Challenges of Drinking Water Security in Selected Coastal Areas with Special Emphasis on Polders and Participation of Youth and Women

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<tr>
<td>ASA</td>
<td>Association for Social Advancement</td>
</tr>
<tr>
<td>BBS</td>
<td>Bangladesh Bureau of Statistics</td>
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<tr>
<td>BMD</td>
<td>Bangladesh Meteorological Department</td>
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<tr>
<td>BUET</td>
<td>Bangladesh University of Engineering and Technology</td>
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<td>BWP</td>
<td>Bangladesh Water Partnerships</td>
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<td>CCSLR</td>
<td>Climate Change and Sea Level Rise</td>
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<tr>
<td>DU</td>
<td>Dhaka University</td>
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<td>FGD</td>
<td>Focus Group Discussion</td>
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<tr>
<td>GOs</td>
<td>Government Organizations</td>
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<tr>
<td>IG</td>
<td>Infiltration Gallery</td>
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<tr>
<td>IWFM</td>
<td>Institute of Water and Flood Management</td>
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<tr>
<td>KII</td>
<td>Key Informant Interview</td>
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<tr>
<td>KM</td>
<td>Kilometers</td>
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<td>NAPA</td>
<td>National Adaptation Program of Action</td>
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<tr>
<td>NGOs</td>
<td>Non-Government Organizations</td>
</tr>
<tr>
<td>SST</td>
<td>Shallow Shrouded Tube Wells</td>
</tr>
<tr>
<td>SSFs</td>
<td>Slow Sand Filters</td>
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<tr>
<td>VSST</td>
<td>Very Shallow Shrouded Tube Wells</td>
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1. Introduction

1.1 Statement of the Problem

1. Water is the foundation of life. Still today in this 21st Century, all around the world, too many people spend their entire day searching for clean and safe drinking water. Water scarcity is either lack of enough water (quantity) or lack of access to safe water (quality) (thewaterproject.org/water-scarcity). Polluted water is not just dirty—it is deadly (National Academy of Sciences, 2007).

2. The clean, safe drinking water scarcity is a growing problem at coastal Bangladesh. In spite of having a large number of natural streams, ponds and good ground water storage, the scarcity of potable water is acute in the coastal area especially in the polders. The river water, for most of the time in the year, is highly turbid and saline. The low saline pond water is used for many domestic purposes, but it is regarded completely unsuitable for drinking. Unlike other areas of Bangladesh, ground water with acceptable quality is not available in most parts of coastal area at relatively shallow depths for easy withdrawal by conventional hand pumped tube wells. The use of easily available water as source of domestic water supply requires extensive costly treatment which is not a practical proposition for scattered rural population nor affordable in the context of rural economic condition.

3. The water supply situation in the coastal area of Bangladesh in terms of coverage, quality and quantity is very poor, though water is one of the basic human needs. In general each person on Earth requires at least 20 to 50 liters of clean, safe water a day for drinking, cooking, and simply keeping clean (National Academy of Sciences, 2007). Different research works depicted that the water security in the coastal area is very poor. Most of the studies showed that salinity is one of the major problems that the coastal region of Bangladesh has been facing over the last couple of decades. Due to sea level rise, frequent natural disasters, changes of climate patterns and man-made alteration of natural settings, the situation of water security is becoming more vulnerable day by day (Bashar, 2012).

4. A good number of research works has been conducted before, both by individuals and institutions, where most of the studies have emphasized upon salinity intrusion and overlooked other challenges to safe drinking water, and the responsibilities of youth and women in that regards. It has also been stated that the women of all age groups are more vulnerable in any hazardous environment. In this context, a study needed to be conducted to identify the real challenges to drinking water security in coastal areas with special emphasis on youth and women. In line with this realization, BWP has taken the initiative to conduct a study to find out the current situation of the drinking water security and challenges in selected polder areas.

1.2 Rationale of the Study

5. The coastal belt of Bangladesh is crisscrossed by rivers and their tributaries which are under active tidal influence. Due to this reason, in 1960s, 123 polders (at present 139), including 49 sea-facing polders were constructed to protect low-lying coastal areas from tidal floods and salinity intrusion in southern Bangladesh. The entire coastal belt, which extends
over 76 upazilas\(^1\), is identified as the problem area where complex hydro-geological conditions and adverse water quality make water supply difficult compared to other parts of the country.

