



# Conservation and Sustainable Management of Water Resources

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## Rain Water Harvesting



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# Challenges

Freshwater issue continues to be a cause of concern for humanity owing to both anthropogenic and natural factors.

Some key water related issues are:

- Depletion of ground water level
- Contamination of ground water
- Dying fresh water bodies such as ponds and lakes

| over-use | pollution | changing climate | erratic rainfall | imperviousness |



# Depleting ground water table

- India faces worst water crisis: NITI Aayog

Source:

<https://www.thehindu.com/sci-tech/energy-and-environment/india-faces-worst-water-crisis-niti-aayog/article24165708.ece>

- Groundwater crisis

Source:

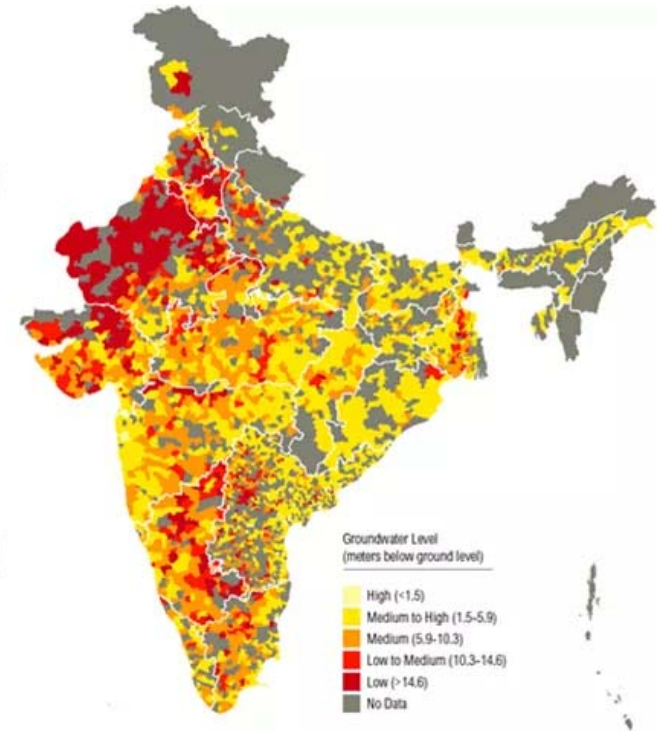
<https://www.thestatesman.com/opinion/groundwater-crisis-1502697503.html>

- India's water crisis: The clock is ticking

Source:

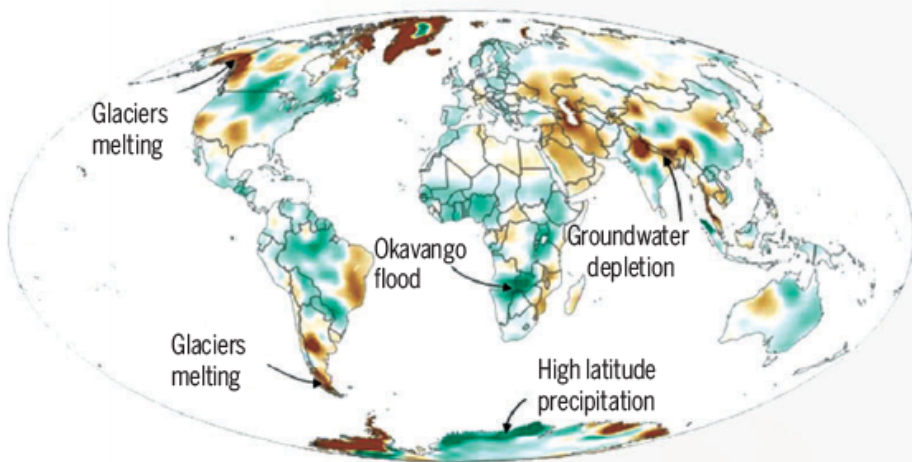
<https://www.downtoearth.org.in/blog/water/india-s-water-crisis-the-clock-is-ticking-65217>

