems in the two schools it runs. The water is used for watering the lawns and flushing toilets.

The [Gujarat](#) State Government has initiated a special purpose vehicle to provide safe drinking water to schools and anganwadis. This has helped many schools, though the number is not known, in the water-scarce districts of Kutch, Surendranagar and Bhavnagar to get RWH systems. They reuse waste water by channelling it to gardens.

Elsewhere, in Valsad district, south Gujarat, that gets 2,200 mm of rain a year, about 30 percent of the schools have large tanks to store water from the municipal supply or water tankers. However, even these are badly maintained and cannot be used to store rainwater. The [Cohesion Foundation Trust](#) is constructing rooftop rainwater harvesting (RRWH) in schools to get around this problem. It is designing systems to store enough water for the school for the rest of the year and is working with the children and teachers for their maintenance.

The State Government of [Andhra Pradesh](#) provided RWH systems to 100 schools in three districts of Andhra Pradesh, Medak, Nizamabad and Hyderabad. Under the project, school children were motivated to use the toilets, maintain the RWH systems, and beautify the school environment. Even here, the children did not look after the RWH systems and once the three-year project ended, they quickly fell into disuse.

In [Orissa](#), Gram Vikas works in 699 villages, mostly tribal, in different districts. It has promoted RWH for water security in these villages, and schools form part of its strategy. Most of the state gets good rainfall, and therefore, the organisation has opted for a well-recharge approach instead of building storage tanks. The wells are lined and covered to prevent contamination. They are sited to keep surface water from flowing into them. The gram panchayat supplies piped water from the wells to each household and the schools. The community contributes 40 percent of the project costs. The systems are working well because they cover the entire community and not just one part, for example, the school.

In [Kerala](#), the state water authority launched the Varsha project to construct RWH systems for low-income families. Many panchayats and urban local bodies have constructed RWH structures in schools as well. However, the children use them during the rains when they have water, and not during the dry months. Here again, regular maintenance is an issue.

The Tamil Nadu State Government issued two ordinances in 2003 that made RWH mandatory in all buildings. The authorities will not issue the completion certificate to a new building unless it has a RWH system. Owners of old buildings have to retrofit them with RWH systems, failing which the local authorities can install these systems and charge the owners. However, even here people have set up RWH systems without really understanding their utility.

The gram panchayat of Aasgaon, Ahmednagar district, [Maharashtra](#), has a grey water reuse programme for the entire village. Grey water from the school is used to tend its gardens as is the water from individual households. None of this water flows into storm water drains; only rainwater from open areas enters these drains, that collect as point outside the village and help recharge groundwater.

Additional research shows that in Dhar, Madhya Pradesh, UNICEF, and its partners have implemented a wise water management plan. This includes RWH, recycling grey water, pumping stored rainwater using a roundabout pump and using it to dilute fluoride-contaminated water. As many as 22 schools in the district have this system. The girls in these villages have more time to attend class rather than providing for water. UNICEF, the Public Health Engineering Department, and NGOs have also developed a system that recycles 200 litres per day per household of grey water for flushing and gardening. This has reduced groundwater demand in these areas by 60 percent, and children have water in the summer months.

While harvested rainwater is used primarily for non-drinking purposes, there are a few instances where, after suitable treatment, it has been used for drinking as well. All these examples show the need for involving schoolchildren, parents, teachers, and principles in planning, operation, and maintenance. This remains the biggest lacuna in all school RWH programmes in different parts of the country. If they are involved, it will solve the problem of security and maintenance of the RWH systems.

The cost of water from RWH systems is another issue. Concrete tanks to store water are prohibitively expensive. Just to provide water for a school of 100 students for 300 days a year, at the rate of 1 litre per child per day would need a tank of 30,000 litres. At a conservative estimate of Rs. 5 per litre for building a cement tank, this would amount to Rs. 1.5 lakh for just the tank, pipes and fittings extra.

Finally, RWH has the potential to mitigate water scarcity in most parts of India but too often, organizations implement these schemes with a target-oriented mindset. The implementation often reflects a departmental approach at the local level; the water supply department sets up the scheme without involving the education department. Good examples of RWH systems are rare. To achieve scale, it would be desirable to have a movement to educate teachers and students on water security and the importance of RWH.

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## Comparative Experiences

### Andhra Pradesh

**Lack of Maintenance Leads to Failure of School Rainwater Harvesting (RWH) Projects, Medak, Nizamabad and Hyderabad Districts** *(from Seema Raghunathan, WaterHealth India Pvt. Ltd., Secunderabad; [response 2](#))*

A School Sanitation and Hygiene Education project was implemented in Andhra Pradesh, which provided basic infrastructure for rainwater harvesting. 100 schools in each district were provided with the infrastructure, which were protected by walls. The children collected Re. 1 towards the maintenance fund. After three years it was observed that although maintaining the rainwater harvesting structures was part of the school activities the structures were not maintained.

### Gujarat

**Teacher and Students Collectively Clean and Maintain Rainwater Harvesting Structures, Kutch District** (from [Shailja Kishore](#), *Aga Khan Rural Support Programme (India), Ahmedabad*)

Under a Government of Gujarat programme, making safe drinking water available in schools and Anganwadis is mandatory. Rainwater harvesting structures are working efficiently in the villages of Bhavanagar and Surendranagar and in water scarce areas of Sandpaper, Radhanpur, etc. Re-use of waste water is done by channeling it to the gardens or plantations. The rain water is diverted into recharge pits. Teachers and student collectively clean and maintain the systems.

**Cohesion Foundation Trust Helps Solve Water Problems in Schools by Constructing Rainwater Harvesting Structures** (from [Richard Parmar](#), *Cohesion Foundation Trust, Ahmedabad*)

Thirty per cent of the schools in South Gujarat had water tanks of 5000 litres capacity, which were constructed by the government. But these were of low capacity and had structural flaws. The poor quality of water was also an area of concern. To deal with this the Cohesion Foundation has now helped schools to construct rainwater harvesting structures, which are being used from this year. The water is being used in toilets, particularly those for girls. The schools have also set up teams of children to take care of the structures. Read [more](#)

## **Karnataka**

**Suvarnajala Ensures Rainwater is Harvested for Drinking and Other Non-potable Uses in a Few Schools** (from *Vishwanath Srikantaiah, BIOME, Bangalore; [response 1](#)*)

The Government of Karnataka programme, Suvarnajala provided 23,683 schools with rooftop rainwater harvesting systems to provide drinking water to school children. This was at a total budgeted expenditure of Rs. 74 crores. The scale of the programme reached every second government school in Karnataka. After testing and treatment the water was used for drinking and flushing toilets in some case. However, the majority of the systems fell into disrepair.

## **Kerala**

**Varsha - A Rainwater Harvesting Project - Suffers due to Negligence in Maintenance** (from [Latha Bhaskar](#), *Ashoka Trust for Research in Ecology and the Environment (ATREE), Thiruvananthapuram*)

The Kerala Water Authority is implementing the Varsha project to construct rainwater harvesting structures for low income families. The beneficiaries contribute 10% and the government 90% of the total cost and the project is being implemented through various agencies. But the schemes implemented in many places have become a breeding ground for mosquitoes due to poor maintenance. Negligence in ensuring their maintenance is an impediment here. Read [more](#)

## **Maharashtra**

**Proper Water Management Strategy Helps in Upkeep of Rainwater Harvesting (RWH) Structure in Aasgaon, Satara District** (from *Nitya Jacob, United Nations Children's Fund (UNICEF), New Delhi; [response 1](#)*)

A school in Aasgaon village has constructed a RWH and water management system. Part of the water from the roof is channelled into a cement storage tank for use in sanitation without further treatment. This is not used for drinking. Part of the run off from the roof is channelled to the trees growing around the building and the compound. Water from the toilets is also diverted into an open area behind the school to water plants. This system has been running successfully here.

