Challenges for Implementation of Rain Water Harvesting Project in Arsenic affected areas of Bangladesh

Presented

by

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Background

- Crisis in supply of safe drinking water due to increasing trend of arsenic contamination in the underground water.
- Challenges in replacing handpump, tubewells.
- RWHS,an alternative water supply option --> since 1997 in Bangladesh.
- Advantage: Free from arsenic contamination.
- The physical, chemical and bacteriological characteristics --> suitable and acceptable.

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- Disadvantage: High initial investment cost.
- Technical and Social evaluation --> analysis of design considerations, field observation, case studies , interviewing users and caretakers -->Charghat and Bagha Upazilas of Rajshahi district.

Objectives of the Study

- To assess of the technical requirements and feasibility--> evaluation of cost-effectiveness of tanks of various sizes --> socio-economic condition of the people.
- To assess the socio-economic aspects.
- To evaluate Users' Acceptability.
- To evaluate Cost and affordability.
- To monitor and document water quality, water security, general system management.

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- To monitor Long term sustainability.
- To evaluate the social impacts.
- To document good experience and learning from the study -->disseminate among the sector agencies, community people.

Study Area

- The study area-->arsenic affected villages at Bagha and Charghat Upazilas in Rajshahi district in the western part of the country.
- The average annual rainfall around 1400 mm.The highest rainfall around 3000 mm, occurs in the month of July.
- Total 3,290 families-->13 villages namely Miapur, Anupampur, Arazi Sadipur, Chandpur, Talbaria, Kaluhati, Batikamari, Fakirpara, Jotnasti, Kishorpur-Beelpara, Monigram, Habashpur and Bajubagha.

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- The average family size: 4.31 to 5.2.
- Main occupation: Agriculture (61.29%).Business (14.51%), Day laborers (15.14%), Service holder (4.71%), other occupation (4.53%) .
- No strong educational background.
- Most of the villagers live below poverty line.

Example: In Kaluhati village among 776 people 458 (59.2%) were living always in financial deficit.

Methodology of the Evaluation Study

- Technical evaluation of the RWHS--> analysis of design considerations, field observation, case studies, interviewing people.
- Interview-->140 families (caretakers)--> evaluating the cost and affordability and maintenance of RWHS--> base line studies.
- The study population :11 to 60 year age groups.
- Randomly selected water samples--> laboratory testing--> stored rainwater quality.

Data Collection and Analysis

Rainwater Storage Reservoir

•Storage=Actual supply of fresh water-water demand.

Supply:

Average catchment area for RWH=20m^2 (approximately)

Run-off coefficient = 0.8 (assuming for ideal CI roof catchment)

Average yearly rainfall = 1400 mm

Average yearly water supply from rainfall = 20 m^2 *0.8*1.4 m =22.4 m^3

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Demand:

Consumption per capita per day, C = 7.5 liters

Number of people per household, n = 6

Monthly water demand = 7.5*6*30 = 1350 liters

= 1.35 m^3

Yearly demand = 1.35* 12 =16.2 m^3

Storage volume required for a nuclear family

= 22.4-16.2=6.2 m^3

•Water demand 7.5 L/ person/ day --> drinking and cooking purposes.

Rainwater Storage Reservoir

- Total 268 RWHS-->capacities -->300 liters, 500 litters, 1.0 m^3, 2.0 m^3, 2.5 m^3, 3.2m^3 -->materials -->CC ring, brick, Ferro-cement, plastic tank, Earthen Motka etc.
- Tank type--> FC tiles tank, FC Jar, RCC ring, Brick tank, Chari tank,Earthen motka, plastic tank.
- Brick tank, capacity 2500 liter, cost 5000 Tk--> use in large number (Fig.1)--> reasonable cost, durability, better performance.

