

Library



Arsenic Free Piped Water Supply at BRAC-UNICEF Village, Sonargaon, Narayangonj



Sponsored by:

**Bangladesh Rural Advancement Committee (BRAC)
UNICEF & DPHE
Arsenic free water supply project, RDA**



Technical Assistance by:



**Rural Development Academy (RDA)
Bogra, Bangladesh.**

Background of the project:

Water is essential to all living organisms for their survival on the earth planet. Human civilization and settlement have been developed on the basis of availability of water sources. Though 70% of the earth is composed of water, only 1% of it is suitable for use. Thus water has become a scarce resource in the earth for its beneficial use in drinking, domestic, agricultural and industrial purposes. A few liters of water are sufficient for a person's daily drinking and food preparation requirement depending on climate and lifestyle. But much larger quantities are necessary when water is used for other domestic purposes such as personal hygiene, cleaning, cooking, laundry and home cleaning, etc. Safe, adequate and accessible supplies of water combined with proper sanitation are the basic needs and essential components of primary health care. They can help in reducing many of the diseases, which affect under privileged populations, especially those who live in rural and urban fringe areas. Safe drinking water means that the water sources must be free from undue microbiological contamination and unsafe levels of physical and chemical contaminants as per guideline of the World Health Organization (WHO) and the national standard. Safe drinking water is important in the control of many diseases. This is well established for diseases like diarrhea, cholera, typhoid and paratyphoid fever, infectious hepatitis, amoebic bacillary dysentery, arsenicosis, and skin disease, etc. It has been estimated that as many as 80% of all diseases in the world are associated with unsafe water.

The proposed project is a national priority project of arsenic free pure drinking water supply in Bangladesh. About 23 millions peoples and 42 districts are affected in Arsenic contamination in Bangladesh. It causes skin cancer, blindness, physical disability and so on. To minimize the above problem Rural Development Academy, Bogra has successfully carried out experimentation since 1998 in Bangabandhu Bridge area of Bangladesh. RDA already constructed such water filtration plants for supplying potable water at 15 different locations such as Proshika Training Centre (Manikganj), East and West sites of Banghabandhu Bridge (Tangail and Sirajganj), Baghabari Power Plant (Sirajganj), Food Village and Aristrocate Hotels (Sherpur, Bogra and Sirajganj), BRAC (Faridpur and Manikgonj), Jamuna Fertilizer Company Ltd.- JFCL (Jamalpur), Palli Biddut Samities (Sirajganj, Gaibandha, Noagoan).

The purpose of water treatment is to convert the raw water from ground or surface source into a drinking, industrial and other domestic purposes. Most important thing of treatment plant is the removal of pathogenic organisms and toxic substances such as heavy metals causing health hazards. Other substances may also need to be removed or at least considerably reduced imparting a better test or laundry activity. These include; suspended matter causing turbidity, iron and manganese compounds and excessive carbon dioxide corroding concrete and metal parts. Various water treatment process have been developed are given in table 1.

Table-1 : Effectiveness of water treatment processes in removing various impurities

+++ etc. = Increasing positive effect
 o = no effect
 - = Negative effect

Treatment process → Water ↓ quality Parameter	Aeration	Chemical Coagulation and Floc	Sedimenta- -tion	Rapid Filtration	Slow sand filtration	Chlorination
Dissolved Oxygen Content	+	o	o	-	--	+
Carbon Dioxide Removal	-	o	o	+	++	+
Turbidity* Reduction	o	+++	+	+++	++++	o
Color Reduction	o	++	+	+	++	++
Taste and Odor Removal	++	+	+	++	++	+
Bacteria Removal	o	+	++	++	++++	++++
Iron and Manganese Removal	++	+	+	++++	++++	o
Organic Matter Removal	+	+	++	+++	++++	+++

* Turbidity of water is caused by the presence of suspended matter scattering and absorbing light rays, and thus giving the water a non-transparent, milky appearance.

Table-2: Guidelines for drinking water quality

Water quality parameter	Measured as	Highest desirable level	Maximum permissible level	Bangladesh standard for drinking water	WHO guideline for drinking water
Total dissolved solids*	mg/l	500	2000	1000	1000
Turbidity	FTU	5	25	10	5
Colour	mg pt/l	5	50	15	15
Iron	mg Fe ⁺ /l	0.1	1.0	0.3-1.0	0.3
Manganese	mg Mn ⁺⁺ /l	0.05	0.5	0.1	0.1
Nitrate	mg NO ₃ /l	50	100	10	10
Nitrite	mg N/l	1	2		
Sulphate	mg SO ₄ /l	200	400		
Fluoride	mg F/l	1.0	2.0	1.0	1.5
Sodium	mg Na ⁺ /l	120	400		
Arsenic	mg As ⁺ /l	0.05	0.1	0.05	0.01
Chromium (Hexavalent)	mg Cr ⁶⁺ /l	0.05	0.1		
Cyanide (free)	mg CN/l	0.1	0.2		
Lead	mg Pb/l	0.05	0.10		
Mercury	mg Hg/l	0.001	0.005		
Cadmium	mg Cd/l	0.005	0.010		

* This includes the major dissolved solids such as SO₄, Cl, HCO₃, Ca⁺⁺, Mg⁺⁺ and Na⁺. The levels indicated depend on open the climate, the type of food, and the work load of the water users. In some recorded cases, people who lived for months on water having a total dissolved solids content in excess of 5000 mg/l.

The cost of DTW and filtration plant will be Tk. 3.15 lakh to 5.00 lakh having a water discharging capacity 2 lakh liter/hour and 15000 liter/hour respectively. The quality of water has been brought up to Bangladesh as well as World Health Organization (WHO) standard. The concentration of iron and arsenic have been reduced from 30 mg/liter to 0.3 mg/liter and 0.07 mg/liter to 0.02 mg/liter. As DTW is a costly equipment. If we use it single purpose, it would not be cost effective and private entrepreneur will not be interested to invest their capital. So to make it cost effective and popular it could be used multipurposely like (irrigation, drinking, horticulture and nursery development, livestock and poultry rearing, aquaculture development etc. Already RDA has been running Government funded project named "Action Research Project on Multipurpose Use of Low-Cost DTW for Long-Term Post Flood Rehabilitation". The experience of this project will be shared for undertaking the multipurpose use of arsenic free safe water in irrigation, horticulture and nursery development, livestock rearing, aquaculture, small cottage industry, food processing and preservation and so on. As because the rural people do not have any budget for drinking

water, so upliftment of the socio-economic condition of the rural people is imperative to ensure effective use of arsenic free potable water in the rural Bangladesh. Due to potable water supply system per-capita domestic water supply can be increased, which is essential in respect of personal health and hygiene. From RDA experience in dual use of DTW during 1985 it was found that per-capita domestic water consumption can be raised from less than 10 liter/day to 50 liter/day, which is an important issue in changing life style of the rural people.

According to the test result of water in Sonargaon, the quality of water is not so good for drinking water standard. Already arsenic and iron contamination have been found in water. The proposed project has been designed for ensuring safe potable water in the rural area and also in different income generating activities at Sonargaon (like irrigation, vegetable and nursery production, livestock and poultry rearing, aquaculture development, small cottage industry and so on). All these would be help in developing the health status as well as socio-economic condition of the rural people.

Objective of the project:

The main objective of the project is to improve socio-economic condition and quality of rural life through ensuring arsenic free safe potable drinking water supply by expanding RDA-developed safe water model. The specific objectives of the project are as follows:

- i. To install low-cost DTW with or without filtration plant for ensuring safe potable arsenic free drinking water supply according to the guidelines of WHO/Bangladesh standard.
- ii. To develop health status of the rural people by increasing per-capita water consumption.
- iii. To reduce the level of water borne diseases.
- iv. To uplift socio-economic status of the rural people by engaging them in different income generating activities like (irrigation, crop production, poultry and livestock rearing, vegetable and nursery production, aquaculture development and small cottage industry etc.).