## **Orissa**

### **Gram Vikas Ensures round-the-clock Water Supply through Rooftop Rainwater Harvesting** (from [Joe Madiath](#), *Gram Vikas, Behrampur, Orissa*)

Gram Vikas works in 699 villages on recharging harvested rain water into the ground instead of making concrete structures. Schools in these villages get piped water from solar pump sets that pump water from the wells to the schools. People contribute 40% of the projects costs, usually as labour. This has ensured continuity of the project and covers the operation and maintenance issues. As a result in all these schools there is running water round-the-clock. Read [more](#)

## **Rajasthan**

### **Barefoot College Ensures Rainwater Harvested in Schools Reaches Communities, Ajmer District** (from [Surekha Sule](#), *Independent Journalist, Pune*)

The Barefoot College was started in 1972 to address problems of drinking water in rural communities. It has created an infrastructure that collects 29 million litres of water in 470 schools and community centres. This also benefits people in 13 villages, who receive piped water supply. They pay Rs. 30 per month for two hours of water supply each day. Drinking water supply for the villages has thus been ensured. Read [more](#)

### **The Save Water Campaign Helps Set up Rooftop Rainwater Harvesting Systems in Schools, Shekhawati** (from [Nitya Jacob](#), *United Nations Children's Fund (UNICEF), New Delhi; response 1*)

To deal with the issue of water scarcity, the Ramkrishna Jai Dayal Dalmia Sewa Trust launched the Save Water Save Life campaign in Chirawa town. They also set up two schools to promote education in the area. Both have rooftop rainwater harvesting systems that collect and store around 75 cu m of water each, that is used for watering the playgrounds. This is part of a larger district-wide initiative to install similar systems in other schools, which has been very successful.

### **Lack of Repair and Maintenance Funds Leads to Disuse of Rainwater Harvesting Structures in Schools, Udaipur District** (from [Alpana Jain](#), *Development Facilitator, Udaipur*)

Rainwater harvesting structures (RWHS) were constructed here in 1500 public, secondary, and senior secondary schools. These were constructed through the Panchayat Samitis. The Panchayati Raj Department provided budgetary support for their construction. However, there is no separate fund for repair and maintenance. As a result, these structures are in working condition only in 30 per cent of the schools.

### **Rainwater Harvesting Structures Fall into Disuse due to Apathy of School Authorities, Karauli District** (from [Arun Jindal](#), *Society for Sustainable Development, Karauli, Rajasthan*)

The Government of Rajasthan constructed rainwater harvesting structures in government schools (under NREGA). A huge amount of money was spent on the construction of these RWH structures. However, no amount was earmarked for their maintenance. As a result, in Karauli district these structures are no longer in use. This was largely due to the apathy of school authorities. In addition, there was also no system of recycling water in these schools.

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## **Related Resources**

### ***Recommended Documentation***

#### **Manual on Rainwater Harvesting Systems in Schools** (from [C. P. Kumar](#), *National Institute of Hydrology, Roorkee*)

Manual; by Arghyam; Bangalore;  
Available at

<http://www.rainwaterclub.org/docs/MANUAL%20ON%20ROOFTOP%20RAINWATER%20HARVESTING%20SYSTEM%20FOR%20SCHOOLS.pdf> (PDF; Size: 700KB)

*A manual on how rainwater harvesting structures can be installed in schools in Karnataka, and the benefits arising out of harvesting rainwater*

**Rooftop Rainwater Harvesting Projects Implemented by Institute of Environmental Studies and Wetland Management, Department of Environment, Government of West Bengal** (from [Tapan Saha](#), Institute of Environmental Studies and Wetland Management, Kolkata)

Report; by Tapan Saha; Institute of Environmental Studies and Wetland Management; Government of West Bengal; Kolkata;

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-20040901.doc> (DOC; Size: 108KB)

*Provides a list of rooftop rainwater harvesting projects and their sites that have been implemented in some districts of West Bengal*

From [Somnath Sen](#), IIT Kharagpur, Kharagpur

**Technical Details of Rainwater Harvesting**

Report; by Centre for Science and Environment; New Delhi;

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-20040905.pdf> (PDF; Size: 604KB)

*Provides technical details for the construction of rainwater harvesting structures, including design tips, requirements, etc*

**Rainwater Harvesting - A Practical Approach**

Presentation; by Rashi Sharma;

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-20040904.ppt> (PPT; Size: 1.60MB)

*Provides details of the pros and cons of constructing above ground and underground rainwater harvesting structures*

From [Vishwanath Srikantaiah](#), BIOME, Bangalore; [response 1](#)

**Rainwater Harvesting, H2S Strip Test for E.coli and SODIS**

Short Film; by Vishwanath Srikantaiah; BIOME; Bangalore; January 2008;

Available at [http://www.youtube.com/watch?v=DV2l6GC9bVc&feature=channel\\_page](http://www.youtube.com/watch?v=DV2l6GC9bVc&feature=channel_page)

*Describes how rainwater quality can be tested for E. coli through H2S strip test, and the same has been used for drinking purposes in Bangalore after testing*

**Rooftop Rainwater Harvesting - Fluoride Free Water**

Short Film; by Vishwanath Srikantaiah; BIOME; Bangalore; January 2008;

Available at [http://www.youtube.com/watch?v=TxvVSw1you4&feature=channel\\_page](http://www.youtube.com/watch?v=TxvVSw1you4&feature=channel_page)

*Describes how in Bagepalli taluk, Karnataka the problem of fluoride in drinking water source (bore well) has been dealt with by using rainwater instead*

From [Nitya Jacob](#), United Nations Children's Fund (UNICEF), New Delhi; [response 1](#)

**Barefoot College Tilonia - Rooftop Rainwater Harvesting Systems as of December 2007**

Report; by The Barefoot College; Rajasthan; December 2007;

Available at [http://www.barefootcollege.org/pdf/RWH\\_Structures.2007.pdf](http://www.barefootcollege.org/pdf/RWH_Structures.2007.pdf) (PDF; Size: 72KB)

*Provides details of the rainwater harvesting campaign by the Barefoot College, which covered 1187 schools in Rajasthan until December 2007*

### **General Guidelines for Construction of a Rainwater Harvesting Tank in Schools**

Guidelines; by Barefoot College; Rajasthan;

Available at [http://www.barefootcollege.org/pdf/Guideline\\_for\\_construction\\_of\\_a\\_RWH\\_tank.pdf](http://www.barefootcollege.org/pdf/Guideline_for_construction_of_a_RWH_tank.pdf) (PDF; Size: 288KB)

*Provides guidelines for constructing rooftop rainwater harvesting structures in schools including site selection, water resource mapping, etc*

From [Shree Padre](#), Water Journalist, Vaninagar, Kerala

### **School RWH with Refreshing Difference**

Article; by Sundara Naik; Farmland Rainwater Harvesting Systems; Chickmaglore, Karnataka;

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-13040901.doc> (DOC; Size: 40KB)

*Describes the impact of the rooftop water harvesting project in 150 schools in Chickmaglore district, which has been hugely successful*

### **Rainwater Harvesting Structures in Chickmaglore District**

Photographs; by Shree Padre; Vaninagar, Kerala;

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-13040901.doc> (DOC; Size: 40KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040902.jpg> (JPG; Size: 280KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040903.jpg> (JPG; Size: 264KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040904.jpg> (JPG; Size: 188KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040905.jpg> (JPG; Size: 196KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040906.jpg> (JPG; Size: 184KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040907.jpg> (JPG; Size: 272KB)

*Photographs of the rooftop rainwater harvesting structures which have been constructed in 150 schools in Chickmaglore district, Karnataka*

From [Sunetra Lala](#), Research Associate

### **Dying Wisdom-State of India's Environment A Citizen's Report**

Book; by Anil Agarwal and Sunita Narain; Centre for Science and Environment; New Delhi; 1997

Available at <http://www.cseindia.org/html/extra/twhs.htm>

*Discusses the rise and potential fall of India's traditional rainwater harvesting systems, and their potential if they are revived*

### **Jalyatra: Exploring India's Traditional Water Management Systems**

Book; by Nitya Jacob; UNICEF; Penguin Books India; New Delhi; April 2008

Available at <http://www.penguinbooksindia.com/Bookdetail.aspx?bookId=7235>

*Examines traditional rainwater harvesting structures and systems of water use across India from a socio-ecological perspective*

### **Rainwater Harvesting Techniques to Augment Ground Water**

Manual; Central Ground Water Board; Ministry of Water Resources; Faridabad

Available at [http://cgwb.gov.in/documents/RWH\\_GUIDE.pdf](http://cgwb.gov.in/documents/RWH_GUIDE.pdf) (PDF; Size: 1.8 MB)