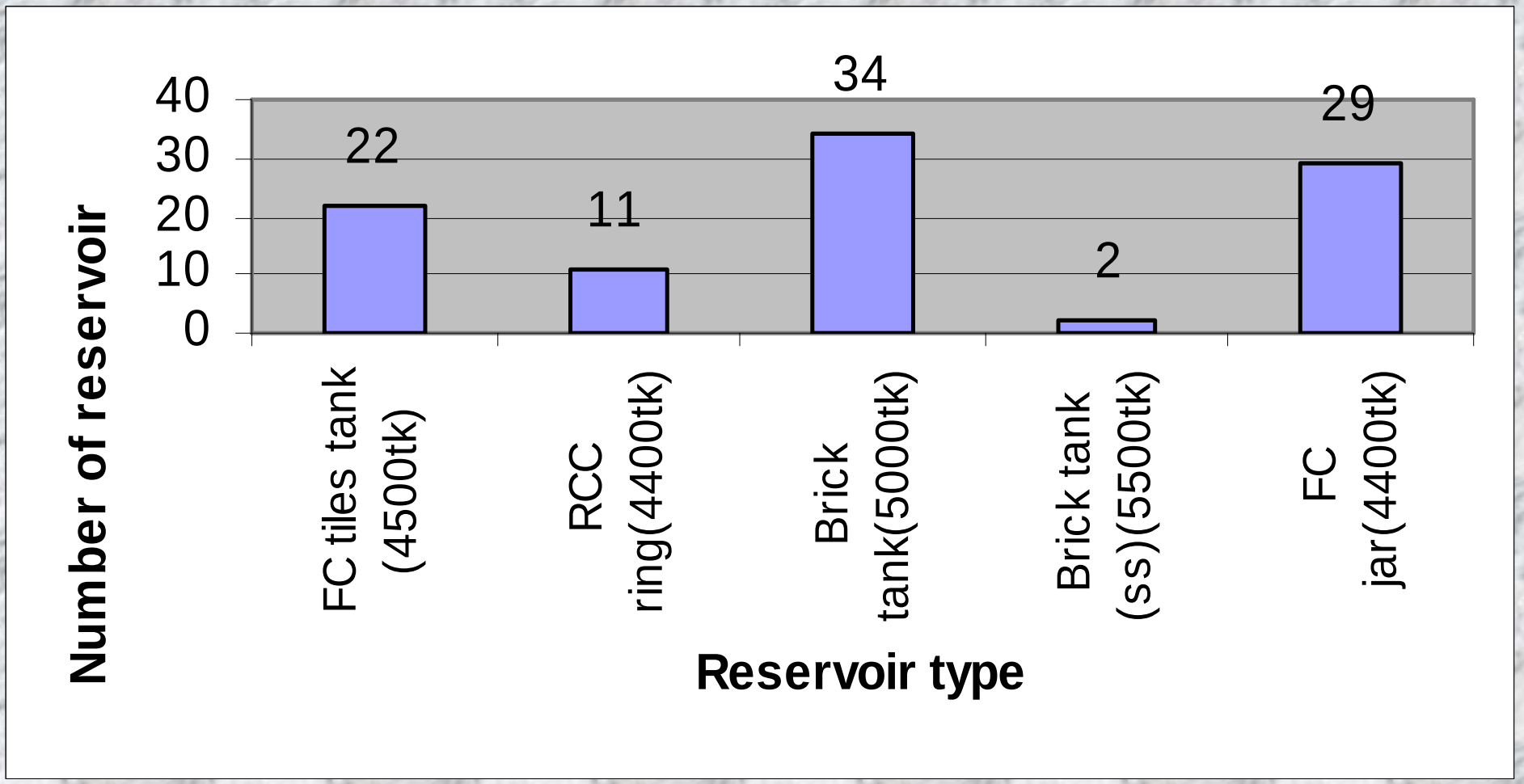

Figure 1: Number and types of reservoir of capacity 2500 liter and catchment area 90-100 sft.

•.FC jar, RCC ring, brick tanks of 1000 liter--> used at less frequency (Fig. 2).