**54%**  
of India's  
Ground-  
water  
Wells Are  
Decreasing



# A Looming Crisis

**1** The rate of groundwater depletion in India is among the highest in the world



## HOW BAD IS THE WATER CRISIS IN INDIA?

(A TIMELINE FORECAST)

- 2019 ● **CHENNAI** ALMOST RUNS OUT OF WATER
- 2020 ● **21 CITIES** INCLUDING **BENGALURU, DELHI, HYDERABAD** TO RUN OUT OF GROUNDWATER
- 2030 ● **40 % OF INDIANS** WILL HAVE NO ACCESS TO DRINKING WATER.
- 2040 ● THERE WILL BE NO DRINKING WATER IN **ALMOST ALL OF INDIA.**

impulse

# Contamination of ground water

- Heavy metal contamination is leading to major environment and health complications. The crippling effects of fluoride and arsenic toxicity is transforming to become a major public health issue today

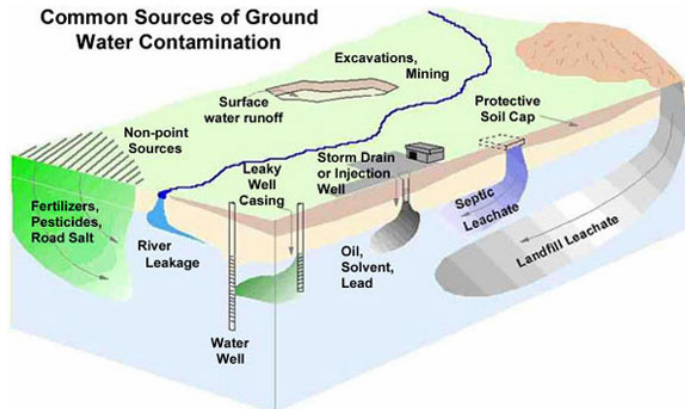
Source: <https://fluoridealert.org/news/heavy-metal-toxicity-and-water-contamination/>

- State groundwater most contaminated

Source: <https://www.tribuneindia.com/news/punjab/state-groundwater-most-contaminated/539909.html>

- Polluted surface and groundwater could cause a Cape Town-like situation

Source: <https://www.downtoearth.org.in/news/water/polluted-surface-and-groundwater-could-cause-a-cape-town-like-situation-62365>



## Groundwater contamination in parts of Delhi districts

**S**

**Salinity** (Electrical conductivity above 3,000 micro mhos/cm)  
New Delhi, North, South, East, West, Northwest, Southwest