*Provides techniques for the collection and storage of rainwater from surface or sub-surface aquifers, which can be used to augment groundwater supplies*

## *Recommended Organizations and Programmes*

**United Nations Children's Fund (UNICEF), New Delhi** (from [Arjun Kant Jha](#), Narisantha, Jaipur)

73 Lodhi Estate, New Delhi 110003; Tel: 91-11-24690401; Fax: 91-11-24627521; [newdelhi@unicef.org](mailto:newdelhi@unicef.org); [http://www.unicef.org/india/children\\_2357.htm](http://www.unicef.org/india/children_2357.htm)

*UN agency which has supported the construction of rooftop rain water harvesting in a few districts of Rajasthan*

From [Vijay Malik](#), Medentech Ltd., New Delhi

**Medentech Ltd., New Delhi**

B-3, Sector-5, Plot Number 6, Dwarka, New Delhi 110075; Tel: 91-9818386774; [vmalik@medentech.com](mailto:vmalik@medentech.com); [www.medentech.com](http://www.medentech.com)

*Company has manufactured effervescent disinfectant tablets for water purification which can be used to purify collected rainwater for drinking purposes*

**International Federation of Red Cross and Red Crescent Societies, Switzerland**

Chemin des Crêts, 17 Petit-Saconnex, Geneva, Switzerland; Tel: 1-212-3380161; Fax: 1-212-3389832; [http://www.ifrc.org/what/health/index.asp?navid=04\\_04](http://www.ifrc.org/what/health/index.asp?navid=04_04)

*World's largest humanitarian organization, providing assistance in the fields of disaster management, healthcare, water and sanitation, etc*

**World Health Organization (WHO), Switzerland**

Avenue Appia 20, 1211 Geneva 27, Switzerland; Tel: 41-22-7912111; Fax: 41-22-7913111; [wrintia@whoindia.org](mailto:wrintia@whoindia.org); <http://www.whoindia.org/EN/Section9/Section10.htm>

*WHO provides technical assistance and collaborates with the government and major stakeholders in health development efforts, including provision of drinking water*

**GSFC Science Foundation, Gujarat** (from [K. D. Bhatt](#))

Vigyan Bhavan, PO Fertilizer Nagar, Vadodara 391750, Gujarat; Tel: 91-9327230811; [drkdbhatt@rediffmail.com](mailto:drkdbhatt@rediffmail.com)

*Has published a manual on rainwater harvesting detailing the basics of artificial recharge and various methods/models adopted for recharging groundwater*

**Kerala Water Authority, Kerala** (from [Latha Bhaskar](#), Ashoka Trust for Research in Ecology and the Environment (ATREE), Thiruvananthapuram)

Rural Development Department Secretariat, Thiruvananthapuram 695001, Kerala; Tel: 91-471-333890; Fax: 91-0471-324903; [kwafin@vsnl.net.in](mailto:kwafin@vsnl.net.in); <http://keralawater.org/home.htm>

*Is implementing the Varsha project to construct rainwater harvesting structures for low income families in Kerala*

**International Water and Sanitation Centre (IRC), The Netherlands** (from Seema Raghunathan, WaterHealth India Pvt. Ltd., Secunderabad; [response 1](#))

Bezuidenhoutseweg 2, 2594 AV The Hague, The Netherlands; Tel: 31-70-3044000; Fax: 31-70-3044044; <http://www.irc.nl/page/103>

*Facilitates the sharing and use of knowledge so that organisations can support poor men, women and children in developing countries to obtain water and sanitation services*

From [Richard Parmar](#), Cohesion Foundation Trust, Ahmedabad

**Cohesion Foundation Trust, Gujarat**

6, Sejal Appt, B/H Navneet Publications, Memnagar, Ahmedabad 380052, Gujarat; Tel: 91-79-27450171; Fax: 91-79-27435888; [info@cohesionfoundation.org](mailto:info@cohesionfoundation.org); <http://www.cohesionfoundation.org/>; Contact Rajesh Kapoor; CEO; Tel: 91-9825329739; [cohesion@indiatimes.com](mailto:cohesion@indiatimes.com)

*Founded as a support organization, providing professional assistance to development organizations and has implemented rainwater harvesting systems for schools*

#### **Water and Sanitation Management Organization, Gujarat**

3rd Floor, Jalsewa Bhavan, Sector 10-A, Gandhinagar 382010, Gujarat; Tel: 91-79-23247170; Fax: 91-79-23247485; [wasmowasmo.org](mailto:wasmowasmo.org); <http://www.wasmowasmo.org>

*Established to achieve drinking water security, environmental sanitation; has also implemented a school rainwater harvesting project in Gujarat*

#### **Gram Vikas, Orissa (from *Joe Madiath*)**

Mohuda Village, Berhampur 760 002, Ganjam, Orissa; Tel: 91-680-2261866; Fax: 91-680-2261862; [info@gramvikas.org](mailto:info@gramvikas.org); <http://www.gramvikas.org/>

*Works to bring improvement in the quality of life of marginalized rural communities and has initiated several rooftop rainwater harvesting projects for schools in Orissa*

From [Sunetra Lala](#), Research Associate

#### **Utthan, Ahmedabad**

36, Chitrakut Twins, Nehru Park, Vastrapur, Ahmedabad 380015, Gujarat; Tel: 91-079-26751023; [utthan.ahmedabad@gmail.com](mailto:utthan.ahmedabad@gmail.com); <http://www.utthangujarat.org/livelihood.htm>

*Works on issues related to gender empowerment and livelihood security; one approach is to promote rainwater harvesting to meet community level water requirements*

#### **Action for Food Production, New Delhi**

25/1-A Pankha Road, D-Block, Janakpuri, New Delhi 110058; Tel: 91-11-28525452; Fax: 91-11-28520343; [afprodel@afpro.org](mailto:afprodel@afpro.org); <http://www.afpro.org/success.htm#16>; Contact D. K. Manavalan; Executive Director; [ed@afpro.org](mailto:ed@afpro.org)

*Non-governmental organization working on implementing rainwater harvesting as part of their efforts to promote effective natural resource management solutions*

#### **Samaj Pragati Sahayog, Bagli**

Bagli, District Dewas, Madhya Pradesh 455227; Tel: 91-7271-275757; [samprag@gmail.com](mailto:samprag@gmail.com)

*Has developed a Watershed Works Manual for those involved in implementing and monitoring rainwater harvesting activities*

#### **National Rural Employment Guarantee Scheme (NREGS), New Delhi**

Ministry of Rural Development, Krishi Bhawan, New Delhi 110001; Tel: 91-11-23063581,23034922; Fax: 23385466; [singhrp@sansad.nic.in](mailto:singhrp@sansad.nic.in); <http://nrega.nic.in/guidelines.htm>;

*Provides for 100 days of work per year to each person in a family below the poverty line; works taken up under the scheme include construction of rainwater harvesting structures*

### ***Recommended Portals and Information Bases***

From [Digu Aruchamy](#), Independent Consultant, Coimbatore

#### **Tamil Nadu Government Gazette, Chennai Metro Water, Tamil Nadu**

<http://www.chennaietrowater.tn.nic.in/rwh/tngo.htm>

*Provides a Government Gazette, which describes how every owner or occupier of a building is required to provide a rainwater harvesting structure*

**Rainwater Harvesting, Tamil Nadu Water Supply and Drainage Board, Tamil Nadu**

<http://www.aboutrainwaterharvesting.com/rwh.htm>; Contact Tel: 91-44-8530420;  
[twadboard@vsnl.in](mailto:twadboard@vsnl.in)

*Comprehensive resource on rainwater harvesting in India, including the history of rainwater harvesting, various methods of rainwater harvesting and success stories*

**RainwaterHarvesting.Org, Centre for Science and Environment, New Delhi**

<http://www.rainwaterharvesting.org/Policy/Legislation.htm>; Contact Gita Kavarana; Tel: 91-11-29955124; [cse@cseindia.org](mailto:cse@cseindia.org)

*Provides details of various rainwater harvesting related legislation in different states across India, including Himachal Pradesh, Gujarat, Karnataka, etc*