Strategy of achieving the objectives:

1. Infrastructure development (completed).

- 1.1 Find out Arsenic and Iron contaminated zone in the Aquifer at Pakunda.
- 1.2 Installation of RDA-developed low-cost DTW.
- 1.3 Construction of multipurpose overhead tank having a capacity of 35,000 liters.
- 1.4 Installation of water filtration plant, having a capacity of 20,000 litre/hour.
- 1.5 Construction of RDA-developed buried pipe (c.c.) irrigation system.
- 1.6 Construction of domestic water supply network for drinking as well as other income generating activities.

2. Social mobilization and group formation

3. Skill development training course

- 2.1 Operation and maintenance of filtration plant.
- 2.2 On-farm water management [Completed (Detailed in Annexure-C)]
- 2.3 Poultry and livestock rearing [Completed (Detailed in Annexure-C)]
- 2.4 Aquaculture development.
- 2.5 Horticulture and nursery development [Completed (Detailed in Annexure-C)]
- 2.6 Food processing and preservation.
- 2.7 RDA-developed DTW drilling technique.
- 2.8 Community drinking water supply management.

4. Seed capital will be disbursed for different types of income generating activities among the target groups.

5. Possible Income generating activities will be undertaken.

- i. Crop production through efficient Irrigation system
- ii. Drinking water supply
- iii. Vegetable and nursery production
- iv. Poultry and livestock rearing
- v. Aquaculture development
- vi. Small cottage industry

Salient features of the project:

- i. The quality of water has been brought up to Bangladesh as well as WHO standard (iron and arsenic contamination free).
- ii. Ensured pipeline network for drinking as well as other income generating activities.
- iii. The conveyance efficiency increased up to 95% through buried pipe irrigation from 50% of the traditional conveyance system.
- iv. Different type of income generating activities (irrigation, vegetables and nursery production, livestock and poultry rearing, aquaculture, small cottage industry) will be under taken for project target group.

Organizational and management setup of the project.

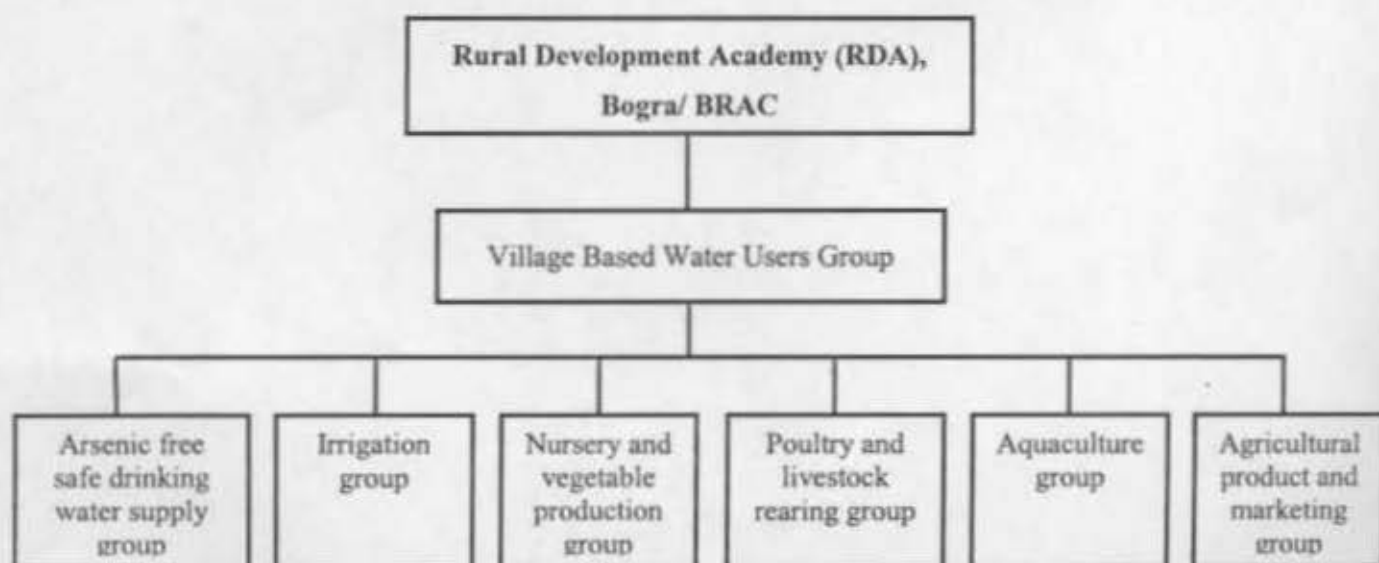
There is a provision of village based water users group among the villagers in each project area which comprises of maximum 6 sub-groups. The groups are as follows:

1. Arsenic free safe drinking water supply group
2. Irrigation group
3. Nursery and vegetable production group
4. Aquaculture group
5. Poultry and livestock rearing group
6. Agricultural product and marketing group

All groups belongs to one main group called village based water users group and all members will be associated with them. There will be a provision for seed capital for income generating activities. These individual group will be provided training at the academy and or successful completion they will be provided credit from the Bank or BRAC with the recommendation of RDA credit supervisors, BRAC representative and also village based water users group.

There is provision for a number of training courses for the target group like of operation and maintenance of filtration plant; food processing and preservation, drilling technique installation, livestock and poultry rearing, aquaculture development, vegetables and nursery production, on-farm water management, community drinking water supply management etc. and also skill development training for GO and NGO officials. After successful completion of the training courses by the concerned target group and also recommendation of RDA credit supervisor and BRAC authority, the different groups will be eligible for getting credit.

After completion of the project period the action research activities will be continued through repay back of the capital investment and also interest of the seed capital from the target group. A total of 50% capital investment will be recovered from the target group within 5 to 10 years. and the money will be deposited in the name of RDA Director General account called Institute of "Water Management. In that way this project will be gradually self sustained and the project will be extended in the other arsenic problematic areas of Bangladesh.



Profile of Pakunda Village

Location	This site is located at 32Km. from Narayanganj under Sonargaon Upazila of Narayanganj District.
Household information	
Total Household	419
Population	2302
Sex of the household head	
Male	407
Female	12
Education of the household head	
Illiterate	162 (38.7%)
Can read only	5
Can write only	18
Can read and write	178
S.S.C. passed	22
H.S.C. passed	20
B.A. passed	12
M.A. passed	2
Tubewell	
Total no. of tubewell	94
Arsenic contaminated	46
Arsenic free	48
Occupation of the household head	
Unemployed	17 (4.1%)
Agriculture	49
Service	114
Business	104
Day laborer	67
Fishing	3
Household work	15
Village transport	18
Others	2
Total earning members	650
Poverty Self Assessment (%)	
Chronic deficit	66 (15.8)
Deficit	94 (22.5)
Break through	135 (32.2)
Surplus	124 (29.6)
NGO member	
BRAC VO	2
BRAC VO member	77 (47+30)
ASA VO	
Male	1
Female	3
ASA female member	30
ASA male	18
Female	60 (2 x 30)
RASAS	
VO = I	
Member = 35 Approx	
Current water source	

Purposes	Arsenic unsafe tubewell	Arsenic-safe tubewell	Dugwells	Pond/River
Drinking	70	324	26	0
Cooking	56	124	29	223
Bathing and others	16	69	0	351

Source : BRAC

Field survey, December 2001.

