LAKE RESTORATION FROM RAINWATER HARVESTING AND GREY WATER AT DIGAS VILLAGE

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Abstract : This study has been undertaken to investigate the determinants of lake restoration from rainwater harvesting and grey water.Storm water flooding has caused infrastructure damage and environmental ecosystem damage in terms of erosion, sedimentation, flooding and potential pollution. Storm water can be viewed either as an expensive threat to environmental protection and social wellbeing, or it can be viewed as an opportunity to promote micro-watershed sustainable development through the use of decentralized storm water solutions such as rainwater harvesting (RWH).And Freshwater scarcity is a serious issue that affects at least one-fifth of the world's population and more will be affected due to population growth, mismanagement, increased urbanization and climate change. Innovative concepts and technologies are straight away needed to close the loop for water. Grey water reuse is one of the main alternatives for reducing potable water consumption in households, industries and commercial buildings. This article aims to review some of the principle grey water treatment technologies and their water applications are lake restoration.

Keyword **- Rural Development, Sustainable Development, Grey water Treatment, Rain Water Harvesting.**

I. INTRODUCTION

Civil engineering involves lots of culture, its application of science that has evolved over time to show potential of sustainable social - social cultural development. In this era of growing needs caused by overflowing population on earth has caused many problems to the nature cycle of the environment. One-third of the developing world will face severe water shortages in the twenty-first century even though large amounts of water will continue to annually flood out to sea from water-scarce regions. The problem is that the sporadic, spatial and temporal distribution of precipitation rarely coincides with demand. Whether the demand is for natural processes or human needs, the only way water supply can match demand is through storage. The limited resources which are wasted or not being utilized fully to its potential of regeneration or reclamation has lead scarcity. Assessing the impacts of climate and land cover due to changes on hydrology, it has been shown significant change in land reclamation time and costing & related farming products. Despite India's booming economy, water insecurity and poor water quality remains a major cause of child mortality and morbidity, especially among the poor. India lost more than 600,000 children under 5 in 2010 due to WASH (Water, Sanitation and Hygiene) related diseases like diarrhea and pneumonia. There are four major ways of storing water— in the soil profile, in underground aquifers, in small reservoirs, and in large reservoirs behind large dams. Storage in the soil profile is extremely important for crop production, but it is relatively short-term storage, often only sufficient for a period of days. In this paper, the authors concentrate on the three kinds of technologies that Summary store water for periods of months, in small reservoirs.

II. STUDY AREA PROFILE OF DIGAS VILLAGE LOCALITY

There are 812 households in the village and an average 4 persons live in every family. Most of the people in the village have agriculture as the primary source of income, apart from this they also do work as wage laborers in government schemes or private works.

Figure 1.1 Digas village locality

Table - 1.1 Digas Study Area

Village name	Digas
Taluka name	Kamrej
District name	Surat
Area	230000m2
Pin code	394330
Population {in census 2011}	3560
Tribal population	1846
Language	Gujarati , Hindi, English, Marathi, Telugu,

Table - 1.2 Digas Cast Wise Population

	Total	General	Schedule Caste	Schedule Tribe	Child
Total	3,560	1,574	140	1,846	425
Male	1,807	811	66	930	238
Female	1,753	763	74	916	187

Table - 1.3 Digas Growth of population (percent) 2001-11

	Worker (Among total population)	Main Worker (Among workers)	Marginal Worker (Among workers)	Non Worker (Among total population)
Total	52.2%	50.2%	2%	47.8%
Male	65%	62.8%	2.3%	35%
Female	39%	37.2%	1.8%	61%

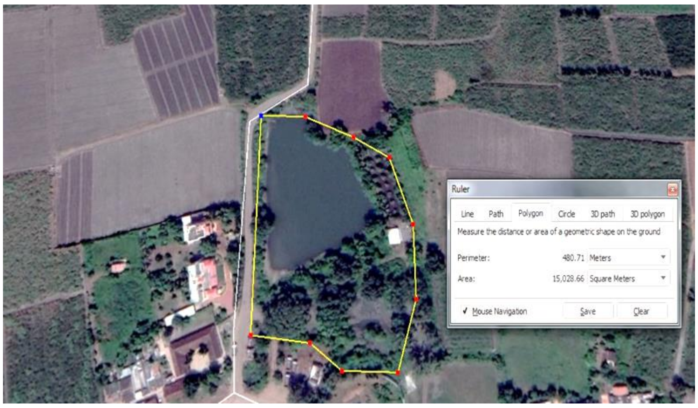
III. PROBLEM STATEMENT

For supply of water one overhead water tank was introduced which is presently in non-working condition to entitle demands of the Digas village locality seen in figure1, Replenishment of ground water is drastically reduced due to paving of open areas. Indiscriminate exploitation of ground water results in lowering of water table rendering many bore-wells dry. To overcome this situation bore wells are drilled to greater depths. This further lowers the water table and in some areas this leads to higher concentration of hazardous chemicals such as fluorides, nitrates and arsenic As per Indian standard of rural water supply its necessary to give 135 liters per person to carry out daily activities which is the unsatisfying need of the Digas dwellers.

