Climate Resilient Water Safety Plan

Faridpur Pourashava Water Supply System

December 2015

Department of Public Health Engineering
(DPHE)

UKaid
World Health Organization
Country Office for Bangladesh

Executive Summary

The Mayor of Faridpur Pourashava assembled a climate resilient water safety plan (WSP) team comprising professionals form different discipline in relation to environment, climate and water engineering in a council meeting dated 03/12/2015 consisting of 19 members. The team has been acting as a core functional unit for developing, implementing, managing, reviewing and updating the climate resilient WSP of the Pourashava pipeline water supply system aiming the health based targets. The team developed the climate resilient water safety plan by following the National Guidelines on Water Safety Framework (WSF) in Bangladesh and the Climate Resilient Water Safety Plans: Managing Risks Associated with Climate Variability and Change provided by, WHO considering the identified climatic and environmental hazards. The higher authority of Faridpur is committed to engage relevant staff of Council to implement "Climate Resilient Water Safety Plan" for Faridpur Pourashava, and to provide continuous support. The climate resilient water safety plan includes structure of the climate resilient water safety plan team, description of Faridpur Pourashava water supply system, hazardous events risk analysis, improvement action plan, operational monitoring and corrective actions, verification, management and communication, supporting programmes and WSP review procedure.

Table of Contents

List of Tables

List of Figures

Abbreviations

CC	Climate Change
WSP	Water Safety Plan
PWSS	Pipeline Water Supply System
WSS	Water Supply Sanitation
DPHE	Department of Public Health Engineering
OHT	Overhead Tank

Chapter I: Climate Resilient WSP Team

1.1 Commitment of Higher Authority

The higher authority of Faridpur is committed to engage relevant staff of Council to implement "Climate Resilient Water Safety Plan" for Faridpur Pourashava, and to provide continuous support. In this regards, a statement of such commitment has been duly signed by the top authority and circulated as a separate declaration. The statement will also be included in the citizen charter of the Pourashava. The declaration is attached with this report as Annex-1.

1.2 Faridpur Climate Resilient WSP Team

The Mayor of Faridpur Pourashava assembled a water safety plan (WSP) team in a council meeting dated 03/12/2012-15 the consisting of 15 members. The team will act as a core functional unit for developing, implementing, managing, reviewing and updating the climate resilient WSP of the Pourashava pipeline water supply system aiming the health based targets. The issue of water safety is related with different factors hence the team comprises professionals and officials from different discipline. This will significantly contribute to the water safety and subsequent health safety. The list of the members of the WSP team is presented in Table 1.

Table 1: List of members of Faridpur Pourashava WSP team

No.	Name	Affiliation /Job Title	Role in WSP team	Contact Information (Phone no.)
1	Seikh Mahatab Ali Methu	Mayor, Faridpur Pourashava	Adviser, L-WSP Team	01911 303227
2	Md. Kausar Ali Mollah	Executive Engineer, Faridpur Pourashava	Chairman L-WSP Team	01711 938000
3	Fahim Hasan Siraji	Executive Engineer, DPHE	Member L-WSP Team	01815 779270
4	Akbor Ali Mollah	Estimator (SAE), DPHE	Member L-WSP Team	01712 901521
5	Mahmud Pial	Journalist, The Daily Fateyabad	Member L-WSP Team	01711 013495
6	Shamsul Bari Sanu	TLCC	Member L-WSP Team	01670 245922
7	Md. Shafiqul Islam	Assistant Engineer	Member L-WSP Team	01760 247575
8	Md. Nuruzzaman	Slum Development Officer	Member L-WSP Team	01716 425475
9	Md. Monwar Hossain	Sanitary Inspector	Member L-WSP Team	01190 935972
10	Trishna Saha	Councillor	Member L-WSP Team	01712 285418
11	A.R Chowdhury (Sabul)	Councillor 2 No Ward	Member L-WSP Team	01711 123769
12	G.R. Bhuyan (Ratan)	Advocate	Member L-WSP Team	01711 159227
13	Md. Lutfar Rahman	Conservancyy Inspector	Member L-WSP Team	01190 935776
15	Md. Zahidul Islam	Supervisor (Water), Pourashava	Member L-WSP Team	01711 314358
15	Mostafa Iqbal Hossain	Superintendent (Water Sec.) Pourashava	Member Secretary	01728 252114

1.3 Objective of Climate Resilient WSP Team

The objective of the team is to ensure the supply of safe water from source to the consumer through implementation of climate resilient WSP in Faridpur municipality. The specific objectives are:

- Periodically review, revise and implementation of climate resilient water safety plan taking into account of present and future climate risks
- WASH related incidence management during climatic events.

1.4 Roles and Responsibilities of the Climate Resilient WSP Team

This section will help to identify the roles and responsibilities of each of the team members in the team. It will also help to identify the necessary tasks associated for sound planning and implementation of climate resilient WSP in time. The general roles and responsibilities of the team are presented on the following and specific roles and responsibilities are presented in Table 2.

1. Participate in development of CC resilient WSP each year
2. Assess for resource requirement and submit proposal to mayor
3. Encourage all consumers to pay water bill regularly
4. Facilitate awareness rising programmes among consumers on the importance of "safe water" and "safe use of water" under the climate change and its variability threats
5. Monitoring of supplied water quality at consumer level
6. Regularly (e.g. quarterly) check of operational monitoring works
7. Regularly check the progress on improvement plan
8. Regularly check the WSP application and its functional integrity in different steps
9. Prepare and check annual report on CC resilient WSP and and its impact on water supply system
10. Follow and implement the guidance and decisions taken by CC resilient WSP team in meetings
11. Monitor the actions taken by water supply authority of the Pourashava on implementation of the CC resilient WSP
12. Increase number of water connections by campaigning

Table 2: Roles and responsibilities of members of the CC resilient WSP team

Team Members	Roles & Responsibility
Chairman	• Chair the regularly the CC resilient WSP meeting • Sign letters and documents relevant to CC resilient WSP implementation • Provide necessary guidance and recommendations for the implementation of different decisions in relation to the CC resilient WSP • Take required steps to ensure financial support for the implementation of the CC resilient WSP • Distribute the responsibilities among the team members and supervise their progress • Ensure the review of the CC resilient WSP document by adviser of WSP team
Adviser	• Participate regularly in CC resilient WSP meetings and approve the decisions taken in CC resilient WSP meeting and take steps for implementation of decisions • Verify and monitor the CC resilient WSP implementation in each step • Ensure systematic implementation of CC resilient WSP for ensuring water safety from source

Team Members	Roles & Responsibility
	to consumer • Take necessary steps to provide resources including financial resources for implementation of activities • Arrange at least one program annually for raising awareness among people • Prepare CC resilient WSP plan each year for WSS • Provide uniforms and safety gears for WSS staff
Member Secretary	• Maintain communication with CC resilient WSP team Adviser & WSP Team members, and share the relevant information • Keep record of all CC resilient WSP documents, meeting minutes, training events, plans etc • Check the CC resilient WSP monitoring log books regularly • Monitor quality of supplied water at regular interval • Verification of CC resilient WSP implementation through sanitary inspection • Develop emergency plans and prepare PWSS staff for emergency situations • Take necessary steps to review and update WSP each year
Member	• Carry out the tasks related to WSP as assigned by the Chairman and Adviser • Communicate regularly with all relevant stakeholders and the surveillance committee • Conduct annual review of environmental, climatic, hydro-geological status of the district as well as the Pourashava and store the relevant information • Assist staff to collect data related to user satisfaction • Help PWSS to take necessary steps during emergency conditions • Provide necessary support to to ensure a successful implementation of CC resilient WSP • Participate all implementation WSP meetings, training and review workshops

1.5 Engagement of Stakeholders

The consumers of the water supply system of Fardipur Pourashava will take necessary actions for keeping the supplied water safe by following the standard method collection, transportation and storage and safe consumption. The Pourashava water sections will take all necessary actions to ensure the availability and safety of water to its consumers by implementing different activities, reviewing and upgrading the climate resilient water safety plan. The DPHE professionals will play advisory roles to provide all sorts of technical supports to implement climate resilient water safety plan. In addition, the Executive Engineer, DPHE, Faridpur, will coordinate participation of different stakeholders and national surveillance committee to implement the climate resilient water safety plan for the Faridpur Pourashava Water Supply System.

Chapter II: Description of Faridpur Pourashava Water Supply System

2.1 Description Water Supply System

The Faridpur Pourashava water supply section was established in 1969. The Pourashava pipeline water supply system has 14 ground water based production well of which 11 has been functioning. The functional production tube wells are at shallow depth and has been pumping the ground water into two water treatment plants one is located in *Goalchamot* and another is in *Jhiltuli*. In the treatment plants the pumped water is processed through different physical and chemical unit. The processed water is lifted to an overhead tank. Water was then distributed to users in different wards of the Pourashava through pipeline. The total length of the pipeline is 129 km. The total number of user connection of the water supply system is 8522. A total of 50% of the holdings in the Pourashava area are covered by the water supply system and the users were spreading over 9 wards of the Pourashava. The remaining holdings have been using shallow hand pump well and occasionally dug well and rain water for drinking water.
The detail of background information of the system is presented in Table 3.

Table 3: Different information of the Faridpur Pourashava pipeline water supply system

<table>
<tr><th>Step</th><th colspan="11">Description</th></tr>
<tr><td rowspan="5">Source of Water</td><td colspan="8">Current source</td><td colspan="3">Ground water</td></tr>
<tr><td colspan="8">Total No of production well (PW)</td><td colspan="3">14 nos.</td></tr>
<tr><td colspan="8">Working condition of the production well (PW) at present</td><td colspan="3">Active = 9; Inactive = 5, Under construction = 3</td></tr>
<tr><td colspan="8">Average depth</td><td colspan="3">368 ft</td></tr>
<tr><td colspan="8">Abstraction process</td><td colspan="3">Turbine pump = 1
Submersible pump = 8</td></tr>
<tr><td rowspan="7">Source Water Quality (ground water)</td><td>Parameter</td><td>Pump 1</td><td>Pump 2</td><td>Pump 3</td><td>Pump 4</td><td>Pump 5</td><td>Pump 6</td><td>Pump 7</td><td>Pump 8</td><td>Pump 9</td><td colspan="3" rowspan="7"></td></tr>
<tr><td>Arsenic</td><td colspan="9" rowspan="6">Water quality testing was done at field. Findings are presented in Table 4 and 5. The instrument used: HACH DR 2800 spectrophotometer (water quality testing lab, Wegtech digital arsenator and Millipore fecal coliform testing kit</td></tr>
<tr><td>Manganese</td></tr>
<tr><td>Iron</td></tr>
<tr><td>Nitrate</td></tr>
<tr><td>Total Coliform</td></tr>
<tr><td>Fecal Coliform</td></tr>
<tr><td>Water Treatment Process</td><td colspan="11">2 Iron Removal Plant</td></tr>
<tr><td>Water Supply System (existing)</td><td colspan="11">The groundwater is abstracted from 9 production wells and transferred into two iron removal plant located in two area (Jhiltuli and Goalchamot) followed by chlorination and reserved into the underground reservoir. The reservoir water is then lifted into an over head tank and from their distributed to the user through piped network.</td></tr>
<tr><td rowspan="3">Reservoir</td><td colspan="4">Reservoir type</td><td colspan="3">Total no</td><td colspan="2">Usable no</td><td colspan="2">Capacity (gallon)</td></tr>
<tr><td colspan="4">Underground reservoir</td><td colspan="3">1</td><td colspan="2">1</td><td colspan="2">150,000</td></tr>
<tr><td colspan="4">Overhead Tank (OHT)</td><td colspan="3">2</td><td colspan="2">2</td><td colspan="2">150,000</td></tr>
<tr><td>Distribution Line</td><td colspan="11">Length of distribution line:129 Km</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="6">Description</th></tr>
<tr><td></td><td colspan="6">Size (Diameter) : 3” to 12”
Total Sluice Valve : 187 Active sluice valve : 65
Total wash out : 36 Active wash out : 0</td></tr>
<tr><td>Distribution time</td><td colspan="6">Average 5.5 hours / day</td></tr>
<tr><td>Water supply connection</td><td colspan="6">Total Connection : 8522
Residential connection : 7425 Nos
Commercial connection : 1097 Nos
Street Water Stand post : 50 Nos</td></tr>
<tr><td>Intended consumer</td><td colspan="6">Residential user : Citizens of Haripur Pourashava
Commercial user : Consumers of hotel & restaurant, people working at office, hospitals and institutions etc.</td></tr>
<tr><td>Intended use</td><td colspan="6">The distributed water is used for drinking, cooking, household washing, bathing and personal hygiene purposes.</td></tr>
<tr><td rowspan="9">Distributed Water Quality</td><td>Parameter</td><td>Unit</td><td>Target (standard)</td><td>HH-1</td><td>HH-2</td><td>HH-3</td></tr>
<tr><td>Fecal coliform</td><td>CFU /100 ml</td><td>0</td><td colspan="3" rowspan="6">Standard: Health Based Target of government (HBT – WSF 2011). A total of 27 household’s storage water samples (3 from each ward) were tested for the parameters mentioned below. Details are provided in Table 3 and 4</td></tr>
<tr><td>Total coliform</td><td>CFU /100 ml</td><td>0</td></tr>
<tr><td>Arsenic</td><td>mg/l</td><td>0.05</td></tr>
<tr><td>Iron</td><td>mg/l</td><td>1.00</td></tr>
<tr><td>Manganese</td><td>mg/l</td><td>0.40</td></tr>
<tr><td>Nitrate</td><td>mg/l</td><td>10</td></tr>
<tr><td colspan="6">Aesthetic requirements
Colour: Clear Taste: Good Odour: Odourless</td></tr>
<tr><td rowspan="4">Sanitary Inspection Score</td><td colspan="6">Reference to the Sanitary Inspection 2015, conducted by DPHE district Office, under the CC resilient WSP implementation program, the risk scores of different steps of water supply system are shown below.</td></tr>
<tr><td>Steps</td><td>Risk Score</td><td>Steps</td><td colspan="3">Risk Score</td></tr>
<tr><td>Production Well</td><td>High</td><td>Overhead Tank</td><td colspan="3">Medium</td></tr>
<tr><td>Pump House</td><td>Medium</td><td>Distribution line</td><td colspan="3">High</td></tr>
<tr><td>Any special controls required?</td><td colspan="6">Treatment and chlorination process for the water supply system.</td></tr>
</table>