**F**

**Fluorides** (above 1.5mg/l)  
East Delhi, New Delhi, Northwest, South, Southwest, North, West

**N**

**Nitrates** (above 45 mg/l)  
East, Central, New Delhi, North, Northwest, South, Southwest, West

**A**

**Arsenic** (above 0.01 mg/l)  
East, Northeast

Source: Lok Sabha secretariat

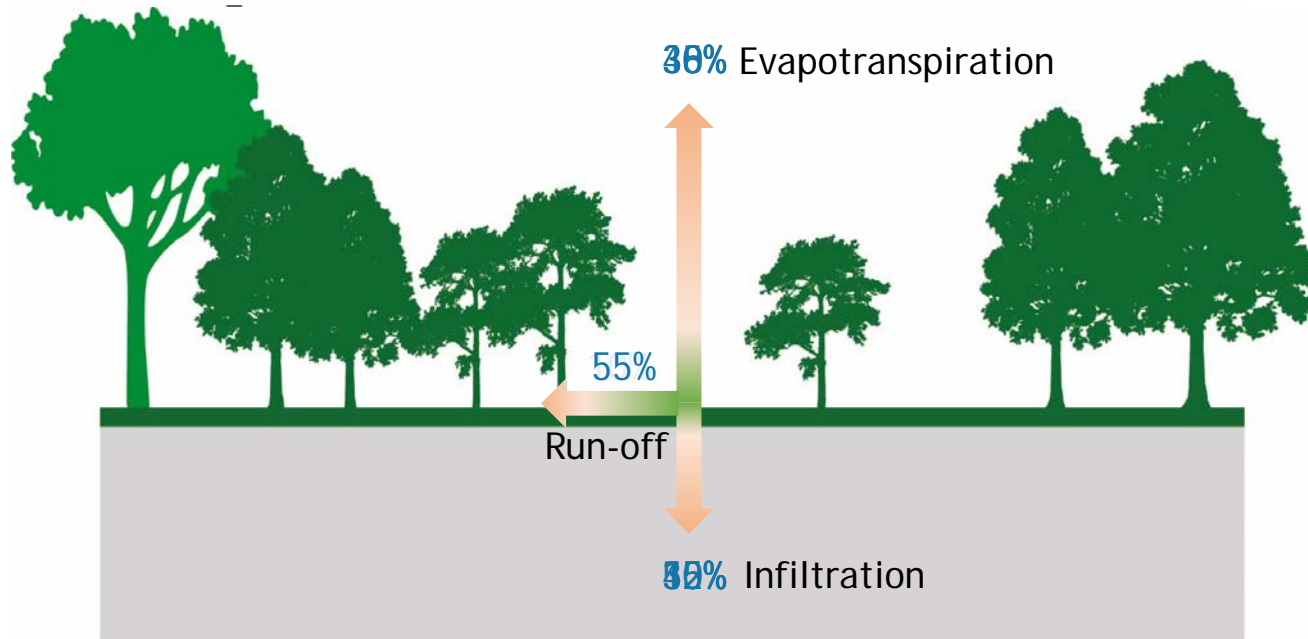




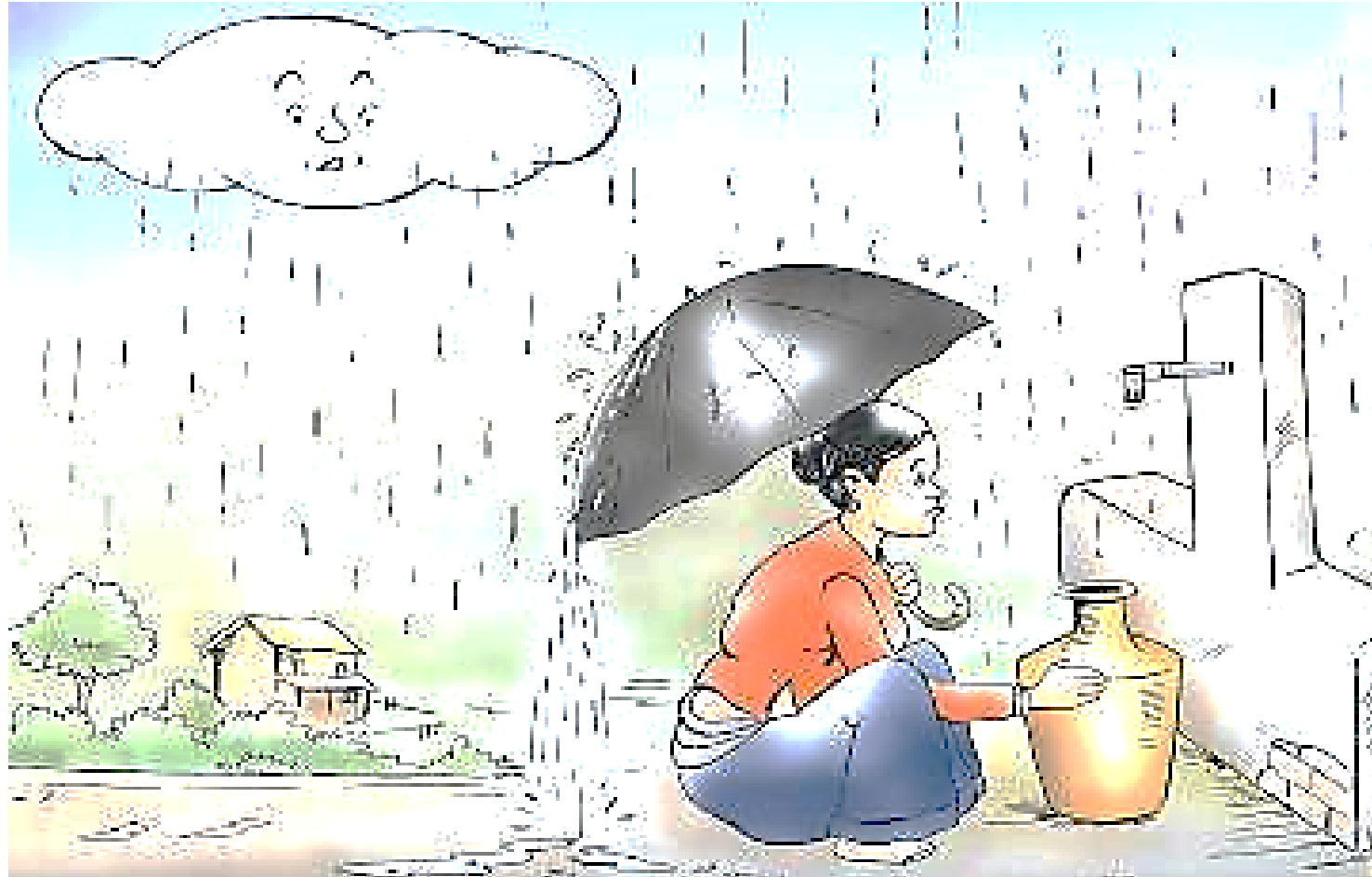


# Hard Surface and Imperviousness

75% Permeable Surface



## Harsh Reality

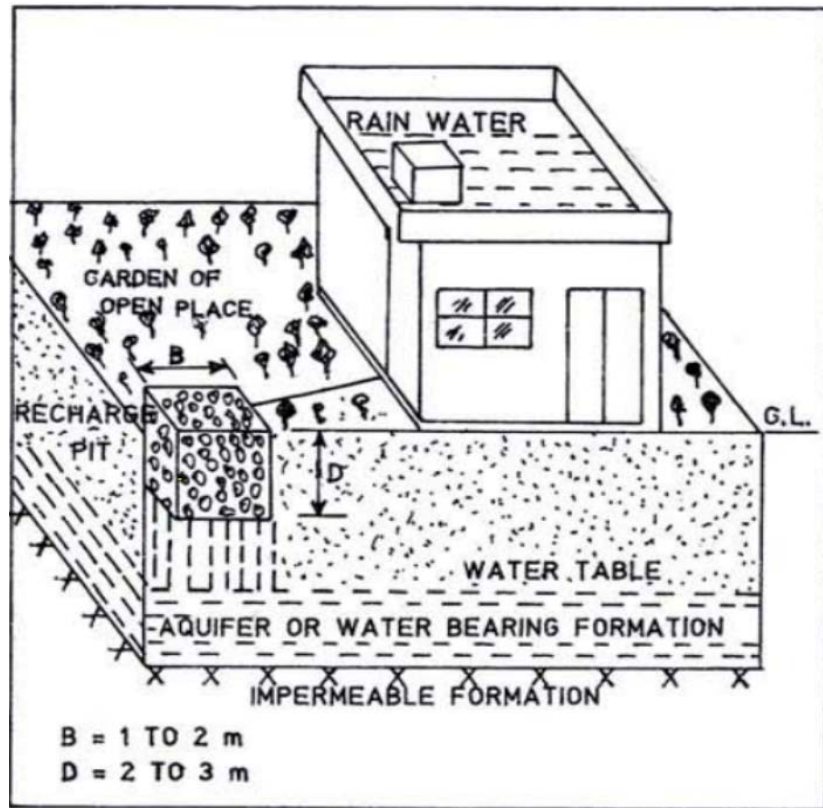