**Barefoot College, Rajasthan** (from [Surekha Sule](#), Independent Journalist, Pune)

<http://www.barefootcollege.org/>; Contact Bunker Roy; Tel: 91-1463-288204;  
[barefootcollege@gmail.com](mailto:barefootcollege@gmail.com)

*The college addresses problems of drinking water, health and sanitation and has helped to set up several rainwater harvesting structures across Rajasthan*

**HarvestH2O: The Online Rainwater Harvesting Community, USA** (from Vijayan Janardhanan, Corps of Engineers, Hyderabad; [response 2](#))

<http://www.harvesth2o.com/>; Contact Doug Pushard; Founder; [doug@harvesth2o.com](mailto:doug@harvesth2o.com)

*Shares knowledge and experiences about developing tools, templates and guidelines for building rainwater harvesting solutions*

**India Water Portal, Arghyam, Karnataka** (from [Sunetra Lala](#), Research Associate)

<http://www.indiawaterportal.org/tt/rwh/>; Contact Vijay Kumar; Tel: 91-80-41698941;  
[portal@arghyam.org](mailto:portal@arghyam.org)

*Provides information regarding the different rainwater harvesting techniques across the country and a list of institutions providing funding for the same*

### ***Recommended Upcoming Events***

**The 14<sup>th</sup> International Rainwater Catchment Systems Conference 2009, Malaysia, 3-6 August 2009** (from [Sunetra Lala](#), Research Associate)

Sponsored by International Rainwater Catchment Systems Association (IRCSA), USA. Information available at <http://www.eng.warwick.ac.uk/ircsa/IRCSA%20Malaysia%20Announcement.pdf> (PDF; Size: 60 KB); Contact Brett Martinson; Web Master; [KLrainwater@nahrim.gov.my](mailto:KLrainwater@nahrim.gov.my)

*Conference will focus on themes such as new approaches and innovations in rainwater harvesting and how it can augment irrigational water supply*

### ***Related Consolidated Replies***

**Roof water Harvesting in Urban Areas for Groundwater Recharge, from Mihir Maitra, India Canada Environment Facility (ICEF), New Delhi (Experiences). Water Community, Solution Exchange, India,**

Issued 22 August 2006. Available at <http://www.solutionexchange-un.net.in/environment/cr/cr-se-wes-22080601.htm>

*Discusses the challenges, and available mechanisms/systems through various experiences of roof water harvesting*

**Rooftop Rainwater Harvesting for Rural Schools in Karnataka, from S. Vishwanath, Arghyam and Rainwater Club, Bangalore (Experiences). Water Community, Solution Exchange, India,**

Issued 9 May 2008. Available at <http://www.solutionexchange-un.net.in/environment/cr/cr-se-wes-04040801.pdf> (PDF, Size: 500 KB)

*Shares a range of RWH experiences, outlines ways NGOs can facilitate the implementation of these programmes and discusses different types of RWH tanks*

**Promoting Rainwater Harvesting Structures in Hilly Terrain, from Arnab Bhattacharjee, Social Activist, Malkangiri, Orissa (Examples; Advice). Water Community, Solution Exchange, India,**

Issued 18 February 2009. Available at <http://www.solutionexchange-un.net.in/environment/cr/cr-se-wes-08010901.pdf> (PDF, Size: 156 KB)

*Provides information regarding appropriate rainwater harvesting structures, suitable for hilly terrain that can be designed and made by local communities*

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## Responses in Full

**Arjun Kant Jha, Narisantha, Jaipur**

UNICEF has done lot of work on rain water harvesting in Rajasthan. To my knowledge recently UNICEF has supported some roof top rain water harvesting measures at the collectors' buildings in 3 or 5 districts of Rajasthan. While constructing these structures, people were not optimistic out the quality.

Therefore, I would advice a survey to address the issue.

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**C. P. Kumar, National Institute of Hydrology, Roorkee**

Government of Karnataka has published a manual on "Rooftop Rainwater Harvesting Systems in Schools". It can be downloaded at

<http://www.rainwaterclub.org/docs/MANUAL%20ON%20ROOFTOP%20RAINWATER%20HARVESTING%20SYSTEM%20FOR%20SCHOOLS.pdf>. I hope that it would be informative.

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**Shailja Kishore, Aga Khan Rural Support Programme (India), Ahmedabad**

The Government of Gujarat has a special purpose vehicle to address the issue of availability, accessibility, and quality of drinking water in the water scarce villages across Gujarat. This effort, in support with from other NGO's, UNICEF and others has been providing safe drinking water to the villages. Under this programme, making safe drinking water available in Schools and Anganwadi's and other institutions in the village is mandatory.

RRWHS and better sanitation facilities along with hygiene education are provided to all those schools that have been deprived of it till date. These can be extensively seen in the village of Bhavanagar, Surendranagar, Kuchchh and very effectively and efficiently working in water scarce areas of Sandpaper, Radhanpur , Varahi, Rapar, Anjahaar , Gandhidham, bhuj, Mundra , mandwi, etc .

Re-use of waste water is done by channeling it to the gardens or plantations. Water is hardly recycled as the quantity from schools is very less. The rain water is diverted into recharge pits.

The teachers and student collectively clean and maintain the system right from the collection, storage and its use.

In Mundra, one school was experimenting with harvesting of water by collection of dew. They were able to collect 25/30 litres of water every night. Despite having laboratory fitness certificate the water was not being used for drinking because of the traditional believe that it is bad for health.

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**Digu Aruchamy, Independent Consultant, Coimbatore**

It is a great learning experience for me to be a part of this community and it is quite heartening to see the high quality of discussion that we see everyday. I would like to share some information on rainwater harvesting that I found to be interesting.

I live in Coimbatore in the southern state of Tamil Nadu and the state government here has done a lot of good work in the area of rainwater harvesting. In 2003, through a gazette notification, the previous state government made it mandatory for all building in the state both in rural and urban areas (homes, offices, educational institutions, industries, etc) to have a RWH structure. It was implemented through force I would say as if any building did not construct the structure within the stipulated time frame, civil amenities like water connection were cut off. You will find the link to the notification at <http://www.chennaietrowater.tn.nic.in/rwh/tngo.htm>.

The concept behind implementing RWH structures in the whole state was really good but the way it was implemented was not really well received by the people and it was done at such haste that many homes did it to just satisfy the government authorities rather than understanding the benefits of the structures.

Now, after the new state government came into power, it eased the law and all existing residential apartments, housing colonies, educational institutions are required to have RRWH systems installed. All new buildings that seek government permission must have RWH in their plans otherwise permission will not be granted. I would say that Tamil Nadu has a very good government policy on RWH and people also realize the importance of water conservation and harvesting as Tamil Nadu is a water starved state and most of our groundwater reserves have already been heavily exploited. The following is a link for the Tamil Nadu government water authority website which provides information on RWH: <http://www.aboutrainwaterharvesting.com/rwh.htm>.

I also found this link on all the legislations that various states in India have passed in this area: <http://www.rainwaterharvesting.org/Policy/Legislation.htm>.

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**Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi (response 1)**

I request you to please get in touch with Leena Aparajit, Scindia School, Gwalior (Email- [leena\\_aparajit@yahoo.com](mailto:leena_aparajit@yahoo.com)) who can share her recent experiences in increasing rainwater storage in 'taals' and recycling of wastewater from hostels for horticulture and flushing toilets, etc in Scindia School. As a result of the initiatives there is a pronounced feeling of water-security in the school.

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**Vijay Malik, Medentech Ltd, New Delhi**

We are a manufacturing and product development company specialising in effervescent disinfectant tablets for water purification, hospital surface infection and general environmental disinfection. We have manufacturing plants in Ireland and India. Medentech is recognised as a world leading authority in the disinfection of water and supplying in over 60 countries worldwide for emergency/HWTS/defence forces and governments. Medentech has been working with leading international organisation like UNICEF, IFRC, WHO, and other agencies for the last 20 years.

Please allow me a moment to introduce you to Aquatabs – Water purification tablets. We have different size of tablets to treat water from 1liter-2500 liters. Most of rain water harvested is bacteriological contaminated and aquatabs help to make it safe for drinking purposes.