NB: The entire water quality test was conducted in September 2015 shown in Table 9, 10 and 11

Table 4: The water quality testing results of the source water

No	Location	Area/ Depth (ft)	Colour	Odour	pH	ORP (mV)	Conductivity (ms/cm)	Turbidity (NTU)	EC 100 ml	OC 100 ml	TC 100 ml	As (µg/l)	Fe (mg/l)	Mn (mg/l)	Nitrate (mg/l)
1	Goalchamot 1 (Infront of Gate)	380	Reddish	Fishy Smell (Iron)	7.50	150.1	1462	57.6	30	280	310	170	6.8	0.4	0
2	Goalchamot 2 (Near Salim's House)	300	Reddish	Fishy Smell (Iron)	7.09	155.4	1693	64.3	25	37	62	235	8.9	0.3	0
3	Goalchamot 3 (Near Bishorjan Ghat)	290	Reddish	Fishy Smell (Iron)	7.42	148.4	1040	82.4	31	192	223	225	14.6	0.3	0
4	Goalchamot 4 (Near Bus Stand)	300	Reddish	Fishy Smell (Iron)	7.18	168.7	1091	136.0	TNTC	TNTC	TNTC	135	11.6	0.9	0
5	Jhiltuli 1 (Road Side)	290	Light Reddish	Fishy Smell (Iron)	7.24	53.9	1035	69.6	36	80	116	110	6.3	0	0
6	Jhiltuli 2 (Near Moshiur's)	290	Light Reddish	Fishy Smell (Iron)	7.44	102.3	1019	67.0	112	204	316	111	4.1	0	0
7	Jhiltuli 3 (Near Anis's House)	295	Light Reddish	Fishy Smell (Iron)	7.34	20.6	852	81.5	12	35	47	105	3.2	0.3	0
8	Jhiltuli 4 (Behind Filter House)	290	Light Reddish	Fishy Smell (Iron)	7.26	58.8	894	69.2	54	43	97	245	2.6	0.3	0
9	Jhiltuli 5 (Near Mizan's House)	300	Light Reddish	Fishy Smell (Iron)	7.16	22.4	440	58.8	53	47	100	103	2.45	0.4	0

Table 5: The water quality testing results of the source water at point of entry to the household's connection

No	Name of the User	Ward	E Coli 100 ml	OC 100 ml	Microbial Risk (based on E. Coli)	Colour	Odour	pH	ORP (mV)	Conductivity (ms/cm)	Turbidity (NTU)	As (mg/l)	Fe (mg/l)	Mn (mg/l)	Nitrate (mg/l)
1	Shohag	Ward 5	0	TNTC	Low	Clear	Odourless	7.55	117.9	944	4.15	0.074	0.35	0.3	3.5
2	Rokeys Begum	Ward 8	TNTC	TNTC	Very High							0.04			
3	Fatema Begum	Ward 9	38	480	High							0.018			
4	Dilip Kumar	Ward 2	12	120	High							0.014			
5	Munin Karmakar	Ward 1	5	120	Intermediate	Clear	Odourless	7.86	123.6	443	8.13		0.85		2
6	Laksman	Ward 3	9	400	Intermediate							0.029			
7	Krishno Dey	Ward 4	4	264	Intermediate							0.041			
8	Gopal Raoy	Ward 7	38	160	High							0.057			
9	Alamgir Bhuyan	Ward 6	0	200	Low							0.066			

Table 6: Microbiological water quality testing results of the household's storage water

No	Name of the User	Ward No	E Coli 100 ml	OC 100 ml	Microbial Risk (based on E. Coli)
1	Sekender Ali	Ward 5	TNTC	TNTC	Very High
2	Rahman Arif	Ward 5	88	TNTC	High
3	Afzal Hossain	Ward 5	40	320	High
4	Nazma Begum	Ward 8	TNTC	TNTC	Very High
5	A Rahman Mian	Ward 8	TNTC	TNTC	Very High
6	Dilip Haldar	Ward 8	TNTC	TNTC	Very High
7	Rakib Hasan Dipu	Ward 9	112	TNTC	Very High
8	Md. Ali Hossain	Ward 9	15	TNTC	High
9	Asaruzzaman	Ward 9	60	TNTC	High
10	Dilip Kumar	Ward 2	10	TNTC	Intermediate
11	Kartick	Ward 2	70	TNTC	High
12	Mihir Kumar	Ward 2	17	TNTC	High
13	Munin Karmakar	Ward 1	55	TNTC	High
14	Sukumar Saha	Ward 1	55	320	High
15	Narayan Malakar	Ward 1	38	TNTC	High
16	Laksman	Ward 3	TNTC	TNTC	Very High
17	Jamal Mia	Ward 3	TNTC	TNTC	Very High
18	A. Rahim	Ward 3	26	480	High
19	Rathindra Nath Gosh	Ward 4	15	TNTC	High
20	Hasina Begum	Ward 4	80	TNTC	High
21	Bimol Krishno Saha	Ward 4	TNTC	TNTC	Very High
22	Gopal Raoy	Ward 7	TNTC	TNTC	Very High
23	Seikh Salim	Ward 7	TNTC	TNTC	Very High
24	Golam Arefin Asad	Ward 7	TNTC	TNTC	Very High
25	Alamgir Bhuyan	Ward 6	TNTC	TNTC	Very High
26	AKM Aminul Haque	Ward 6	TNTC	TNTC	Very High
27		Ward 6	5	225	Intermediate

2.2 Flow Diagram of Water Supply System

The water supply process flow diagram is presented in Fig. 1

Fig. 1: Process flow diagram of the Faridpur Pourashava pipeline water supply system

Chapter III: Hazardous Events Risk Analysis

3.1 Hazards and Hazardous Events

Hazard is defined as any physical, chemical, biological and radiological agents that cause harms to public health. The hazardous events are those events which catalyse the hazardous agents and thus increase the degree of risk for disaster. Hazards could be natural or human induced or it could arise from the different hazard drivers e.g., environmental, climatic, physical or human induced or the system itself if poorly managed. In the water supply system hazardous events and subsequent hazardous agent resulted in deterioration of the of safe water security e.g., deterioration of the water quality, unavailability, non-functionality or inaccessibility.

The schematic diagram of the *Jhiltuli* treatment plant is presented in Fig. 2. The *Jhiltuli* treatment plant has some associated inherent risks. The production wells were at shallow depth. The backwash sludge of IRP containing high level of arsenic and iron are disposed off firstly, in a low lying area near the sedimentation unit of the treatment plant then it was transferred to pond/lagoon. A total of three production wells existed within the distance of 5-50ft distant from the lagoon. Settlements existed within the premises and there were septic tanks but those were not cleaned for a long time. In addition in the vicinity of the treatment plants ring slab latrines existed. When all the production well are in full operation then there is high chance of leaching of arsenic and fecal matter from the lagoon to the shallow aquifer due to the absence of any aquitard (impermeable layer).

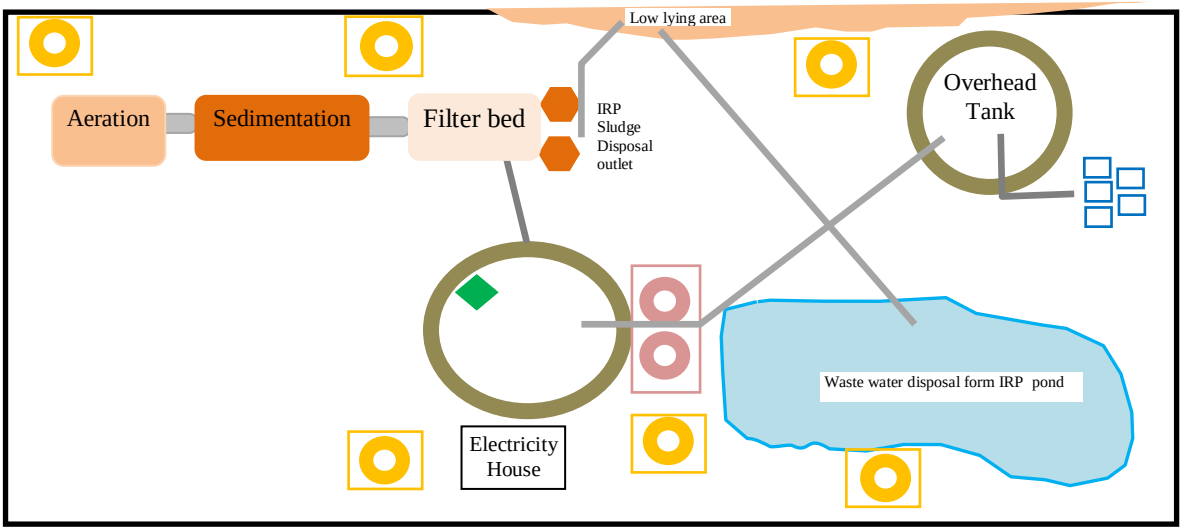

Fig. 2: Schematic flow diagram of the Jhiltuli treatment plant

The *Goal Chamot* treatment plan is located by the side of the river *Kumar* and like *Jhiltuli* treatment plant it has some inherent risks. There were four functional production wells within the range of 325-340ft. The high iron and arsenic bearing sludge generated from treatment plant and fecal sludge generated from the residences of workers of the treatment plant including the slums and household in the surrounding area

was disposed of into the river. In monsoon the water depth of the river becomes around 30-35 ft and most of the disposed sludge and fecal maters flows away in the down stream. But in summer time the water depth of the river becomes 3-4 ft and there is no river flow therefore all the disposed fecal mater and