# Mitigating depletion of ground water table and ground water contamination

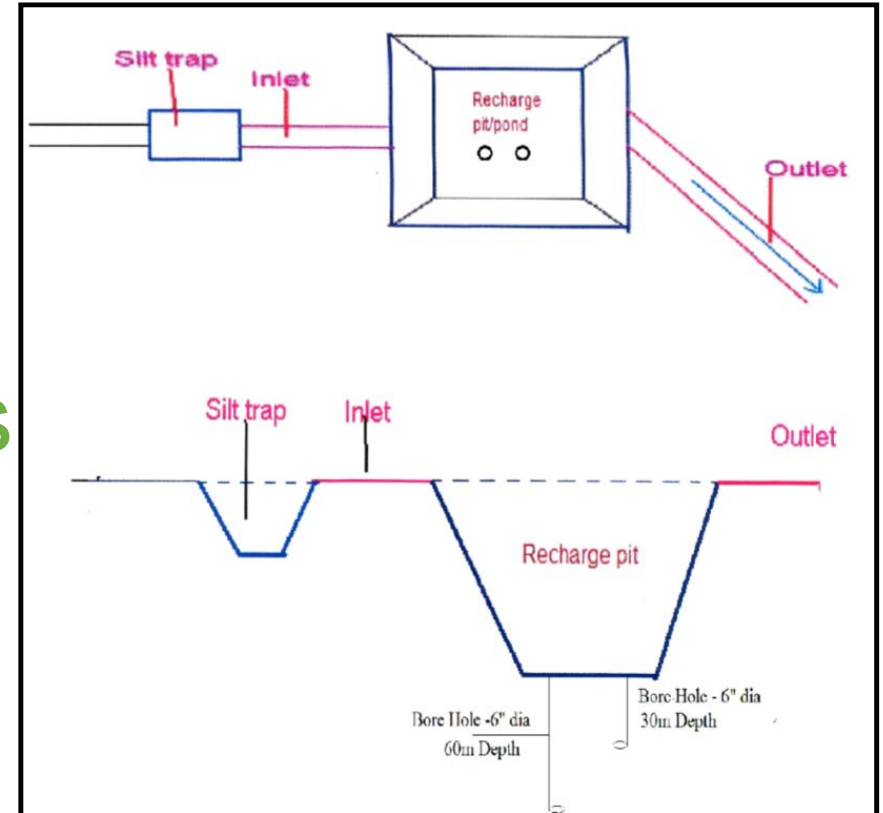




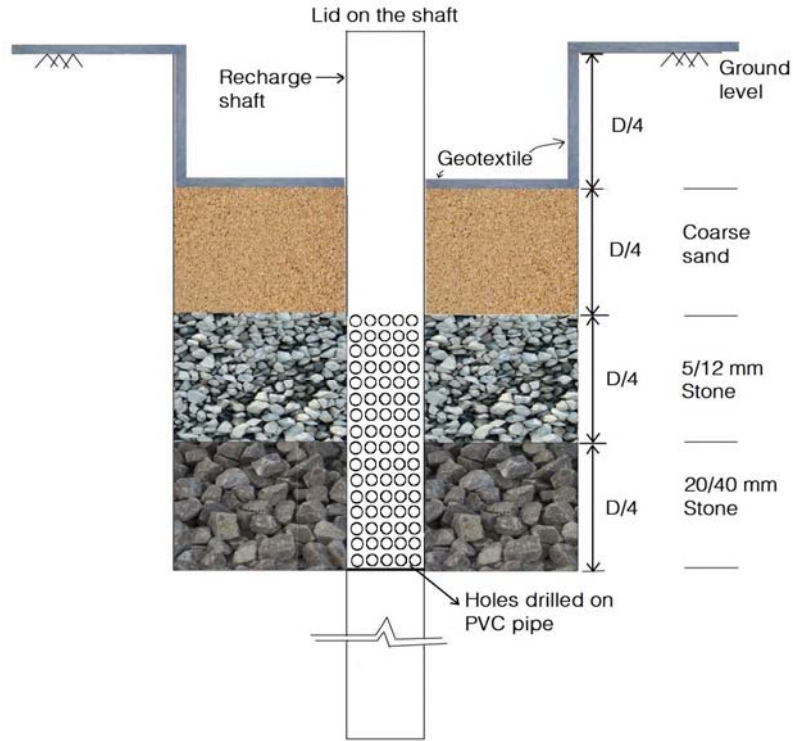
# Conventional RWH Vs Improvised RWH (JNTU Model)



