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Rainwater Harvesting

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ABSTRACT: Rainwater harvesting is the collection of water volume from raindrops. Rainwater harvesting has been the main source of water supply for potable and non-potable uses in the old days because the water conveyance systems were not used for water distribution during these days and the method used for rainwater harvesting was simple and primary (rainwater was mostly collected from roofs and some was collected directly from the sky). Usage of the collected water volume from rainwater harvesting was direct and without any treatment. Presently, the water supply systems have improved but the demand is increasing due to the population growth, and development. The available water resources are limited and/or seasonal, which made the experts working in the water sector to search for solutions to the water shortage. Many countries around the world are facing water shortages. Optimization of water usage and the conservation of water as a natural resource can help to overcome water shortage. Rainwater can be used for potable and non-potable uses. The potable uses include drinking, bathing, and cooking and washing.

I. INFORMATION

World's population has been constantly increasing and so has the water demand. However, supplies from water resources are limited and estimated to be 2% from the total available water in nature. The population growth has direct influence on the water supply demand rates. For example, worldwide water demand has increased six folds between 1990 and 1995 while the population was only doubled and the demand of the agricultural sector is almost 70% of the total demand

The rate of the growth in the urban area is about four times that of the rural areas. Based on this fact, the concept of sustainability must be considered in planning and management of the available water resources. With the development and growth of urban populations, the paved and roof area will increase and this situation is ideal for implementing rainwater harvesting techniques. Rainwater harvesting has been the main source of water supply for potable and non-potable uses in the old days because the water supply systems were not developed yet. The method of harvesting rainwater at that time was simple and primary. Usage of the collected water volume from rainwater harvesting was direct and without any treatment. The rainwater was mostly collected from roofs and some was collected directly.

Based on the size of the catchment, rainwater harvesting systems can be divided to medium and small. The medium size is a system which collects rainwater from catchment areas in educational institutions, airports, army camps, and others. Small systems collect rainwater from the roof of houses. Water can be also collected from open areas and store it in a depression of land or basins. The storage from rainwater harvesting system can be used for portable and non-potable uses. It is preferable to integrate the rainwater harvesting systems with the existing conventional water

supply systems.

This will help to meet the increasing demand for water supply and contribute to the sustainability of the water supply. Many countries around the world are still promoting the usage of harvested rainwater for potable and non-potable uses. Examples of these countries are the USA, Germany, Australia, China, and Japan. The volume of rainwater collected is different from place to place. For example and based on pilot project in Zambia, Africa, a volume of 10 m³ of rainwater was collected annually.

II. METHODOLOGY.

Rainwater Harvesting System

Rainwater can be captured by using the rainwater harvesting system. Generally, rainwater harvesting system is the direct collection of rainwater from roofs and other purpose built catchments, the collection of sheet runoff from man-made ground or natural surface catchments and rock catchments for domestic, industry, agriculture and



environment use. The systems can be categorized as small, medium and large scale (Gould 1999). Normally, the size of rainwater harvesting was based on the size of catchment area (Thamer et al., 2007).

In scientific term, rainwater harvesting refers to collection and storage of rainwater and also other activities aimed at harvesting surface and groundwater, prevention of losses through evaporation and seepage and all other hydrological studies and engineering interventions, aimed at conservation and efficient utilization of the limited water endowment of physiographic unit as a watershed (Agrawal and Narain, 1999).

Water Shortage in Malaysia

The Malaysian economy has gone through rapid structural change since independence in 1957. In global arena, Malaysia is often considered as a 'develop' country. The urban growth is dynamic in accordance with the rapid economic growth and industrialization. The infrastructure has been strained by rapid urban growth and there are high needs of improvement of amenities such as water supply, electricity, transportation, environment and drainage.

The impacts of the growth have put excessive demands on water supply and water resources. Besides economy and industrialization, the number of population also has increase. Malaysia has a few cities with high density of population such as Lembah Klang, Pulau Pinang and Johor Bahru. These cities required more demands on water supply than other cities in Malaysia.