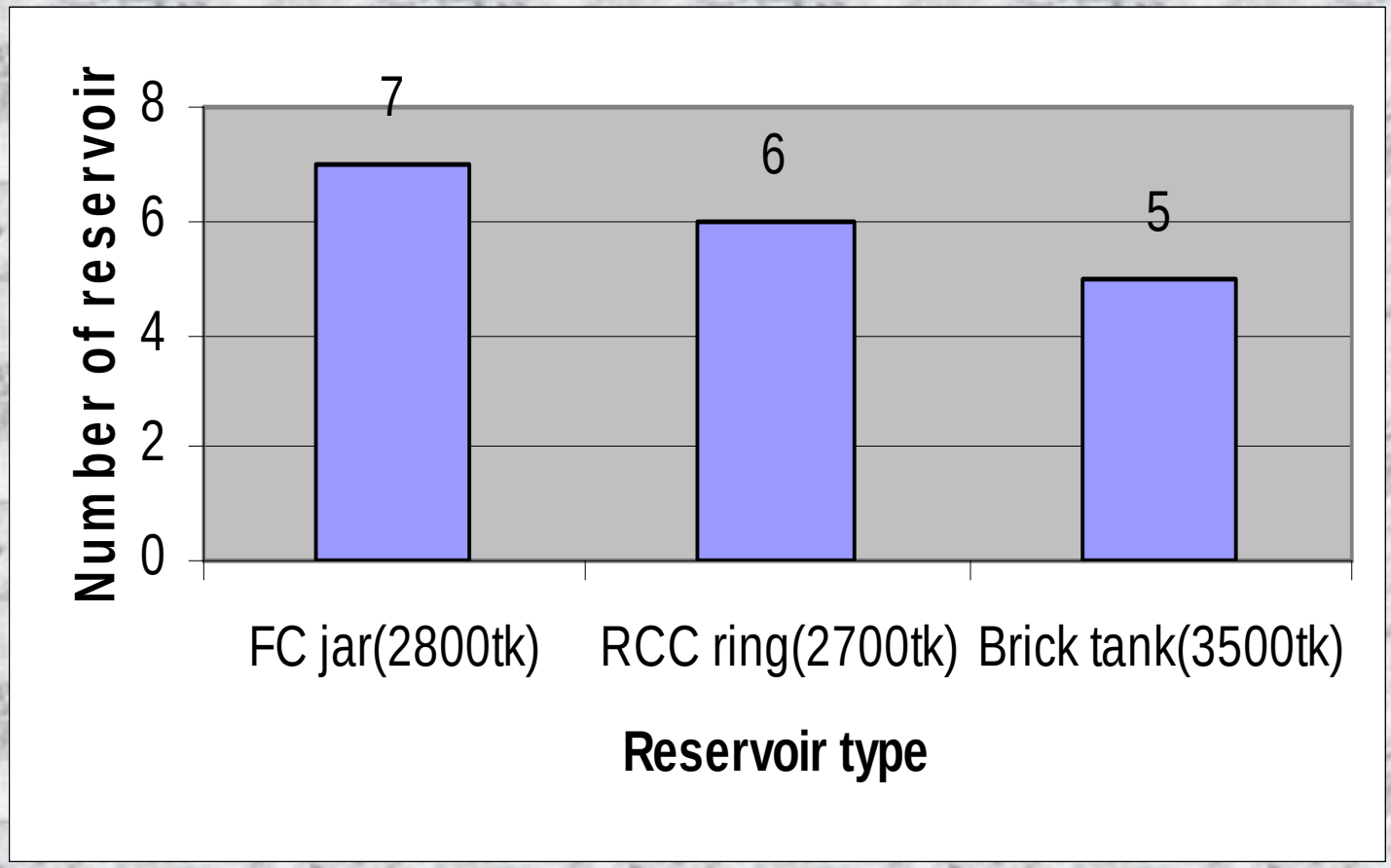

Figure 2: Number and types of reservoirs of capacity 1000 liter and catchment area 70-80 sft.

•Earthen motka-->low income group people(such as agri-labor,day labor)-->monthly income less than 1500 Tk.