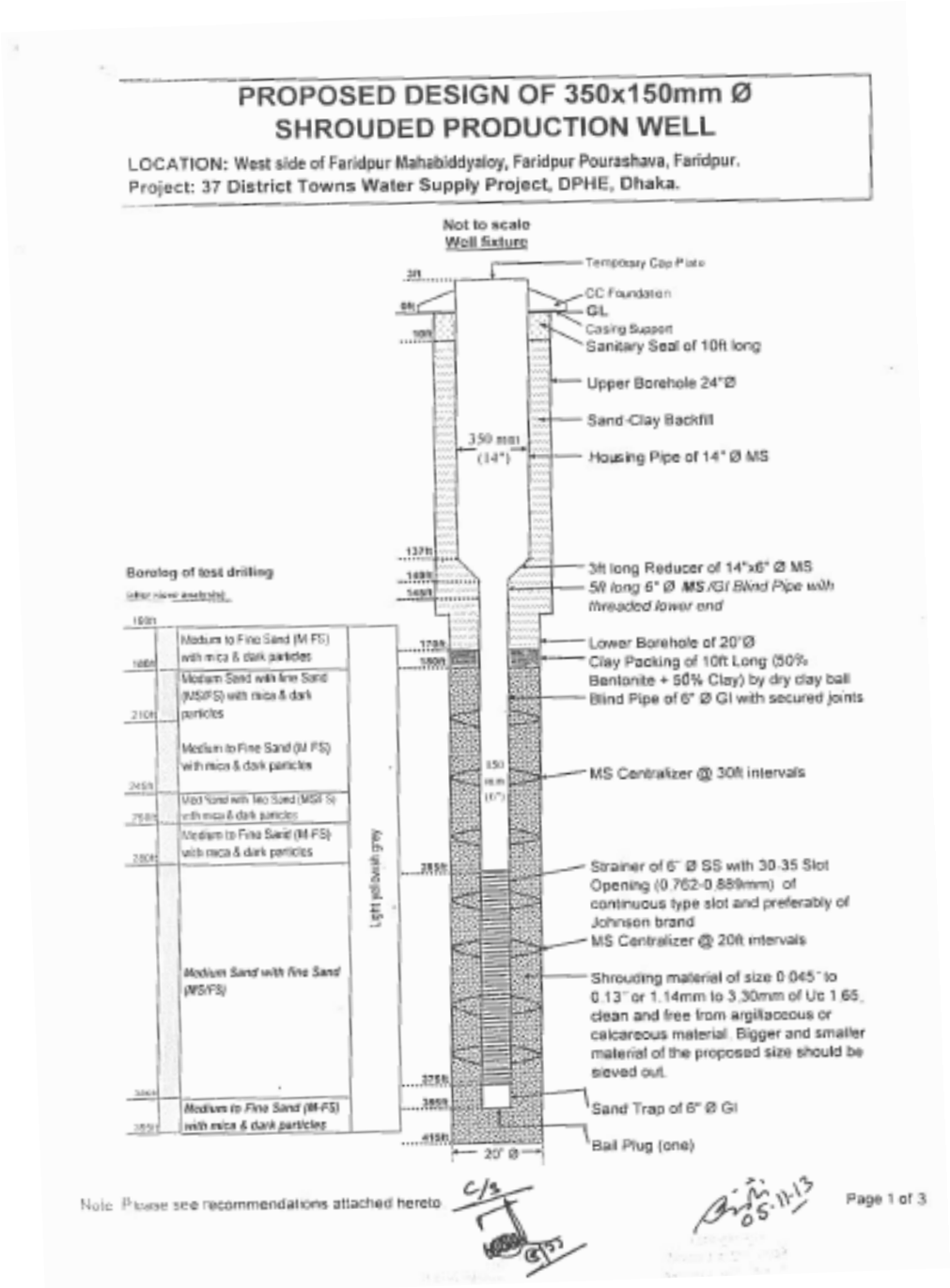

Fig. 3: The bore log of one of the production well *Jhiltuli*

sludge remained in the vicinity of the river within the range of 400-500 ft from the production well. The agricultural runoff in the river through drainage in the monsoon also increases the concentration of the pesticide and fertiliser residue in the river which becomes concentrated in summer. This situation leaves

all the production well to a vulnerable condition of leaching the fecal matter and the arsenic sludge into the shallow aquifer. It needs to be noted that the ground water recharge occurred maximum in the river aquifer interface. The schematic diagram of the treatment plant is presented in Fig. 6.

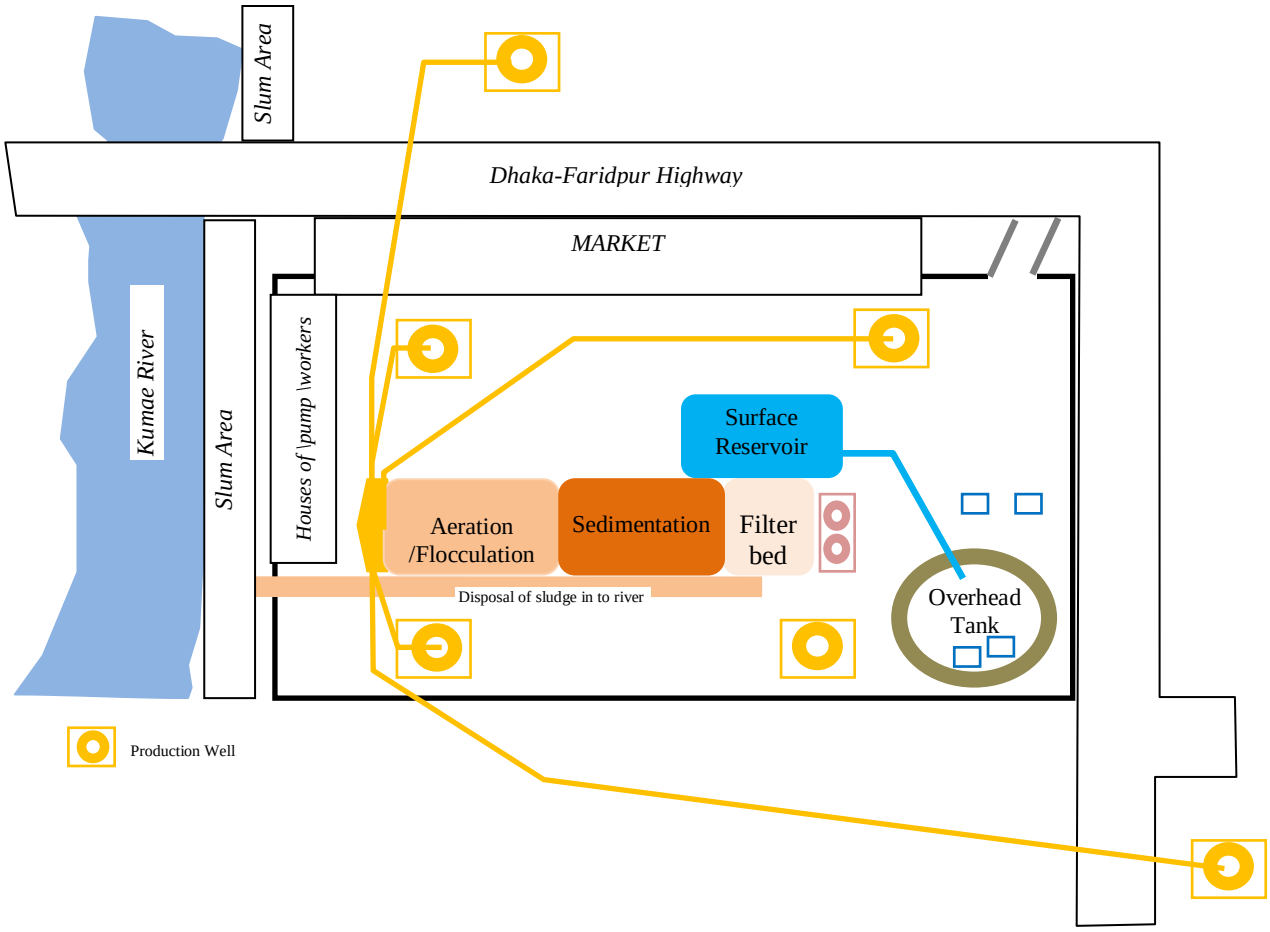

Fig. 4: Schematic flow diagram of the Goalchamot treatment plant

3.2 Identified Problems of Water Supply System

The problems identified during sanitary inspection and KAP survey are presented in Table 7.

Table 7: Identified problems of the Faridpur Pourashava pipeline water supply system

Step of Water Supply System	Present Problem
Source of Water	The quantity of water does not meet the demand in some parts of the supply system.
Catchments area	In *Jhiltuli* treatment plant the production wells are located within 5-40ft distant from the backwash sludge deposal pond. The backwash sludge of the IRPs contained high level of arsenic and. Soak well existed within the premises with septic tank (needs cleaning). Slab latrine of the Pourashava dwellers also

Step of Water Supply System	Present Problem
	existed surrounding the premises. The production wells are not sealed. Hence when all 4 productions are in operation arsenic and fecal matters enter into the system. In *Gaolchamot* treatment plant the backwash sludge deposed off in the Kumar river. The production wells are within 150-200ft distant from the river Kumar. Soak wells, ring slab latrine and slum exist surrounding the treatment plant. The catchments area is highly vulnerable to the arsenic and fecal contamination. The vulnerability will further exacerbated with the increase of temperature and erratic heavy rainfall and bad fecal sludge management.
Source Water Quality	Presence of arsenic, iron and fecal contamination in supply water with a variable degree (ground water).
Water Treatment Process	Drainage system of drain out water after washing out filter bed is poor. It causes flooding on the ground floor and causes inconvenience. There is no functional chlorination system in the treatment plant and the water is supplied without any disinfection.
Reservoir	Overhead and underground water reservoir tank has not been cleaned for a long time.
Distribution Line	Presence of garbage and stagnant waste water in the sluice valve chamber in different location including the treatment plant premises. Iron deposition inside the pipelines has reduced the effective diameter of pipelines. The wash-outs are in vulnerable condition due to lack of pressure, wash out cannot be performed properly.
Water supply connection	The area is low lying and erratic heavy rainfall inundated the user connection for number of days which allows the contaminated water to entry into the pipeline when there is no supply.
Distributed Water Quality	Presence of Arsenic, Fecal Contamination and nitrate in significant concentration.

3.3 Risk Assessment

The existing and anticipated hazards associated with the operation and maintenance, climate and environmental drivers were identified considered during the risk assessment process. The significant impacts of the hazards were evaluated considering the biological, chemical and physical quality of the water and the supply system. The identified biological, chemical and physical hazards in different processes of the water supply system were scored by utilizing the likelihood and severity matrix as presented in Table 8. The risks were determined by semi-quantitative risk matrix approach and categorized. The hazardous, hazardous events, risk associated at different steps of Faridpur water supply system is presented in Table 9. The risks are determined by using the following equation:

$$\text{Estimation of Risk Score} = \text{Likelihood} \times \text{Severity}$$

The steps of calculation of the risks are presented in the following:

- Step 1: Identification of the likelihood (L) of the occurrence

- Step 2: Evaluating the severity (S) of consequences if the hazard occurred
- Step 3: Estimating the risk score (R) by multiplying by the score of likelihood and severity
- Step 4: The risk were categorized as high (score >15), medium (score 6-14) and low score (<5)

Table 8: The likelihood and severity matrix of risk

Definition & score of "likelihood" & "severity

Likelihood		**Severity**	
Rank (Score)	Definition	Rank (Score)	Definition
Almost Certain (5)	Once per day	Catastrophic (5)	Potentially lethal to a large Population
Likely (4)	Once per week	Major (4)	Potentially lethal to a small Population
Possible (3)	Once per month	Moderate (3)	Potentially harmful to a large population but no mortality
Unlikely (2)	Once per year	Minor (2)	Potentially harmful to a small population but no mortality
Rare (1)	Once every five years	Insignificant (1)	Negligible impact in terms of severity of disease or numbers of people affected

Risk Score & Ranking

Severity and Likelihood Matrix		**Severity**				
		Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Likelihood	Almost certain (5)	**5**	**10**	**15**	**20**	**25**
	Likely (4)	**4**	**8**	**12**	**16**	**20**
	Possible (3)	**3**	**6**	**9**	**12**	**15**
	Unlikely (2)	**2**	**4**	**6**	**8**	**10**
	Rare (1)	**1**	**2**	**3**	**4**	**5**

Risk Rating		
Low (L ≤ 5)	**Medium (M 06-14)**	**High (H ≥ 14)**

3.4 Determination and Validation of Control Measures

Control measures are the preventive approach comprising a number of actions that will reduce the existing and anticipated risk and will ensure the water security and consistently meets the water quality targets thus reduce the health risk. Therefore, the Pourashava water supply authority has incorporated some control measures for ensuring the water security and safety since its installation. These control measure were visited to find out their status and effectiveness. It was done through different techniques namely analyzing the historical records, intensive operational monitoring, scientific literature and finally through observation. The findings are presented in Table 9 and also in operational monitoring section in Chapter V. The operational monitoring will also provide sufficient information whether further validation is required or not required.

3.5 Reassessment and Prioritization of Risk and New Operational Control

The general approach is that if the and existing control measure is found to be ineffective or not sufficient for long time, then the risk will be reassessed in terms of likelihood and consequences. Therefore all risks were again reassessed by considering new operational control system and categorized according to the risk score. The lower priority risks will be minimized as part of routine good practice activities and the higher priority risks will be minimized by updated new operational control or system modification (improvement action plan). The prioritization of risk with existing control is presented in Table 9.

