Neeru a Rainwater Harvesting Project for Rural India

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ABSTRACT

The intent of this paper is to present a project "Neeru", which literally means "Water" in Kannada. The purpose of this paper is to come up with a solution in the form of a project to solve the water problems at Sivaganga farm. If implemented successfully this project could become a prototype for local farmers who could also take up and implement this project in their farm, and can make the case for the creation of a viable economical, social and environmentally sustainable solution for rural development in India.

Introduction

The project titled Neeru is a proposed Rain Harvesting Project for usage of rainwater in poultry and farming in Sivaganga farm, located in Kanakana Halli, Sivagange Road, Solur Hobli Bangalore Rural District. Included in this project is the study of current water requirements and the need for rainwater harvesting to meet water requirements. A prototype project is proposed on a 1.75-acre land area which houses a 1000 sq m area of poultry shed; the roof of the poultry shed is used as a catchment basin for rainwater harvesting.

Site Description

The Farm site is a triangle with an approximate area of 1.75 acre and with one of the sides of the triangle abutting the proposed BMRDA Satellite town ring Road and its two other side abutting adjacent dry farmland. This farm has 3 rectangular poultry sheds with dimension of 33mx6.75m, 50mx6.75m and 70mx6.75m for a total shed area of approximately 1000 sq m. These sheds are located as shown in the figure 1 below; these sheds could raise 9000 chicken birds. In addition, the farm has a workers quarters, 30,000 liter over head tank and its present vegetation includes 300 Arecanut trees, 60 coconut trees, 50 silver oak/teak trees and 5 other trees.

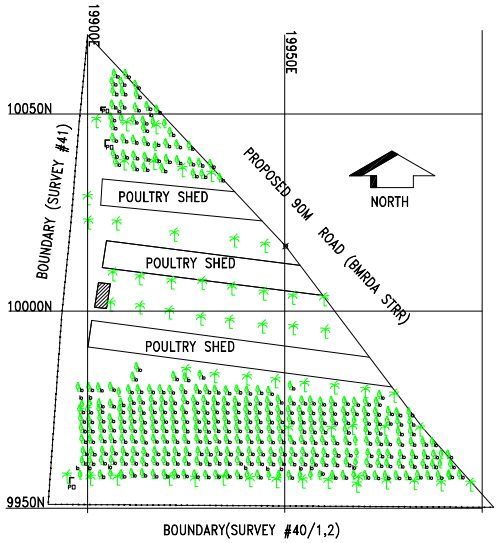


Figure 1: Site location

The current water requirement for the poultry is approximately 3,40,000 liters annually based on 6 liter per bird and five, 7-week batches in a year as shown in chart-1.

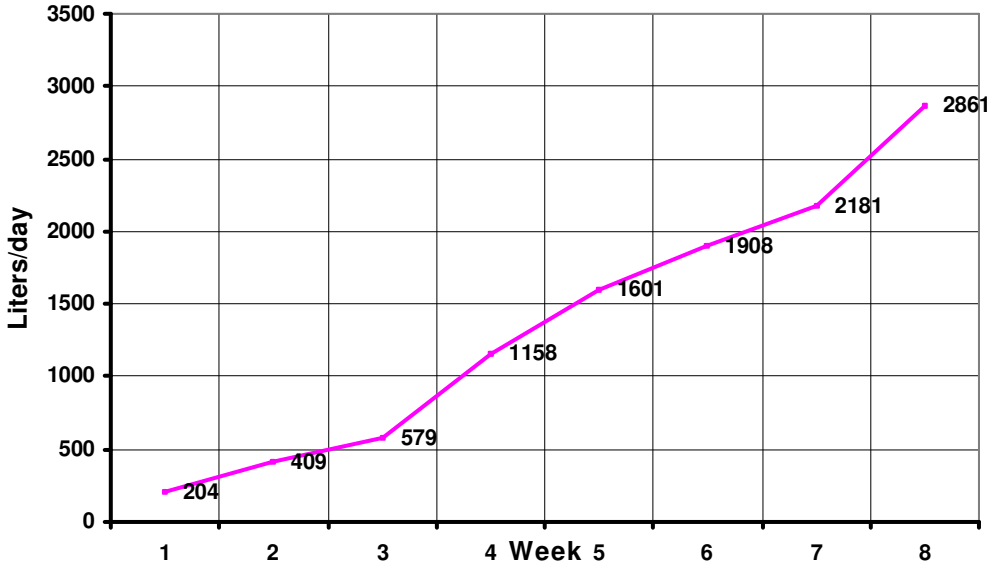


Chart 1: Water Consumption by 9,000 Birds (liters/day)

Water requirement for the vegetation based on principles of horticulture is about 1000 liters per tree per year, taking into account 870 mm of annual rain spread over 60 days in a year. Hence water required, excluding rain would be 3,50,000 liters annually.