Implementation of Rainwater Harvesting System in Malaysia

Rainwater harvesting system was introduced after the 1998 drought by Ministry of Housing and Local Government (MHLG). The 1999 'Guidelines for Installing a Rainwater Collection and Utilization System' can be seen as the initial phase of the rainwater harvesting policy in Malaysia. The main purpose of these guidelines is to reduce the dependence on treated water and provides a convenient buffer in times of emergency or a shortfall in the water supply. It also proposed the construction of 'mini dams' or rainwater tanks in urban area instead of continuing to build giant dams upstream (Mohd.Shawahid et al., 2007). This guidelines is intended as an 'ideal manual' for reference for those who want to install a rainwater harvesting and utilization system (MHLG, 2008) After five years of this guidelines, namely in 2004, the Ministry of Housing and Local Government has prepared another cabinet paper to the National Water Resources Council to encourage government buildings to install a rainwater collection and utilization system. The Council has later announced that rainwater utilization is to be encouraged, but not mandatory.

Potential for Quality Living

Extreme climate events such as drought and flood happened frequently nowadays because of the global weather change. This event affected the water resources utilization for various purposes. As a result, many countries adopting strategies to conserve the available water resources including promoting the usage of rainwater harvesting system for landscaping and agricultural.

III. LITERATURE REVIEW

Che-Ani, Shaari, et al., 2009 These pollutants are mainly due to septic tank leakage and under-maintained wastewater treatment, mill discharges and industrial effluents. Rainwater as a source of water for potable and non-potable uses has been considered by some. Studies have found that rainwater treatment is required in order to remove heavy metals and pathogenic content in water.

Lee Mokhtar, et al., 2016 Harvesting and storing of rainwater could be implemented as an alternative for water supply. Moreover, initiation of such initiative has been instigated, following the drought between 1997 -1998; Quality of rainwater is influenced by several factors such as the locality and neighbouring activities, collection system and storage material, rainfall time span, and interval of wet and dry.

Kasmin, Bakar, et al., 2016; Moreover, initiation of such initiative has been instigated, following the drought between 1997 -1998. Quality of rainwater is influenced by several factors such as the locality and neighbouring activities, collection system and storage material, rainfall period, and interval of wet and dry. In general, urban areas with more industrial activities will have more suspended debris in the atmosphere which will be carried during rainfall (Man, 2015).



Nichols et al. (1976) Rainwater harvesting system is the collection of rainwater directly from roofs and other built catchments, the collection of sheet runoff from man-made ground or natural surface catchments and rock catchments for domestic, industry, agriculture and environment use The systems can be characterized as small, medium and large scale, usually the size of rainwater harvesting was established on the size of catchment place.

IV. CONCLUSION

1. **Water Conservation:** Harvesting rainwater reduces the demand on traditional water sources like groundwater and municipal water supplies. This helps in conserving these valuable resources, especially in regions facing water scarcity or drought.
2. **Cost Savings:** Implementing rainwater harvesting systems can lead to significant cost savings over time. By using harvested rainwater for non-potable purposes such as irrigation, toilet flushing, and outdoor cleaning, households and businesses can lower their water bills.
3. **Reduced Flooding and Erosion:** Harvesting rainwater helps to control stormwater runoff, reducing the risk of flooding in urban areas. It also helps to prevent soil erosion by capturing rainwater before it flows over the ground and carries away topsoil.
4. **Improved Water Quality:** Rainwater is naturally soft and free from many contaminants found in ground or surface water. Harvested rainwater can be used for various purposes after minimal treatment, contributing to improved water quality and reducing the reliance on chemically treated water.
5. **Self-Sufficiency:** Rainwater harvesting promotes self-sufficiency by providing an alternative water source, particularly in areas where access to clean water is limited or unreliable. This resilience becomes especially important during times of drought or when traditional water sources are contaminated.
6. **Environmental Benefits:** By reducing the demand for water from rivers, lakes, and underground aquifers, rainwater harvesting helps to protect natural ecosystems and wildlife habitats. It also reduces energy consumption associated with pumping and treating water from centralized sources.
7. **Community Engagement:** Rainwater harvesting projects can foster community engagement and cooperation. Community-based initiatives to implement rainwater harvesting systems can promote awareness about water conservation and environmental stewardship, leading to a more sustainable and resilient community.
8. **Adaptation to Climate Change:** With changing precipitation patterns and increasing frequency of droughts and extreme weather events due to climate change, rainwater harvesting provides a decentralized and adaptable solution to water management. It allows communities to capture and store rainwater during wet periods for use during dry spells, helping to mitigate the impacts of climate variability.

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