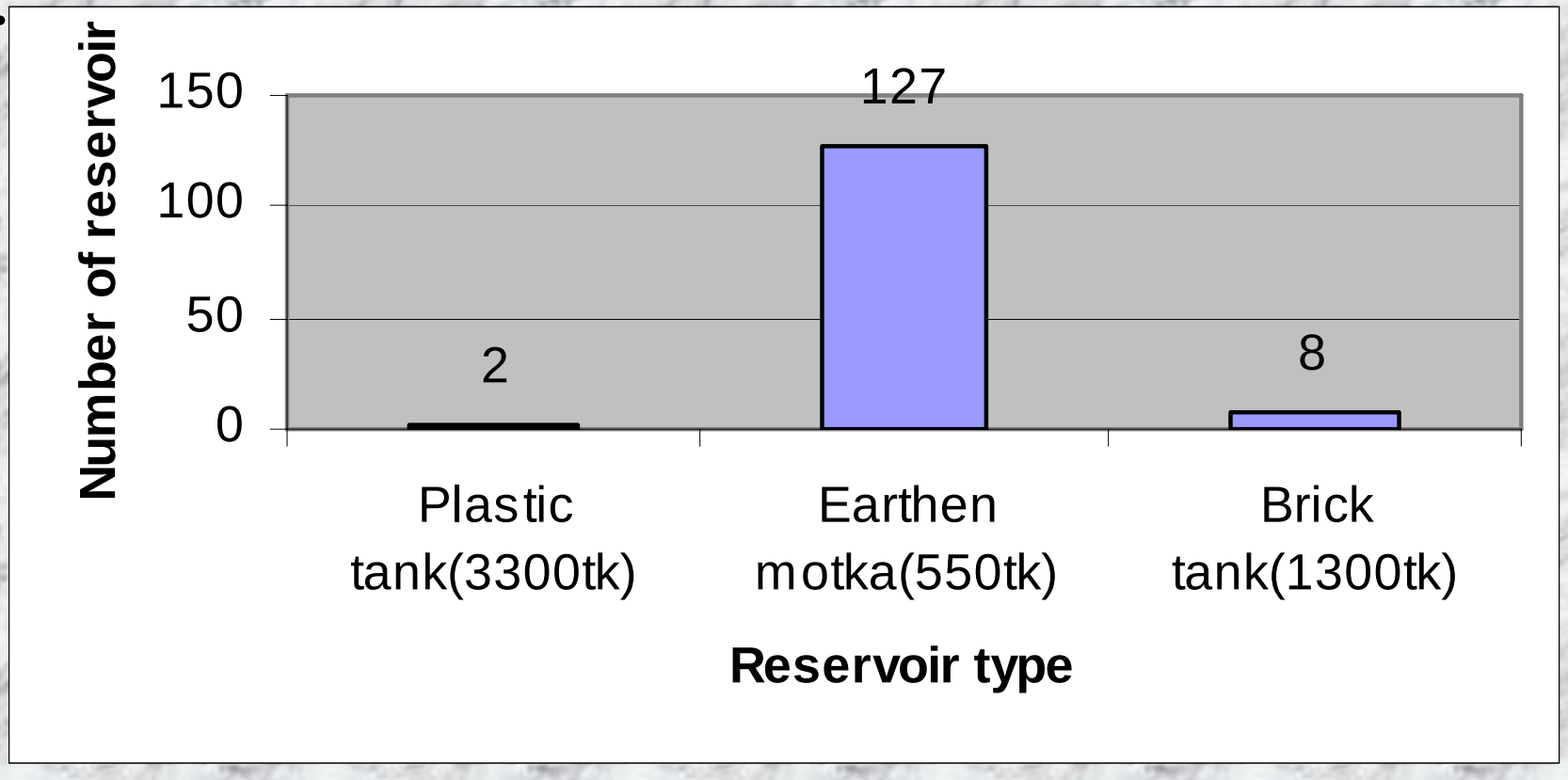

Figure 3: Number and types of reservoirs of capacity 500 liter and catchment area 60-70 sft.

•Interviewing 140 families--> FC jar, Brick tank, Earthen motka, plastic tank--> used by 35, 39, 37 and 2 families respectively (Fig.4)-->low cost, capacity, durability, availability of the reservoir and materials.