6. Adverse water quality due to lack of upstream water flow, increases the salinity of groundwater and surface water because of the rise in sea level, makes the drinking water situation of coastal area highly problematic. Besides extreme weather condition and ongoing climate change are increasing the vulnerability of drinking water security of the coastal area of southern Bangladesh. To identify the role of youth and women in relation to the challenges of safe drinking water in this hazardous situation, demands an integrated study to be conducted.

7. The subject study, thus undertaken, focuses on the present status of drinking water and the role and participation of youth, particularly women, in safe drinking water management and identifies effective measures to improve water security in the coastal areas. It helps better understanding of water resource management, and constraints and challenges regarding access to safe drinking water in the selected study areas. It will also help to explore policy, institutional, technical and financing options, to address the issues of water security in coastal areas of southern Bangladesh, which still is a major concern.

1.3 Objective of the Study

8. The broad objective of the study is to know the challenges to safe drinking water and responsibilities of youth and women in the selected coastal polders of Bangladesh.

9. The specific objectives are as follows:
   ✓ To assess the present status of drinking water in the study area,
   ✓ To find the constraints regarding access to water,
   ✓ To know the challenges to safe drinking water in the localities,
   ✓ To find out the role and participation of youth particularly women in safe drinking water management,
   ✓ To identify the health risks related to water, and
   ✓ To find out the GOs and NGOs interventions to solve the problem.

1.4 Scope of work

10. The major scope of work to understand the present situation of water security, its challenges and to identify the role of women along with the youth of the study areas are described in following:
   ✓ Collection and analysis of available statistical data and other information at polder level on water quality and quantity;
   ✓ Identification and description of drinking water collection and management constraints, and challenges for youth and for women in drinking water collection and management;
   ✓ Identification of the extent of security of water used for drinking and other purposes and its impacts on health;

\(^1\)Upazila is an administrative sub-district of Bangladesh.
Organization of a regional workshop before finalizing the draft report, for data and mapping validation and obtaining feedback on approach, methodology and preliminary findings.

1.5 Limitation of the study

This research has been an exploratory study, conducted basically to find linkages among water, women and youth, and health in the context of southern Bangladesh coastal area with special attention to the selected polders. The field, this study ventured into, is less traveled thus there was scarcity of data and information. Therefore, it appears as a challenge to draw generalization of the research findings for the study area within short time. However, the study, perhaps first of its kind, reveals the challenges of drinking water and participation of youth and women in coastal region of Bangladesh.
2. Literature Review and Conceptual Framework

2.1 Review of Literature

12. Khanom & Salehin (2012) conducted a study under Department of Soil, Water and Environment, DU and Institute of Water and Flood Management (IWFM), BUET, cooperatively in 2012 on “Salinity Constraints to Different Water Uses in Coastal Area of Bangladesh”. In their study they tried to delineate the salinity related problems in multi-purpose uses of water and assess better water management options in a small scale water resources subproject in southwest coastal region of Bangladesh. They showed that from the end of April till the beginning of June, salinity levels both in the river and in the canal are considerably higher than the drinking water standards as well as the standards for irrigation water. Salinity levels of ground water at shallow depths (65-70 ft) are low, whereas salinity levels at deeper depths (840-1350 ft) are very high (3000-4000 μS/cm). They furthermore argued that salinity in the canal has been a constraint to irrigation water use and it caused considerable yield reduction over the last 4 years and the reduction rate was 5-5.5 to 2-2.5 ton/ha for boro and from 4.5-5 to 2.5 ton/ha for aus. Again, a number of health related problems like diarrhea, fever, high blood pressure, gastric problem, skin problems had been identified as caused by salinity. In their study they recommended repairing of the regulator gate and other possible management options such as application of gypsum, plantation of leguminous crops, and selection of more salt-tolerant crops, harvesting rainwater, exploring suitable locations for tube-wells which need to be tested and monitored on a regular basis.