Table 9: Hazardous events, control measures risk associated at different steps of Faridpur Pourashava water supply system

Step	Hazard Ref No	Hazardous Event	Hazard type	Risk (without control) L = likelihood S = severity R = risk score	Risk with climate factors L = likelihood S = severity R = risk score	Existing Control Measures/ preventive action/ barriers (Ref. for OM plan in Chapter 5, Table 11)	Is the existing control measure effective? Y = yes, N = no U = uncertain N/A: Not applicable	Risk with existing control L = likelihood S = severity R = risk score	Required Corrective Action (Ref. for OM plan in Chapter 5 Table No 11)	Risk after Corrective Actions L = likelihood S = severity R = risk score	Improvement Action Plan Ref. (Ch. 4 Table 9)
S	**3.1.1**	Scarcity of water in source (groundwater) due to water table depletion of water table in dry season.	Physical	L: 2 S: 4 R: 8 **(Medium)**	L: 3 S: 5 R: 15 **(High)**	No control measure	N/A	L: 3 S: 5 R: 15 **(High)**	Prevent installation of irrigation pump and household tube well in and around the catchment area	L: 2 S: 4 R: 8 **(Medium)**	Explore the deep aquifer by suing Rigs
S	**3.1.2**	Arsenic contamination of/in supplied water over Bangladesh standard due to high arsenic content in production well's water because of small/less capacity of iron removal plant to remove high arsenic	Chemical	L: 5 S: 4 R: 20 (High)		No control measure	N/A	L: 5 S: 4 R: 20 **(High)**	Aware people for collecting drinking water from other safe water sources	L: 1 S: 3 R: 3 **(Low)**	Design and install a large arsenic iron removal plant
S	**3.1.3**	High iron content of/in supplied water due to high iron content in production well's water because of irregular maintenance of IRP	Chemical	L: 5 S: 2 R: 10 (Medium)		Iron Removal Plant (IRP)	Y	L: 2 S: 2 R: 4 **(Low)**	N/A		N/A
S	**3.1.4**	High E. Coli contamination at shallow aquifer water due to presence of soak pit because of improper distance between the production well and soak pit (<10m) Temperature increase will increase the E. Coli concentration then the normal because of more favourable condition	Biological	L: 3 S: 5 R: 15 **(High)**	L: 4 S: 5 R: 20 **(High)**	No control measure	N/A	L: 4 S: 5 R: 20 **(High)**	Removing soak pit latrine from the 10 m distance of production tube wells Regularize the chlorination in the water supply system	L: 1 S: 5 R: 5 **(Low)**	**N/A**
PTW	**3.2.1**	Fecal contamination of groundwater at source (PTW) due to ineffective sanitary seal because of unsealing of production well in pump house	Physical, Biological	L: 3 S: 5 R: 15 **(High)**		Sanitary seal does not exists	N/A	L: 2 S: 5 R: 10 **(Medium)**	Repair all sanitary seals	L: 1 S: 5 R: 5 **(Low)**	N/A
PTW	**3.2.2**	Microbiological contamination of groundwater at source (PTW) due to ineffective non-return valve because of back flow of water into aquifer	Biological	L: 2 S: 5 R: 10 (Medium)		Non return valve existed	Y	L: 1 S: 5 R: 5 (Low)	N/A	N/A	N/A
WTP	**3.3.1**	Microbiological contamination of water at treatment plant due to ingression of birds/insects because of absence of bird net around the treatment plant	Physical, Biological	L: 3 S: 5 R: 15 (High)		No control measure	N/A	L: 3 S: 5 R: 15 (High)	Regular cleaning of the filter bed	L: 1 S: 5 R: 5 **(Low)**	Install a bird net around the treatment plant
WTP	**3.3.2**	Chemical contamination of water in aeration unit due to improper/ irregular cleaning	Chemical	L: 3 S: 5 R: 15 (High)		No control measure	N/A	L: 3 S: 5 R: 15 (High)	Aeration chamber must be cleaned after every three month	L: 1 S: 5 R: 5 (Low)	N/A
WTP	**3.3.3**	Biological contamination of water in sedimentation chamber of treatment plant due to growth of plants/ algae on the walls because of irregular cleaning	Biological	L: 4 S: 4 R: 16 (High)		No control measure	N/A	L: 4 S: 4 R: 16 (High)	Sedimentation tank must be cleaned every month	L: 1 S: 4 R: 4 (Low)	N/A
WTP	**3.3.4**	Biological contamination of water in clear water reservoir of treatment plant due to growth of plants/ algae on the walls because of irregular cleaning	Biological	L: 4 S: 4 R: 16 (High)		No control measure	N/A	L: 4 S: 4 R: 16 (High)	Clear water reservoir must be cleaned in every three month	L: 1 S: 4 R: 4 (Low)	N/A

Step	Hazard Ref No	Hazardous Event	Hazard type	Risk (without control) L = likelihood S = severity R = risk score	Risk with climate factors L = likelihood S = severity R = risk score	Existing Control Measures/ preventive action/ barriers (Ref. for OM plan in Chapter 5, Table 11)	Is the existing control measure effective? Y = yes, N = no U = uncertain N/A: Not applicable	Risk with existing control L = likelihood S = severity R = risk score	Required Corrective Action (Ref. for OM plan in Chapter 5 Table No 11)	Risk after Corrective Actions L = likelihood S = severity R = risk score	Improvement Action Plan Ref. (Ch. 4 Table 9)
WTP	**3.3.5**	Biological contamination of water in overhead water tank of treatment plant due to growth of plants/ algae on the walls because of irregular cleaning	Biological	L: 4 S: 4 R: 16 (High)		No control measure	N	L: 4 S: 4 R: 16 (High)	Overhead water tank must be cleaned after every three month	L: 1 S: 4 R: 4 (Low)	N/A
WTP	**3.3.6**	Biological contamination of water at sluice valve chamber in the treatment plant area due to intrusion of contaminated water because of leakage in gland packing.	Biological	L: 4 S: 4 R: 16 (High)		Repair of gland packing if leakage is observed	N	L: 4 S: 4 R: 16 (High)	Check gland packing of sluice valves at a regular interval and ensuring the filling of sluice valve chamber with sand	L: 1 S: 4 R: 4 (Low)	N/A
DL	**3.4.1**	Fecal contamination in supply water increased then the normal in distribution line due to increase of temperature because of improper chlorination of water before distribution	Biological	L: 4 S: 4 R: 16 (High)	L: 5 S: 4 R: 20 (High)	One manual chlorinator	U	L: 5 S: 4 R: 20 (Medium)	Regular dose adjustment and maintenance of the chlorinator	L: 1 S: 4 R: 4 (Low)	N/A
DL	**3.4.2**	High contamination of pipe line water and inadequate supply to consumer then the normal during increase of temperature due to inadequate washing because of non-functional and lost washouts	Physical Chemical Biological	L: 5 S: 5 R: 25 (Hight)	L: 5 S: 5 R: 25 (High)	No	N/A	L: 5 S: 5 R: 25 (High)	Locate the existing wash out and inspect whether it is repairable then fix it	L: 2 S: 5 R: 10 (Medium)	Ensure necessary measure for rising enough pressure by cleaning of the pipeline
DL	**3.4.3**	Contamination of water at sluice valve chamber due to intrusion of contaminants through the leakage in gland packing because of erratic rainfall, flooding, and water stagnation	Biological	L: 4 S: 4 R: 16 (High)	L: 4 S: 5 R: 20 (High)	No	N/A	L: 4 S: 5 R: 20(High)	Cleaning of sluice valve chamber at a regular basis	L: 2 S: 4 R: 8 (Medium)	Repair the sluice valve chamber with cover and fill up the sluice valve chamber with sand
DL	**3.4.4**	Scarcity of water due to reduction in pipe diameter because of deposition of iron layer formation inside the pipe	Physical	L: 3 S: 2 R: 6 (Medium)		Wash out is being performed once in 3 months.	U	L: 3 S: 2 R: 6 (Medium)	Washing need to be performed every month	L: 1 S: 2 R: 2 (Low)	N/A
DL	**3.4.5**	Agrochemical and fecal contamination of pipeline water during erratic and heavy rainfall due to leakages in pipeline in low lying area of the Pourashava because of using low grade pipes and irregular repair	Biological Chemical	L: 4 S: 4 R: 16 (High)	L: 4 S: 5 R: 20 (High)	Regular repair	Y	L: 3 S: 4 R: 12 (Medium)	The quality of material used for repairing the distribution network need to be ensured	L: 1 S: 4 R: 4 (Low)	N/A
HH/C C	**3.5.1**	Microbiological contamination in water at house cinnection pipe in low lysing areas due to leakages in joint because of use of improper material (*sandal in stead of rubber gascate)*	Microbial	L: 3 S: 5 R: 15 (High)	L: 4 S: 5 R: 20 (High)	No control measure	N/A	L: 4 S: 5 R: 20 (High)	Use rubber gasket by expert pipe mechanics during providing house connection	L: 1 S: 5 R: 5 (Low)	Provide rubber gasket
HH/C C	**3.5.2**	Contamination of water at house connection pipe due to leakage because of using heat and iron rod instead of pipe driller during providing house connection	Physical, Microbial	L: 3 S: 5 R: 15 (High)		No control measure	N/A	L: 3 S: 5 R: 15 (High)	Use drilling machine by expert pipe mechanics during providing house connection	L: 1 S: 5 R: 5 (Low)	Provide drilling machine

Step	Hazard Ref No	Hazardous Event	Hazard type	Risk (without control) L = likelihood S = severity R = risk score	Risk with climate factors L = likelihood S = severity R = risk score	Existing Control Measures/ preventive action/ barriers (Ref. for OM plan in Chapter 5, Table 11)	Is the existing control measure effective? Y = yes, N = no U = uncertain N/A: Not applicable	Risk with existing control L = likelihood S = severity R = risk score	Required Corrective Action (Ref. for OM plan in Chapter 5 Table No 11)	Risk after Corrective Actions L = likelihood S = severity R = risk score	Improvement Action Plan Ref. (Ch. 4 Table 9)
HH/C C	**3.5.3**	Increased biological contamination of water during Pre monsoon (increased temperature) due to leakage in house connection pipe because the pipeline is exposed to waste water drain	Physical, Microbial	L: 3 S: 5 R: 15 (High)	L: 4 S: 5 R: 20 (High)	No control measure	N/A	L: 4 S: 5 R: 20 (Medium)	Use pipe casing if pipe line goes through drain, and raise pipe line above drain height	L: 2 S: 5 R: `10 (Medium)	N/A
HH/C C	**3.5.4**	Increased of biological contamination in water at the time of collection due to unhygienic condition of tap and platform during erratic rainfall, water stagnation because of irregular cleaning and maintenance.	Physical, Microbial	L: 2 S: 5 R: 10 (Medium)	L: 4 S: 5 R: 20 (High)	PWSS staff encourages consumers to maintain hygiene by cleaning the tap and platform	U	L: 2 S: 5 R: 10 (Medium)	PWSS staff, through Mayor notice, will direct all consumers to maintain hygiene and construct platform at collection point	L: 1 S: 5 R: 5 (Low)	N/A
HH/C C	**3.5.5**	Increased of biological contamination in user's underground tank water at households due to intrusion of surface runoff from surrounding areas because of erratic rainfall, water stagnation and flooding	Physical, Microbial	L: 2 S: 5 R: 10 (Medium)	L: 3 S: 5 R: 15 (High)	Consumers try to protect their underground tanks from surface runoff using temporary barriers/ embankments	U	L: 2 S: 5 R: 10 (Medium)	PWSS staff, through Mayor notice, will direct all consumers to raise height of the lead of the underground tank above the ground/flood level	L: 1 S: 5 R: 5 (Low)	N/A
HH/C C	**3.5.6**	Contamination of water in consumer's underground tank and OHT due to absence of lid cover because of user's negligence	Physical, Microbial	L: 2 S: 5 R: 10 (Medium)		Consumers try to protect their underground tanks/ OHT by using covers	U	L: 2 S: 5 R: 10 (Medium)	PWSS staff, through Mayor notice, will direct all consumers to use appropriate lid on tanks	L: 1 S: 5 R: 5 (Low)	N/A
HH/C C	**3.5.7**	Wastage of water from the users over head tank (OHT) due to overflow because of over pumping of water from the underground water reservoir	Physical	L: 5 S: 1 R: 5 (Low)		Consumers try to avoid such incidences.	U	L: 4 S: 1 R: 4 (Low)	PWSS staff, through Mayor notice, will direct all consumers to prevent over flow from OHT	L: 1 S: 1 R: 1 (Low)	N/A
HH/C C	**3.5.8**	Contamination of water by users due to unhygienic collection and storage of water in households because of lack of knowledge	Physical, Microbial	L: 3 S: 5 R: 15 (High)		Few consumers are aware and try to avoid such practices.	U	L: 3 S: 5 R: 15 (High)	PWSS staff, through Mayor notice, will demonstrate consumers how to collect/store water	L: 1 S: 5 R: 5 (Low)	N/A
HH/C C	**3.5.9**	Unavailability of water at households during supply hour due to use of illegal suction pumps by some other users because of low water flow in the supply line against demand	Physical	L: 3 S: 3 R: 9 (Medium)		Users have been warned to not use these pumps and some connections need to be cut	U	L: 2 S: 5 R: 10 (Medium)	PWSS staff, through Mayor notice, has to take strict actions against these illegal pumps	L: 1 S: 5 R: 5 (Low)	N/A