Annexure -C

Training course organized for the target groups of Pakunda**Nursery Development Technology Course for the project beneficiaries****Duration : (15-21 October'2001), Batch : 02**

Sl.no	Participant Name	Father Name	Village	Upazila	District
1.	Hazi Md. Tozammel Haque Khan	Late Hazi Abu Almas Khan	Pakunda	Sonargaon	Narayanganj
2.	Md. Abdullahil Baki	Md. Mobarak Ullah Mazumder	Pakunda	Sonargaon	Narayanganj
3.	Md. Sohrab Hossain Bhuyan	Md. Ali Akbar Bhuyan	Pakunda	Sonargaon	Narayanganj
4.	Md. Habibur Rahman Khan	Md. Tabarak Hossain Khan	Pakunda	Sonargaon	Narayanganj
5.	Md. Shahidul Islam Bhuyan	Md. Yusuf Ali Bhuyan	Pakunda	Sonargaon	Narayanganj
6.	Md. Maksud Hossain Sikder	Md. Hasem Sikder	Pakunda	Sonargaon	Narayanganj
7.	Md. Rasel Bhuyan	Md. Shamsul Haque Bhuyan	Pakunda	Sonargaon	Narayanganj
8.	Md. Sanowar Hossain Bhuyan	Mohammad Hossain Bhuyan	Pakunda	Sonargaon	Narayanganj
9.	Md. Jalil Miah	Md. Miaz Uddin	Pakunda	Sonargaon	Narayanganj
10.	Md. Nasir Miah	Md. Zahrul Islam	Pakunda	Sonargaon	Narayanganj

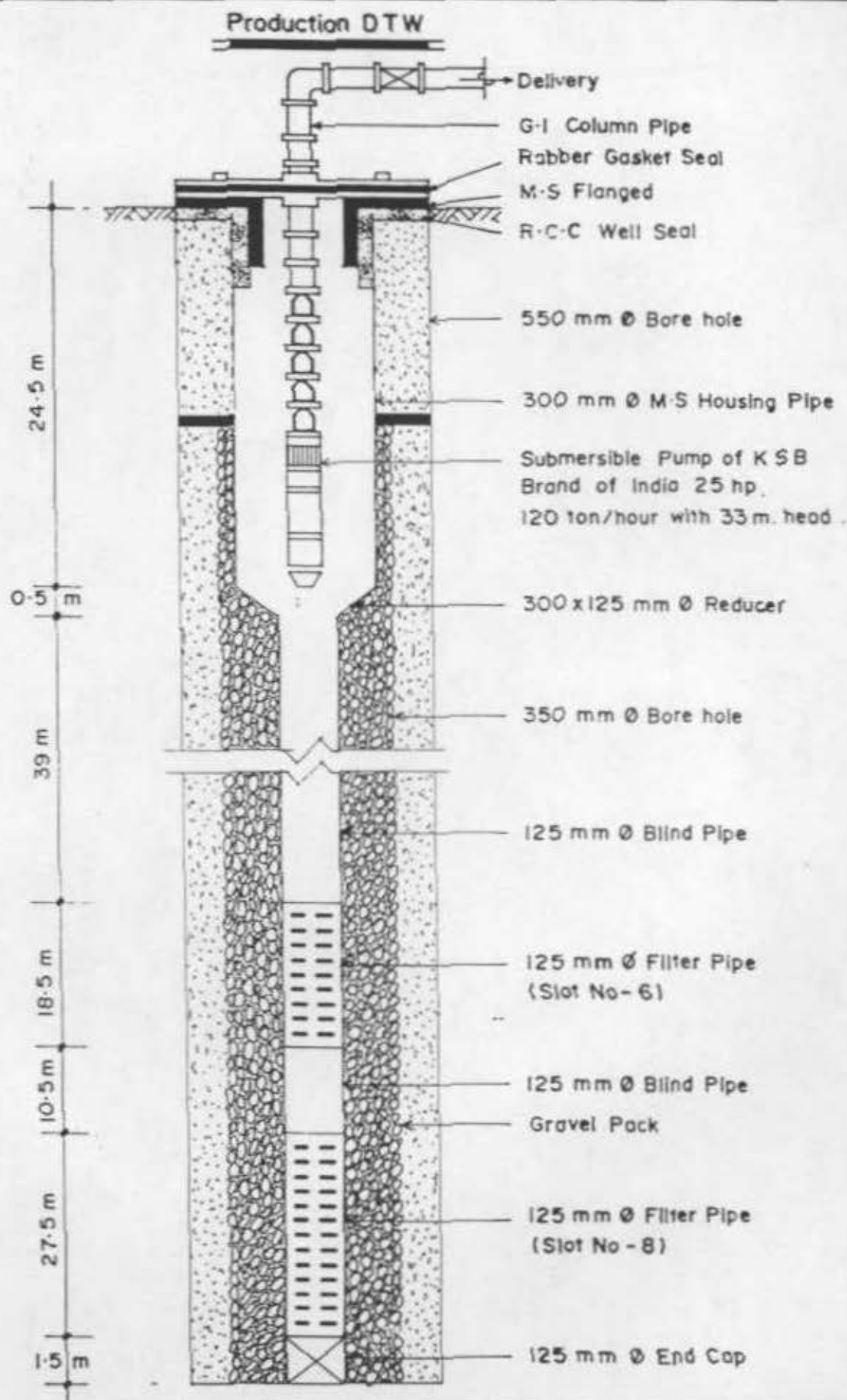
On Farm Water Management Course for the project beneficiaries**Duration : (18-27 November'2001), Batch : 02**

Sl.no	Participant Name	Father Name	Village	Upazila	District
1.	Hazi Md. Tozammel Haque Khan	Late Hazi Abu Almas Khan	Pakunda	Sonargaon	Narayanganj
2.	Md. Shamsul Haque Miah	Late Mohar Ali	Pakunda	Sonargaon	Narayanganj
3.	Md. Alam Miah	Md. Noor Islam Miah	Pakunda	Sonargaon	Narayanganj
4.	Md. Ibrahim Miah	Md. Rafiqul Islam	Pakunda	Sonargaon	Narayanganj
5.	Md. Faruk Miah	Md. Abu Siddique Miah	Pakunda	Sonargaon	Narayanganj
6.	Sree Joy Mangal Bishwash	Sree Chand Mohan Bishwash	Pakunda	Sonargaon	Narayanganj
7.	Abdullahil Kafi	Md. Mobarak Ullah	Pakunda	Sonargaon	Narayanganj
8.	Md. Tahidur Raihan	Hazi Md. Tozammel Haque Khan	Pakunda	Sonargaon	Narayanganj
9.	Md. Obaidur Rahman	Md. Humaian Kabir Bhuyan	Pakunda	Sonargaon	Narayanganj
10.	Md. Motahar Hossain Bhuyan	Late Abul Kashem Bhuyan	Pakunda	Sonargaon	Narayanganj
11.	Md. Nesar Ahmed Bhuyan	Md. Sharif Bhuyan	Pakunda	Sonargaon	Narayanganj
12.	Md. Tareq Hasan Bhuyan	Md. Piarur Rahman Bhuyan	Pakunda	Sonargaon	Narayanganj

