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Feasibility Study of Aquawall - An Alternative for Conventional Rain Water Harvesting System

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Abstract: *Rainwater harvesting has been an age-old activity, practiced by many cultures in areas of poverty and wealth, but unfortunately our urban communities discard using it due to ignorance and lack of education. The challenge is to change the attitude of the state agencies responsible for environmental policy to make population being part of water saving, reduction of vulnerability and adaptation to climate change with rainwater harvesting. In our urban space limitations make it necessary to propose a system of "vertical water tank" that fulfills this function. The Aquawall project is based on the appropriate technology and the circular economy, made by self and is designed in a modular way, taking up minimal space, made of nine towers of six three-liter bottles each, connected to a PVC base*

Keywords: rainwater harvesting, aquawall, vulnerability, adaptation

I. INTRODUCTION

Aquawall system, which has produced a rainwater-harvesting technology made from reused PET bottles (Polyethylene terephthalate), a raw material typically used to make plastic packaging materials for a wide range of consumer goods, proves reusable in creating a vertical type water tank that proves compact and resistant to liquid pressures. It is common in our rural areas that homes have a system for rain water storing, however, in our urban space limitations make it necessary to propose a system of "vertical water tank" that fulfills this function. The aquawall is made by self and is designed in a modular way, taking up minimal space, made of nine towers of six three-litter bottles each, connected to a PVC base. We try to raise awareness about the proper disposal of plastic waste in order to mitigate the environmental impacts we have on our planet. Water scarcity (closely related to water stress or water crisis) is the lack of fresh water resources to meet the standard water demand. There are two types of water scarcity namely *physical* and *economic water scarcity*. Physical water scarcity is where there is not enough water to meet all demands, including that needed for ecosystems to function. for example Central Asia, West Asia, and North Africa often experience physical water scarcity. Economic water scarcity on the other hand, is the result of lack of investment in infrastructure or technology to draw water from rivers, aquifers, or other water sources. It also results from weak human capacity to meet water demand. Much of Sub-Saharan Africa experiences economic water scarcity.

II. THEROTICAL CONTENT

Rainwater harvesting is a multipurpose way of supplying usable water to consumers during a crisis period, recharging the groundwater and finally reducing the runoff and water logging during the season of heavy rainfall. Traditional knowledge, skills, and materials can be used for this system. During the rainy season, an individual can collect water on his rooftop and manage it on his own. Reserved rainwater on rooftops can be used for self-purposes or domestic use. Water from different rooftops of a lane can also be collected through a piped network and stored for some time. This water can be then channeled to deep wells to recharge ground water directly, to ponds to replenish groundwater slowly, and to reservoirs to dilute reclaimed water for non-potable use. Unless it comes into contact with a surface or collection system, the quality of rainwater meets Environmental Protection Agency standards, and the independent characteristic of its harvesting system has made it suitable for scattered settlement and individual operation. If needed, a chemical treatment such as chlorination can be used to purify the water. The acceptance of rainwater harvesting will expand rapidly if methods are treated such as building services and if designed into the structure instead of being retrofitted.

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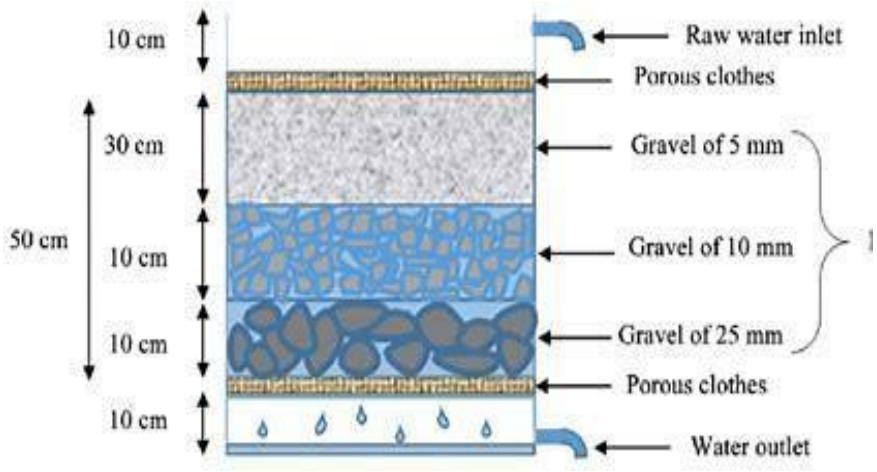

Fig.2 Sand filter

The group of sand filters is very similar to the slow and quite Type. The ecosystem in a slow sand filter includes bacteria, protizoa such as rhizopods & ciliates, rotifers, copepods, and aquatic worm. The rate of filtration for a normal slow sand filter varies from 100 to 200 lit/hr. Slow sand filtration is a type of centralized or semi-centralized water purification system. A well-designed and properly maintained slow sand filter (SSF) effectively removes turbidity and pathogenic organisms through various biological, physical and chemical processes in a single treatment step. Only under the prevalence of a significantly high degree of turbidity or algae-contamination, pre-treatment measures (e.g. sedimentation) become necessary. Slow sand filtration systems are characterised by a high reliability and rather low lifecycle costs. Moreover, neither construction nor operation and maintenance require more than basic skills.

Hence, slow sand filtration is a promising filtration method for small to medium-sized, rural communities with a fairly good quality of the initial surface water source. As stated by the WHO, slow sand filtration provides a simple but highly effective and considerably cheap tool that can contribute to a sustainable water management system.