S = Source PTW = Production Tube Well and pump house WTP = Water Treatment Plant DL = Distribution Line HH/C C = Household/Commercial Connection

Chapter IV: Improvement Action Plan

There was a need for the improvement of the operational practices among the professionals and workers of the Pourashava water supply system for reducing the present and anticipated risk considering the hazards and hazardous events. Some of the identified hazardous events required new control measures or improvement of the existing control measures considering the health based targets. Hence the action plan contains two fold of actions namely operational monitoring for good practices and improvement plan. The

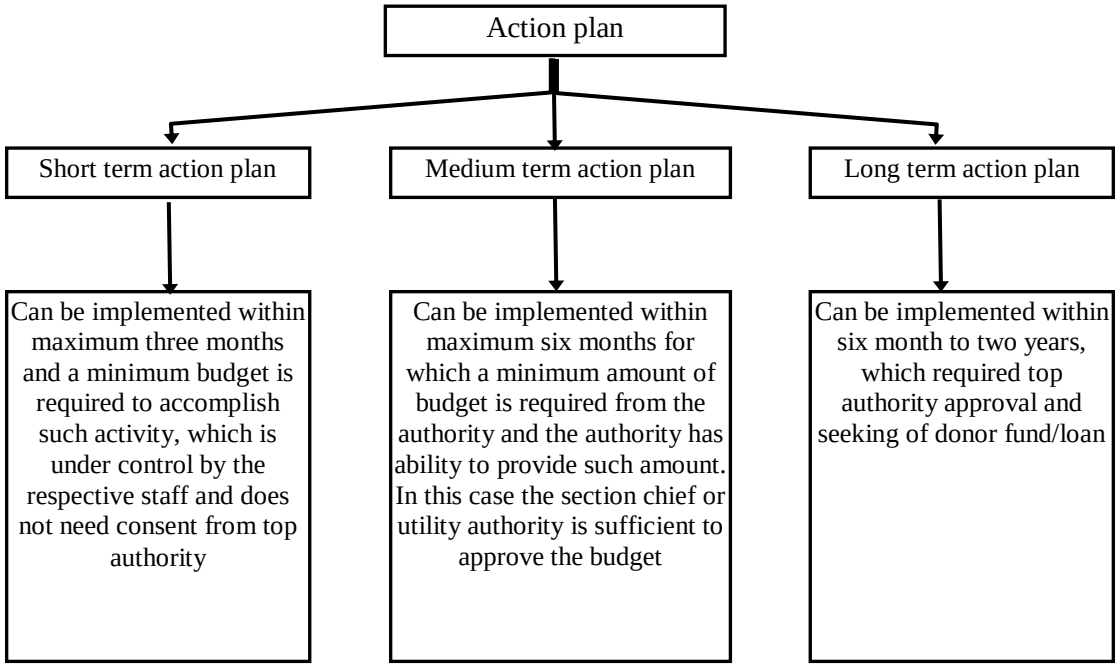

Fig. 5: Different types of action plan

plan of operational monitoring is presented in Chapter V Table 12 and the improvement plan is presented in Table 12. The plans are categorized into three categories namely short term, medium and long term (Fig. 7). Successful implementation of this action plan will ensure the utility to provide safe water to the consumer considering the health based targets. Every high or unacceptable re-assessed risk needs some action to reduce the risk to an acceptable level, assuming that the improvements are effective. Based on the proposed new control measure or improvement opportunity, the timeline for implementing the improvement action plan is presented in Table 15.

Table 10: Improvement action plan of Faridpur Pourashava water supply system

Step	Hazardous Event Reference	Activities	Description	Responsibility	Time frame	Plan Type	Status
S	3.1.2	Construction of a new AIRP/arsenic removal unit in the treatment plant	The AIRP/arsenic removal unit will reduce the arsenic level below Bangladesh standard	Mayor, Faridpur Pourashava	Dec 2017	Long term	Not started

Step	Hazardous Event Reference	Activities	Description	Responsibility	Time frame	Plan Type	Status
WTP	3.3.1	Installation of a bird net around the treatment plant	It will protect filter bed from fouling and bird excreta	Mayor, Faridpur Pourashava	Dec 2016	Medium term	Not started
DL	3.4.2	Making all the existing washout functional	It will clean the distribution line for desired water quality	Mayor, Faridpur Pourashava and Engineer, Faridpur Pourashava	Feb 2016	Short term	Started
DL	3.4.3	Repair the sluice valve chamber with cover and filling the sluice valve chamber with sand	It will minimize the intrusion of biological and agrochemical elements	Mayor, Faridpur Pourashava and Engineer, Faridpur Pourashava	Jan 2016	Short term	Started
HH	3.5.1 3.5.2	Provide rubber gasket and drilling machine	It correctly connect the source to the household	Mayor, Faridpur Pourashava and Engineer, Faridpur Pourashava	Jan 2016	Short term	Started

S = Source, PTW = Production Tube Well and pump house WTP = Water Treatment Plant
DL = Distribution Line HH/C C = Household/Commercial Connection

Chapter V: Operational Monitoring and Corrective Actions

The intended objective for a control measure is generally measured through the operational monitoring. It represents the effectivness of a control meansure considering the operational target. The corrective action is action to be taken when the results of operatiomal monitoring at a control point indicate an actual, or pending loss of control. The operational monitoring and the corrective actional are management procideure. A sustematic operational monitoring plan is required to provide information to the management authority that an existing control system or new control system at dufferent steps of the water supply system working properly considering the control linit. During monitoring, if it is found that the control measure of a certain component exceeds beyond the control limit i.e. not working properly to prevent the aniticipated hazardous event, then the operational staff will take necessary and appropriate corrective action to resolve the problem. The monitoring plan will also guide the corrective action plan corresponding to the control limit of respective monitoring indicators and as a whole said to be Operational Monitoring Plan. Its main components are mainly composed of the folloiwing questions.

- What will be monitored?
- How it will be monitored?
- Where it will be monitored?
- Who will monitor it?
- When it will be monitored?

Table 13 represents the operational monitoring plan of Fardipur Pourashava. It inlcudes control limit for each control system is defined in the table (??). Accordingly, the corrective action procedure is described in the plan if the control system fails to meet the critical control limit. The responsible staff for the

monitoring activities will note the monitoring information using a log sheet attached as Annex-2 at the end this report.

Table 11: Operational monitoring plan of Faridpur Pourashava water supply system

Step	Reference of Hazardous Event	Monitoring of Operational Control		Control Limit	Corrective Action		Reference Supporting Programs
Source	3.1.1	What	Is there any incidence of installing irrigation pump within catchment area?	No irrigation pump has been installed within 500m of catchment area	What	Inform higher authority and WSP team	20.01, 20.02
		How	Inspection		How	Phone/ visit	
		When	Once in 3 months		When	If any incidence is found	
		Where	Within 500 m area of catchment		Where	Office	
		Who	Pump Operator		Who	Pump Operator	
	3.1.2	What	Is Arsenic concentration in source water within acceptable limit?	Concentration of Arsenic in source water is < 0.05 mg/l	What	Inform AE (Water) instantly about high concentration of Arsenic	
		How	Test water sample collected from source		How	Show water quality report	
		When	Once in 3 months		When	After testing water	
		Where	Water quality test laboratory		Where	Office of AE (Water)	
		Who	Pump Operator and Lab Assistant		Who	Lab Assistant	
	3.1.3	What	Is Iron concentration in source water within acceptable limit?	Concentration of Arsenic in source water is < 1 mg/l	What	Inform AE (Water) instantly about high concentration of Iron	
		How	Test water sample collected from source		How	Show water quality report	
		When	Once in 3 months		When	After testing water	
		Where	Water quality test laboratory		Where	Office of AE (Water)	
		Who	Pump Operator and Lab Assistant		Who	Lab Assistant	
	3.1.4	What	Residual chlorine at supply water	Concentration of residual chlorine < 0.02 mg/l	What	Calibrate the chlorine dosing system	
		How	Water quality test		How	After testing water	
		When	Once in a month		When	When exceeds or less then the limit	
		Where	At household level		Where	At treatment plant	
		Who	Pump Operator		Who	Assistant Engr. (water)	
PTW and Pump House	3.2.1	What	Is Sanitary Seal working properly?	Sanitary Seal is in good condition	What	Repair Sanitary Seal	
		How	Inspection		How	Hire/employ expert labour	
		When	1st week of the month		When	If found broken	
		Where	Pump house		Where	Pump house	
		Who	Pump Operator		Who	AE (Water)	
	3.2.2	What	Is non-return valve working properly?	Non-return valve is functional	What	Repair/ replace non-return valve	
		How	Listening the sound		How	Hire/employ mechanic	
		When	Every day		When	If found not functioning	
		Where	Pump house		Where	Pump house	
		Who	Pump Operator		Who	AE (Water)	
Treatment Plant	3.3.1	What		The birdnet has no	What		
		How			How		
		When			When		
		Where			Where		
		Who			Who		
	3.3.2	What	Is the aeration chamber cleaned?	Cleaned	What	Cleaning of aeration chamber	
		How	Inspection		How	Pourashava working staff	
		When	Once in a month		When	If the aeration chambers found dirty	
		Where	Aeration chamber		Where	Aeration chambers	
		Who	Treatment Plant Operator		Who	Water Super	
	3.3.3	What	Is the sedimentation tank cleaned?	Cleaned	What	Cleaning of Sedimentation tank	

Step	Reference of Hazardous Event	Monitoring of Operational Control		Control Limit	Corrective Action		Reference Supporting Programs
		How	Inspection		How	Pourashava working staff	
		When	1st week of month		When	If the sedimentation tank found dirty	
		Where	Sedimentation tank		Where	Sedimentation tank	
		Who	Treatment Plant Operator		Who	Water Super	
		What	Is the clear water reservoir cleaned?		What	Cleaning of clear water reservoir	
		How	Inspection		How	Pourashava working staff	
	3.3.4	When	1st week of month	Cleaned	When	If the clear water reservoir found dirty	
		Where	clear water reservoir		Where	Clear water reservoir	
		Who	Treatment Plant Operator		Who	Water Super	
		What	Is the overhead tank cleaned?		What	Cleaning of overhead tank	
		How	Inspection		How	Pourashava working staff	
	3.3.5	When	1st week of month	Cleaned	When	If the overhead tank found dirty	
		Where	Overhead tank		Where	Overhead tank	
		Who	Treatment Plant Operator		Who	Water Super	
		What	Is the sluice valve chamber is under dirty water or have leakages	There is no dirty water or leakage in the sluice valve chamber	What	Repair or replace sluice valve	
		How	Inspection		How	Purchasing	
	3.3.6	When	Once in a month		When	Leakages	
		Where	Treatment plant area		Where	Treatment plant	
		Who	Treatment Plant Operator		Who	AE (Water)	
Distribution Line		What	Are their any leakages in the distribution line?		What	Repair of leakages in the distribution line	
		How	Visual inspection		How	Purchasing new material	
	3.4.1	When	Once in a month	No leakages	When	As required	
		Where	Distribution line		Where	Distribution line	
		Who	Pipeline Mechanics		Who	AE (Water)	
		What	Is washout working or not?		What	The wash is working effectively	
		How	Visual inspection		How	Raising washout for appropriate pressure	
	3.4.2	When	Once in a months	Washout is operational	When	Sufficient pressure is not available at wash out	
		Where	Wash out		Where	Wash out	
		Who	Pipeline Mechanics		Who	AE (Water)	
		What	Is there sufficient quality water disinfectant reserved for emergency situation		What	Available Available water disinfectants present in the store	
		How	Stick register		How	Purchasing	
	3.4.3 (1)	When	Once in six month	Available water disinfectants	When	Once in six month	
		Where	Store		Where	Store	
		Who	Water Super		Who	AE (Water)	
		What	Is there any dirt's or waste water in sluice valve?		What	Repair and/or cover, chamber and filling by san	
		How	Inspection		How	Construction by purchasing sand	
	3.4.3 (2)	When	Once in a months	Sluice valve chamber is clean	When	When uncleaned	
		Where	Sluice valve		Where	Sluice valve chamber	
		Who	Pipeline Mechanic		Who	AE (Water)	
		What	Is the washout performing at desired interval?		What	Washout event done in every month	
		How	Inspection		How	Ensure sufficient manpower	
	3.4.4	When	Once in a months	Monthly washing the pipeline	When	In every month	
		Where	Wash out		Where	Washout	