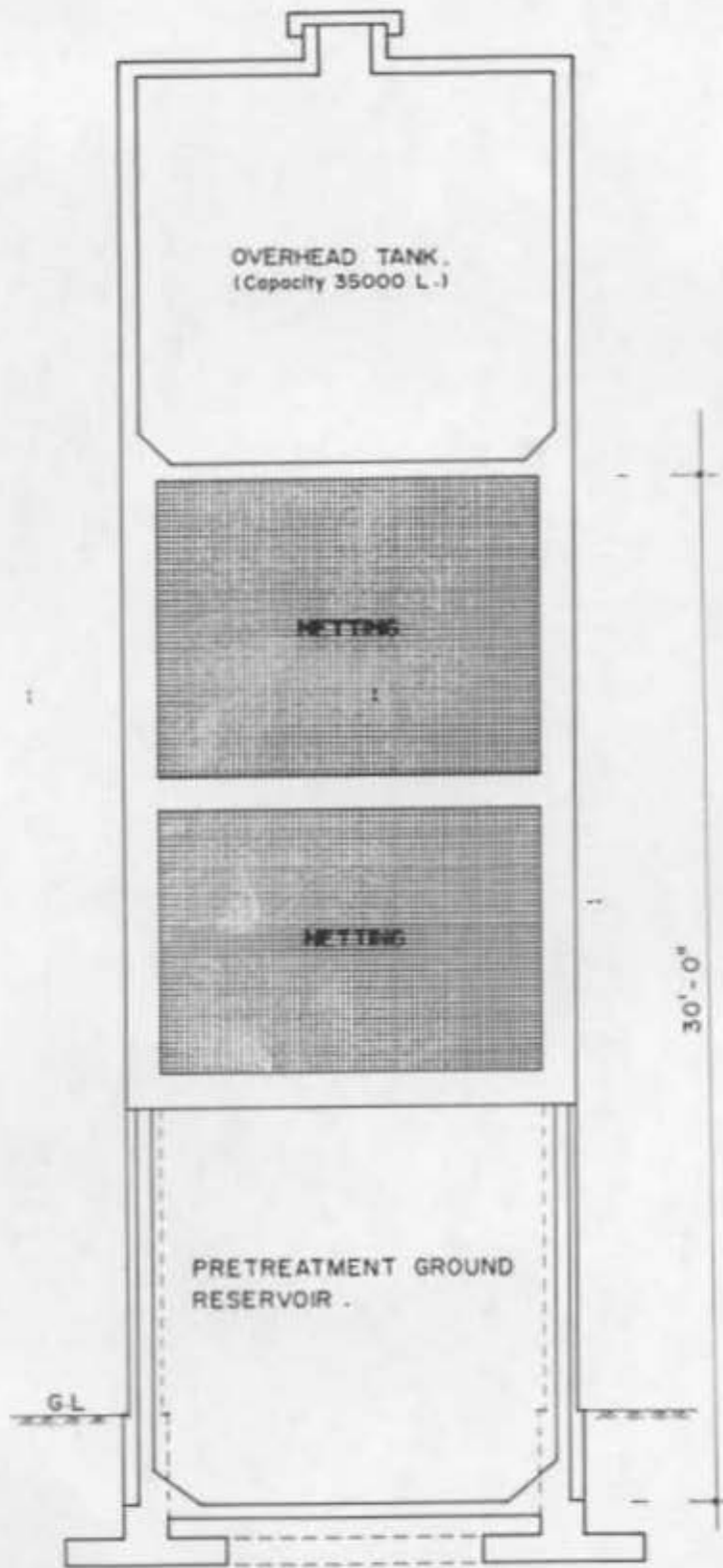
Poultry and Livestock Husbandry Course for the project beneficiaries**Duration : (26 December'2001-04 Janunary'2002) Batch : 02**

Sl.no	Participant list	Father Name	Village	Upazila	District
1.	Md. Mahfuzur Rahman Sikder	Md. Abdus Sattar Sikder	Pakunda	Sonargaon	Narayanganj
2.	Md. Mojibur Rahman Sikder	Md. Abu Hanif Sikder	Pakunda	Sonargaon	Narayanganj
3.	Md. Mohibul Islam	Md. Nurul Haque Bhuyan	Pakunda	Sonargaon	Narayanganj
4.	Md. Morshed Alam Bhuyan	Rezaul Karim Bhuyan	Pakunda	Sonargaon	Narayanganj
5.	Md. Mahmud Hasan Ibrahim	Md. Hanif Bhuyan	Pakunda	Sonargaon	Narayanganj
6.	Md. Al Amin Bhuyan	Late Aminul Haque Bhuyan	Pakunda	Sonargaon	Narayanganj
7.	Md. Tariqul Islam	Kazi Shahidul Islam	Pakunda	Sonargaon	Narayanganj
8.	Md. Mir Mamun	Mir Mozammel Hossain	Pakunda	Sonargaon	Narayanganj
9.	Md. Al Amin Bhuyan	Md. Shohel Bhuyan	Pakunda	Sonargaon	Narayanganj
10.	Md. Sharif Hossain	Md. Hasmal Ali	Pakunda	Sonargaon	Narayanganj
11.	Md. Borhan Uddin	Md. Humayan Kabir Bhuyan	Pakunda	Sonargaon	Narayanganj
12.	Md. Shafiqul Islam Bhuyan	Md. Mezhab Uddin Bhuyan	Pakunda	Sonargaon	Narayanganj
13.	Md. Anamul Hasan Bhuyan	Md. Siddique Bhuyan	Pakunda	Sonargaon	Narayanganj
14.	Md. Sohrab Bhuyan	Md. Ali Akbar Bhuyan	Pakunda	Sonargaon	Narayanganj