V/s



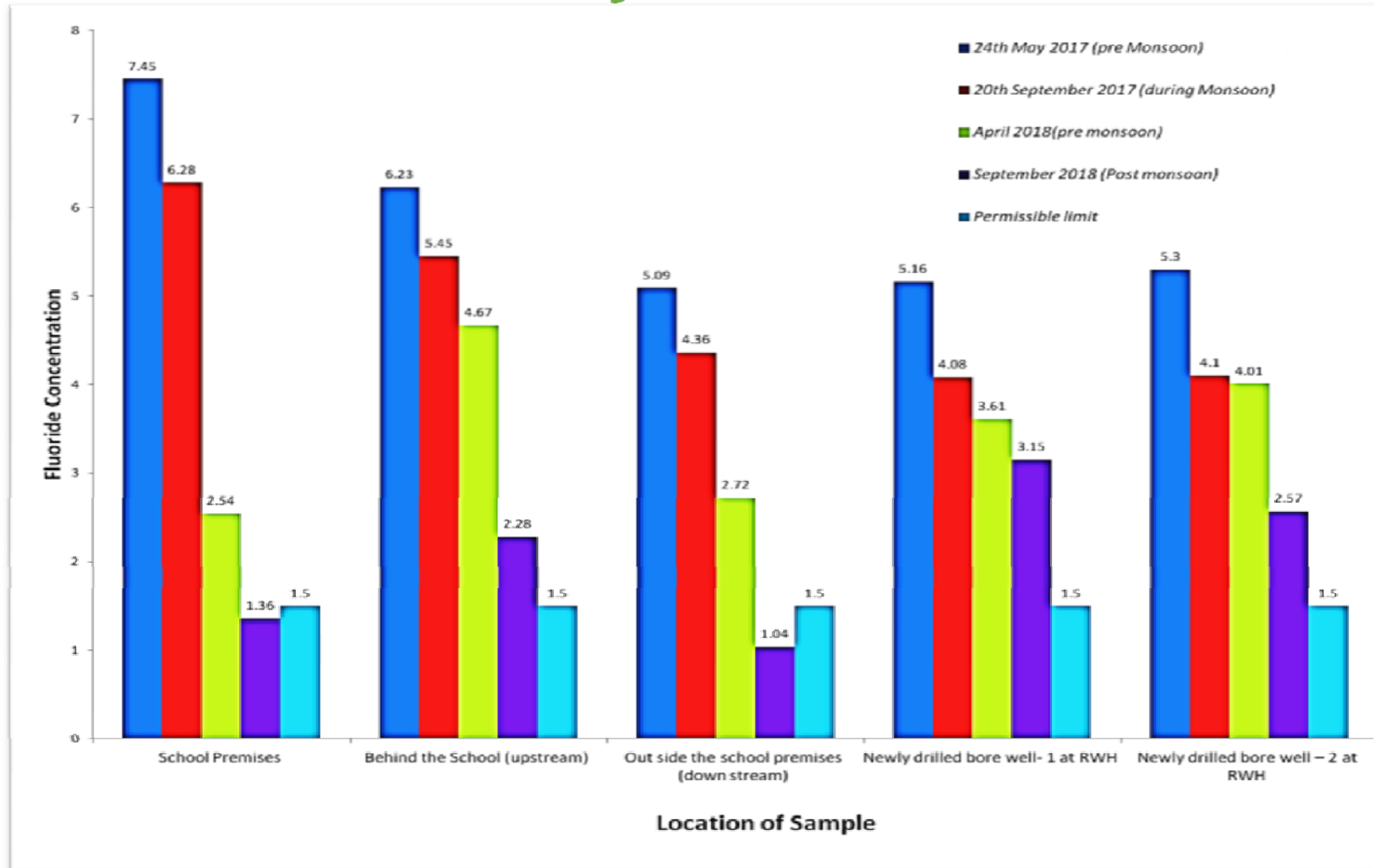
# Roof top & surface water collection (JNTU Model)