IV. PROPOSED DESIGN & DATA ANALYSIS

A lake large enough to accommodate water from the rain water harvesting which is accompanied with grey water system to purify water from the households & to utilize the waste water to put it to use for further storage and supply.

Location: **21°16'08.1"N 73°03'05.6"E**



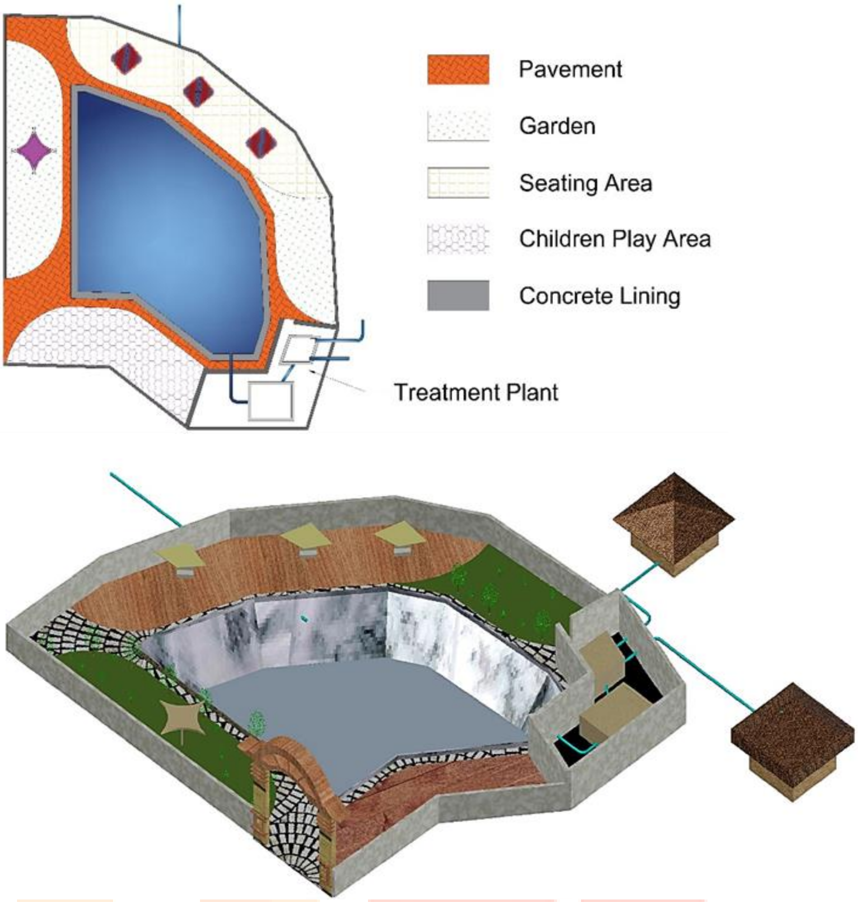


Figure - 1.2 Digas Lake design Plan & 3D View

V. ILLUSTRATION OF DESIGN

Suppose the storage tank has to be designed for 50 m2 roof area in Surat area where average annual rainfall is 1100mm. The runoff coefficient for roof top is 0.85, so for every 1 mm rainfall, the quantity of water which can be harvested is 50 x 0.001 x 0.85 = 0.045 m3 or 45 liters

The monthly consumption of water is 20,000 liters. Table given below illustrates the method of calculation of required storage capacity of the tank.

Table - 1.4 Digas Lake design Plan & 3D View

Month	Monthly rain fall in mm	Rainfall Harvested in liters	Cumulative rain fall harvested	Monthly Demand in liters	Cumulative demand	Difference between (4) &(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
July	98	16660	16660	20000	**20000**	**-3340**
Aug	136	23120	39780	20000	**40000**	**-220**
Sept.	122	20740	60520	20000	**60000**	**520**
Oct.	282	47940	108460	20000	**80000**	**28460**
Nov.	354	60180	168640	20000	**100000**	**68640**
Dec.	141	23970	192610	20000	**120000**	**72610**
Jan.	30	5100	197710	20000	**140000**	**47710**
Feb.	8	1360	199070	20000	**160000**	**39070**
Mar.	5	850	199920	20000	**180000**	**39920**
Apr.	15	2550	202470	20000	**200000**	**2470**
May	38	6460	208930	20000	**220000**	**-11070**
June	61	10370	219300	20000	**240000**	**20700**

From the above table, it can be seen that difference between cumulative rainfall harvested and cumulative demand is maximum in the month of December at 72,610 liters. So the capacity of storage tank should be 72,610 liters, say 73,000 liters.