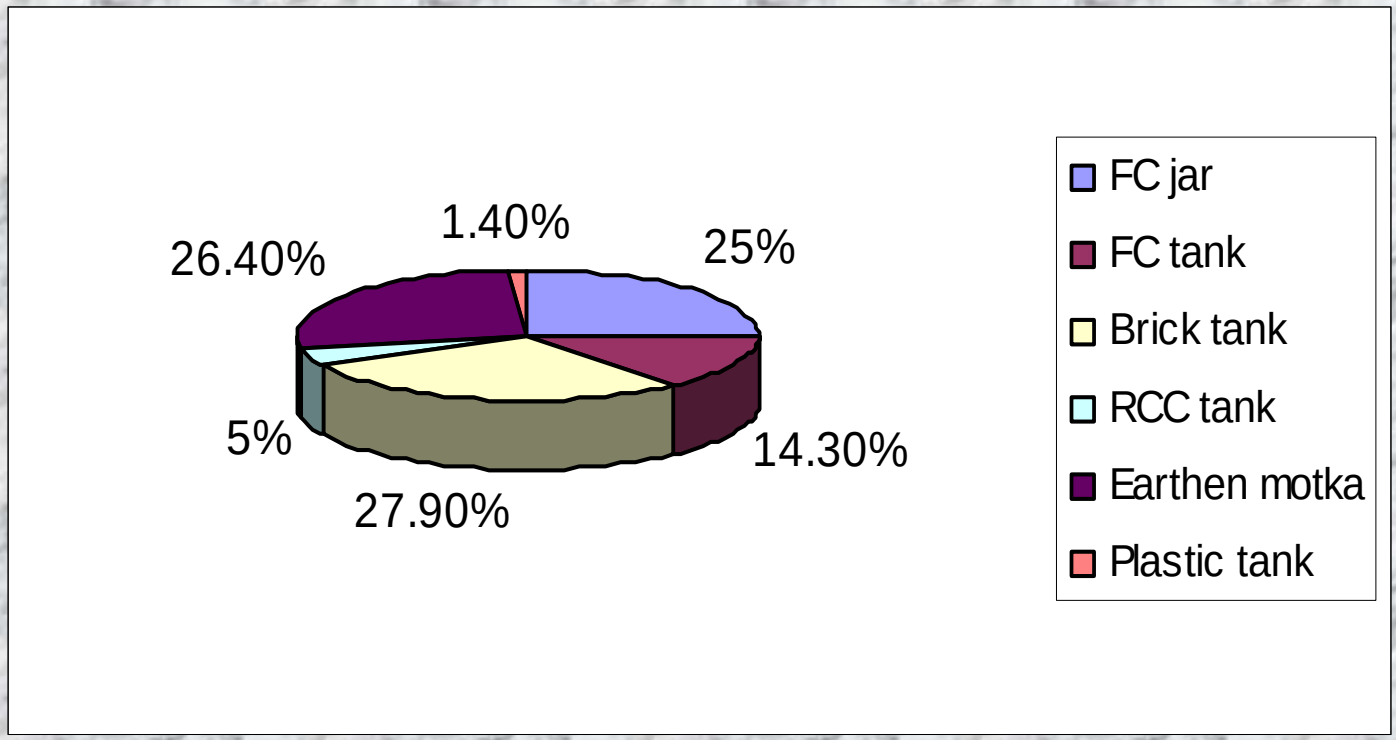

Figure 4: Percentage of different types of reservoir was in use during survey period.

•Reservoirs (in percentage) used by the villagers of the study area ,shown in the following figure (Figure5).

