CONSTRUCTION OF RAIN WATER HARVESTING SYSTEM AT SOMAWATHI NIVASA

Project Completion Report

Submitted to

Stichting Waterhelp

February 2009

Lanka Rain Water Harvesting Forum

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PROJECT COMPLETION REPORT

Project name:	**Somawathi Nivasa Rain Water Harvesting System Design**
Duration:	3 **months**
Date of report:	13 February 2009
Reporting period:	**1st October 2008 – 31st December 2008**

Table of Content

Context

The project aims to is to construct 40 m^3 rainwater harvesting tanks at Somawathi Nivasa, at Habaraduwa, Galle, Sri Lanka

Activity planned until and during this period

List of planned activities

1. Site visit and Designing a RWH system .
2. Submission of proposal with Budget
3. Signing of agreement
4. Construction of tank
5. Operation and maintenance training

Results achieved

1. **Site Visit and Designing of RWH system**
   A site visit was made to the Somawathi Nivas in 22/02/2008 to look at the feasibility of implementing a RWH system for the premises. Discussion was had with the Manager of the premises Mr Laki Abeygoonawardena regarding the water problem and need at the site.

2. **Submission of project proposal**
   A project proposal was submitted with budget in June 2008, see attached annex 1. The proposal and budget was revised to increase the capacity of the tank according to the Somawathi Nivas requirement, see attached annex 2 revised budget.

3. **Signing of Agreement**
   Agreement was drafted and finalized and signed on October 2008.

4. **Construction of tank**
   Tank construction commenced in November 2008. At first the pit was dug to the required size, then the masons constructed the under ground tank
   Construction process
   a. Digging of pit – the pit was dug at cylindrical shape with pit 18 ft diameter and 10.5 ft height.
   b. Plastering of tank wall with Ferro cement (Chicken mesh and cement)
   c. Concreting of tank cover: The normal partial under ground tank has a dome shaped cover. However, the management of Somawathi Nivas requested to have a flat cover for esthetic purpose. Therefore, the design of the tank had to be modified. The cover was made with 2 concrete bars running parallel across

the tank mouth. Concrete slabs were placed on top of the bars. (figure 1)