VI. GRAY WATER TREATMENT SYSTEM

Gray water is water from washing machines, showers, bathtubs, and bathroom sinks. It is wastewater that can contain some soap, salts, hair, suspended solids and bacteria, but that is clean enough to water plants.

Gray water (treated or untreated) is not the same as municipal recycled water, which is highly treated wastewater from a centralized treatment facility. Recycled water can be used for landscape irrigation, toilet and urinal flushing, cooling, and other approved uses.

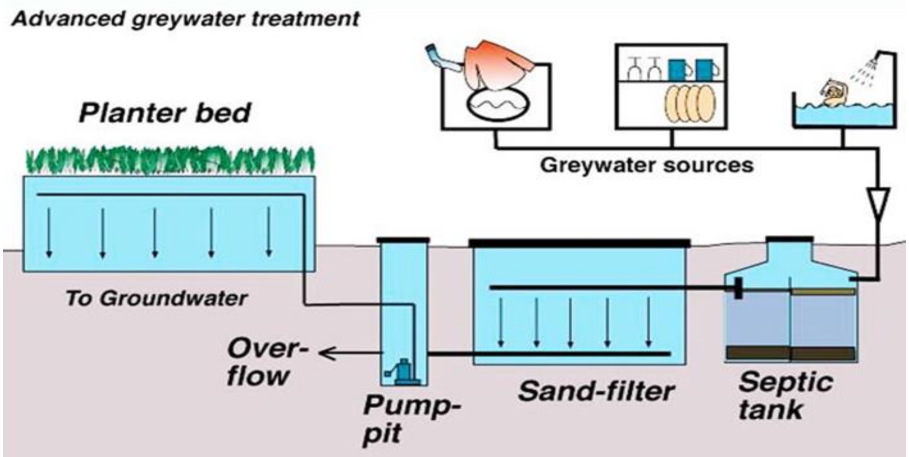


Figure – 1.3 Gray water Treatment system

♦ Parts of Grey Water Treatment

1. Collection point

It is the starting point of the treatment system where water gets collected from the property. It is important that the collection points are properly maintained.

2. Aerobic screening

It is the process of removing insoluble material from the wastewater. The process efficiently reduces the material into almost negligible residue which is discharged into the public sewerage system. Remaining greywater flows to the second stage.

3. Biological treatment plant

In this process, air is flown into the water so that bacteria can consume impurities up to a large extent. To achieve the maximum metabolizing levels, a sustainable concentration of biomass is maintained in the chamber. As a result, almost all of the incoming waste gets cleaned, and the amount of residue is the minimum. Typically, 99.9% of the water can be reused which is a pretty high level of efficiency.

4. Ultrafiltration

Special membranes with microscopic pores prevent bacteria, virus, and particles. It is called ultrafiltration process. Membranes should be cleaned regularly by air scouring so that maximum cleaning is assured.

5. Disinfection using UV method

Ultraviolet lamps are used for additional protection against the pathogen. It acts as an additional barrier.

6. Chlorination

Chlorine is added to the water in reticulation and storage system. It removes impurities by ionizing water molecules.

7. Storage of treated water

Treated clean water is kept in the storage unit so that it can be used in several applications. Toilet flushing, Surface irrigation and public washing machines are a few examples.

8. Filter

• The filter chamber is usually made out of reinforced concrete, filled with sand and gravel to the height of 1.5-2 meters. The water is supplied to the top of the sand-bed and filtered as it flows through the layers of graded sand and gravel. A system of perforated pipes on the bottom drains the chamber (WHO 1996). The filter chamber can be constructed as open tanks (rapid gravity filters) or closed tanks (pressure filters).

This filtering process is determined by two basic physical principles. First, relatively large suspended particles get stuck between the sand grains as they pass the filter medium (mechanical straining). Second, smaller particles adhere to the surface of the sand grains caused by the effect of the van der Waals forces (physical adsorption).

9. Pump

• If all of the plants you wish to irrigate with graywater are below the building's drain lines, then the graywater system and irrigation lines could use gravity to distribute the water. If any of the plants you wish to irrigate with graywater are higher than the surge tank or the building's drain lines you will need a small, inexpensive pump to lift the water to the plants.

Use this formula to estimate the square footage of the landscape to be irrigated:

$$LA = \frac{GW}{ET \times PF \times 0.62}$$

Where:
LA = landscaped area (square feet)
GW = estimated graywater produced
ET = evapotranspiration
PF = plant factor
0.62 = conversion factor

Total Cost of Lake: 63, 50,695 INR

Time required for construction: 1-2 year

V. CONCLUSION

Proposed design proposal of rain water harvesting network with lake will accumulate to storage and reutilize the grey water from the households, contributing to sustainable environment for development in rural water sector of digas locality achieving minimum water supply criteria of 135lpcd as per Indian standard. The lake will also contribute to recreational place for the people.

VI. REFERENCES

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