13. Faisal and Kabir (2005) jointly published an article in Sage Journal on “An Analysis of Gender–Water Nexus in Rural Bangladesh.” In their article they presented a comprehensive analysis of the gender–water nexus in rural Bangladesh based on extensive field survey, focus group discussion, and interview with key informants. They carried out the study at seven field areas across Bangladesh. The authors presented their findings in four key areas: household water management, health and well-being, irrigation water management, and water related vulnerability. It was observed in their study that water for household use is collected by women and children, who face an array of physical, psychological and social problems. They showed that the water collection process depends on income/social class, location of water source, time of the day, and religious/cultural factors. They identified that the time spent for water collection imposes significant opportunity costs as loss of income and education opportunities. They identified that tube well water is widely used for drinking, but pond and river water is extensively used for other purposes. This, along with the lack of sanitation, causes frequent outbreak of water-borne diseases. There found that improper storage of water, poorly maintained tube wells, and arsenic in shallow wells pose additional threats to health especially on women and children. Women in arsenic affected areas face excommunication if detected with arsenicosis. The authors showed in their findings that the women of coastal areas are more in vulnerable situation as they are forced into fry(fish) collection labor under very unhealthy and unsafe conditions. These difficulties are exacerbated during natural disasters such as floods and droughts. At the same time there is very little participation of women in agricultural water management as ‘right to water’ is perceived as linked with ‘right to land’, over which women have little control. These hardships and deprivations are fundamentally caused by the lack of a number of factors: awareness, education, access to resources, empowerment, and institutional support.
14. Basar (2010) conducted another study on "Water Security in Coastal Region of Bangladesh: Would Desalination be a Solution to the Vulnerable Communities of the Sundarbans?" In his study he pointed issues like climate change and sea level rise (CCSLR) and man-made destruction due to widespread commercial shrimp farming which are the reasons of water salinity, decrease of soil productivity and finally decrease of water and food security in the coastal areas of Bangladesh. Basaris very specific in his study and showed the impact of the salinity intrusion in the coastal areas. At the same time he discussed about Government policy and finally recommended techniques for desalination which are as follows-

1. Impact of Water Salinity on Livelihood Operation: First, he showed that salinity intrusion makes the whole coastal belt's water availability unsecured and pushing poor people's lives to a more vulnerable position than before. Second, Water salinity causes an increase in soil salinity which further decreases the agricultural productivity and brings enormous pressure on food security, and last it destroys the ecosystem.

2. Government and development organizations: What is their observation? In this section Basar takes a critical view of the role of GO and NGOs. He cited from the policy paper, which briefly explained the causes and impacts of water salinity on the coastal economy and the coping strategy for Bangladesh government whereas much greater focus was given on climate change and sea level rise. But the future of water security for the poor coastal inhabitants was much neglected.

3. He provided a brief and clear idea about desalination, in which he claimed a new prospect towards water security. Desalination is the process of removing salt and other minerals, especially from sea water to produce potable water for household or irrigation purpose (AHSD, 2002). Here he furthermore included some techniques of desalination.

4. At the end of his study he recommended techniques for desalination which could be a solution for salinity-prone coastal region. Whereas, Bangladesh facing lack of energy supply, to recover the lack of energy sufficiency renewable sources of energy can be used. Besides, small reactor (CAREM) based nuclear desalination plant (IAEA Proceedings, 2007:383) might become workable for Bangladesh. He pointed that Tunisian Model of small-scale desalination plant could be the most viable desalination solution for Bangladesh (Elfil, H. et al, 2006: 320).

15. Khan, et al (2011) conducted a study on "Drinking Water Salinity and Maternal Health in Coastal Bangladesh: Implications of Climate Change" at Dacope. The objective of the study was to estimate salt intake from drinking water sources and examine environmental factors that may explain a seasonal excess of hypertension in pregnancy. The data was collected in October 2009 through March 2010. In their paper they showed that the average estimated sodium intakes from drinking water ranged from 5 to 16 g/day in the dry season, compared with 0.6-1.2 g/day in the rainy season. Average daily sodium excretion in urine was 3.4 g/day (range, 0.4-7.7 g/day). Women who drank shallow tube-well water were more likely to have urine sodium > 100 mmol/day than women who drank rainwater [odds ratio (OR) = 2.05; 95% confidence interval (CI), 1.11-3.80]. The annual hospital prevalence of hypertension in pregnancy was higher in the dry season (OR = 12.2%; 95% CI, 9.5-14.8) than in the rainy season (OR = 5.1%; 95% CI, 2.91-7.26). In the conclusion they showed that the estimated salt intake from drinking water in this population exceeded recommended limits. The problem of saline intrusion into drinking water has multiple causes and is likely to be exacerbated by climate change-induced sea-level rise.