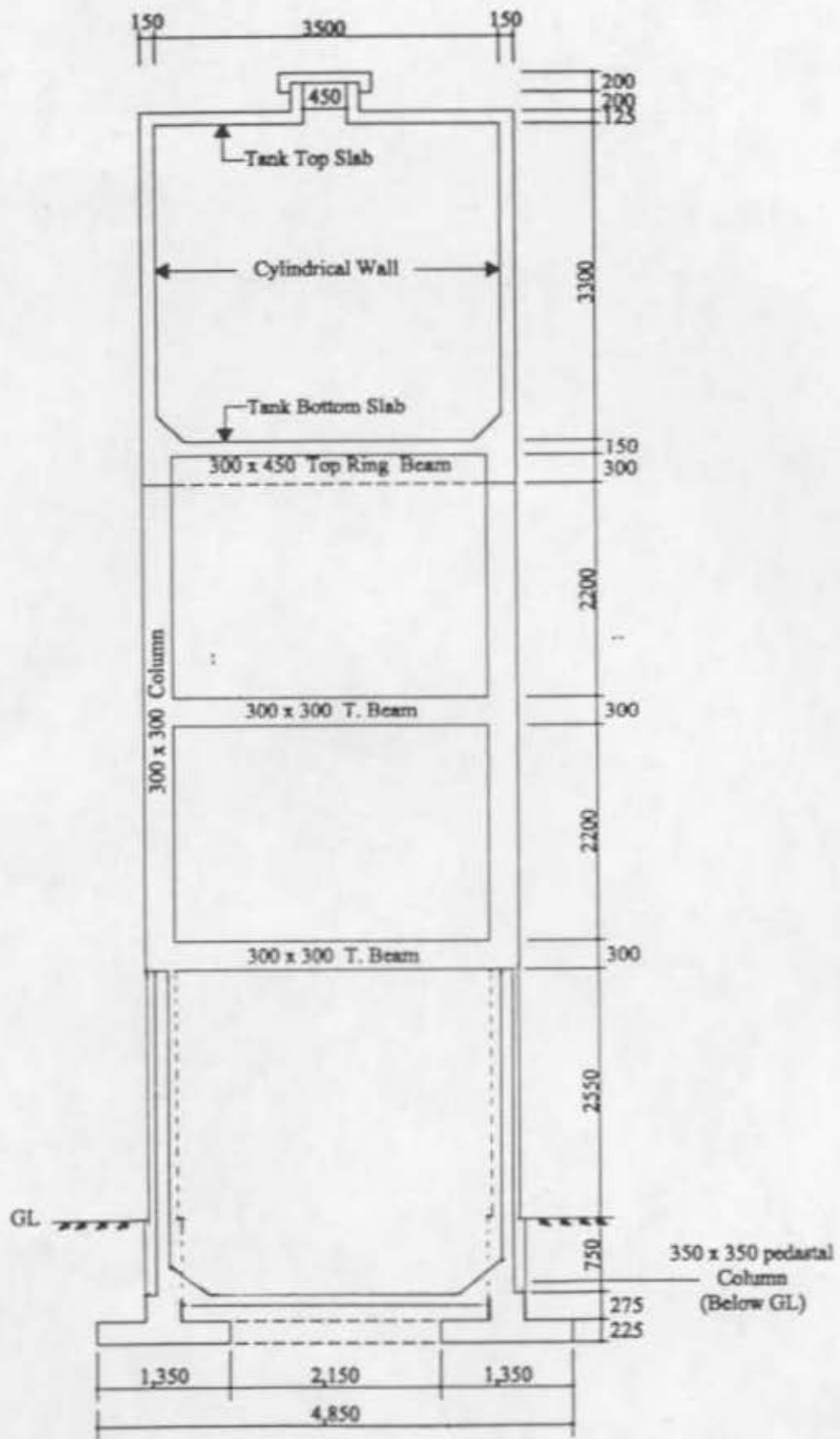
Drawing



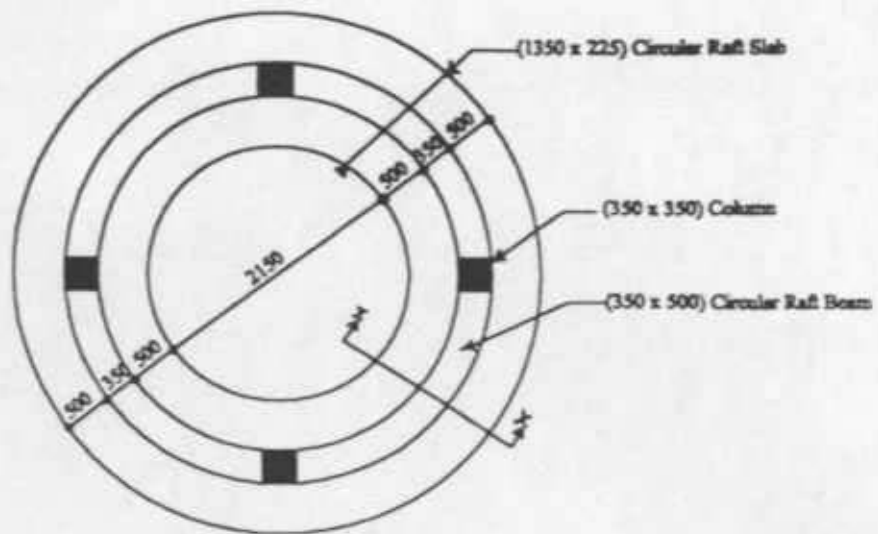
● **LOW COST DEEP TUBEWELL**
AT BRAC-UNICEF VILLAGE, SONARGAON .



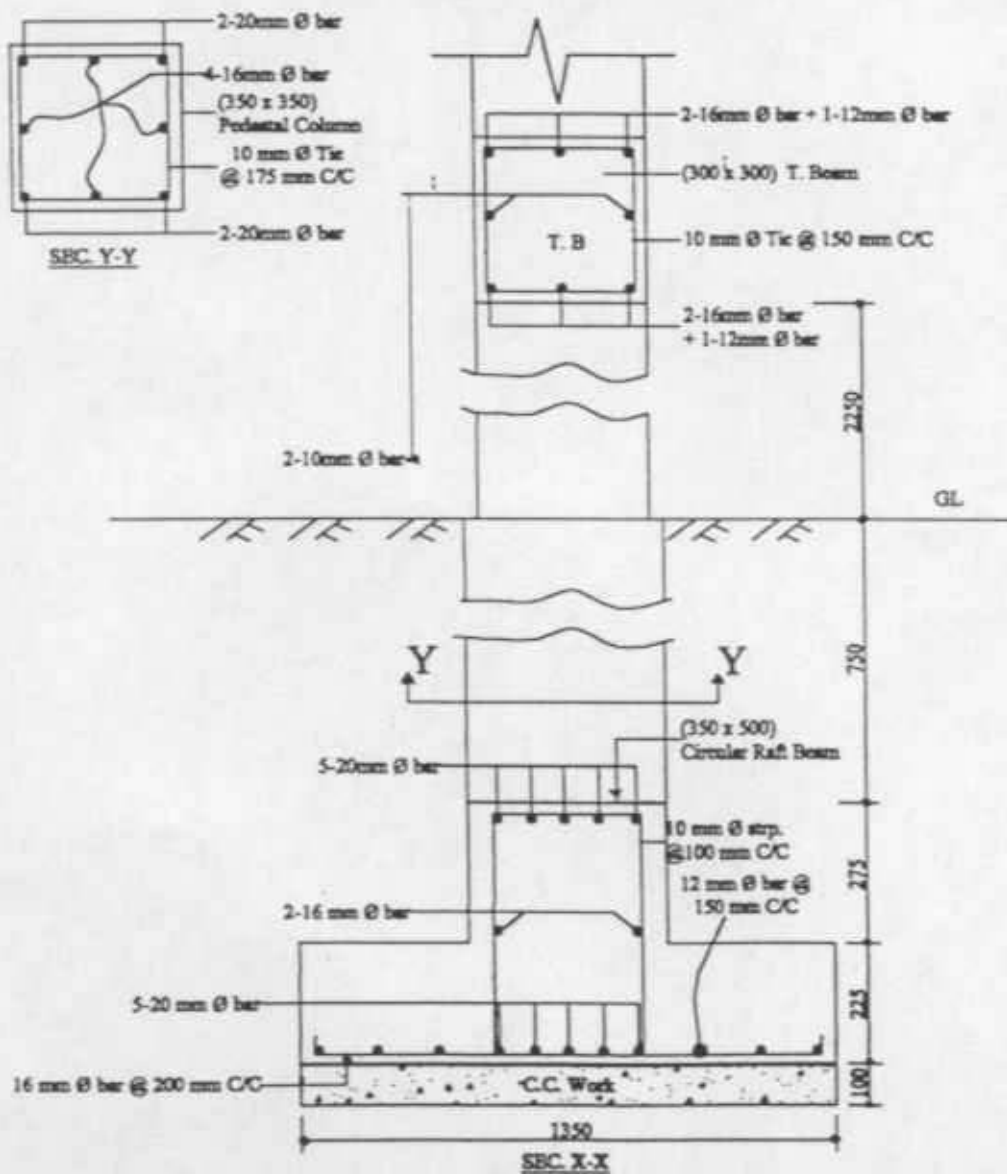
● MULTIPURPOSE OVERHEAD TANK
AT BRAC-UNICEF VILLAGE , SONARGAON .



