

A RAIN WATER HARVESTING SYSTEM FOR MAI MISHAM SCHOOL, ETHIOPIA



Background: Ethiopia is a landlocked country located in the Horn of Africa. With a population of about 83 million people, spanning 472,000 square miles. It is bordered by Sudan and South Sudan in the west, Somalia and Djibouti in the east, Eritrea in the north and Kenya in the south. The red dot shows the approximate location of the project site, Mai Misham, which is SE of the town of Adowa, within the State of Tigray.

Project Site: This proposal targets the development and installation of a rain water harvesting/catchment system to benefit school children of the Mai Misham Elementary School in the medium term until more sustainable source(s) could be developed that would also benefit the community in the long run.

Most of the residents of the area live in highly scattered farmhouses and depend on farming, domesticated animals, and very limited local businesses. The 400 school children and staff, as well as approximately 4600 others in the vicinity, must secure their water from intermittent – and increasingly depleted – sources two or more miles distant. Rainfall in the area is estimated between 400 mm to 800 mm (15.7 inches to 31.5 inches).

Local Support: Dr. Peter Van Arsdale and others (notably Tsegaye Hailu and Letay Gebre-Egziabher) have visited and worked at the project site on several occasions, dating from 1994. The terrain is rugged, the people eager to help themselves. Sandstone outcroppings are sandwiched between overlying volcanic and underlying metamorphic rocks. As one resident said, “We have plenty of rocks, not water!” The nearest commercial town, Edaga Arbi, sits at an elevation of about 6500 feet, three miles to the south. During the visit of the Denver volunteers in June 2010, the community constructed a library building with funds from former students of the school as well as an access road that was, unfortunately, washed away during the first rainfall while we were there. The Denver volunteers funded the construction of shelves, tables and chairs and shipped about 500 children’s books from Denver.

TECHNICAL CONSIDERATIONS

Rainwater-Harvesting Volume

Rain would be harvested as runoff from the roofs of the Mai Misham classroom building and from the new library. Traditionally, it rains for three to four months annually (between June and September). Rainfall varies from 400 mm to 800 mm. The roofs are made of corrugated and galvanized iron sheets. The material does not corrode easily, has a long life, and requires minimum maintenance.

In the calculations below we have assumed an average rainfall of 600 mm or 23.6 inches. (Figures are rounded to the nearest 10th)

Runoff volume = annual rainfall (inches) x area of roof surface (ft²) x 0.623 gallons/in. rainfall

The factor 0.623 is the amount of water that can be collected (in gallons) from 1 inch of rain in a square foot area

Area of classroom building roof* = 35m x 3m x 2 sides = 210 m² or 2,260 ft²

Area of library roof = 15m x 3m x 2 sides = 90 m² or 970 ft²

Total Catchment Area = 300 m² or 3,229 ft²

Assuming an average rainfall of 23.6 inches (600 mm) during three-to-four month “wet season”,

Volume to be harvested = 23.6 inches x 3,228 ft² x 0.623 gallons = 47,460 gallons

Assuming an efficiency of 85%, the effective volume = 47460 X 0.85 = 40,340 gallons per year or

= 152,700 liters per year

*All dimensions shown in this proposal are estimates only and would need field verification.

The Conveyance System

Conveyance will consist of properly-sized and constructed gutters and down spouts leading to the storage tank. To simplify the design and minimize the cost of the system, one storage tank, located between the classroom building and the library may be constructed. However, this is open for REST’s experts to decide. The ground elevation provides sufficient choices for the location of the tank or tanks, if more than one tank seems to be a better alternative.

The conveyance system would include a mechanism by which first wash from the roofs, which contains bird droppings, dust leaves and other detritus, may be discharged before reaching the storage tank.

