RAINWATER HARVESTING AT VIDYA PRABODHINI - COLLEGE

Final Report

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Submitted by

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With

PROVIDENT HOUSING LIMITED

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1.0 Overview

Vidya Prabodhini college is located in Porvorim, Goa and is run by the Prabodhan Education Society. It occupies an area of 3850 sqm on a laterite plateau.

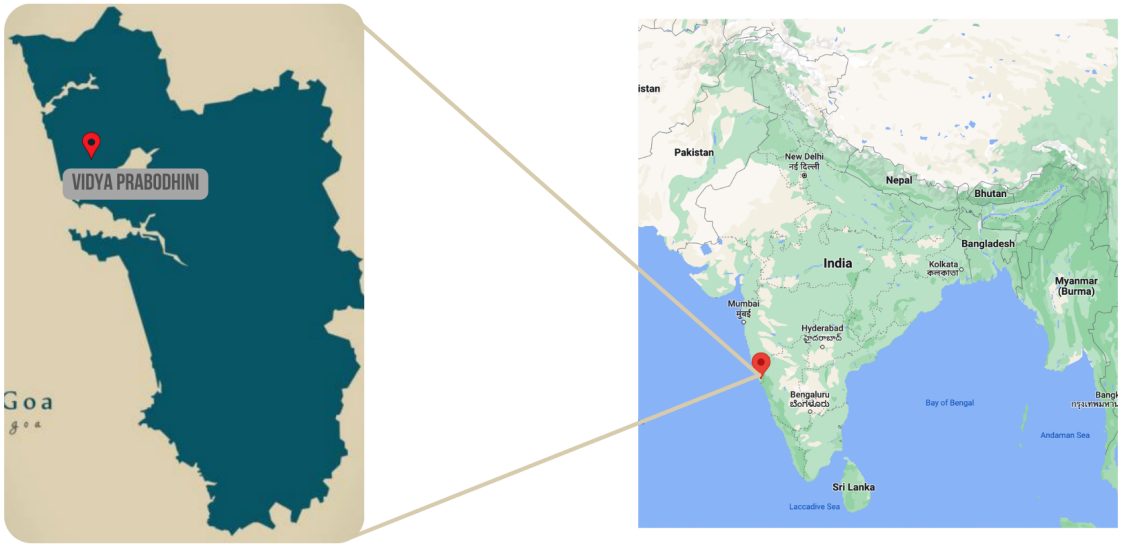

Fig 1: Location of Vidya Prabodhini college

Vidya Prabodhini College of Commerce, Education, Computer & Management

The building has 3 floors with a central quadrangle and classrooms on each floor. Next to the building is a 4000 sqm playground. The building accommodates students from class one to degree college. The total population of the school is 2893 including students and staff.

Fig 2: Front view of the college

2.0 Source of water and its storage (system before intervention)

The main source of water for the college is a borewell located in the playground. The institution also has municipal water supply connections.
Water from the borewell is pumped into a 60,000L sump located at the entrance of the playground. Water from this sump is pumped into the two overhead tanks of 10,000L capacity each. From here, water is then passed through Aquaguard filters for drinking purposes.

Fig 3: Overview and locations of key elements in the collage

Water is used for drinking, handwashing, toilet, washing utensils in the canteen, cleaning and watering plants in the garden/pots. The total water demand per day is calculated to be **60,000 L**.

3.0 Water Management

To make the school more water-sustainable, Biome was approached to design and develop water management strategies that would be beneficial to the college as well as become an element of education for the students. The project was funded by Provident Housing Limited - a subsidiary of Puravankara Limited. The project was taken up in July 2022.

3.1 Rainwater Harvesting

Goa receives about 3000 mm of rain annually. Rainwater harvested from even a part of the roof can be used to serve the college's needs during the monsoon. Using the harvested rainwater can reduce the demand and stress on the groundwater and municipal water. Hence, a roof area of **1221 sqm** was considered for this purpose.

Given the roof area of 1221 sqm, and the 3000 mm annual rainfall of the place, the annual runoff from the area is calculated to be **3207 KL** per year. This will serve the college's water demand for about **55 days** of the year.

3.1.1 Tasks Undertaken

To enable rooftop rainwater harvesting, a new storage sump and a recharge well that can take overflows were considered on the college premises. The design and the flow of water through the system are explained in detail below.

Plumbing: Water from the 1221 sqm rooftop area is directed downwards through a system of downtake pipes. These are fitted with rainy filters (https://www.rainyfilters.com/) that help filter whatever dust is present in the water.

Fig 4: Installation of the plumbing system for rooftop RWH

As a part of this system, first rain separators have also been installed to remove the first few minutes of the rain that might carry more dust/leaves/dirt from the rooftop.

Fig 5: Fist rain separator

Fig 6: Rainy filter

New Rainwater Sump: A new sump of 3KL capacity (6ftx6ftx3ft) serves as a rainwater storage tank before overflowing into the existing sump or the recharge well.