Need for Rainwater Harvesting

Currently all water requirements excluding rain is provided by a bore well located 250 meters across the farm, but the new proposed BMRDA's Satellite Town Ring Road (STRR) would obstruct the water pipe line and would prevent water flow into the farm. This will have both economic and social impact on livelihood and will also effect the environment. Hence there is an urgent need to save the vegetation on the farm and to continue poultry farm cultivation. One of the solutions proposed to solve the water problem was to bore a well at the farm but the success rate of such a bore well is very low. This had induced us to look to rains to solve the problem. Hence it has become imperative to go for Rainwater harvesting.

Rain Water Harvesting Strategic (Concepts are taken from Reference 1)

Rainwater Harvesting is essentially collecting rainwater and using it during the dry period. Rain or precipitation falling on land (ground vegetation etc.) is either absorbed into the ground or travels as surface run off to a low lying area. But if precipitation falls on a structure, predominantly it travels as surface run off. Hence the basic strategy for rainwater harvesting for farmland is to not allow any water that falls, to travel out of the farm as runoff. And for the structures on the farmland the strategy is to set up a rainwater harvesting system that comprises of catchments, transportation through pipes/ filtration, and storage in tanks for reuse. Thus three steps for the rainwater harvesting are

1) Collection of rain water
2) Storage of rain water
3) Usage of rain water

Collection of Rainwater: The roof in the structure directly receives the rainfall and is the catchments for the water harvesting system and provides water to the system. Rain falling on the roof travels as run off and the quantity of runoff is the volume of precipitation times the run off coefficient. The mean precipitation data from the past 100 years (refer to appendix Table 1) is used as a basis for rainfall calculation and is depicted in chart-2 and chart-3. Typically 90 % of the rain falling on the structure is harvested. Refer to chart-2 for monthly rainwater collection.