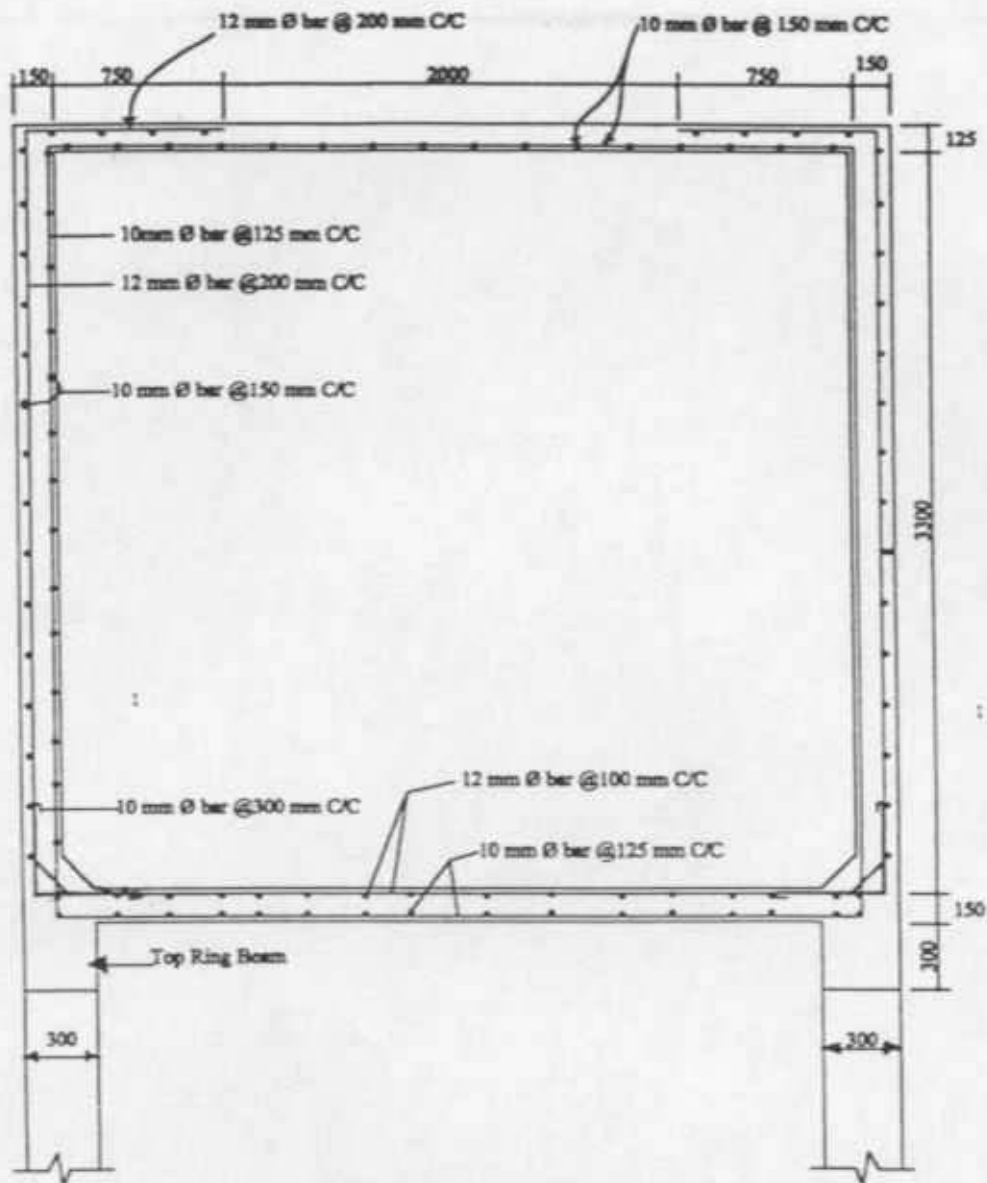
Section Elevation of Overhead Water Tanks



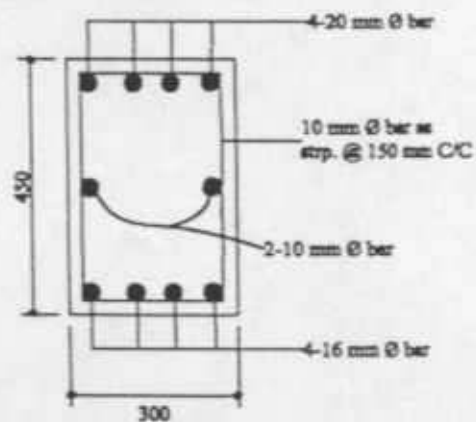
Plan of raft Foundation



Section Showing Details of Reinforcement in Foundation, Circular Beam and Raft Slab

