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Design and Development of Rain Water Harvesting System for AMGOI Campus

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Abstract: *The main aim of this project is to cater the need of water in Ashokrao mane group of institution vathar. This project will not only be helpful to fulfill the need of water, but also to increase the groundwater tank capacity. Keeping in mind the increasing water demands, quality of water supply, variations in water availability, and also advantages and disadvantages of collecting the rainwater, it was planned to design the rainwater harvesting in the college. The main purpose of constructing the rainwater harvesting in this college is to meet the increasing demand of water for utilization in laboratories of Civil Engineering, Mechanical Engineering, Physics, Chemistry, workshop ,canteen usage, and also for water sprinkling system in the premises of the college. The present population of AMGOI College is nearly 2000 members which includes students, teaching and non- teaching.*

Keywords: Catchment , Rainwater harvesting , Roof –Top water , Rainwater .

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I. INTRODUCTION

One of the biggest challenges of the 20th century is to overcome the growing water shortage. Over the years, rising population, growing industrialization and expanding agriculture have pushed up demand for water. So that water conservation has become the need of the day. Rain water harvesting is away to capture the rain water at the time of downpour, store the water above the ground or charge the underground water and use it later. Based on the place the water tanks are classified intotree ways-

1.Underground water tank.
2.Tank resting on ground.
3.Elevated and overhead water tank.

II. DATA COLLECTION

- Population-
  No Of Student =1700 nos.
  No of teaching and non teaching staff =200nos.

Total person =Apro. 2000 nos.

- Total water required for one person in college =45 lpcd (IS 1172-1993).

- Catchment Area-
  Total Area = 5048.76sq.M
  Open Space Area (Duct) = 928.35 Sq.M
  Total Catchment Area =5048.76-928.35 =4120.41 Sq.M

- **Rainfall Data** –

Average Rainfall Data = 778.56mm (Kolhapur)
Source –Irrigation department kolhapur
Volume of water received(m^3)=area of catchment x amount of rainfall
= 4120.41X 0.778
= 3205.67 m^3 / year

Measurement Sheet

SR NO	Particular	NO	Length (m)	Width (m)	Height (m)	Quantity (m^3)
1	**Earth work in Excavation** **i)upto 1.5(soft murum) ii)1.5 to 2.67(hard murum)**	1 1	5.46 5.46	4.68 4.86	1.5 1.17 **TOTAL**	39.80 31.05 **70.85**
2	**Cement Concrete In foundation (1:1.5:3)**	1	5.46	4.86	0.15	**3.98**
3	**RCC Work (M20)** **I) RCC Wall** a) Long wall b) Short wall	 2 2	 5.46 4.5	 0.18 0.18	 2.20 2.20	 4.324 3.564
	II)RCC Bottom Slab	1	5.46	4.86	0.3	7.96
	III) RCC Top Slab	1	5.46	4.86	0.17	4.51
	Deduction **a) Manhole** **BDeduct Manhole**		$\frac{\pi}{4}X0.25^2$	-	0.17	0.03 0.3
					TOTAL	**20.02**
4	**12mm plastering inside with 1:2 cement mortar** **i.long wall** **ii.short wall**	2 2	5.0 4.5	- -	2.2 2.2	22 19.8
					TOTAL (RS)	**41.8**

Abstract Sheet

SR.No	Particular	Quantity	Rate	Cost
1	**Earth work in Excavation** **i)upto 1.5(soft murum)** **ii)1.5 to 2.67(hard murum)**	255.89 39.8 31.05	 145 177	 5,771 5,495.85
2	**Cement Concrete** **In foundation** **(1:1.5:3)**	3.98	5895	23,462.1
3	**RCC Work (M20)**	20.02	7610	1,52,352.2
4	**12mm plastering inside with 1:4cement mortar (water proofing)** **i.long wall** **ii.short wall**	41.8	74/-per cum	3093.2
			TOTAL	1,90,174.25/-

We constuct two underground tank So Final cost of tanks are
=1,90,174.25+1,90,174.25
=3,80,348.5/-

III. DESIGN OF UNDERGROUND WATER TANK ON SAP2000

Procedure-

- Start model with template
- Define material property
- Define shell section
- Modify grid system
- Draw top slab
- Draw wall panels
- Define load cases
- Define and assign joint pattern

- Assign soil and water pressure on wall panels
- Assign load on top and bottom
- Assign spring support
- Define load combination
- Run analysis
- View analysis result