Step	Reference of Hazardous Event	Monitoring of Operational Control		Control Limit	Corrective Action		Reference Supporting Programs
		Who	Pipeline Mechanic		Who	AE (Water)	
	34.5	What	Are their any leakages in the distribution line?	No leakages	What	Repair of leakages in the distribution line	
		How	Visual inspection		How	Purchasing new material	
		When	Once in a month		When	As required	
		Where	Distribution line		Where	Distribution line	
		Who	Pipeline Mechanics		Who	AE (Water)	
House Connection	**3.5.1**	What	Is proper instruments are used for new HH connection	Rubber gaskets is used for new HH connection	What	Ensure available instruments during connection	
		How	Visual inspection		How	Standard instrument purchase	
		When	During new connection		When	When the limit cross	
		Where	At household		Where	At house connection site	
		Who	Asst. Engr. (Water)		Who	Executive Engineer	
	3.5.2	What	Is proper instruments are used for new HH connection	Drilling machine is used for new HH connection	What	Ensure available instruments during connection	
		How	Visual inspection		How	Standard instrument purchase	
		When	During new connection		When	When the limit cross	
		Where	At household		Where	At house connection site	
		Who	Asst. Engr. (Water)		Who	Executive Engineer	
	3.5.3	What	Is house connection pipe line exposed to open drain?	No house connection pipe line is exposed to wastewater drain	What	Use casing pipe to cover the pipe line from wastewater and elevate the pipe above drain	**20.02, 20.03, 20.04, 20.05, 20.06, 20.07, 20.08**
		How	Inspection		How	Hire/employ mechanic	
		When	Once in a month		When	If exposed house connection pipe is seen	
		Where	Household connection pipe line		Where	Household connection pipe line	
		Who	Bill Distributor		Who	AE (Water)	
	3.5.4	What	Is the water collection place/ platform hygienic?	The water collection place/ platform is clean and hygienic	What	Place an order for all consumers to maintain hygiene and construct platform at collection point.	**20.02, 20.03, 20.04, 20.05, 20.06, 20.07, 20.08**
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If hygienic platform is not found	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	
	3.5.5	What	Is the underground tank's top level at least 6" above the ground level?	All households have their underground tank's top level at least 6" above ground level	What	Place an order for all consumers to raise the level of underground tank's top	**20.02, 20.03, 20.04, 20.05, 20.06, 20.07, 20.08**
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If underground tank's top level is found below ground level	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	
	3.5.6	What	Do underground reservoir and OHT have lid?	Households that have underground reservoir and OHT use lid/ cover to protect water from contaminatio n	What	Place an order for all consumers to use lid/ cover for underground reservoir and OHT	**20.02, 20.03, 20.04, 20.05, 20.06, 20.07, 20.08**
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If underground tank and OHT lid/cover is not found	
		Where	Households that have underground and OHT		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	

Step	Reference of Hazardous Event	Monitoring of Operational Control		Control Limit	Corrective Action		Reference Supporting Programs
	3.5.7	What	Does wastage of water occurs through overflow from reservoirs?	Consumers switch the motor off as soon as the reservoir gets full each time	What	Place an order for all consumers to prevent wastage of water through overflow	**20.02, 20.03, 20.04, 20.05, 20.06, 20.07, 20.08**
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If overflow is observed at any household	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	
	3.5.8	What	Is the practice of collection and storage of water by consumers hygienic?	Consumers practice hygienic ways to collect and store water in house	What	Place an order for all consumers to follow hygienic practice during water collection and storage	**20.02, 20.03, 20.04, 20.05, 20.06, 20.07, 20.08**
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If unhygienic practice is observed	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	
	3.7.9	What	Is there any practice of using illegal pumps in the pipe lines to get more water during supply hour?	No household is using illegal pumps in the pipe lines to get more water during supply hour	What	Disconnect the pipe line of the user	**20.02, 20.03, 20.04, 20.05, 20.06, 20.07, 20.08**
		How	Inspection		How	Hire/employ mechanic	
		When	Once in a month		When	If illegal pumps used	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	

S = Source PTW = Production Tube Well WTP = Water Treatment Plant DL = Distribution Line
HH/C C = Household/Commercial Connection

Chapter VI: Verification

Consistant delivery of the safe water considering health based targets need a strong verfiacation process. It will build concrete evidence that the overall system design, its operation and magement are effective. in delivering safe water consitantly and constantly considering the specified quality water. It includes three following majror activities. The schedule for verfication of different control measures condiering the hazard is prosented in Table 14.

1. Delivered water quality monitoring – will provide information that the delivered water is safe
2. Internal and external auditing of WSP operational activities – helps to assess the WSP activities and verify the status of proper implementation process
3. Consumer satisfaction – checking that consumers are satisfied with the supplied water

Table 12: Verification schedule of water safety plan for Faridpur Pourashava

Step	Ref. of Hazardous Event	Activity	Description	When	Responsible Person/ Organization	Record
S	3.1.1	Check depletion of water table at source	Discuss with Pump Operator if water table depletion caused interruption in ground water abstraction in any season, and check if any irrigation pump was installed within 500 m of source	Once in a year	Executive Engineer - Pourashava, and Executive Engineer- DPHE	Log book
S	3.1.2 3.1.3	Check quality of water at source	Test water sample collected from source at laboratory (both and DPHE), especially for Iron and Arsenic.	Once in a year	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
S	3.1.4	Check the	Collect the temperature and rainfall data from the	Once in a	Executive Engineer-	Log

Step	Ref. of Hazardous Event	Activity	Description	When	Responsible Person/ Organization	Record
		monthly temperature, rainfall and flood forecasting data	Faridpur weather station	year	Pourashava, and Executive Engineer- DPHE	book
			Check whether the alum dosing and chlorine dosing systems are functioning properly, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
PTW	3.2.1	Audit WSP monitoring activities and corrective actions taken at PTW and Pump House to maintain the water supply system	Check whether the sanitary seal is in good condition, and audit the log book for regular monitoring of sanitary seal.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
PTW	3.2.2		Check whether the non-return valve is in good condition, and audit the log book used for regular monitoring of non-return valve.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
PTW			Check whether the pressure meter is in good condition, and audit the log book used for regular monitoring of pressure meter.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
PTW			Check whether the pump house is in good/ hygienic condition, and audit the log book used for regular monitoring of pump house cleaning.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
PTW			Check whether the electric panel, board, switch and other equipment are in good condition, and audit the log book used for regular monitoring of electric equipment.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
WTP	**3.3.3**	Audit WSP monitoring activities and corrective actions taken to maintain the treatment plant effectively	Check whether the walls of flocculator chamber and sedimentation chamber are in good condition, and audit the log book used for regular monitoring cleaning of these walls.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
			Check whether the over flow pipes of flocculator is protected and in good condition, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
WTP	**3.3.1**		Check whether the bird net used around the treatment plant in good condition, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
WTP		Audit WSP monitoring activities and corrective actions taken to maintain the CWR effectively	Check whether the over flow pipes of CWR is protected and in good condition, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
WTP			Check whether the sluice valve of CWR is functioning properly to prevent intrusion of untreated water, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
WTP	**3.3.4**		Check whether the CWR is clean and in hygienic condition, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
WTP	**3.3.5**	Audit WSP monitoring activities and corrective actions taken to maintain the Overhead Tank effectively	Check whether the lid/ cover and ventilation system of OHT is in good condition, and audit the log book used for regular monitoring.	Once in a year	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
			Check whether OHT is cleaned regularly and in good condition, and audit the log book used for regular monitoring.	Once in a year	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
			Check whether the centrifugal used for lifting water into OHT has any leakages, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
DL	3.4.1	Audit WSP monitoring activities and corrective actions taken to maintain the Transmission	Check if there is layer of iron deposition inside the pipe lines, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book
DL	3.4.2 3.4.3		Check if there is any exposed pipe line and whether there is any leakage through inspection, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer- Pourashava, and Executive Engineer- DPHE	Log book

Step	Ref. of Hazardous Event	Activity	Description	When	Responsible Person/ Organization	Record
DL	3.4.4	and Distribution pipe lines effectively	Check whether sluice valve chamber slab is in good condition, any incidence of water stagnating inside the sluice valve chamber and if there is any leakage in gland packing of sluice valve through inspection, and audit the log book used for regular monitoring.	Once in 6 months	Ex Executive Engineer-Pourashava, and Executive Engineer- DPHE	Log book
DL	3.4.5		Check whether the wash outs are working properly and end caps are in place, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer- DPHE	Log book
HH/C C	3.5.1 3.5.2 3.5.3	Audit WSP monitoring activities and corrective actions taken to ensure good practice during providing house connection and at household level	Check whether rubber gasket and pipe cutter/ driller are used during providing house connection, and no pipeline is exposed to wastewater in the drains, and audit the log book used for regular monitoring.	Once in 3 months, and during providing house connections	Executive Engineer-Pourashava, and Executive Engineer- DPHE	Log book
HH/C C	3.5.4 3.5.5 3.5.6 3.5.7 3.5.8 3.5.9		Check whether consumers are collecting and storing water in hygienic manner, underground tanks are above ground level in all households, underground tank and OHT have proper lid/ cover, consumers cleaning their underground and OHT regularly, if there is any wastage of water though overflow in households, and if anyone is using illegal pumps, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer- DPHE	Log book

S = Source PTW = Production Tube Well and pump house WTP = Water Treatment Plant
DL = Distribution Line HH/C C = Household/Commercial Connection

Chapter VII: Management And Communication

7.1 Management Procedure

Water Safety Plan Team will be responsible for planning, implementation, monitoring modification, review, auditing, and resource allocation etc. of the water safety plan. The team consist of 19 members headed by the Mayor of the Pourashava. The member Secretary will be responsible for keeping and storing of all sorts of the documents in relation with the water safety plan implementation will. All sorts of communication need to make through the WSP team leader. Such management procedures are divided into three parts as presented below:

1) General Procedures:
   All of the actions need to be documented to maintain, normal operating conditions for the production of safe drinking water. This includes procedures of all treatment processes, distribution system operations and maintenance of the system. These are called Standard Operating Procedure (SOP). Moreover, all types of records from different components need to be kept in the log sheets.
2) Procedures for corrective action
   Procedures are in place for incident situations (situations outside of normal operating conditions), describing corrective actions necessary to maintain safe water and protect consumers. All information related to the incident and associated corrective measure need to be recorded.

3) Procedures for emergency

There should be management procedures setting out a communication plan to alert and inform consumers and other stakeholders when there is a problem with the safety of water supply

Control of Document and Records

It is essential to keep written documents for each step of WSP related activities. On the other hand, all sort of records related to WSP activities need to be collected in a prescribed format or log sheet. Such written documents and keeping records in log sheets are part of management procedure that ensures proper operation of WSP activities. The documents and records related to management procedures will be controlled by member Secretary WSP team and Assistant Engineer (Water) of PWSS section of Faridpur. Assistant Engineer (Water) will also be responsible to circulate the necessary documents and records to the concerned person in PWSS and also to WSP Team members. Table 15 shows the list of management procedures of Faridpur PWSS section.

Table 13: Management procedures related documents

No	Management procedures	Controlled by	Status of document preparation
1	Citizen Charter	Executive Engineer and AE (Water), Faridpur Pourashava	Completed; Preserved in Utility
2	Water Safety Planning	Executive Engineer and AE (Water), Faridpur Pourashava	Completed; 2015
3	Communication strategy relevant to water quality	Executive Engineer and AE (Water), Faridpur Pourashava	Described in sec 7.2 of WSP Document
4	Operational Monitoring Log Sheet	Executive Engineer and AE (Water), Faridpur Pourashava	Completed; Annex-2
5	Corrective Action Log Sheet	Executive Engineer and AE (Water), Faridpur Pourashava	Completed; Annex-2
6	Sanitary Inspection Form	Sanitary Inspector and AE (Water), Faridpur Pourashava	Completed; Annex-3
7	Customer Complain Register / Log Sheet	AE (Water), Faridpur Pourashava	Completed, Preserved in Utility
8	Management Procedure for Emergency	Executive Engineer and AE (Water), Faridpur Pourashava	Completed; Annex-4
9	Asset management of PWSS	Executive Engineer and AE (Water), Faridpur Pourashava	Completed; Annex-5
10	Protocol for protection of source and catchment	Executive Engineer and AE (Water), Faridpur Pourashava	Not completed
11	Protocol for maintenance of pumps	Executive Engineer and AE (Water), Faridpur Pourashava	Not completed
12	Cleaning procedure of underground clear water reservoir and overhead tank	AE (Water), Faridpur Pourashava	Not completed
13	Cleaning procedure of transmission and distribution line	AE (Water), Faridpur Pourashava	Not completed
14	Chlorination process in supplied water	AE (Water) - Faridpur Pourashava,	Not Completed

No	Management procedures	Controlled by	Status of document preparation
		Executive Engineer - DPHE	
15	Consumer satisfaction survey form	Executive Engineer and AE (Water), Faridpur Pourashava	Not completed

7.2 Communicating Procedure of Water Quality Related Information

The consumers have right to get information in relation to the quality of water they are getting form the supply system. A communication plan is presented in Table 16.