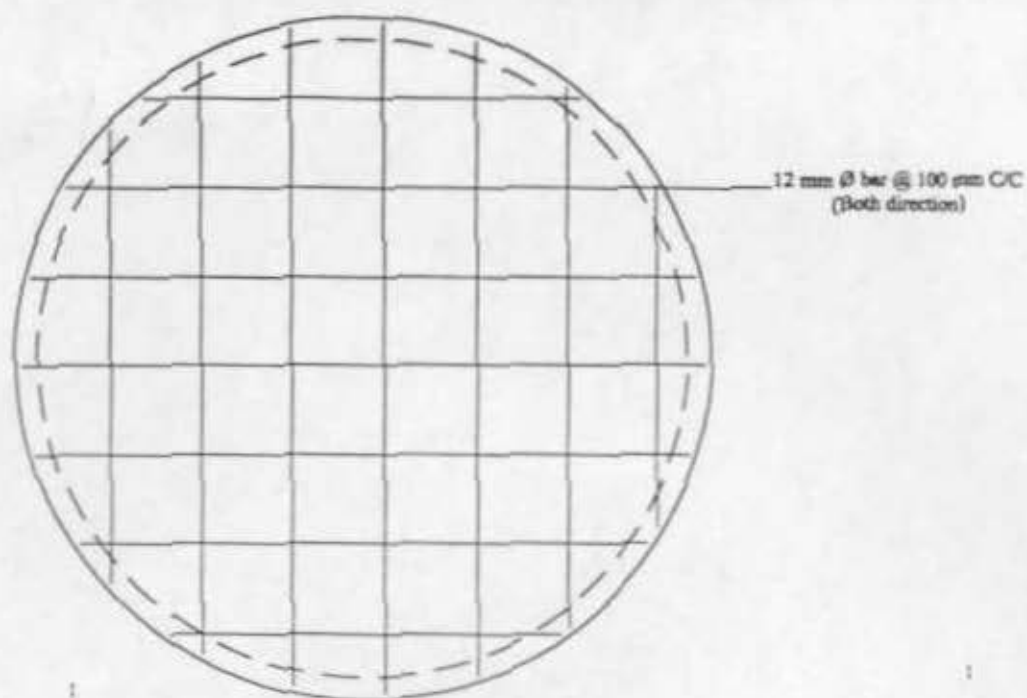


Tank Details / Reserver

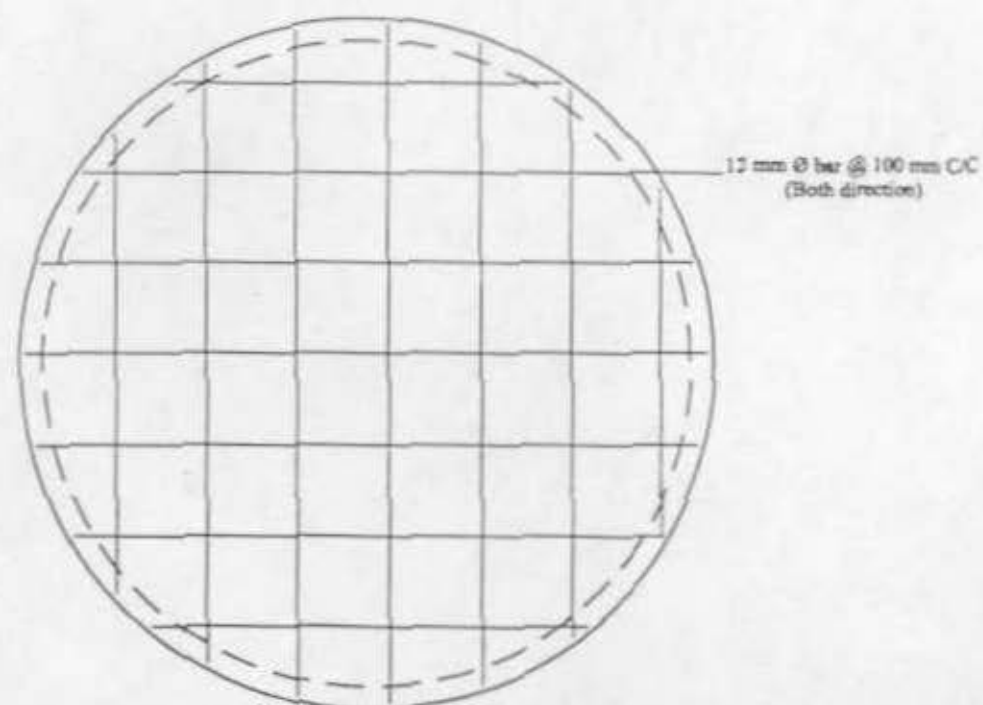


Top Ring Beam Details

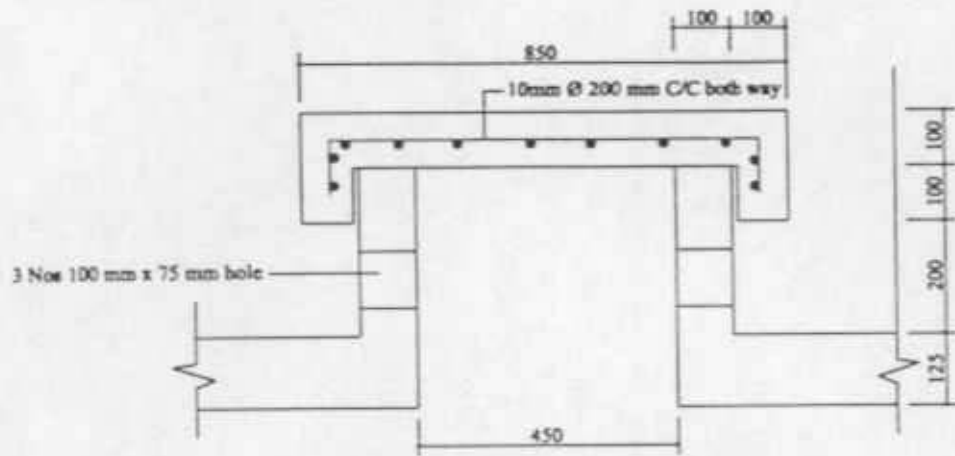
Tank Bottom Slab Reinforcement Details



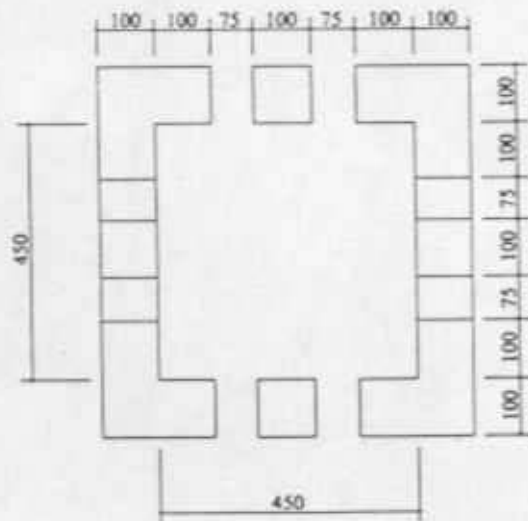
Plan Showing Top Reinforcement



Plan Showing Bottom Reinforcement



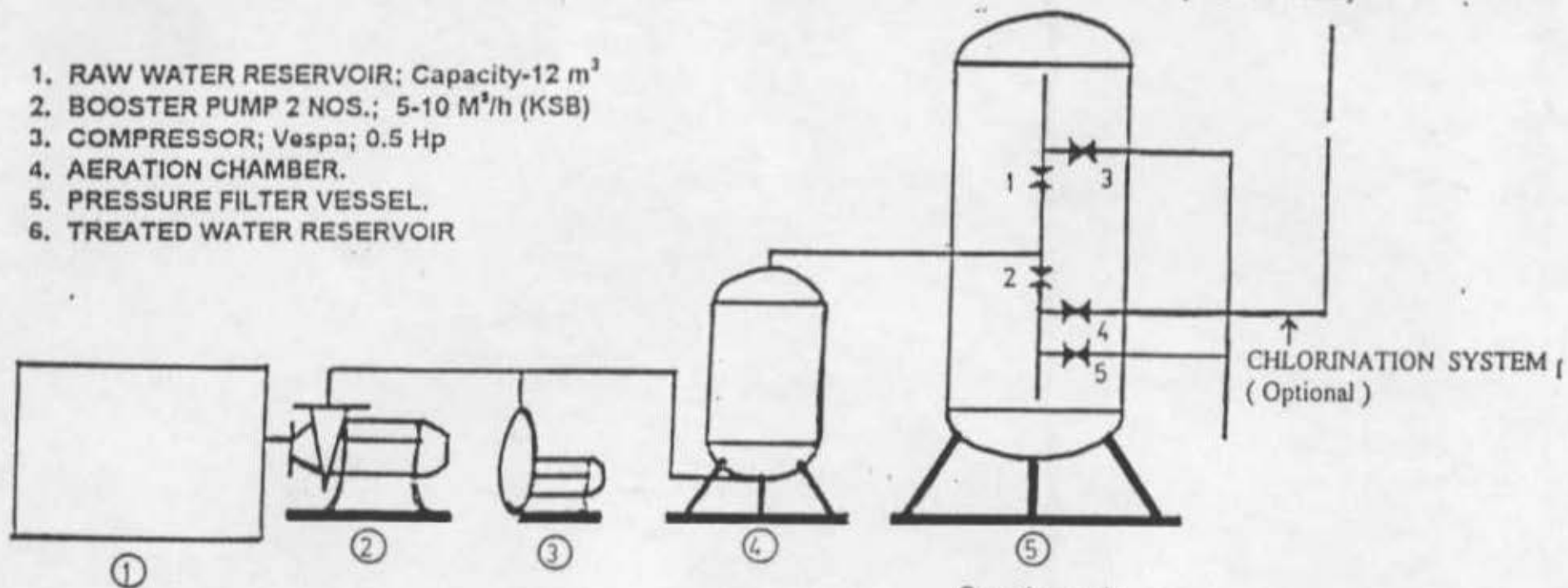
X-Sec. of Manhole Cover



Plan Of Manhole

TREATED WATER RESERVOIR
(Overhead tank)

1. RAW WATER RESERVOIR; Capacity-12 m³
2. BOOSTER PUMP 2 NOS.; 5-10 M³/h (KSB)
3. COMPRESSOR; Vespa; 0.5 Hp
4. AERATION CHAMBER.
5. PRESSURE FILTER VESSEL.
6. TREATED WATER RESERVOIR



Operation mode

1,4 - open

2,3,5 - close

Back wash mode

2,3 - open

1,4,5 - close

LAYOUT OF WATER TREATMENT PLANT

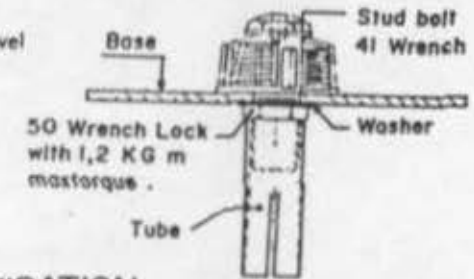
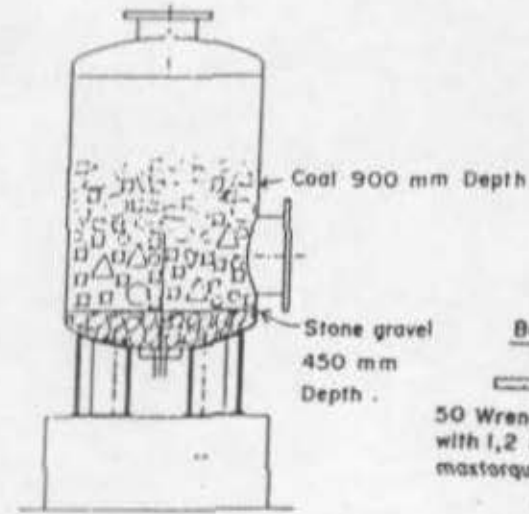
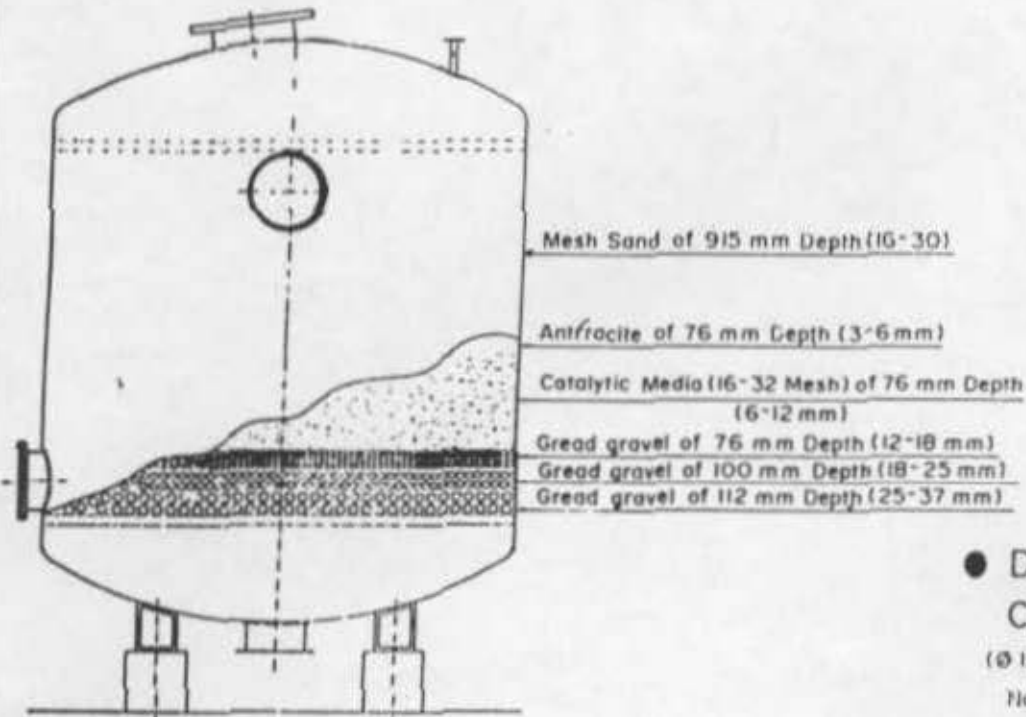
DETAIL OF WATER TREATMENT PLANT AT BRAC-
UNICEF VILLAGE, SONARGAON, NARAYANGANJ.