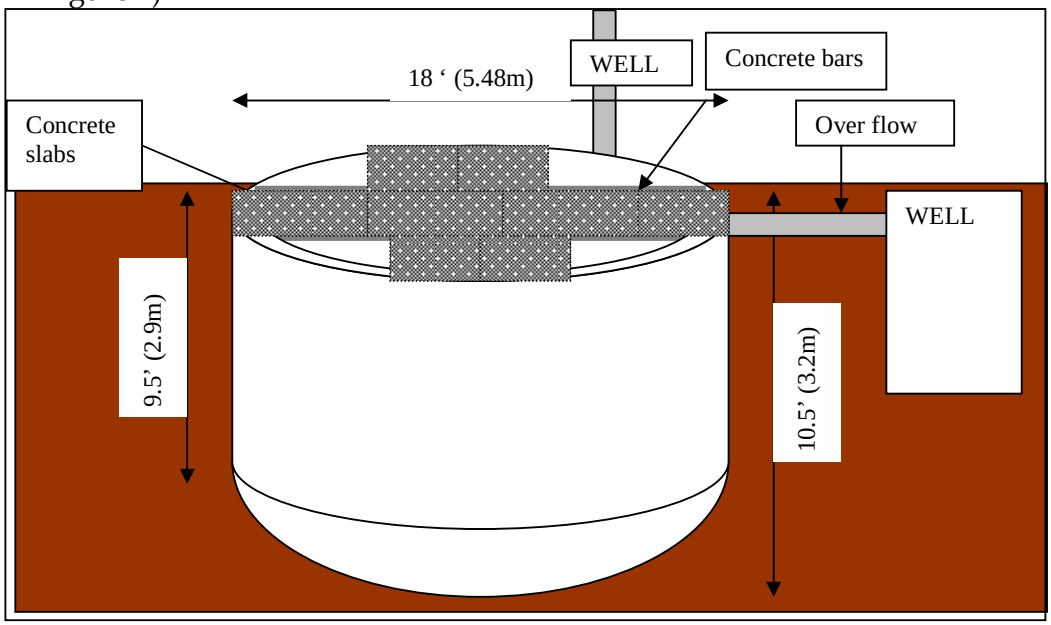
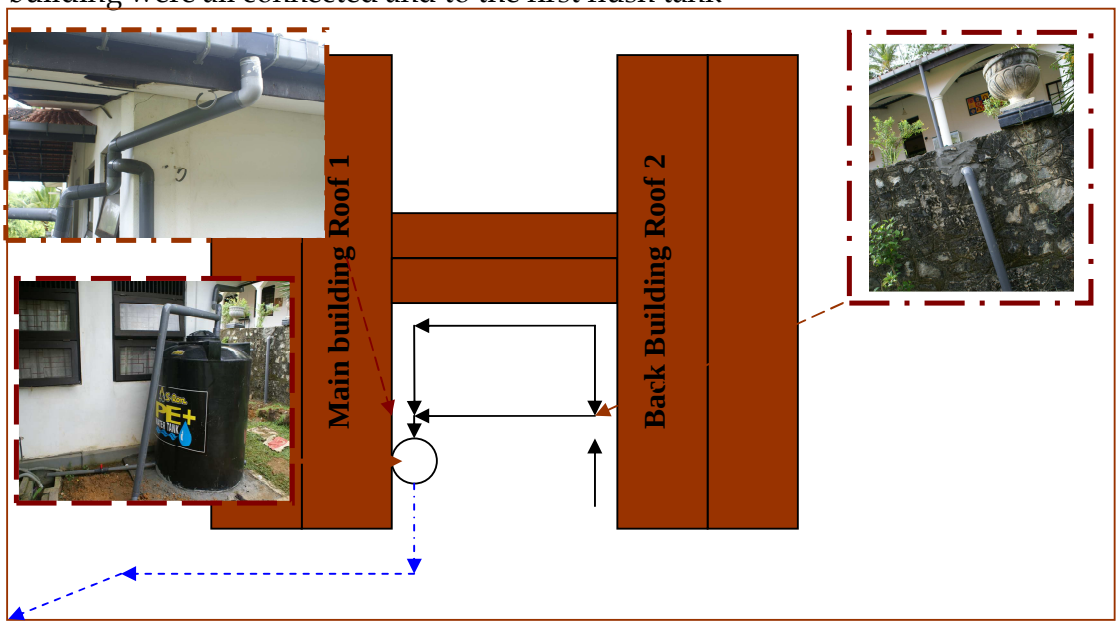


Figure 1: Dimension and design of tank

5. Collection system

The roof of the back building (roof 2) with dining hall as well as the back side of the main building (roof 1) was used as the catchment surface. The gutter from the back building was connected through a PVC down pipe and brought down to the back of the main building and gutters from the back of the main building were all connected and to the first flush tank



All gutters were connected by a down pipe to a 2 m3 first flush tank.

6. First flush

Consists of 2m^3 PE tank to collect the first 2000 liters of roof washing. PVC down pipes connecting all gutters are connected to the first flush tank. The