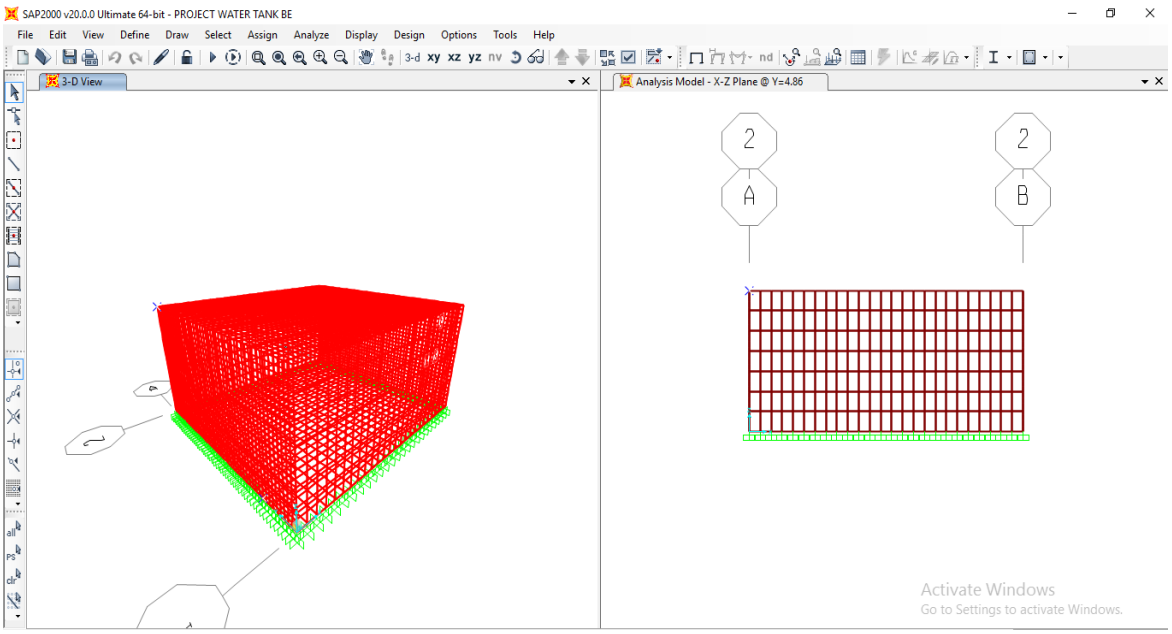

Fig.design of underground water tank on SAP2000

IV. DESIGN OF RECHARGING PIT -

FOR CATCHMENT : (Calculations are for 1 storm, considering intensity of storm as 2cm/hr)

Collected data –

1. Catchment area

1. Rooftop area =4120.41m2

Assume,

2. Average rainfall intensity =1.01cm per 2 hr.

3. Runoff coefficient,

For roof top area = 0.95

4. Storm duration = 2 hr.

Now, by using rational formula,

For roof top area,

Q = C.I.A /3.6

= 0.95 × 10 × 4120.41× 10-6 /3.6

= 0.01087 m3/sec

Total runoff = 0.01087m3/sec

Now,

Total runoff volume = peak runoff rate × storm duration

=0.01087×2×3600

= 78.264m3

= 78264 lit

For this volume of water, recharge pit of dimensions 5 m × 5.25 m ×1.5 m can be constructed, at the open place available beside college.

The recharge pit should be filled with the metal, to recharge silt free water. Hence the materials to be filled in the pit are 60 mm metal, 40 mm metal, 20 mm metal, fine sand. The material should be filled depth wise in the pit. The coarser material to be filled at the bottom and finest on the top. The uppermost fine sand layer can be separated from the 20 mm metal layer by using non corrosive wire mesh. It will help for the yearly maintenance.

Depth of material for recharge pit-

material to be filled	% depth of material	depth (in m)
60 mm Aggregate	30 %	0.45
40 mm Aggregate	30 %	0.45
20 mm Aggregate	25%	0.30
Fine sand	25 %	0.30

V. ESTIMATION AND COSTING OF RECHARGE PITS-

Measurement Sheet

SR NO	Particular	NO	Length (m)	Width (m)	Height (m)	Quantity (m^3)
1	**Earth work in Excavation(m)**	1	5	5.25	1.5	39.375
					TOTAL	**39.375**

Abstract Sheet

Item No	Item	Quantity (Cu.M)	Rate	Total Cost
1	Excavation	39.375	145 per cum	5709.375
2	Labour Charges	Lump sum	1000/-Per day	2000
3	Materials (60,40,20mm metal)	11.812 11.812 7.875 7.875	1575 per cum 809.22 per cum 809.22 per cum 809.22 per cum	40907.62
			TOTAL	48616.99/-

We construct two recharging pit So Final cost of pits are-
=48616.99+48616.99**=97233.99/-**

VI. RESULTS AND DISCUSSIONS

1 Approximate expenditure for underground storage tank(1&2 each) (5 m x 4.5m x 2.2m) is Rs. **=3,80,348.5/-**

2. For Catchment 1

For recharge, size of recharge pit (1&2 each) is taken as(5 m x 5.25m x 1.5m) is

Rs. ==48616.99+48616.99**=97233.99/-**

3. Total annual runoff from catchment area considered (1 & 2): **3205.67 m^3 / year**

5. Total recharge through pits: 78264 lit

Filter material for filling the recharge pit is decided as 60 mm metal (30% depth), 40 mm metal (30% depth), 20 mm metal (20% depth), Fine sand (20% depth) .

VII. CONCLUSION

It is concluded that RCC tank which is to be constructed should be an underground one, so that upper surface of the tank can be utilized economically for any land purpose of any such small structure.

Hence it was finally concluded that implementation of **Rainwater Harvesting Project** to the campus of AMGOI campus will be the best approach to fight with present scenario of water scarcity in all aspects, whether it is from financial point of view or from optimum utilization of land surface. Therefore, water is highly a precious natural resource which is always in high demand in the campus of N.I.T. Rourkela and thus**, Rainwater Harvesting At Amgoi** campus is highly recommended.

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