III. OBJECTIVE

- To reduce plastic bottle waste.
- To provide viable option to minimize waster scarcity in rural areas.
- To provide good quality of water.
- To reduce ground water pollution and to improve the quality of groundwater through dilution when recharged to groundwater there by providing high quality water.
- The rooftop rainwater harvesting is less expensive, easy to construct, operate and maintain.
- To meet the ever-increasing water demand

IV. BENEFITS OF RAINWATER HARVESTING

Rainwater harvesting is a simple and primary technique of collecting water from natural rainfall. At the time of a water crisis, it would be the most easily adaptable method of mitigating water scarcity. The system is applicable for both critical and normal situations. It is an environmentally friendly technique that includes efficient collection and storage that greatly helps local people.

The associated advantages of rainwater harvesting are that :

- it can overcome the burden on the public water supply, which is the main source of city water.
- it can be used in case of an emergency (i.e., fire).
- it is solely cost effective as installation cost is low, and it can reduce expense that one has to pay for water bills.
- groundwater level is highly recharged during rainfall.

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V. QUALITY OF ROOFTOP RAINWATER

The quality of harvested rainwater is an important issue, as it could be utilized for drinking purposes. Quality of captured water from roof top depends on both roof top quality and surrounding environmental conditions, that is, local climate, atmospheric pollution, and so forth. Tests must be performed to check its viability and applicability before using as drinking water. Previous researches showed that water quality of collected water did not always meet standard limits due to unprotected collection. Local treatment of harvested water could easily make water potable. Again rainwater could be also identified as non-potable sources for the purpose of washing, toilet flushing, gardening, and so forth, where quality is not a great concern. In this respect, treatment of collected water is of no such importance; rather it is used for household purposes. In this paper an assessment has been made on the quality of rainwater collected through a well maintained catchment system

VI. DEFINITION OF RAINWATER HARVESTING

The harvesting of rain water involves the collection of water from surfaces on which rain fall subsequently stores the water for later use. It is accumulation and deposition of rain water for use on site. The harvested
water can also be used as drinking water, long term storage and ground water recharge etc.

VII. RAIN WATER HARVESTING METHOD

It is easy to collect rain water from the building, roofs and many other sources. As long as you are ready and you have everything with a few different items, what it needs, harvest rain water and enjoy naturally delicious, clean and useful water start? Rainwater harvesting systems can be purchased from various home improvement stores completely. The costs of these systems are different. Broadly there are two ways of harvesting rainwater.

(a) Surface runoff harvesting
(b) Roof top rainwater harvesting

Fig.2 Layout of Model

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(a) Surface runoff harvesting

Surface water can be stored by diverting the flow of small creeks and streams into reservoirs on the surface or underground, it is the system that collects rainwater, which flow away as surface runoff. the runoff rainwater is caught and used to recharge aquifers by adopting appropriate techniques.

(b) Roof top rainwater harvesting

Rooftop Rain Water Harvesting is the technique through which rain water is captured from the roof and stored. This method is less effective and expensive it is easy to install at small

VIII. TEST PERFORMED ON ROOFTOP RAINWATER

- pH meter test
- Turbidity test

pH meter test: -

The Ph meter is a laboratory equipment which is used to measure the acidity or alkalinity of solution.

pH Meter Test	Value
Rooftop Rainwater	7.4 – 9.10

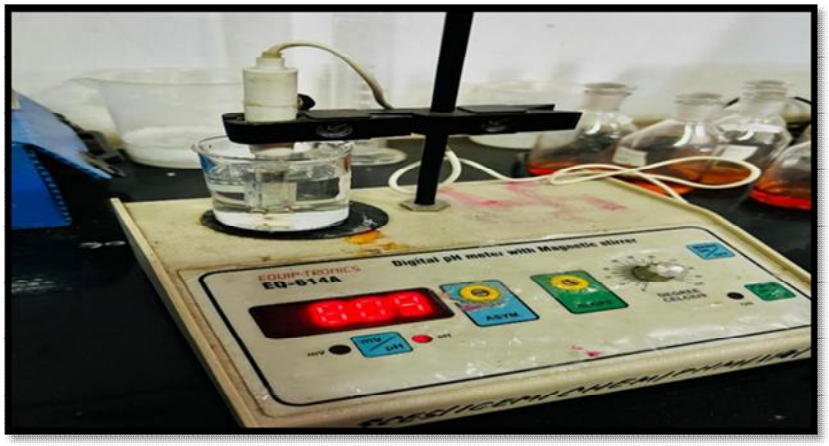

Fig.3 pH test on Rooftop Runoff Rainwater

Turbidity test

Measuring the turbidity is important when measuring the quality of water. Turbidity is used to indicate the presence of pathogens, bacteria, and other contaminants such as lead, mercury which are harmful to both aquatic life and human health.

IX. CONCLUSION

Demand on water resources has increase day by day due to the population growth and expansion in urbanization, industrialization and irrigated agricultural. Adopting the concept of sustainability and conservation of water resources can help to cope with the global water shortage. Rainwater harvesting system is one of the concepts that can be implemented to meet the water shortage problem. The quantity and quality of rainwater collected is different from place to place depending on the weather, geographic location, activity in the area and storage tank. Furthermore, rainwater has a lot of potential as an alternative water resource for the future because of its high quality. Rainwater quality always

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exceeds the surface water and comparable to ground water because of it does not come in contact with soil and rocks where it can dissolve salts and mineral which is harmful for potable and non-potable uses.

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