The Storage System

The aim is to build sufficient storage to supply the school population with water during the school year, which is assumed to be about 9 months. The total water demand assuming 2 liters/person/day comes to:

Total Volume = 400 students and staff X 2 liters/person/day x 5 days/week X 4 weeks/month X 9 months =
144,000 liters or 144 cu. meters

We also anticipate that this storage tank would serve the community in the future when sustainable source(s) of water are found in the area. Sustainable sources may include ground water pumped from wells along the valley of Mai Ira or on top of the Beleho/Mai Misham Ridge or surface water piped by gravity flow from Mai Sessela Reservoir or other reservoir that may be built in the upper reaches of Mai Ira or any combination of these.

We are confident that REST, being very familiar with the challenges of the rural setting, would counsel us of the options that are available and more appropriate, both from the practical as well as the cost perspectives.

**MAIMISHAM SCHOOL PROJECT:
STORAGE TANK DIMENSIONS**

		cu m	gallons	cu ft
Total volume required		144	38040	5086
Two tanks:	Volume per tank	72	19020	2543
Three tanks:	Volume per tank	48	12680	1695

R		R ²		H	
m	ft	m	ft	m	ft
1.75	5.7	3.1	32.9	7.5	24.6
1.25	4.1	1.6	16.8	9.8	32.1

Two Tank Configuration

R=1.75m
D=3.5m
H=7.5m

OR

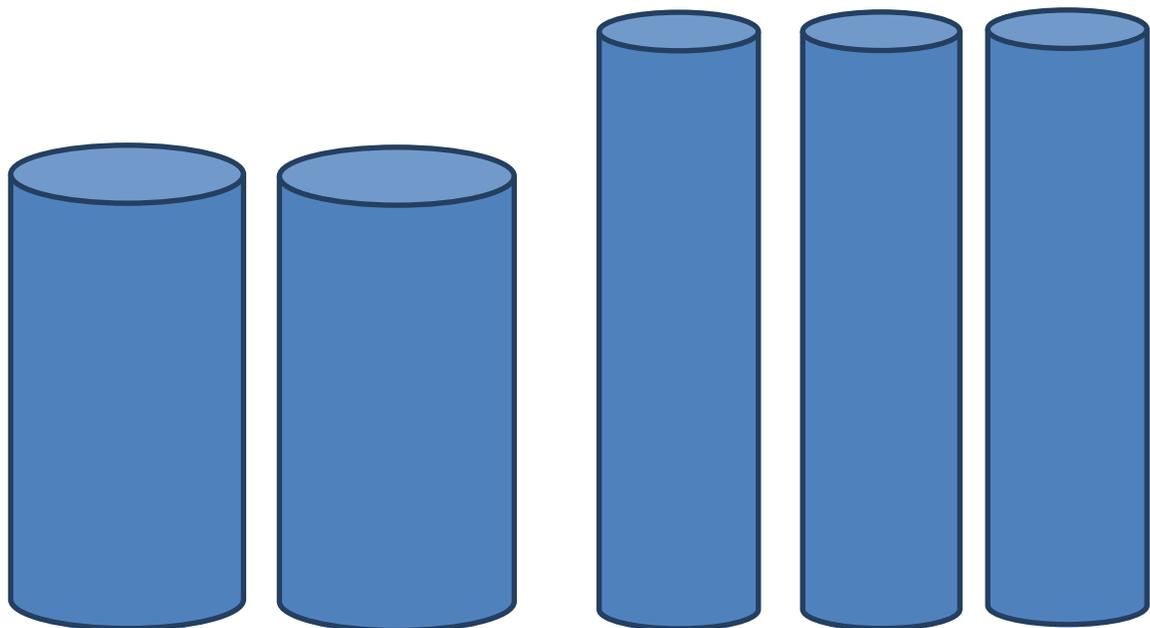
R=6ft
D=12ft
H=25ft

Three Tank Configuration

R=1.25m
D=2.5m
H=9.8m

OR

R=4.1ft
D=8.2ft
H=32.1ft



UNITS		
1 meter	3.28	feet
1 cu. m	264.17	gallons
1 cu ft	7.48	gallons
1 gallon	3.78	liters