Fig 7: New sump during constriction

Existing Sump: The overflow from the rainwater sump is connected to the existing sump of 60KL capacity.

Recharge well: Water from the rainwater sump overflows into a recharge well. The static volume of this recharge well is 13KL and is 5 feet in diameter and 24 feet deep.

Fig 8: Recharge well ducting construction

Other measures:

Valves have been fitted to control the flow of water between the two sumps and also to the recharge well. The recharge well has also been covered by a grill at the top of the well. Also, a grill has been installed around the recharge well to ensure safety.

Fig 9: Recharge well protected by safety grill

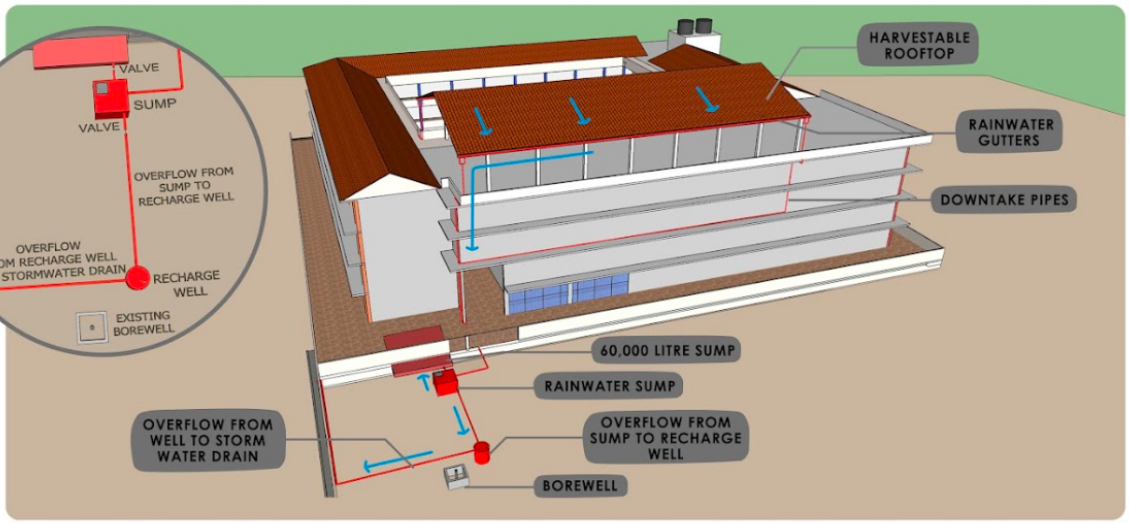

Fig 10: Schematic of the RWH system in the college

3.2 Water demand management

Along with rainwater harvesting, it was also necessary to conserve water and manage its demand. For this, 3LPM spray-type aerators are installed for hand wash taps in the toilets. This helps reduce total water wastage by two-thirds.

Fig 11: Water flow before(left) & after(right) fixing aerators

4.0 Training and awareness program

Once the execution of the project was completed it was necessary to train the staff and students of the college to enable better management of the system in the future.

4.1 Training for the regular maintenance of the system

A training session was organised on regular maintenance of the system where students and staff were made aware of all the elements of the system, their functions and how they could be maintained. A training schedule was conducted for the same to make the process more streamlined.

Fig 12: Training session for students and staff

4.2 Usage and handover of water testing kits

A training session was organised for the staff on the basic water testing methods using kits. For this, testing of the pH, TDS, and bacterial contamination for rainwater was undertaken using hand-held meters and H2S vials.

One pH meter, one TDS meter, calibration solutions for both, and H2S vials were handed over to the institution for regular use.

Fig 13: Water testing kit handed over to the institute

Fig 14: training for the usage of the testing kit

5.0 Installation of the communication board

The necessity of a board as a communication medium to demarcate the essential elements of the system was also felt. This would help people understand at leisure as well as help raise awareness. The board is installed near the recharge well.