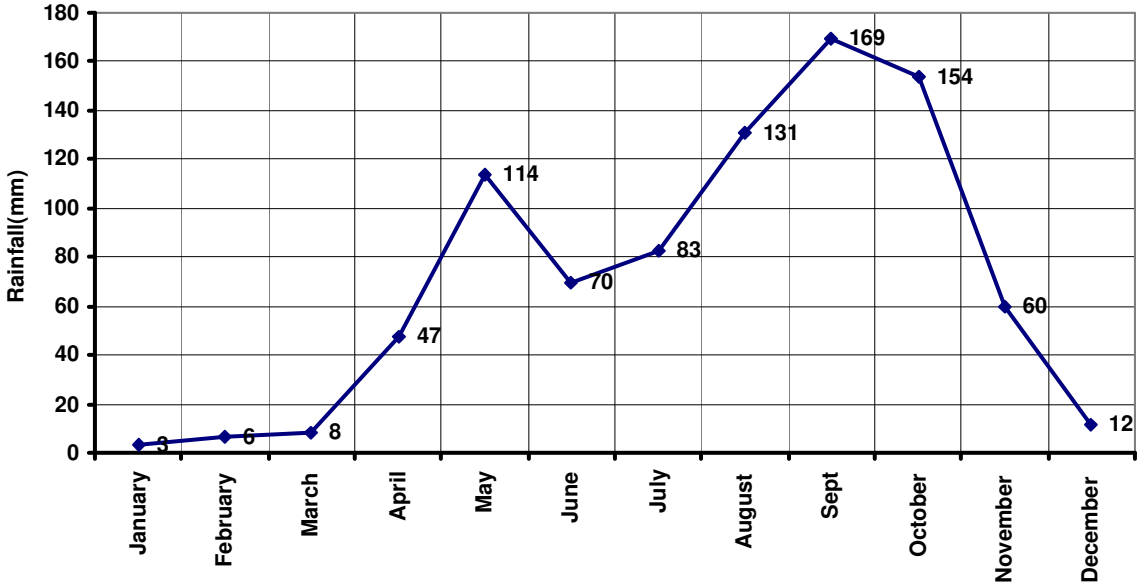


Chart 2: Monthly mean rainfall data

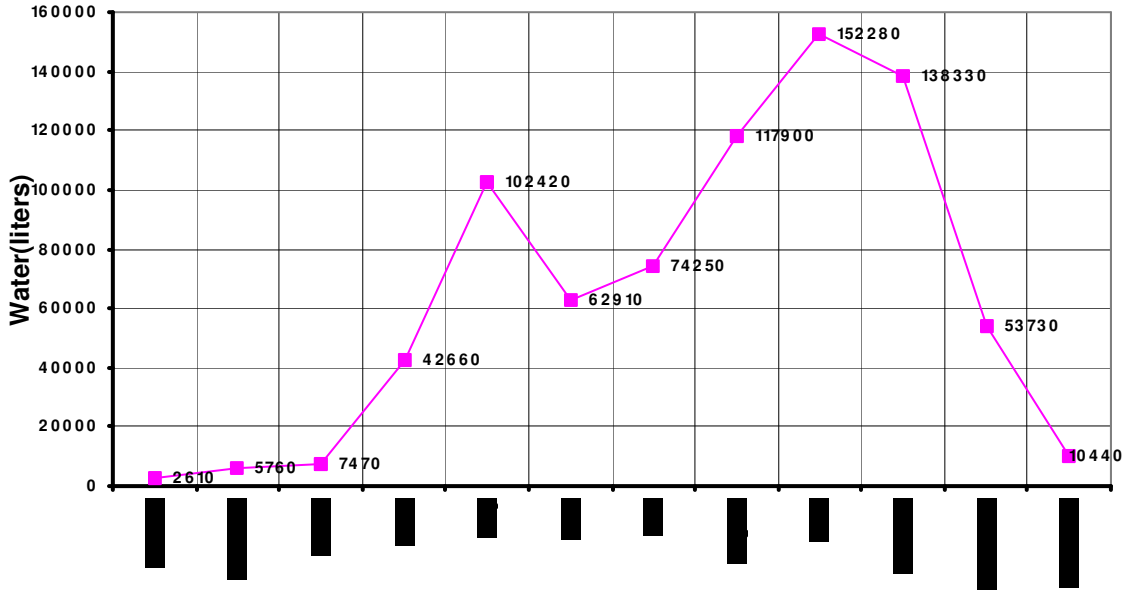


Chart 3: Monthly roof rainfall collection

Based on the rain discharge, roof drains are adequately designed and collector pipes from the roof drain to the storage tank are appropriately designed (Refer to drawings in appendix-2). Also a filter is provided at the final storage deliver to remove all solid wastes in the water.

Storage of Rain Water: Storage is basically a tank to hold collected water and the capacity of storage is based on a monthly maximum collection of 1,10,000 liters. This quantum of water could be used to sustain poultry for 4 months, which would ensure water to poultry in dry spell months. Of course increase in the capacity of the tank would increase water storage but would also increase the cost of the project.

Usage of Rain water: Summary of water collection from roof and water demand requirement of poultry and surplus for vegetation is shown in chart-4; from the chart it can be inferred that in mean rainfall year rainwater harvesting would fulfill water demands on the farm.