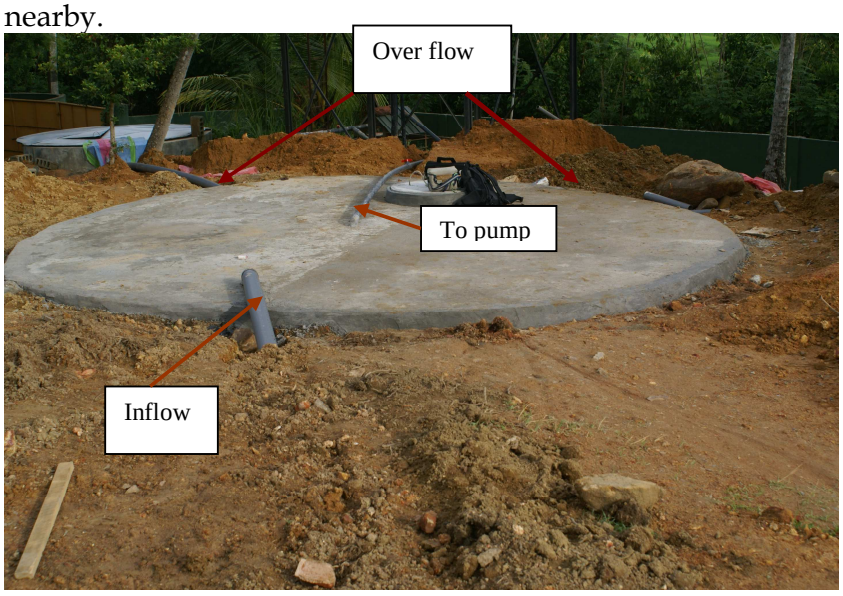
over flow from the first flush tank is connected by PVC pipes layered under ground and connected to the under ground tank

7. Delivery pipes laying

Estimated 50 m of 4″ PVC pipes laid under ground around the main building and across the drive way and connected to the under ground rain water tank

8. Recharging

Two over flow pipes from the rain water tanks is connected to the two wells nearby.



9. Connection to the main water system

A pipe from the rain water tank was connected to the pumping system which pumps water to the overhead tank.

Problems encountered and constraints

- The cost of unskilled labor for digging of pits was under estimated in the budget.
- The design of the tank had to be modified since Somawathi Nivas management wanted a flat roof. Therefore, the cost of the tank increase since concrete with metal bars had to be used instead of ferrocement dome.
- First flush tank designed was initially designed with a floating ball, which was modified by the mason using a bottle. However, later this had to be removed since it was blocking the water flow into the tank.

Activities to be carried out

- Awareness program to children and Operation and maintenance training to staff. This is to be carried out in end of February 2009.

Acknowledgment

Our sincere thanks goes to Mr Laki Abeygoonawardena and his staff at Somawathi Nivas for the corporation and support given to LRWHF in carrying out this task successfully.

Statement of Account

Activity	Estimated Cost (LKR)	Expenditure (LKR)
1. Material and labour cost of 20 m³ Partial under ground tank (see annex1)	177,396.00	273,319.00
2. Fist flush and drainage pipes		
2.1 2m3 liter plastic tank	18,000.00	19,000.00
2.2. 3 1/2" PVC pipe length 2	960.00	4,137.00
2.3. 3 1/2" Y connector	120.00	
2.4. Down pipe clips 12@ 26	312.00	100.00
2.5. 4" pipe length 20 m @ 1760	35,200.00	11,502.00
Sub total	*54,592.00*	
3. Pump and connection to the overhead tank		
3.1 Pump	14,000.00	
3.2. PVC pipes and connections	6,000.00	
Sub total	*20,000.00*	
4. Contingencies and Miscellaneous 5%	*12,599.40*	
5. Co-ordination & Administration 20%	*50,397.60*	50,397.60
Total	**314,985.00**	**358,455.60**

Annex 1 Project proposal

Somawathi Nivasa Rain Water Harvesting System Design

Main Building Roof Area: 1542 m^2
Daily water demand: 14,000 liters
Present Source: 2 wells,
Problem: During the season (3 month of the year) the capacity of the well decrease and there is scarcity of water for the orphanage.
Annual Rain fall in the area: 2400 mm

Proposed Rain water harvesting system:
To use the roof of the main building to collect the rain water to a partial under ground tank located near the well. The over flow from the rain water tank can be directed to the well, to enhance the capacity of the well too. The rain water tank can be connected to the over head tank to be used during dry season and any other time.