CAPACITY: 15,000 LITRE/HOUR

Designed:

M.A. Matin

Joint Director, RDA, Bogra.

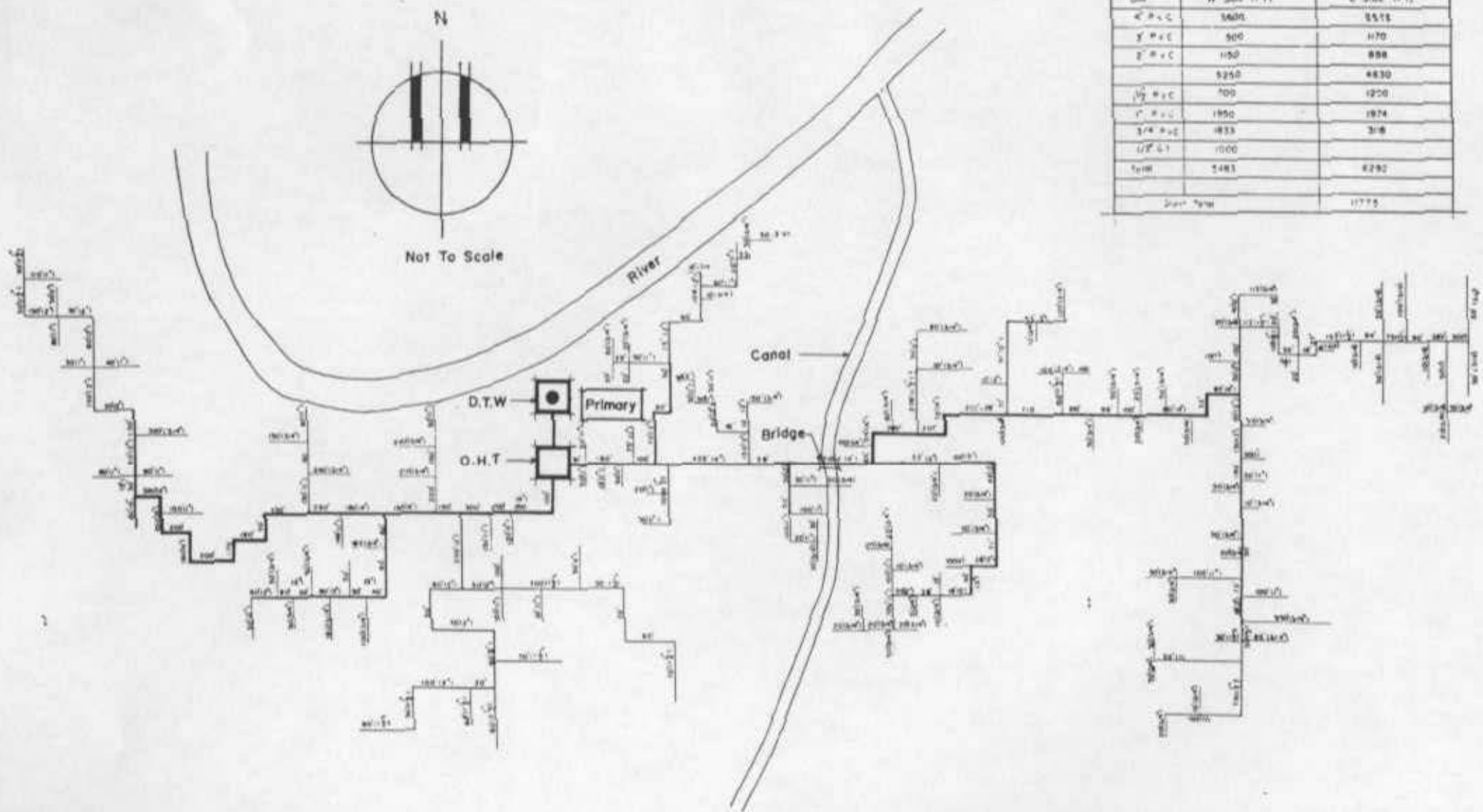


● DETAILED OF MEDIA OF OXIDATION CHAMBER (Air Water Mixture Vessel)
 (Ø 1200 x 1500 H-O-S)
 Not to Scale .

● STRAINER DETAIL
 Not to Scale .

● DETAILED OF MEDIA OF FILTER
 (Ø 3000 x 2800 H-O-S)
 Not to Scale .

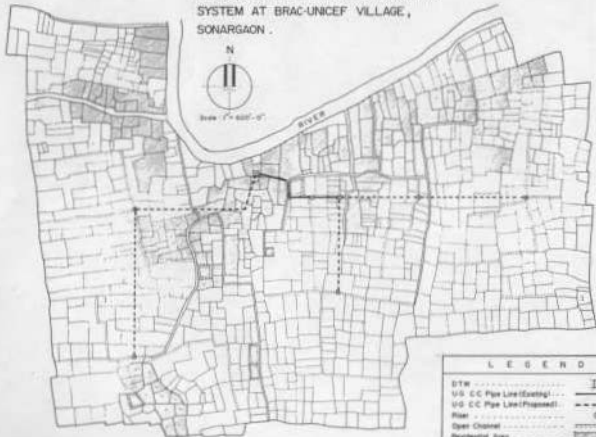
Designed:
 M.A. Matin
 Joint Director, RDA, Bogra.



Dist	W Side (Ft)	E Side (Ft)
4" P.C.C	5600	5518
3" P.C.C	500	170
2" P.C.C	1150	898
	5250	4830
1 1/2" P.C.C	700	1200
1" P.C.C	1950	1974
3/4" P.C.C	433	318
1/2" G.I	1000	
Total	14883	8292
Dist. Total		17775

● LAY-OUT PLAN OF PIPE LINE NETWORK
AT BRAC-UNICEF VILLAGE, SONARGAON.

UNDERGROUND C-C PIPE LINE IRRIGATION
SYSTEM AT BRAC-UNICEF VILLAGE,
SONARGAON .



LEGEND

- | | | |
|----------------------------|---------|---------|
| DTW | | 10' |
| US C-C Pipe Line(Existing) | --- | --- |
| US C-C Pipe Line(Proposed) | - - - - | - - - - |
| Rise | ⊙ | ⊙ |
| Open Channel | | |
| Residential Area | | |