Table 14: Communication plan for water quality related issues

No	Issue	Information	Media
1	Emergency advise during any significant incidents with the drinking water supply	- Drink water after purifying with water purification tablet - To clean reservoir	- Through miking - Leaflet distribution
2	Summary information to be made available to consumers	- Water quality of supplied water	- Annual Report - Notice Board
3	Establishment of mechanisms to receive and actively address community complaints in a timely fashion	- Customer complain - Procedure of corrective action and notify to customer	- Customer complain register (log) book - Approval from customer prior to take corrective action

Chapter VIII: Supporting Programs

Supporting programs will create an enabling environment for the proper implementation of water safety plan that will help to achieve the health based targets. Each of the programs is composed of a set of activities which includes awareness, education, training and modification of water supply system among the users as well as the providers can be treated as a win win situation. The supporting programs are enrolled under the improvement action plan of the WSP and could be short, medium and long term. The supporting programs developed or to be developed for Faridpur Pourashava water supply system includes:

- Consumers education supporting program
- Operator training supporting program
- Environmental sanitation improvement program

The Pourashava Water Super of the water supply system will be responsible for developing, coordinating, maintaining and implementing the supporting programs. The Pourashava authority can utilize its own technical resources for supporting program or can engage NGOs, universities or training institution for implementation of the consumer's education support program.

Table 15: List of Supporting Program for WSP of Faridpur Pourashava in the year 2015

Sl. No.	Hazard Ref No.		Description	Responsibility	Timeframe	Status
20.01	3.1.1 to 3.5.10		Meeting of WSP Team (local meeting)	Mayor, Executive Engineer and AE (Water)	January , 2016	Started
20.02	3.5.3 3.5.4 3.5.5 3.5.6 3.5.7 3.5.9		Orientation of caretakers and Users on CC Resilient WSP (Total number of participants will be 30-50	Mayor, Executive Engineer and AE (Water)	January , 2016	Started 3.5.2
20.03	3.5.10		Orientation session with TLCC	Mayor, Executive Engineer and AE (Water)	January , 2016	Started
20.04	3.5.5 3.5.6 3.5.9 3.5.10		Orientation Session with Ward Sanitation taskforce Committee	Mayor, Executive Engineer and AE (Water)	January , 2016	Started
20.05	3.5.4		Session with School Teachers and School Management Committees (participants 40 two events)	Mayor, Executive Engineer and AE (Water) Mayor, Executive Engineer and AE (Water)	January , 2016	Started
20.06	All Hazards from 3.1.1 to .10	Motivating people for Water Safety Plan from source to consumption	Cable TV Show (5 minutes Programme)	Mayor, Executive Engineer and AE (Water)	January , 2016	Started
20.07		Climate Change, water security and health	Local Newspaper supplement	Mayor, Executive Engineer and AE (Water)	January , 2016	Started
20.08		Water use Hygiene Practice	CC resilient WSP Campaign at community level	Mayor, Executive Engineer and AE (Water)	January , 2016	Started
20.09		Climate Change, water safety and health	Bill Board Rent	Mayor, Executive Engineer and AE (Water)	January , 2016	Started
20.10		Motivating people for Water Safety Plan from source to consumption	Sign Board	Mayor, Executive Engineer and AE (Water)	January , 2016	Started

Chapter IX: WSP Review Procedure

9.1 Purpose of WSP Review

The purpose of the water safety plan document review is to maintain its effectiveness considering the information and experiences gathered during its implementation aiming the health based targets. The review need to be done periodically considering its designed activities to overcome any unavoidable and unfavourable circumstances. The review need to be done in terms of water supply management system, technical aspect of the supply system, water quality, water availability.

9.2 Review Procedure and Elements

WSP Team will meet at least once in a year to review all aspects of water safety planning. Gathering information or records from operational monitoring and verification monitoring will help the review process significantly. The progress of improvement action plan should also be discussed in the review meeting. Moreover the following issues can be considered for discussion in the review meetings:

- Changes of membership of the WSP team and allocation of responsibility among team members
- Climate change the new emerging issue and its long term impact on the water supply system
- Direction of necessary action, and responsibility of the concerned staff during emergency
- Changes or modification necessary for water supply management system in catchments, treatment or distribution process especially considering the climate change issues
- Outcome of internal and external audits
- Staff changes in water supply section
- Keeping and archiving all types of documents and records

9.3 WSP Document Upgradation

The water safety plan document is a live document and it could be modified or improved considering the new knowledge or information as obtained during its implementation. The WSP Document Controller is responsible for keeping an up-to-date version of the WSP and circulation of the updated version to other WSP team members and interested parties.

Annex

Annex-I: WSP Team Declaration

ফরিদপুর পৌরসভা কার্যালয়,

জেলাঃ ফরিদপুর।

স্মারক নং ....১৫৭২/৮....

তারিখঃ ০৩/০১/২০১৬ইং

প্রাপক ঃ তত্ত্বাবধায়ক প্রকৌশলী
গ্রাউন্ড ওয়াটার সার্কেল
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
১৪, শহিদ ক্যাপ্টেন মনসুর আলী স্বরণী,
কাকরাইল, ঢাকা-১১০০।

বিষয়ঃ Local WSP Team প্রসঙ্গে।
সূত্রঃ ৩৯১ জনস্বাঃপ্রঃঅঃ(ফরি) তারিখঃ ৩/১২/২০১৫ইং

উপরোক্ত বিষয়ের প্রেক্ষিতে প্রকল্পের নির্দেশনা অনুযায়ী ফরিদপুর পৌরসভার Local WSP Team গঠন পূর্বক ব্যক্তিগন এর নামের তালিকা ও পদবীসহ প্রেরণ করা হইল।

নং	নাম	পদবী	WSP তে পদবী	মোবাইল নম্বর
১	শেখ মাহ্তাব আলী মেথু	মেয়র, ফরিদপুর পৌরসভা	উপদেষ্টা, L-WSP Team	০১৯১১-৩০৩২২৭
২	মোঃ আউয়ার আলী মোল্যা	নির্বাহী প্রকৌশলী ফরিদপুর পৌরসভা	চেয়ারম্যান, L-WSP Team	০১৭১১-৯৩৮০০০
৩	কাহিম হাসান সিরাজী	নির্বাহী প্রকৌশলী জনস্বাস্থ্য প্রকৌশল অধিদপ্তর	সদস্য, L-WSP Team	০১৮১৫-৭৭৯২৭০
৪	আকবর আলী মোল্যা	প্রকৌশলী (এস.এ.ই) জনস্বাস্থ্য প্রকৌশল অধিদপ্তর	সদস্য, L-WSP Team	০১৭১২-৯০১৫২১
৫	মাহবুব পিয়াল	সংবাদিক, দৈনিক ফতেহাবাদ	সদস্য, L-WSP Team	০১৭১১-০১০৪৯৫
৬	সামছুন্নাহার্ আনু	T.L.C.C	সদস্য, L-WSP Team	০১৬৭০-২৪৫৯২২
৭	মোঃ শফিকুল ইসলাম	সহকারী প্রকৌশলী, ফ. পৌ	সদস্য, L-WSP Team	০১৭৬০-২৪৭৫৭৫
৮	মোঃ নুরুজ্জামান	বস্তি উন্নয়ন কর্মকর্তা	সদস্য, L-WSP Team	০১৭১৬-৪২৫৪৭৫
৯	মোঃ মনোয়ার হোসেন	সেনেটারি ইন্সপেক্টর ফ. পৌ	সদস্য, L-WSP Team	০১১৯০-৯৫৫৯৭২
১০	তৃষ্ণা সাহা	কাউন্সিলর ফ. পৌ	সদস্য, L-WSP Team	০১৭১২-২৮৫৪১৮
১১	অজিবুর রহমান চৌধুরী (সাবুল)	কাউন্সিলর, ২ নং ওয়ার্ড ফ.পৌ	সদস্য, L-WSP Team	০১৭১১-১২৩৭৬৬
১২	মোঃ শফিকুল হোসেন তাপস	কাউন্সিলর, ৯ নং ওয়ার্ড ফ.পৌ	সদস্য, L-WSP Team	০১৭১১-৪০৬৬৫৩
১৩	সিভিল সার্জন	ফরিদপুর	সদস্য, L-WSP Team	
১৪	সরফুল আমিন	ইনচার্জ, আবহাওয়া অফিস, ফরিদপুর।	সদস্য, L-WSP Team	
১৫	গোলাম রব্বানী ভূঁইয়া (রতন)	এ্যাডভোকেট	সদস্য, L-WSP Team	০১৭১১-১৫৯২২৭
১৬	মোঃ জাহিদুল ইসলাম	সুপারভাইজার (পানি) ফ.পৌ	সদস্য, L-WSP Team	০১৭১১-৩১৪৩৮৫
১৭	লুৎফর রহমান	কঞ্জারভেন্সি ইন্সপেক্টর, ফরিদপুর পৌরসভা	সদস্য, L-WSP Team	০১১৯০-৯০৫৭৭৬
১৮	স্বপন কুমার সিংহ	কম্পিউটার অপারেটর, পানি শাখা, ফ.পৌ	সদস্য, L-WSP Team	০১৭২২-২৪৩৬৬০
১৯	মোস্তফা ইকবাল হোসেন	তত্ত্বাবধায়ক, পানি শাখা, ফ.পৌরসভা	সদস্য সচিব L-WSP Team	০১৭২৮-২৫২১১৪

শেখ মাহ্তাব আলী মেথু
মেয়র
ফরিদপুর পৌরসভা।

স্মারক নং ..১৭৩৮/২(২)

তারিখঃ ...৫/১/২০১৬

অনুলিপি অবগতির জন্য ঃ
১। তত্ত্বাবধায়ক প্রকৌশলী, জনস্বাস্থ্য প্রকৌশল অধিদপ্তর ফরিদপুর বিভাগ, ফরিদপুর।
২। অফিস কপি।

শেখ মাহ্তাব আলী মেথু
মেয়র
ফরিদপুর পৌরসভা।
৫ ৩/১/১৬

Annex-II: Sample of Monitoring and Corrective Action Log Sheet

Annex - IIa: Log sheets for Pump Operator

Daily Monitoring Log Sheet for Pump Operator

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
1	Pressure meter is working properly	Every day															
2	PTW filter is functioning properly	Every day															
3	Non-return valve of the pump is working properly	Every day															

Weekly Monitoring Log Sheet for Pump Operator

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
4	Pump house is clean and in hygienic condition	Once in a week															

Monthly Monitoring Log Sheet for **Pump Operator**

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
5	The net protection at the opening of over flow pipe is working properly	Once in a month															
6	Sanitary seal of the pump is functioning properly	Once in a month															
7	Electric equipment of the pump house is working properly	Once in a month															

Monthly Monitoring Log Sheet for Pump Operator

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
8	There is no irrigation pump with 500 m of the PTW	Once in 3 months															
9	Sample collected form source to test As concentration has been sent to the laboratory	Once in 3 months															
10	Sample collected form source to test Fe concentration has been sent to the laboratory	Once in 3 months															
11	Sluice valve at the connection of CWR and PTW is functioning properly	Once in 3 months															

Monthly Monitoring Log Sheet for Pump Operator

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
12	CWR has been cleaned by using bleaching powder	Once in 6 months															
13	The lid on the OHT is working properly	Once in 6 months															
14	The net protection at the ventilation of OHT is working properly	Once in 6 months															
15	Plaster of the of the wall of OHT is in good condition and not causing any pollution	Once in 6 months															
16	OHT has been cleaned using bleaching powder	Once in 6 months															

Annex-II (b): Log sheets for Plant Operator

Monthly Monitoring Log Sheet for Plant Operator

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
17	The walls of sedimentation chamber and flocculator are clean	Once in a month															
18	The Alum Dosing system is working properly and water is sent to laboratory	Once in a month															
19	The net protection at the overflow pipe of Treatment Plant is working properly	Once in a month															
20	The bird net around the Treatment Plant is working properly	Once in a month															
21	The Chlorine Dosing system is working properly and water is sent to laboratory	Once in a month															
22	There is no leakage in the centrifugal pump used for lifting water	Once in a month															

Annex-II (c): Log sheets for Pipe Line Mechanic

Monthly Monitoring Log Sheet for Pipe Line Mechanic

Sl. No.	Activity	When	Date									Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
													Comments	Date and Signature	Comments	Date and Signature
23	There is no exposed pipe line in the network	Once in a month														
24	No deposition of Iron inside the pipe line	Once in a month														
25	No leakage in the gland packing of the sluice valve	Once in a month														

Monthly Monitoring Log Sheet for Pipe Line Mechanic

Sl. No.	Activity	When	Date									Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
													Comments	Date and Signature	Comments	Date and Signature
26	No leakage found in pipe line during wash out and other inspections	Once in 2 months														
27	Sluice valve chamber slab is in good condition	Once in 2 months														
28	No stagnation of water inside sluice valve chamber	Once in 2 months														
29	All wash out lines are active	Once in 2 months														
30	All wash out lines have end cap in place	Once in 2 months														
31	No house connection pipe is exposed to waste water in the drain	Once in 2 months														

Monitoring Log Sheet for Pipe Line Mechanic during providing house connection

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
32	Rubber gasket is used at the joint of house connection	During providing house connection															
33	Pipe cutter/ driller is used at the joint of house connection to drill the pipe	During providing house connection															

Annex-II (d): Log sheets for Bill Clerk

Monthly Monitoring Log Sheet for Bill Clerk

House No:..... Bill ID:..... Address:..... Zone:..... Connection Type:.....