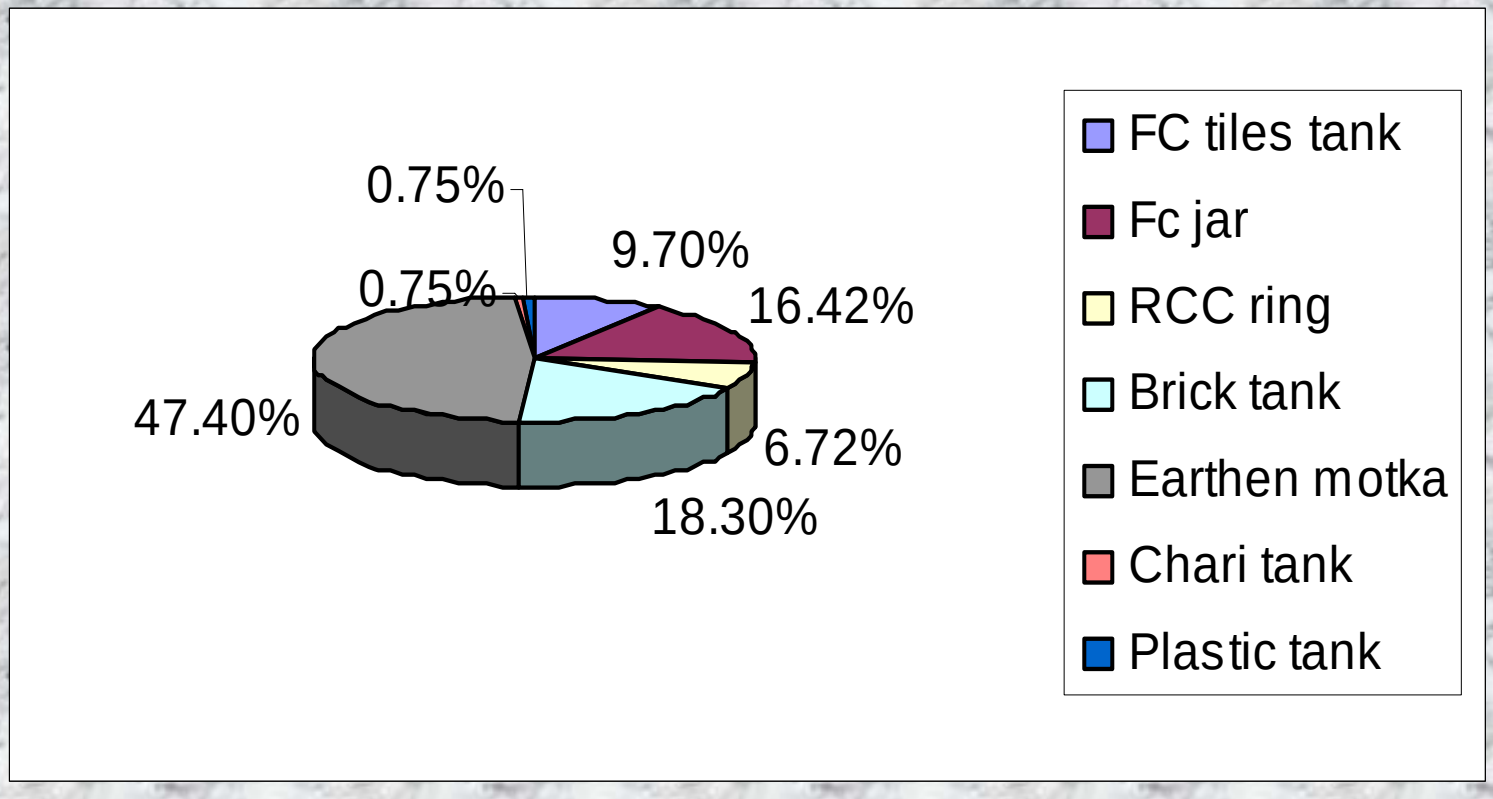

Figure 5: Percentage of different types of reservoirs were in use during survey period.

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- The FC tiles tanks -capacity 3200 liter, RCC ring tanks -capacity 2000 liter, plastic tanks-->limited use -->relatively higher cost against capacity, need of high catchment area.
- Chari tank-->limited use--> low performance.

Quality of Harvested Rainwater

•Percentage of As and Fe contaminated underground water sources increases relative to one another.