There are two options which can be used to make rainwater safe for drinking. Big aquatabs can be put in storage tank/drinking water tank in schools. This will disinfect water and keep it safe for next 24 hours. We have developed inline systems which can be used very effectively. These in-line systems need to be replaced after 3 months. Our products are as per WHO/UNICEF specifications and the ingredient used is approved by WHO for lifelong consumption.

I hope you will find this useful. Do let me know if you need more information.

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#### **Surekha Sule, Independent Journalist, Pune**

I would suggest looking at the Tilonia (Rajasthan) experience where Bunker Roy runs a school rainwater harvesting project. The Barefoot College, founded by Bunker Roy, was started in 1972 with the conviction that solutions to rural problems lie within the community. Practical knowledge and skills are emphasized rather than paper qualifications. The College has been built by local people. The campus spread over 80,000 square feet area consists of a 700,000 litre rainwater harvesting tank. The College addresses problems of drinking water, education for girls, health and sanitation, as well as social awareness and the conservation of ecological systems in rural communities. The College serves a population of over 125,000 people – both in the immediate vicinity as well as distant areas. For more information please visit [www.barefootcollege.org](http://www.barefootcollege.org).

The Barefoot College has created a massive infrastructure that collects 29 million litres in 470 schools and community centres. This benefits people in 13 villages, who have piped water supplied through this infrastructure. They pay Rs. 30 per month for two hours of water supply each day. The goal of providing easy access to drinking water has been achieved and this model has connected the school RWH systems to the community.

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#### **K. D. Bhatt, GSFC Science Foundation, Vadodara**

In response to the query on the subject of rainwater harvesting, I would like to inform you that GSFC Science Foundation has published a manual on rainwater harvesting detailing the basics of artificial recharge and various methods/models adopted for recharging the rainwater. The manual also contains some of the case studies to highlight the successful implementation of the different recharge schemes and gains thus achieved in terms of surplus water quantity. The basic objective of this publication was to create awareness about the importance of rainwater harvesting and present the technological approach to the same in a more simplified way for people to be able to implement it on their own.

Further, I would like to make use of this forum of experts and put forward my doubt related to water quality. In case of storm water recharge through a recharge well, generally a deep bore well is drilled on favourable location until the most prolific confined aquifer is tapped and

subsequently, through the network of column and screen pipe assemblies and filter media, a recharge well structure is installed.

When storm water is recharged through such recharge wells, though adequate care is taken to filter out the finest impurities, it generally removes the suspended impurities only. Since the storm water run off carries the load of both suspended and dissolved impurities, the filter media comprising mainly of sand, gravel and pebbles, etc. can not remove the dissolved impurities since the contact time of run off water with the filter media is very short as compared to natural percolation of water underground and secondly the thickness of the filter media (generally about 1 m thick) is not sufficient to cleanse the dissolved impurities. In such cases, the water with the dissolved impurities (chemicals, pesticides etc.) directly enters the fresh water aquifer.

My questions, therefore, are:

- (a) How can we remediate pollution of confined aquifers?
- (b) Can any changes be proposed in the recharge method to avert the problem?

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**[Dinesh Kumar](#), Institute for Resource Analysis and Policy, Hyderabad**

Let me congratulate [K. D. Bhatt](#) for bringing out this issue of groundwater contamination through well recharging. Yes, no one should have an iota of doubt over the fact that “the techniques practiced so far in India to recharge aquifers using runoff from roof catchments and agricultural fields will eventually contaminate the groundwater. While the roof catchments will contain toxic contaminants from manufacturing or vehicular emissions (suspended particulate matter), the field runoff will contain the pesticide and fertilizer residues (depending on which crops the farmer has grown before the monsoon). The filters, irrespective of their thickness, cannot reduce the concentration of dissolved solids, some of which can be extremely harmful (like nitrate and pesticide residues). In the case of roof water tanks in schools, we may be risking the health of the innocent children, though the cause is noble.

K.D. Bhatt himself has undertaken a study of groundwater contamination from agriculture under the IWMI-Tata water policy research program in Vadodara district a few years ago. So, he is the right person to add on this point about aquifer contamination from field runoff.

My extensive traveling in Saurashtra and Kachchh (just to see the functioning of this system) had not shown me a single evidence of rural people and schools cleaning the roof catchments before the rains. There is no point in blaming the NGOs and the communities for this. The problem is the effort required to clean the roof, and the amount of water required for the same. Even if we do these preparatory works, there is no guarantee that sufficient amount of rain would occur immediately after the cleaning operation. The community members were largely found to be using the “roof water tanks” for storing the water transported through tankers during summer, which would later be used for cattle drinking etc.

The “roof water collection tanks” are often the habitats for reptiles (snakes, lizards etc.), because of the cool environment inside during the summer.

Let us see under what situations people use this system. Here, I am really sorry that I had to cite international examples: in drought-prone areas of Australia; and high rainfall areas of Japan and Thailand, people do roof water harvesting. In the first case, the water supplied by the utilities is very expensive. So, for low valued uses (car washing, gardening), people take water from roof water tanks. More importantly, these communities have large roofs, which increases the volume of roof water collected in spite of low rainfalls. In Japan also, the water supplied by utilities is expensive. So, the roof water (with 3000 mm plus annual rainfall) is used for car washing (of course by the rich people). In Thailand (again with high rainfall), roof water tanks are used for

collecting the peak urban floods, so as to improve the cost effectiveness of flood control measures. In nutshell, the economic viability is extremely important. Here, in our condition (in low to medium rainfall areas), the cost per unit of water works out to be prohibitively expensive as compared to many alternative water supply systems. Today, it is somewhere in the range of Rs. 80-100 per m<sup>3</sup> of water (annualized cost) without any major treatment facilities except filtration.

However, we can get high quality water from a desalination system at a cost of Rs. 50/m<sup>3</sup> of water (that remove all impurities) provided we have electricity to run it. I am using a desalination system (of capacity 10 litres per hour) in my house which cost me Rs. 12000 (cheaper than a 10 m<sup>3</sup> roof water tank) for the past 8 years and replaced the membrane only once. It can generate 10,000 litres of pure water in a year if run for just 2.5 to 3 hours a day. Of course, the total production volume would increase in proportion to the total hours of running. This has the size of a 20 litre bucket and is kept in the kitchen.

So, from the point of view of private costs and benefits, there is no incentive for communities to practice it as they get much cheaper water supplies from other sources (tanker water costs them Rs. 40-Rs.50/m<sup>3</sup>). From economic cost-benefit point of view, the government does not have any incentive to invest in it on a large scale. **But, these systems can work wonders in high rainfall regions (with rainy events spread over 6-7 months), in hilly and mountainous terrains from both hydrological and economic point of view.** You will see that people are investing their own resources sometimes.

I have an open question: do these manuals on RWHS discuss about the costs per unit of water (I would like colleagues from UNICEF to react to this)? The economics (private cost-benefits) will change depending on the: physical condition (hydrological regime, roof area per capita and the materials used); socio-economic setting (whether scattered population or concentrated population; city or rural etc.) and policy environment (whether people pay for water supplies in volumetric terms and how much) as my analysis in 2004 suggested. Please read the paper: Kumar, M. Dinesh (2004) Roof Water Harvesting for Domestic Water Security: Who Gains and Who Loses?, Water International, 39 (1).

I am sorry for writing about some hard and unpleasant facts. Of course, there are situations where these technologies work. However, we need to do some more homework to find out that. Otherwise, in my opinion, it will all lead to wastage of public money. May be my observations are skewed. I would look forward to differing opinions from my beloved colleagues. I sincerely hope UNICEF is exercising a lot of caution on this matter of water quality and child health, particularly in the context of decentralized water systems like RWHS.

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**[Ajit Seshadri](#), The Vigyan Vijay Foundation, New Delhi (response 2)**

For institutions that have sensed a need for wise water management – its principles and practices (after having to put in a lot of efforts for sourcing water) the interest is very positive. In cases where institutions got a grant and installed these initiatives, they are not properly maintained. A RWH unit which is not maintained is as good as not having one installed. Also in institutions, where the drainage of storm-water/rainwater is a problem, RWH gives relief of clearance of accumulated rainwater to ground aquifers. These are cases of institutes made in low-lying areas, or at depressions in the topography. Some could be developed at the very spot which have a pond or a low-lying pool. To have RWH, WWT recycling plant, bio-waste composting, and good greens in the school environs has always contributed to build support for education on sustainable development.