Fig 15: Communication board near the recharge well

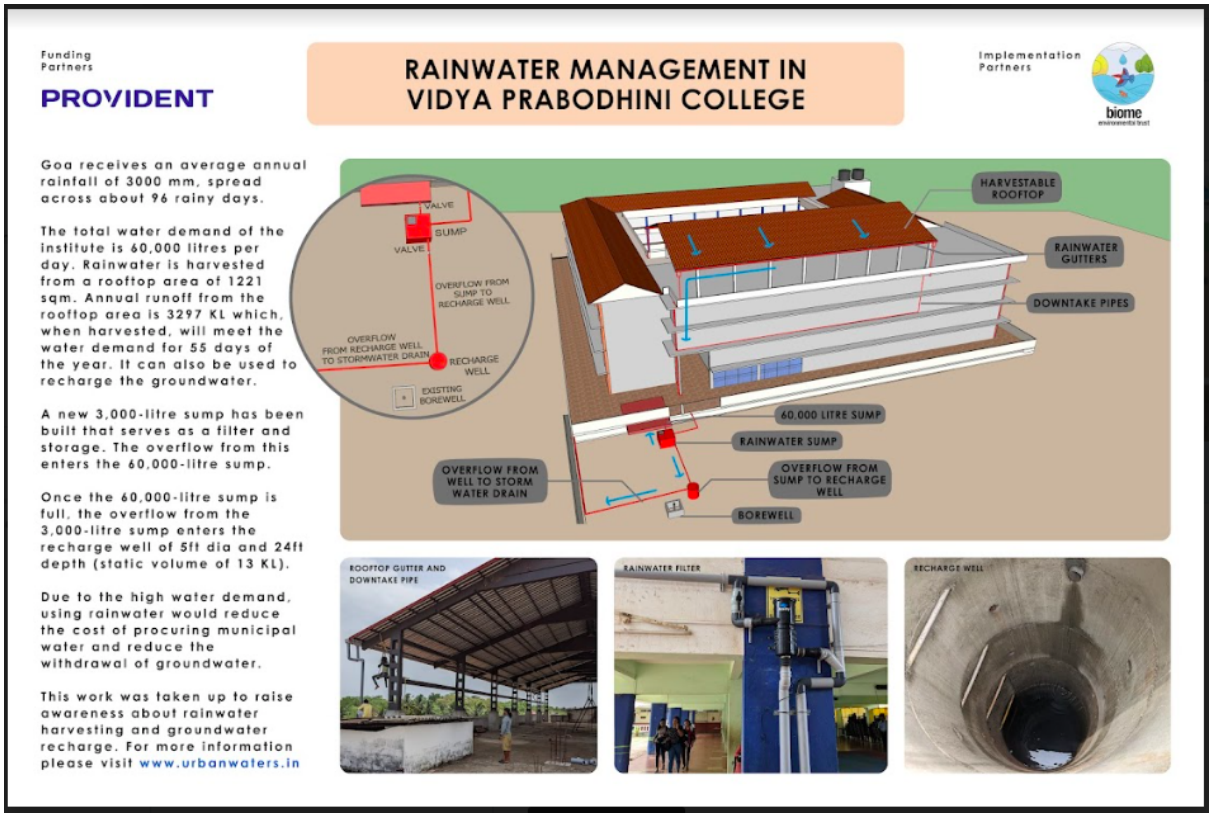

Fig 16: Contents of the communication board

6.0 Water quality report

Water quality testing was carried out by sending water samples from the two sumps and the recharge well to a lab. The consolidated report based on lS 10500'.2012 Drinking water specification is in the table below.

Vidya Prabodhini Water Analysis Report (IS 1 0500'.2012 Drinking water specification)						
Sl No.	**Parameters**	**New Sump Water**	**Old Sump Water**	**Well Water**	**Desirable Limits**	**Permissible Limits**
1	pH value	6.7	7.6	7.5	6.5-8.5	No relaxation
2	Colour, Hazen Unit	3.0			5.0	15
3	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity, NTU	**1.3**	<0.5	<0.5	1.0	5
5	Total Dissolved Solids, mg/L	58.9	272.0	194.0	500	2000
6	Total Hardness as CaCO3, mg/L	27.4	124.0	88.0	200	600
7	Calcium as Ca, mg/L	7.8	19.0	29.0	75	200
8	Magnesium as Mg, mg/L	1.9	18.0	4.0	30	100
9	Alkalinity as CaCO3, mg/L	13.2	90.0	65.0	200	600
10	Chlorides as Cl, mg/L	7.7	12.0	20.0	250	1000
11	Sulphates as SO4, mg/L	4.9	2	8	200	400
12	Boron as B, mg/L	0.07			0.5	2.4
13	Iron as Fe, mg/L	0.12	<0.1	<0.1	1.0	no relaxation
14	Fluorides as F, mg/L	0.1	0.1	0.1	1.0	1.5
15	Sodium as Na, mg/L	0.8			-	-
16	Bicarbonates, mg/L	13.2			-	-
Microbiological Parameters						
17	E.coli, MPN/100ml	Not detected	Absent	Absent	Not detectable	Not detectable
18	Coliforms, MPN/100ml	**12**	**Present**	**Present**	Not detectable	Not detectable

Table 1: Water quality test report

Annexure

The table below provides the distribution of rainfall over the months of the year.

Rainfall Pattern 1981-2010		
Goa		
	Rainfall (mm)	**Number of rainy days**
JAN	1.0	0.1
FEB	0.1	0
MAR	0	0
APR	4.3	0.3
MAY	81	3.8
JUN	892.3	21.2
JUL	907.4	25.6
AUG	596.6	23.1
SEP	260.3	12.8
OCT	145.8	6.5
NOV	26.7	2
DEC	2.5	0.2
Annual	**2918.0**	**95.7**

Table 2: Average Rainfall received in Goa