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
34	Clean platform at the point of water collection	Once in a month															
35	Top of underground tank is at least 6" above ground level	Once in a month															
36	Both underground and overhead tanks have proper lid	Once in a month															
37	Both underground and overhead tanks are cleaned regularly	Once in a month															
38	No wastage of water through overflow from underground/ overhead tank	Once in a month															
39	Sample has been collected and sent to laboratory for testing (for selected houses only)	Once in a month															
40	Household not using any illegal pump to get more water during supply water	Once in a month															

Annex-II (e): Log sheets for Lab Assistant

Monitoring Log Sheet for Lab Assistant

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
41	Water quality test report shows that Alum Dosing system in the Treatment Plant is working properly	Once in a month															
42	Water quality test report shows that Chlorine Dosing system in the Treatment Plant is working properly	Once in a month															
43	Samples collected from selected households have been tested	Once in a month															
44	As concentration in the samples collected from source is within acceptable limit	Once in 3 months															
45	Fe concentration in the samples collected from source is within acceptable limit	Once in 3 months															
46	E. Coli concentration in the samples collected from source is within acceptable limit	Once in 3 months															

Annex-II (f): Log sheets for Completion of Corrective Action

Ref No:	
Monitoring Point:	
Identified problem	
Necessary Corrective Action	
Estimated Cost:	

Person		☐ **Monitoring Inspector**	☐ **Assistant Engineer (Water)**	☐ **Executive Engineer**	☐ **Mayor**
Signature					
Date	Received				
	Sent				
Activity / Decision / Comment					

Annex-III: Sanitary Inspection Form

The following sanitary Inspection Forms have been attached in the following pages:

SI Form – 1: Well Field / Well Site
SI Form – 2: Pump House
SI Form – 3: Reservoir
SI Form – 4: Transmission & Distribution Mains
SI Form – 5: Valve Chamber / Washout Chamber
SI Form – 6: Stand Pipe / House Connections
SI Form – 7: Road, Drain & Ditch Crossing
SI Form – 8: Underground Household Reservoir Tank

Sanitary Inspection Form-1

Type of facility **WELL FIELD /WELL SITE**

1. General information: Area/Location:……..
2. Code number:…….
3. Date of visit:……..
4. Water samples taken? Y/N Sample No……..……

Specific diagnostic information for assessment

(**Please indicate at which sites the risk was identified**) **Risk Sample No.**

1. Is there any sanitary landfill/cesspool/ditch within 30m or zone of influence of well? Y/N
2. Is there any evidence of human faeces in vicinity of well field/site? Y/N
3. Are there animal faeces in the vicinity of the well field/site? Y/N
4. Is there any evidence of solid waste in the vicinity of the well field/site? Y/N
5. Is there any evidence of excessive algal growth in proximity of the well field/site? Y/N
6. Can stagnant or dirty water collect in well head chamber? Y/N
7. Is the well field/site unfenced or insecure? Y/N
8. Is not there a non-return valve with the transmission main? Y/N

Risk score: 7-8= Very High, 5-6 = High, 3-4 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-8)

Signature of PWSS Super/assistant:

Comments:

Sanitary Inspection Form- 2

Type of facility **PUMP HOUSE**

1. General information: Area/Location:……..

2. Code number:……..

3. Date of visit:……

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(Please indicate at which sites the risk was identified) **Risk Sample No.**

1. Is not the pump house provided with standby/alternative source of power? Y/N

2. Is any observable part of the inside of the pump house corroded or damaged? Y/N

(Including ladders, roof struts, walls)

3. Is there evidence of leakage/cracks in the pump house? Y/N

(Check the inside of the pump house to look for faults)

4. Can run-off form stagnant pools close to the pump house? Y/N

5. Can stagnant or dirty water collect inside pump house? Y/N

6. Is the pump house unfenced or insecure? Y/N

7. Is there evidence of faecal material surrounding the pump house? Y/N

8. Has the pump house not been cleaned within one month? Y/N

9. Is the valve in the powerhouse leaking? Y/N

10. Are the fuses by pass? Y/N

Risk score: 9-10 = Very High; 7-8 = High; 4-6 = Medium; 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-10)

Signature of PWSS Super/Inspector:

Comments:

Sanitary Inspection Form-3

Type of facility **RESERVOIR**

1. General information: Area/Location: ……..

2. Code number: ……..

3. Date of visit: ……

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(**Please indicate at which sites the risk was identified**) **Risk Sample No**

1. Are vents of reservoir not covered? (Could vermin get into the reservoir?)	Y/N
2. Is the inspection cover or concrete around the cover corroded or damaged	Y/N
3. Is the inspection cover not in place when inspected?	Y/N
4. Is any observable part of the inside of the tank damaged or dirt?	Y/N
5. Is there evidence of leakage/cracks in the reservoir?	Y/N
6. Can rainwater be collected in the reservoir?	Y/N
7. Can stagnant or dirty water collect in the reservoir?	Y/N
8. Is the reservoir unfenced or insecure?	Y/N
9. Is there evidence of faecal material surrounding the roof tank?	Y/N
10. Has the tank not been cleaned within one month?	Y/N
11. Does observe the presence of larvae or insects in the tank?	Y/N

Risk score: 10-11= Very High, 7-9 = High, 4-6 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-11)

Signature of PWSS Super/assistant:

Comments:

Sanitary Inspection Form-4

Type of facility **TRANSMISSION MAINS/DISTRIBUTION MAINS/RETICULATION SYSTEM**

1. General information: Area/Location: ……..

2. Code number: ……..

3. Date of visit: ……

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(**Please indicate at which sites the risk was identified**) **Risk Sample No.**

1. Is there any evidence of leakage? Y/N
2. Is there any evidence of human faeces in vicinity of pipe? Y/N
3. Are there animal feces in the vicinity of the pipe? Y/N
4. Does the primary main pass through stagnant water? Y/N
5. Is there any evidence of solid waste in the vicinity of the pipe? Y/N
6. Is there any evidence of excessive algal growth in proximity of the pipe? Y/N
7. Is there any evidence of a primary line crossing culvert? Y/N
8. Are there not any air valves connected to the elevated pipe? Y/N
9. Are there any exposed pipe or any portion of it? Y/N
10. Is the pipe line prone to flooding? Y/N
11. Is the supply through this main intermittent? Y/N

Risk score: 9-11= Very High, 6-8 = High, 3-5 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-11)

Signature of PWSS Super/assistant:

Comments:

Sanitary Inspection Form-5

Type of facility **VALVE CHAMBER/WASHOUT CHAMBER**

1. General information: Area/Location: ……..

2. Code number: ……..

3. Date of visit: …….

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(Please indicate at which sites the risk was identified)	**Risk Sample No**
1. Is the valve not operational?	Y/N
2. Was the cover missing or kept away when visited?	Y/N
3. Is the valve box cover cracked/rusted?	Y/N
4. Is the valve corroded?	Y/N
5. Does the valve leak?	Y/N
6. Is there heap of solid waste around the valve chamber?	Y/N
7. Is there debris or fecal matter in the valve box?	Y/N
8. Is not the valve installed properly?	Y/N
9. Is there stagnant water in valve box?	Y/N
10. Are there evident standpipes connected to the valve?	Y/N

Risk score: 8-10 = Very High, 6-7 = High, 4-5 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-10)

Signature of inspectors/assistant:

Comments:

Sanitary Inspection Form-6

Type of facility **STAND PIPES /HOUSE CONNECTIONS**

1. General information: Area/Location: ……..

2. Code number: ……

3. Date of visit: ……..

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(Please indicate at which sites the risk was identified) **Risk Sample No**

1. Does the standpipe/house connection leak? Y/N
2. Does surface water collect around the standpipe/house connection? Y/N
3. Is there animal feces in the vicinity of the standpipe/house connection? Y/N
4. Are pipes exposed close to the standpipe/house connection? Y/N
5. Is human excreta on the ground within 10m of the standpipe/house connection? Y/N
6. Is the main pipe submerged in stagnant water? Y/N
7. Are there solid waste dumps 10m from the standpipe/house connection? Y/N
8. Are there stagnant pools of water close to the house connection pipe? Y/N
9. Does the house connection pipe pass through sewage/pit latrines/septic tank foul water bodies? Y/N
10. Does the house connection pipe cross a drain/ditch? Y/N

Risk score: 8-10 = Very High, 5-7 = High, 3-4 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-10)

Signature of health inspectors/assistant:

Comments:

Sanitary Inspection Form-7

Type of facility **ROAD, DRAIN AND DITCH CROSSINGS**

1. General information: Area/Location:. …….

2. Code number: ……

3. Date of visit: ……..

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(Please indicate at which sites the risk was identified)	**Risk Sample No**
1. Is there a valve box within 1m of road crossing?	Y/N
2. Is the supply pipe exposed close to the road crossing?	Y/N
3. Is there evidence of ingress into the pipe from stagnant water?	Y/N
4. Is there evidence of cattle faeces in the area surrounding of the pipe?	Y/N
5. Is there evidence of leakage around the pipe?	Y/N
6. Does pipe cross open ditch/trench?	Y/N
7. Is there evidence of faeces in trench/ditch?	Y/N
8. Is there waste material around the pipe?	Y/N
9. Is the pipe submerged in stagnant water?	Y/N
10. Is the pipe damaged/cracked/leaking/pitted?	Y/N

Risk score: 9-10 = Very High; 6-8 = High; 3-5 = Medium; 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No. 1-10)

Signature of PWSS Super/Assistant:

Comments:

Sanitary Inspection Form-8

Type of facility UNDERGROUND HOUSEHOLD RESERVE TANK

1. General information: Area/Location: …….

2. Code number: …….

3. Date of visit: …….

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment
(Please indicate at which sites the risk was identified) Risk Sample No

1. Are vents not covered? (Could vermin get into the reservoir?) Y/N

2. Is the inspection cover or concrete around cover damaged or corroded? Y/N

3. Is the inspection cover not in place when inspected? Y/N

4. Is any observable part of the inside of the tank corroded or damaged? Y/N

5. Is there evidence of leakage/cracks in the reservoir? Y/N
(check the outside of the tank to look for faults)

6. Can run-off form stagnant pools get into to the reservoir? Y/N

7. Can stagnant or dirty water get into the reservoir? Y/N

8. Is the reservoir unfenced or insecure? Y/N

9. Is there evidence of fecal material surrounding the valve box? Y/N

10. Has the tank not been cleaned within one month? Y/N

11. Is there flow control valve in the reservoir? Y/N

12. is the area prone to flooding/ Y/N

Risk score: 10-12 = Very high; 7-9 = High; 4-6 = Medium; 0-3 = Low

Results and recommendations
The following important points of risk were noted: (List No: 1-12)

Signature of Inspector:

Annex IV: Disease Information Register

No.	Year	Month	Reported Cases in Respective upazilaSadar Hospital or any government Hospital existed in the Pourashava						
			Diarrhea	Cholera	Dysentery	Hepatitis	Jaundice	Skin disease	...

Annex V: Water Table Recording Register

Month	Water Table (ft) Year													
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Jan														
Feb														
Mar														
Apr														
May														
Jun														
Jul														
Aug														
Sep														
Oct														
Nov														
Dec														

Annex VI: Flood statistics (Area inundated during flood)

Month	Area (sq ft) Year													
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Jan														
Feb														
Mar														
Apr														
May														
Jun														
Jul														
Aug														
Sep														
Oct														
Nov														
Dec														

Annex VII: Some Images

Aeration Unit

Sedimentation Unit

Filter Bed

Chlorination Unit

Sluice Valve

Sluice Valve

Sludge

Sludge Disposal

HH Connection

HH Connection