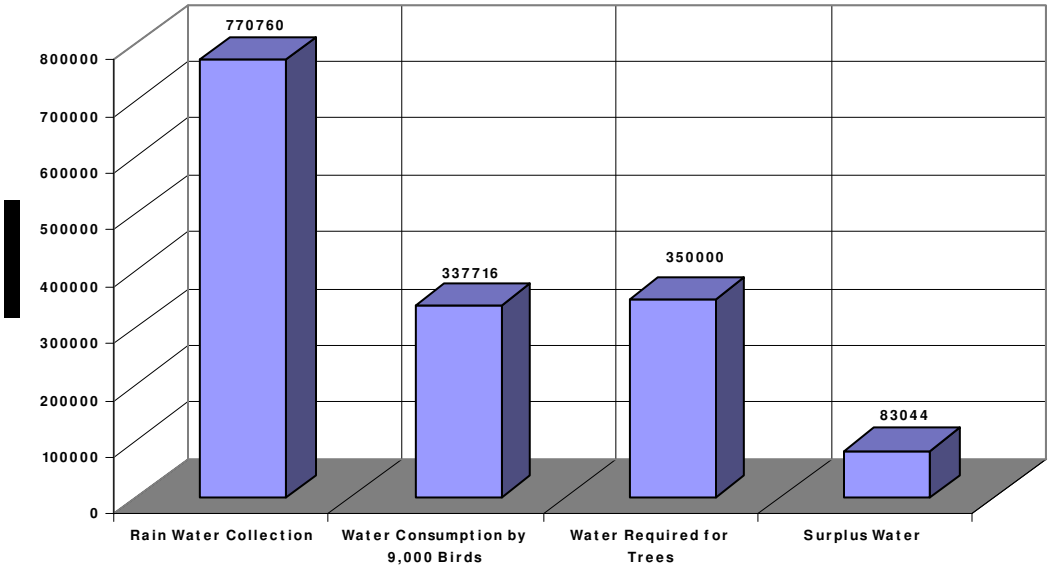


Chart-4 Annual Water Demand/Supply (Roof Catchments Area: 1000 SQM.)

Project Implementation

The project will bring back a way of life that is both respectful of tradition as it is of significance to eco-friendly living in rural India. Hence the design and construction shall be insightful to the local tradition of the place. The architecture will be rural in spirit and will use native materials and construction methods to create buildings that are appropriate to the climate and history of the place, and will be built by resident of the village.

Roofing design and detailing: The roof is a 30-degree gabled roof consisting of regular spaced timber truss with cross purling and battens to support clay-tiled roof. The eve end of the roof has a sheet metal gutter to drain rainwater. Gutters are all slope unidirectional toward one end of the roof. This design is incorporated in all the three sheds and the water is made to drain to one side of the roof (refer to appendix-2 drawing). A coarse mesh is provided at the end of the gutter to prevent the passage of debris. The size of the gutter is according to the flow during of 20mm/hour intensity rain. Gutters are fixed and supported

by steel brackets at regular intervals so that they do not sag or come down when loaded with water.

Piping: Pipes are conduit is basically a drain that conveys rainwater from the roof end to the storage system. These pipes are laid perpendicular to the roof gutter and connect all the ends of the shed. In this way all the rainwater from all the three roofs gets collected at one point and is conveyed to the tank through the filter. The conduit is a 6 inches diameter PVC pipe.

Flush valve and Filter design: The first spell of rain carries a relatively larger amount of pollutants from the air and catchments surface and this first spell of water should be drained out. Providing a flush valve at the end of the conduit before it joins the filter ensures that the runoff from the first spell of rain is drained out and does not enter the filter system. After the first spell of water is drained out, the remaining water is made to pass through the filter, which removes suspended pollutants from collected rainwater. This filter unit here is a 1.5mx1.5mx1.5m chamber having an inlet and an out let. The chamber is filled with 30cmx25mm stone aggregate layer topped by a 30cm sand layer toped by a 10cm charcoal layer and finally a 10cm 10mm stone aggregate layer. The out let from he filter is led to the storage tank.

Storage tank design: The storage tank is a masonry tank with dimension of 7.5x7.5x2 meter above ground located next to the first poultry shed. The dimension of the tank is based on 1,12,500 liter storage and the location is based on the available space. The tank is constructed above ground to facilitate gravity flow of water from the tank to irrigation the vegetation on the farm.

Project costing

As we own the farm the cost of land is not included. The estimate cost analysis for the project is given below:

Construction including Structure and Roofing, Roof Gutter, Piping, Valve, Filter, Storage tank and other miscellaneous tasks is approximately 5 lakhs and equipment to raise 9000 birds at 25 Rs. per bird is 2.25 lakh Rupees.

The operational annual expenses including workers salary for 2 families, utility, and EMI payment at 4% interest is 2 lakhs and monthly income based for a 5 batch per year including sale of manure generated and yield from vegetation sale is 3.5 lakhs. Net profit per year would be 1.5 lakhs.