However, we have gathered some disturbing information. At NCR Delhi, there are many mechanisms of providing assistance and grants. Despite these, institutions do not come forward and make RWH units. The first question they ask is "how will it benefit my site". It is true, quantity of rainwater, is shared by many nearby places, but the quality of the groundwater will improve due to inter-mixing of groundwater with pure rainwater. To comply with rules, the plot owners make RWH structures, but are reluctant to maintain it. RWH exists in paper and remains non-functional and does no environmental good to the society.

Also we have felt that, individuals, and small complexes should not have to shoulder the burden of undertaking rainwater harvesting. This should be left to the urban-local bodies, as they already maintain the storm/rainwater drainage at the colony level. All that will be required is to make bigger RWH units taking care of a row of houses and these community RWH systems can have bigger recharge bores at colony parks, etc. These would also be controlled and monitored and the cost would be lesser.

The same applies to waste water treatment by STPs, all these ought to be functional such that the processed water is capable of being re-used for lower-end uses and irrigating parks, farms, etc. Parallel encouragement ought to be given to educational institutions to set up demo-working units to keep the same in working order and also to set in the propagation of IEC, etc at local levels.

We have had working examples of RWH, WWT, bio-waste composting to manure, etc in urban, rural schools and other institutions and opine that all these ought to be encouraged with other do-able green initiatives such as urino-manure for fertigation, solar- electric uses, bio-gas plants and incinerator-biomass uses.

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**Tapan Saha, Institute of Environmental Studies and Wetland Management, Kolkata**

Please see <http://www.solutionexchange-un.net.in/environment/cr/res-20040901.doc> (DOC; Size: 124 KB) for a list of RWH system installed in West Bengal by our Institute. I request members to assist us in implementing RWH systems in more schools in West Bengal, especially in the water scarce areas such as Purulia, Bankura, Birbhum, parts of West Midnapur, and the arsenic and fluoride prone districts of West Bengal.

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**Chandra Shekhar Sharma, Sarva Shiksha Abhiyan, Bundi**

I attach an article and a picture of the RWH system installed in our school in Bundi. Please see <http://www.solutionexchange-un.net.in/environment/cr/res-20040903.pdf> (PDF; Size: 34KB) and <http://www.solutionexchange-un.net.in/environment/cr/res-20040902.jpg> (JPG; Size: 1.38MB) for more details.

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**Somnath Sen, IIT Kharagpur, Kharagpur**

I am attaching two files as a resource material on RWH. The first one (please see <http://www.solutionexchange-un.net.in/environment/cr/res-20040905.pdf>) (PDF; Size: 604KB) provides details about RWH and the second one - a presentation (please see <http://www.solutionexchange-un.net.in/environment/cr/res-20040904.ppt>) (PPT; Size: 1.60MB) is a compilation of key elements used during installation of the system. I hope members will find this useful.

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**Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi (response 3)**

It is indeed very encouraging to note that schools, colleges, institutions, and NGOs are contributing towards evolving principles and practices on rainwater and wise water management. The benefits are both tangible and intangible. Also, the initiatives are working examples of providing water security and the practices can be perfected by different communities at different places. Since the communities stand to benefit, this ought to be maintained/sustained at all costs/efforts.

The information provided on dew-harvesting is indeed an eye-opener, and the dew water can be used for potable uses with UV-sun remediation techniques, etc for horticulture and other such uses.

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**[Vishwanath Srikantaiah](#), BIOME, Bangalore (response 1)**

**Please give experiences that demonstrate the extent to which these options recognized and included in the various state government budgets for rural water supply, education, and tribal welfare departments?**

One of the biggest investments in India for schools has come from the Government of Karnataka in a programme called SUVARNAJALA, which sought to provide 23,683 schools with rooftop rainwater harvesting systems to provide drinking water to school children at a total budgeted expenditure of Rs 74 crores.

**What is the scale at which initiatives such as rainwater harvesting and grey water re-use have been applied in schools in different states?**

As before the scale of the programme reached out to virtually every second government school in Karnataka

**Please give experiences of how the harvested rainwater or re-recycled water is used in schools?**

In the private schools I have worked with rainwater harvesting initiative, and after testing and treatment it has been used for drinking purpose. The water has also been used for non-potable purposes, primarily toilet flushing. There are of course the usual protocols to be followed such as testing for water quality in terms of BIS 10500. Please see [http://www.youtube.com/watch?v=DV2l6GC9bVc&feature=channel\\_page](http://www.youtube.com/watch?v=DV2l6GC9bVc&feature=channel_page) and [http://www.youtube.com/watch?v=TxvVSw1you4&feature=channel\\_page](http://www.youtube.com/watch?v=TxvVSw1you4&feature=channel_page) for more details.

As I am a subscriber and sometimes a contributor to this forum I feel I have the right to restate the objectives of the Solution Exchange forum. It is in so far as I understand 'to exchange experiences which members have on a question posted by a member'. It is bothersome and tiresome to have individuals air their opinions on issues as well as to digress and use this as a discussion forum and not Solution Exchange but an opinion exchange. I feel that it infringes my right and defeats the purpose of the forum.

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**[Nitya Jacob](#), United Nations Children's Fund (UNICEF), New Delhi (response 1)**

I had visited Chirawa, a small town in Shekhawati that was home to the industrial family of the Dalmias. The Ramkrishna Jai Dayal Dalmia Sewa Trust (RKJD Sewa Trust) of the group launched the Save Water Save Life campaign around 2002 in the region to challenge the problems of deteriorating climatic conditions and natural resources, especially water.

They have set up two schools to promote education among the people of Chirawah. The schools are named Shri Dalmia Higher Secondary School and Shri Dalmia Girls Higher Secondary School. Both have rooftop rainwater harvesting systems that collect and store around 75 cu m of water

each that is used mostly for watering the playgrounds. This is part of a larger district-wide initiative to install similar systems in other schools but I am aware of only two large systems. Being a private trust, they have not taken any money from the government for the systems and therefore these do not reflect in the local line department budgets.

In Tamil Nadu, the State Government passed two ordinances in 2003 to amend the Tamil Nadu Panchayats Act 1994 and the Municipal Laws. In order to augment ground water resources, it has been decided to make it mandatory to provide rain water harvesting structure in all buildings. As rain water harvesting structures will have to be put up before the ensuing monsoon, it has also been proposed to give a time limit to be specified in the Rules, to provide rain water harvesting structure by the owner or occupier of every building and in case they do not provide rain water harvesting structure within the above said period, the authorities of the local body concerned will provide the rain water harvesting structure in those buildings and recover the cost of provision of rain water harvesting structure with the incidental expense from such owner or occupier as property tax. It has also been decided that if such owner or occupier of the building fails to provide rain water harvesting structure on or before the date to be specified in the Rules, the water supply connection provided to such building shall be disconnected.

These cover schools also, but it is not clear how widely the orders have been implemented. I request a fellow member to fill the Community in on this.

Another major campaign by the Barefoot College has covered 1187 schools till November 2007 ([http://www.barefootcollege.org/pdf/RWH\\_Structures.2007.pdf](http://www.barefootcollege.org/pdf/RWH_Structures.2007.pdf); PDF, Size: 72KB). Here again, while the initiatives are significant, they do not seem to have a link with the local line departments and as such it is hard to say to what extent the programmes are included in the departmental activities. The college has also evolved guidelines for constructing rain water harvesting tanks in schools ([http://www.barefootcollege.org/pdf/Guideline\\_for\\_construction\\_of\\_a\\_RWH\\_tank.pdf](http://www.barefootcollege.org/pdf/Guideline_for_construction_of_a_RWH_tank.pdf); PDF, Size: 288KB). The beauty of the Barefoot system is it can be constructed by village people without formal degrees in engineering using local material or readily-available material. The water is used for multiple purposes.