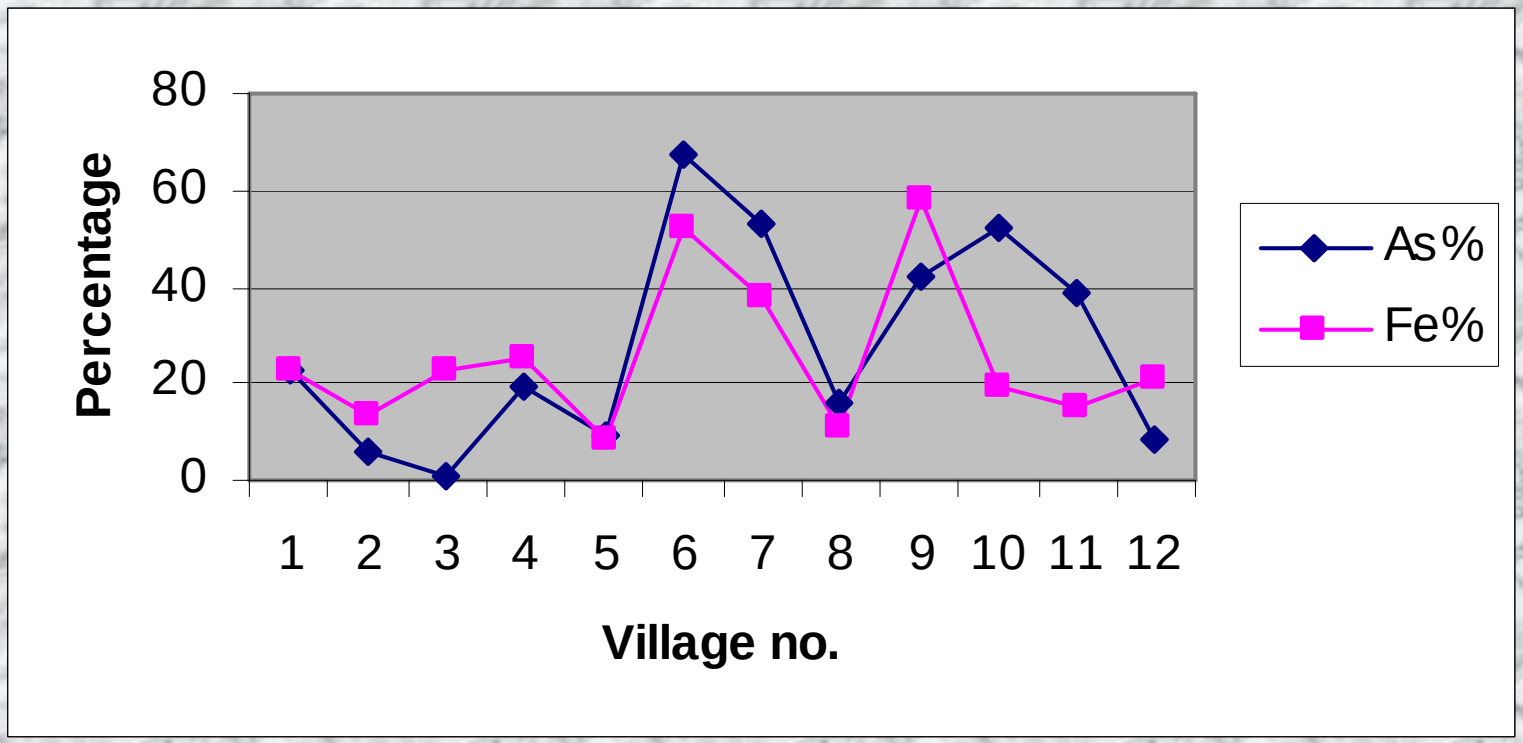

Figure 6: Relationship between As and Fe affected underground water sources.

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- 1340 water samples--> TC:samples 894 bacteria free, 446 contaminated. FC: samples 1083 bacteria free, 254 contaminated--> not cleaning the roof catchment, inlet gutter before rain events, not opening the screw cap to divert the first flush water, not washing the empty storage tank with bleaching powder.

- 2419 water samples-->pH:335 samples within the acceptable limit (6.5-8.5).

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- 1035 water samples-->Turbidity:50 samples unacceptable (greater than 5 NTU)--> improper collection of water from the catchment.
- Pb and Zn:acceptable limit.
- Iron and Fluoride: below detectable range of measurement, i.e., < 0.05 mg/L.

Operation & Maintenance

- Low cost of O&M, nearly 20 Tk/ year.
- Poor operation and maintenance : Lack of education and awareness.

Table1: Types of caretakers considering quality of O&M of different types of reservoirs

Type of reservoir	Good	Medium	Bad	Total no. of reservoirs
FC jar	12	14	9	35
FC tank	5	9	6	20
Brick tank	23	8	8	39
RCC ring	3	2	2	7
Earthen motka	6	21	10	37
Plastic tank	0	0	2	2

- Less number good caretakers of Earthen motka(Table 1)-->used by the people of low income group,almost no educational background.

Social Aspects

- Economic value of Rain Water.
- Change of beliefs and attitude toward Rain Water.
- Positive health effect for using Harvested Rain Water.
- Growth of ownership feelings and enhancement of status.
- Development of Rain Water Management Skill.

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- Afforestation.
- Less time consumption for collecting water.
- Small Family Size Norm.

Conclusion

- Rain water is potentially safe, reliable and affordable alternative source of water supply.
- Can be used for drinking and cooking for at least 8-10 months of the year.
- RWHS is widely used because different types of reservoirs are available and people of different income level can afford it according to their income level.
- Simple operation and low maintenance cost (20Tk/year)

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- Availability of CI roof catchment area.
- The quality of stored rainwater is well accepted by people of the study area.