## RWH in Action



# Reduction in Heavy Metal Concentration



# Benefits of RWH and advantage of JNTUH Model

- Harvest **good quality water** at low costs and conserve water
- Takes the water down to the aquifers resulting in instant **ground water recharge**
- Helps reduce our reliance on water sourced from dams/ reservoirs/lakes/rivers and **reduce electricity consumption**
- **Prevents flooding** by capturing excess runoff and prevents soil erosion
- It is a **zero-maintenance** structure with zero discharge
- Water **quality improves** through dilution (including removal of **Fluoride and Arsenic**)
- High benefit-cost ratio and **longer life-span** of the structure
- **No water stagnation** and mosquito breeding
- An emerging **skill development and entrepreneurship** opportunity for local communities

# Waterbody conservation and lake restoration through sustainable technologies

Eco-technologies for wastewater treatment such as Constructed Wetlands and Floating Islands are fast gaining popularity as they are low-cost, low maintenance and sustainable. Such intervention may be viewed as artificially designed macro-ecosystems based on ecological principles in order to achieve desired degree of treatment.

- Hydrophytes such as *Cana indica* have been widely applied in Floating Islands for the remediation of surface water and wastewater due to their efficacy in assimilating nutrients and creating favorable conditions for the microbial decomposition of organic matter (Wang et al., 2009).

Source: [https://irrec.ifas.ufl.edu/irsws/publications/Zhao\\_Ecol\\_Engin\\_2012.pdf](https://irrec.ifas.ufl.edu/irsws/publications/Zhao_Ecol_Engin_2012.pdf)

- The Subsurface Flow Constructed Wetlands (SFCW) are structurally manmade treatment systems built in an earthen or semi concrete depression, strategically filled with pea nut sized river gravel providing substrate for riparian plant species anchorage and slimy complex for bacterial film growth, with inlet and outlet arrangement (Billore et. al., 1999).

Source: <http://www.moef.nic.in/sites/default/files/nlcp/H-%20Constructed%20Wetlands/H-3.pdf>





← Constructed Wetlands

Floating Islands →





# Turning weed into wealth

Fresh water ecosystems today are struggling with water hyacinth (*Eichhornia spp*) infestation, however their use as raw material for handcraft, pulp and manure has given a ray of hope ensuring economic development and social empowerment for local communities.

- In the Northeast, 10 years of crafting wealth from a notorious weed

Source: <https://indianexpress.com/article/lifestyle/art-and-culture/in-the-northeast-water-hyacinth-crafting-notorious-weed-5080471/>

- Researchers innovate to make money out of water hyacinth

Source: <https://india.mongabay.com/2018/01/researchers-innovate-to-generate-money-out-of-water-hyacinth/>

- In Haryana's Jhajjar, villagers turn an invasive weed into handcraft

Source: <https://www.hindustantimes.com/gurugram/in-haryana-s-jhajjar-villagers-turn-an-invasive-weed-into-handcraft/story-MfxqQBFet7f4jpfzh981Cl.html>





**Thank you...**