In the school in Aasgaon village, Satara district, Maharashtra, they have constructed a RWH and water management system. Part of the water from the roof is channelled into a cement storage tank for use in sanitation without further treatment but not for drinking. Part of the run off from the roof is channelled to the trees growing around the building and the compound. Water from the toilets is also diverted into an open area behind the school to water plants and does not enter storm water drains built through the village; storm water drains carry only rain water to a recharge point while all grey water from kitchens and toilets is used in gardening in the entire village. For several houses also have rooftop rain water harvesting systems to meet their non-drinking domestic needs; drinking water is supplied by the panchayat and stored separately in each house.

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**[Vijayan Janardhanan](#), Corps of Engineers, Hyderabad** (*response 1*)

I would like to ask [Vishwanath Srikantaiah](#) how a project for 23,683 schools can be funded with a meager 74 crores? This works out to approximately Rs. 30000 per school and you would be able to build storage tanks of no greater than 6000 litres capacity. This would be a meager storage to harvest the entire year's rain. What about the disinfection cost, storage of potable water and taps for use? How has the outlay for the programme been arrived at? Even a school of 100 children running 300 days a year would need a minimum of 30000 litres at the rate of 1 litre per child per day.

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**Vishwanath Srikantaiah, BIOME, Bangalore** *(response 2)*

I would like to thank [Vijayan Janardhanan](#) for his question. Please see <http://rdpr.kar.nic.in/schemes/SJ.pdf> (PDF; Size: 40KB) and look for Suvarnajala. You will find the information that the Government of Karnataka provides on this project.

We, from an organization called Civic-Bangalore, have asked for the latest status of the project under the RTI. We are yet to get a reply though we have now made a second appeal since it is more than 3 months since we applied. As and when we have the information I would be too happy to share it with you and those interested.

In so far as your question goes, this is how exactly it was built-we mostly built 3000 to 8000 litre tanks. How is it performing? The jury is out on whether the non-functioning systems are 90% or 95 % but the RTI should answer us. What is of interest to us is also the new ones which are functioning. If there had been a leadership at the school/School Development management committee/Gram Panchayat level, additional funds could have been mobilized and utilized to build larger tanks as well as to take care of the maintenance including using a H2S strip test regularly and disinfecting with chlorine. I will bring such examples to the fore in more details later.

This programme also shows the dangers of centralized planning and design which results in a scheme with inbuilt inefficiencies. The funds came from Bharat Nirman of the Centrl gvernment.

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**N.C.S. Seema, WaterHealth India Pvt. Ltd., Secunderabad**

It is interesting to know that roof top water is been used for consumption for personal use and also domestic use but it would be interested to know the storage methodology. It would also be of importance to know if there was any need for filtration of the water for drinking purpose, as there are chances of micro biological contamination in rural areas if the water is stored for longer time periods and is not properly stored.

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**Nitya Jacob, United Nations Children's Fund (UNICEF), New Delhi** *(response 2)*

In these examples, there is minimal filtration and that too using a sand bed filter to strain out large particles. The rain water harvested is not used for drinking as far I am aware in these cases but for hand washing, flushing toilets and maintaining playgrounds. In other examples from Rajasthan and Gujarat, people use harvested rain water for drinking directly with no treatment – I have had water to drink from roof top systems and *tankas* (underground rainwater storage tanks with their own cemented catchment). In the Karnataka example quoted by Vishwanath, people use a sand bed filter to clear the water before storing in an underground cement tank; they extract the water from a handpump and drink it without further treatment.

We ran a discussion last year on the Water Community on water disinfection methods. You can view it at <http://www.solutionexchange-un.net.in/drm/cr/cr-se-drm-wes-01090801-fullcr.pdf> (PDF; Size: 368KB).

I would be interested to know if WaterHealth has worked with schools at the district or state level to get rain water harvesting incorporated into government programmes, and at what scale. It will help understand the real buy-in from the authorities.

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**Latha Bhaskar, Ashoka Trust for Research in Ecology and the Environment (ATREE), Thiruvananthapuram**

There is no dearth of rainwater harvesting projects in Kerala. The Kerala Water Authority is implementing the Varsha project to construct rainwater harvesting structures for low income families. The beneficiaries contribute 10% and the government 90% of the total cost and are implemented through experienced agencies. The Government declared 2004 as the "Year for Rainwater Harvesting". With the objective of promoting rainwater harvesting, the Kerala Government has set up a Rain Centre under the nodal agency - Kerala Rural Water Supply and Sanitation Agency. They are functioning as resource centre, coordinating with the Government and non-government agencies (NGOs) as well as conducting information and education campaigns. But the schemes implemented in many places become a breeding ground for mosquitoes due to poor maintenance. Negligence in ensuring their timely maintenance is the main problem.

Many local bodies, government departments, and NGOs are interested in constructing rainwater harvesting projects in schools. Many schools, even now, do not have a reliable source of water for drinking and other uses such as toilet flushing, cooking, washing hands and feet, etc. Rainwater harvesting tanks installed in many schools are helpful for such purposes. But they are available for regular use only during rainy seasons, when there is continuous flow. Otherwise these structures remain abandoned waiting for the next rains.

No doubt, it is the best source of drinking water in areas where there is fluoride, nitrate, iron, or salt in the groundwater, unfit for consumption. In these places the rainwater harvesting tank can provide mineral free water for consumption. But the question is whether the fate of these projects would be any different if a blind eye is turned to the need for carrying out timely maintenance. Therefore, awareness campaigns regarding the advantages of rainwater harvesting is needed to create demand and to motivate people to get them involved in the whole process. Rainwater harvesting can be most successful in areas facing water problems due to scarcity and contamination. Various awareness creation methods need to be organized to ensure maintenance and management of the structures for sustainable use. Simple maintenance instructions as listed below, if observed correctly will ensure positive results.

- Involve students in monitoring rainfall, total rain in a year, water collected in the rainwater tank and teach them how to ensure good maintenance of the system
- Putting an information board with maintenance details, and keeping a small rain gauge in the schools, etc will be helpful
- Cut the shady trees above the catchments roof or ensure removal of falling leaves regularly to prevent blockage in the gutters and pipes. Decaying leaves may also colour the water and cause bad odour
- Put a rain separator and wash out the first rains to prevent the dirt to come into the filter and the tank
- Paint the storage tank white on the outside, to keep the water inside cool and prevent the growth of bacteria. Every year the tank must be white washed neatly. Now fiber glass tanks are used in many places. These tanks also must be cleaned regularly, at least once a month
- The tank also should be sealed from the top using covers and keep it always fully covered. This will prevent the growth of algae or bacteria in the tank
- The tank should also be completely water tight. If there is any leak in the tank or even dampness, the problem should be addressed immediately with the help of a trained mason
- Water quality checking needs to be done regularly if it is used for consumption. Simple testing kits will be helpful for such testing

- The method suggested for treating for bacteria is chlorination. Liquid chlorine or chlorine tablets are available for treatment of water. Depending on the volume of the rainwater in the tank, chlorine needs to be added to disinfect the water
  - Repair the system in time and ensure smooth operations.
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**Muhammad Mukhtar Alam, Centre For Ecological Audit, Social Inclusion and Governance, New Delhi**

I recall my work with Save the Children, in Gujarat during the reconstruction and community mobilization phase. I was with the organization from February - September 2003. During this period I was handling works related to 114 anganwadis and the hospital at Fatehgarh, Rapar Taluka that Save the Children UK constructed. All the anganwadis were equipped with water tanks. I now realize that water harvesting structures could have also been built for supplying water as supply of water to schools and anganwadis in the water deficient areas has been a concern. I would be grateful, if members from Gujarat could share details about the status of water supply and storage system at the anganwadis and schools in Rapar Taluka.

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**Alpana Jain, Development Facilitator, Udaipur**

The rainwater harvesting structures in Udaipur have been implemented in 1500 public, secondary, and senior secondary schools. These are schools which have been constructed through the Panchayat Samitis. The Gram Panchayats in the area get the budgetary approvals for the RWH systems through the Panchayati Raj Department.

These structures are in working condition in not more than 30% of the schools. Most schools which have a working rainwater harvesting structure are in the urban areas, where the schools have a boundary wall and there is someone to guard the facility. In the case of the schools in rural areas, the underground water tanks (size 10 feet x 10 feet) are usually leaking because of poor construction material, or the PVC pipes on the roofs are leaking because of excess heat. These are also broken by children. These pipes and tanks are not maintained because there is no separate fund for the repair and maintenance of such structures and the school budget is spent on other activities. The teachers also feel that even if they were repaired these pipes would again be broken by children.