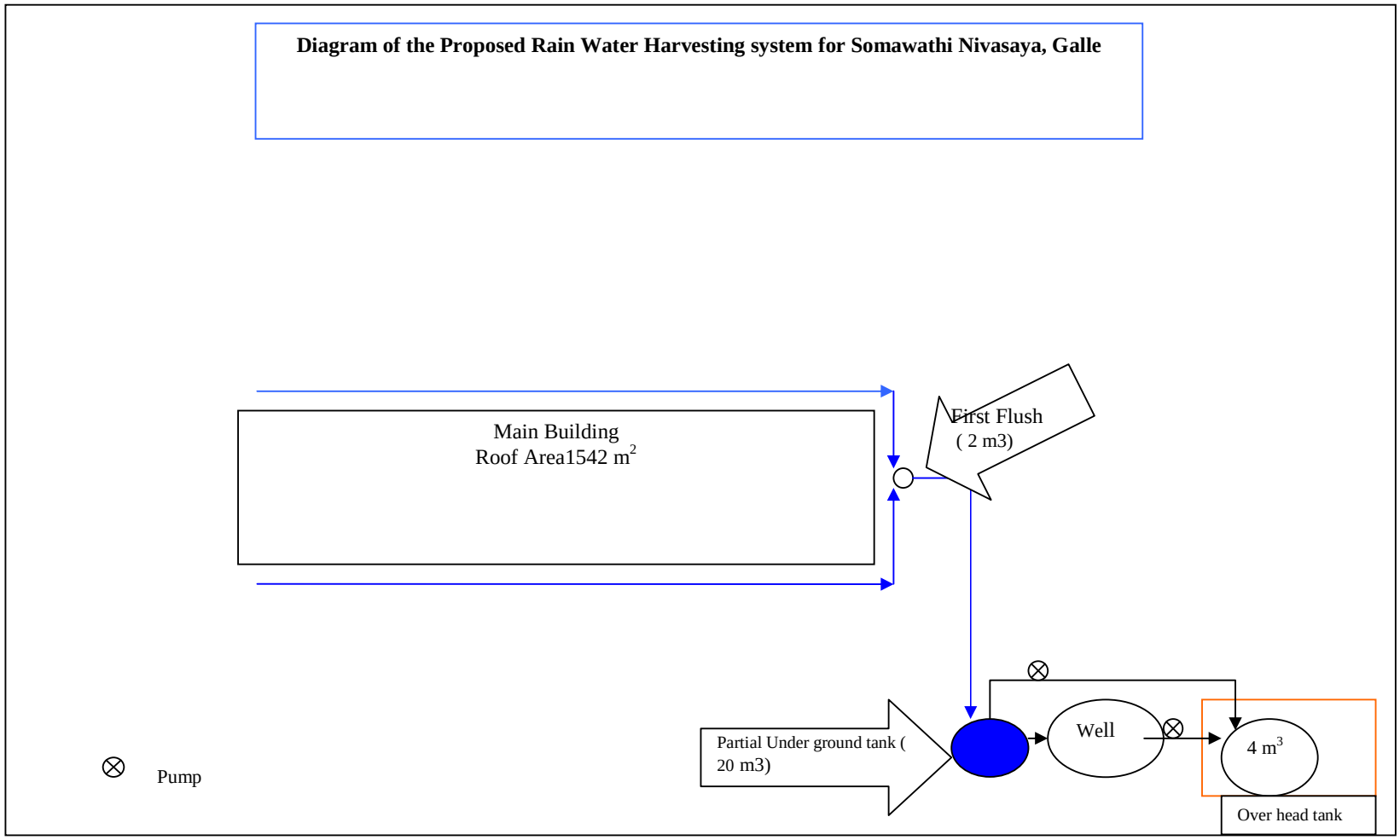
How Rain water is collected
Rain water falling on the roof is collected through the gutters from both side of the roof and brought to one point and collected to a 2,000 liter plastic tank. This will act as the first flush. The first washing from the roof which contains dust and debris will be collected to the first flush tank. Generally it is stated that the first 1-2 mm of rain will wash the roof adequately. Thus for a 1542 m^2 roof the first approximately 2000 liters (1542 m^2 x 1.5 mm = 2.3 m^3). Once this tank is full the clean rain water will then be directed to a partial under ground tank of 20,000 liter (20 m^3) capacity for storage. The overflow from the partial under ground tank will be directed to the well.