Conclusions

Lack of water for farming brings with it unemployment in Rural India trigging migration to urban areas has been both an environmental and a social problem in Rural India. Here an attempt is made to solve both these problems by first solving water problem using rainwater harvesting and then using collected water and available land resource to establishing a Poultry Industry that will generate employment in rural India. Hence this project may be a solution to rural unemployment problem and this project with good economic proceeds could be a vision to bring back a way of farmers life that is both respectful of tradition i.e continuing farming and eco-friendly living for our times. It is a vision to think native, to live in harmony with nature, and through the process blend the urban rural divide.

References:

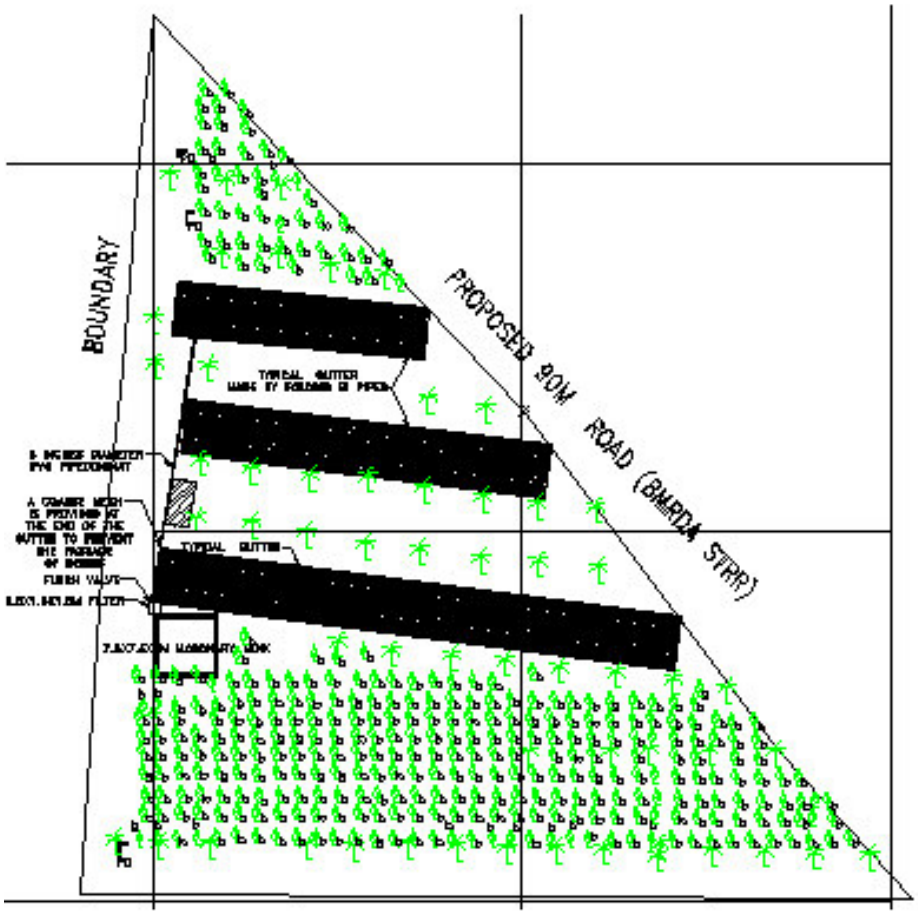
1. www.rainwaterharvesting.org Center for science and environment. New Delhi.
2. Michael R. Lindeburge, Civil Engineering Reference Manual, Professional publication Inc, California. 2003
3. www.caos.iisc.ernet.in Center for atmospheric & Oceanic Science. Indian Institute of Science.

Appendix-1

A Rainfall data for Magadi taluk (1900-2000)

Mean Rainfall (cm)		
Max	**Min**	**Mean**
191.35	**48.59**	**86**
Month	**Mean Rainfall (MM)**	**Mean Rainfall (CM)**
January	**3**	**0.29**
February	**6**	**0.64**
March	**8**	**0.83**
April	**47**	**4.74**
May	**114**	**11.38**
June	**70**	**6.99**
July	**83**	**8.25**
August	**131**	**13.1**
Sept	**169**	**16.92**
October	**154**	**15.37**
November	**60**	**5.97**
December	**12**	**1.16**

Appendix-2 Drawings



1 RAINWATER SYSTEM KEY PLAN