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**Arun Jindal, Society for Sustainable Development, Karauli, Rajasthan**

The Government of Rajasthan has extensively constructed rainwater harvesting structures in government schools (under NREGA). A huge amount of money has been spent on the construction of these RWH structures. However, no amount has been earmarked for their maintenance. In addition, the place for storing rainwater has not been suitably selected.

In Karauli district these structures are not in use at any place. The Gram Panchayats constructed these structures, but the school authorities are not bothered about the proper use and maintenance of these structures. In these schools there is also no system of recycling used water.

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**Joe Madiath, Gram Vikas, Behrampur, Orissa**

Rainwater harvesting (RWH) is unsuited to areas where rainfall is high. In these areas, it is better to have ground water recharge structures. The cost of storing rain water is high, at least Rs. 2 per litre, while ground water recharge can be achieved for next to nothing. In areas where rain

fall is low, or in water-stressed areas, it can be stored for drinking water if the structures are made properly. This water can be filtered to remove any impurities.

In our experience, we have not had any positive inputs from the line departments at the village in Orissa. They are interested in drilling for groundwater, and this has increased the contamination of drinking water by fluorides, arsenic and salinity. They are not interested in any recharge mechanisms from RWH.

Gram Vikas works in 699 villages across the state and has a strategy of recharging harvested rain water straight into the ground instead of making concrete storage structures. The emphasis is on digging open wells, soil recharge and watershed management. We work with villagers on these activities, clean the existing dug wells and test water from them once a month. The schools in these 699 villages are part of our programme to harvest rainwater as well. In all these villages, there is running water round the clock. In areas where there is no electricity, we have installed solar pump sets that pump water from the wells to individual household taps; each house has three taps – one in the kitchen, one in the bathroom and one in the toilet. The people are fully involved in these projects; we do not initiate a project unless the entire village is unanimous about its need. The entire water supply and sanitation systems are made to high standards so people take pride in making and using them. Most of these villages are tribal. Schools also get piped water from the same system.

We prefer dug wells as the recharge and water storage structures. These are clay lined to prevent seepage from the sides, and covered to keep animals other impurities out. They communicate with the aquifer only through the bottom of the pits and this helps maintain water quality. Under the new Accelerated Rural Water Supply Programme guidelines, 20% of the funds can be used under Swajaldhara for these activities. The water supply norms under Swajaldhara prescribe storage of 10 litres per capita per day, but Gram Vikas has raised this to 40 lpcd.

People contribute up to 40% of the projects costs, usually as labour, while the government contributes the costs of steel and cement. This ensures the continuity of the project and covers the operation and maintenance issues.

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**[Seema Raghunathan](#), WaterHealth India Pvt. Ltd., Secunderabad (response 1)**

In my previous assignment, we worked very closely with government school, in creating awareness and providing drinking water facilities, toilets facilities, and rainwater harvesting. Now, to a great extent we can see greenery in these schools. This project was supported by UNICEF, IRC and the Government of Andhra Pradesh.

The status of RWH in these schools needs to be assessed and also the impact on the water table.

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**[Richard Parmar](#), Cohesion Foundation Trust, Ahmedabad**

**What is the scale at which initiatives such as rainwater harvesting and grey water re-use have been applied in schools in different states?**

In South Gujarat, generally the annual rain fall is about 2200 mm. Although there is good rain fall in the area, there is also very high run off, due to the terrain. This leads to scarcity of water for drinking and domestic purposes. During summer months water scarcity becomes severe. The schools face acute water shortages for drinking and cooking, forcing children to carry drinking water from their homes. In about 30% of the schools, there were water tanks of 5000 litres capacity, above the ground level, which were constructed by the government. These were connected with the government water supply scheme, but are not in good condition. These could

not be considered as Rooftop Rain Water Harvesting Systems (RRWS) because of their inadequate capacity and structural flaw.

The poor quality of water is also a strong area of concern. This causes skin disease among children. During monsoons the children drink turbid water and suffer from water borne diseases such as diarrhoea, amoebiasis, giardiasis and Hepatitis A.

Therefore, the schools decided to adopt RRWS. Cohesion Foundation with the support of Millepede Foundation, Hong Kong (in Chikhli taluka) and Water and Sanitation Management Organization (WASMO) (in Vansda, Kaprada and Dharampur talukas), has helped schools to construct RRWS. The schools will start using RRWS from this year. The other measures promoted by us are recharge of dug wells. RRWS is also being promoted in the village levels, particularly for villages which are situated in the hills.

**Please give experiences of how the harvested rainwater or re-recycled water is used in schools**

Before the construction of RWSS, students and teachers used overhead tanks built in schools, many of which were damaged. Since the construction of RRWH structures, they have understood the importance of water. The schools have set up teams of children to take care of the RRWH structures. The schools train and motivate children to take care of the RRWH structures and the schools maintain the RRWH structures. The schools will be using water from the RRWH structures for drinking and cooking mid-day meals. In some of the schools, motor is used to pump water in water tanks from RRWS, and connections have been provided to the toilets in the schools, especially in those meant for adolescent girls.

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**Shree Padre, Water Journalist, Vaninagar, Kerala**

As per the initial plan of the RD & PR Department about 23,682 schools spread across all the districts of Karnataka were supposed to be provided with RWH structures at a cost of Rs. 74 crores. They had constructed over 12,000 structures by March 2007 and spent over Rs. 30 crores. Based on Arghyam's survey and analysis they decided to revive the defunct structures before going ahead with further constructions. Unfortunately, not much happened with regard to reviving the broken structures. However, we do not have the final figures of RWH structures.

For more information regarding the rainwater harvesting structures please check <http://www.solutionexchange-un.net.in/environment/cr/res-13040901.doc> (DOC; Size: 40KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040902.jpg> (JPG: Size: 280KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040903.jpg> (JPG: Size: 264KB ), <http://www.solutionexchange-un.net.in/environment/cr/res-13040904.jpg> (JPG: Size: 188KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040905.jpg> (JPG: Size: 196KB), <http://www.solutionexchange-un.net.in/environment/cr/res-13040906.jpg> (JPG: Size: 184KB) and <http://www.solutionexchange-un.net.in/environment/cr/res-13040907.jpg> (JPG: Size: 272KB).

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**Seema Raghunathan, WaterHealth India Pvt. Ltd., Secunderabad (response 2)**

In my previous work with the Children's Environment Science Congress, I had the opportunity to coordinate the School Sanitation and Hygiene Education project in three districts of Andhra Pradesh - Medak, Nizamabad and Hyderabad, which provided basic infrastructure such as drinking water, sanitation, rainwater harvesting and hygiene education in association with the Government of Andhra Pradesh, IRC and UNICEF.

The findings of the project are as follows:

- The 100 schools in each district were provided with the above infrastructure (and protected by a wall)
- We arranged for educational materials such as paintings; and imparted hygiene education
- The tree plantation/avenue plantation in and around the school were developed and the children adopted the plants. The same have now grown and they all look very green and fresh
- The comfort in using the toilets helped children to motivate their parents to construct toilets in their homes
- The massive awareness on hygiene education and child-to-child communication brought about behavioural changes in the children and through them in their parents
- Provision of safe water helped in retaining the children as earlier most of them would go home for drinking water and due to the lack of toilets, but with the provision of the above the children stayed back at school. The children collected Rs. 1 towards the maintenance fund, used for procuring materials like soaps, brooms, etc. The project went on for 3 years. Such projects need to continue with regular focus on changing the behaviour of children
- Although maintaining the rainwater harvesting structures was part of the school activities but the structures were not maintained.

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**[Vijayan Janardhanan](#), Corps of Engineers, Hyderabad** (*response 2*)

In some parts of Australia the system of filtration of rainwater for drinking purpose is in vogue. We could ask members from Australia to help us with the process and systems in use. I also found this site interesting for rainwater harvesting - <http://www.harvesth2o.com/>. It should throw up some answers to our queries.

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*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](mailto:se-wes@solutionexchange-un.net.in) with the subject heading "Re: [se-watr] Query: Use of Rainwater and Wise Water Management in Schools - Experiences; Advice. Additional Reply."*

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