Level of Service
Since it is not necessary to meet the total water demand of the orphanage through rain water during the dry season due to availability of well water, 50% of the daily demand (7000 liters) is used to calculate the rain water harvesting system.
Calculations (Annex1) indicate that to obtain 89% satisfactory service level, the capacity of the storage tank has to be 650,000 liters. However, due to availability of space and funds this option is disregarded. Therefore, calculation were done for storage capacity of 24,000 liter (20,000 liter partial under ground tank, 4000 liter existing plastic tank). Although this system will only give 40% satisfaction, by recharging the well with overflow from the tank the well capacity can be enhanced.

Estimated Budget:

Activity	**Cost (LKR)**
1. Material and labour cost of 20 m^3 Partial under ground tank	70,000
2. Fist flush and drainage pipes	25,000
3. Pump and connection to the overhead tank	20,000
4. Contingencies and Miscellaneous 5%	5, 750
5. Co-ordination & Administration 20%	24, 150
Total	**144,900**

Diagram of the Proposed Rain Water Harvesting system for Somawathi Nivasaya, Galle



Annex 1

RAINWATER TANK PERFORMANCE CALCULATOR: RESULTS

Your data

Location	Galle
Roof area	1542 m^2
Nominal demand	7000 litres
Mean daily runoff	8128 litres
Water management strategy	Seasonal

Results

Using the nominal demand and tank size that you specified of 7000 litres per day:

	Your Tank	Comparisons		
Tank Volume (litres)	**24000**	**40600[4]**	**162600[4]**	**650200[4]**
Reliability[1]	27%	40%	66%	85%
Satisfaction[2]	40%	52%	74%	89%
Efficiency[3]	38%	49%	69%	84%

Using a calculated[5] nominal daily demand of 8128 litres per day:

	Your Tank	Comparisons		
Tank Volume (litres)	**24000**	**40600**	**162600**	**650200**
Reliability	23%	36%	59%	76%
Satisfaction	36%	47%	68%	82%
Efficiency	39%	51%	74%	90%

Relative costs:

	Your Tank	Comparisons		
Tank Volume (litres)	**24000**	**40600**	**162600**	**650200**
Relative cost[6]	1.0 X	1.4 X	3.2 X	7.2 X

Notes

1. Reliability is the fraction of days the total demand will be met by the system
2. Satisfaction is the fraction of the total water demand that can be met by the system

3. Efficiency is the fraction of the runoff from the roof captured by the system
4. The comparison tank volumes are based on the average daily roof runoff multiplied by 5 days, 20 days and 80 days respectively
5. The calculated nominal demand is set at the mean daily runoff
6. Compares the typical cost of each comparison tank with that of your tank size

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Mean daily runoff	8128 litres
Water management strategy	Seasonal

Results

Using the nominal demand and tank size that you specified of 7000 litres per day:

	Your Tank	Comparisons		
Tank Volume (litres)	**40000**	**40600[4]**	**162600[4]**	**650200[4]**
Reliability[1]	40%	40%	67%	86%
Satisfaction[2]	51%	51%	74%	89%
Efficiency[3]	48%	48%	70%	84%

Using a calculated[5] nominal daily demand of 8128 litres per day:

	Your Tank	Comparisons		
Tank Volume (litres)	**40000**	**40600**	**162600**	**650200**
Reliability	36%	36%	60%	77%
Satisfaction	46%	46%	68%	82%
Efficiency	50%	51%	75%	90%

Relative costs:

	Your Tank	Comparisons		
Tank Volume (litres)	**40000**	**40600**	**162600**	**650200**
Relative cost[6]	1.0 X	1.0 X	2.3 X	5.3 X

Annex 2 Revised budget

Somawathi Nivasa Rain Water Harvesting System Cost Breakdown
(September 2008)

Activity	Cost (LKR)
1. Material and labour cost of 40 m^3 Partial under ground tank (see annex1)	177,396.00
2. Fist flush and drainage pipes	
2.1 2m3 liter plastic tank	18,000.00
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