16. Ahmed (1996) M. submitted a paper on “Reaching the Unreached: Challenges for the 21st Century, Coastal Water Supply in Bangladesh” on 22nd WEDC conference at New Delhi,
India. In his paper he first discussed the hydrological condition of the coastal area. He pointed that the entire coastal area is underlain by thick water bearing formations of varying depths and the regional hydrogeology is very complex. He found that in the coastal area, brackish ground water is available within 0 to 2.5m below the ground surface. In some regions low saline ground water is available in deep aquifers at a depth greater than 200m. So, the low saline water in and around most of 81,000 ponds in the coastal area is considered as a potential source for low-cost water supply in the coastal area.

17. Second, Ahmed argued that the quality of water is the main constraint affecting water supply system in the coastal area. He discussed about the challenges of safe water management in the coastal area. These are- salt water intrusion in the surface and ground waters in dry season, the indiscriminate use and unhygienic sanitary practices, the application of organic and inorganic fertilizers for fish cultivation, and the presence of chlorides, and dissolved iron in excess of acceptable limits is the main water supply problem.

18. Third, he described the present water supply situation of the coastal area. The ground water supply in the coastal area is based on manually operated shallow tubewells, 20m to 75m in depth and deep tubewells, 75m to 350m in depth. This is again based on the availability of fresh groundwater.

19. At the end, Firoz discussed the alternative water supply systems in the coastal area. Here he showed that at present the people of coastal area managed their water from some alternative sources. Such as- Very shallow shrouded tube wells (VSST); Shallow shrouded tubewells (SST); slow sand filters (SSFs); Infiltration gallery (IG); Rain water collection system and solar desalination.

20. Sultana, (2007) conducted a research on “Suffering for Water, Suffering from Water: Political Ecologies of Arsenic, Water and Development in Bangladesh.” In her dissertation she looked into the socio-ecological implications of a drinking water crisis in Bangladesh, within the context of broader development processes. In that case she imposed a particular attention to gendered and classed differences in how people cope with, respond to and adapt to changing water conditions, uses, and rights. In the findings of her thesis she showed that women are marginalized and suffer the most from the drinking water crisis; this has a strong class and locational dimension to it. Then she pointed out that the discourses of ‘community’ and ‘participation’ is problematically used in water management. It has observed that there is greater water hardship, exposure to poisoning from arsenic, and conflicts over water as a result of not only the contamination of erstwhile safe water sources and ensuing water scarcity and poisoning, but also from the ways ‘community’ and ‘participation’ notions are practiced. Furthermore, the thesis shows that attempts at privatization of water in the wake of arsenic is likely to further marginalize those without access to safe water, and thereby unlikely to reduce the poisoning of millions of people.

2.2 Conceptual Framework

21. As water moves in time and space consistent with the hydrological cycle, the term water management covers a variety of activities and disciplines. Again, many factors contribute to water security, ranging from biophysical to infrastructural, institutional, political, social and financial – many of which lie outside the realm of water. In this respect, water security lies at the centre of many security areas, each of which is intricately linked to water. The water security mainly depends on water availability, quality and its management, which are influenced by economic condition, politics and culture. The following Figure 2.1 shows the linkages of water security drivers at a glance:
2.3 Operational Definition of Terms

2.3.1 Drinking Water Security
22. This study deals with drinking water only, as such it focuses on security of drinking water (as per Terms of Reference). This study captures definition of “drinking water security” on the basis of definitions of water security given by David Grey and Claudia W. Sadoff (2007) and UN-Water (2013). In this study drinking water security refers to “the reliable availability of an acceptable quantity and quality of water for health, the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining human well-being, for ensuring protection against water-borne pollution and water related disasters.

2.3.2 Polder
23. A polder is a low-lying tract of land enclosed by embankments that forms an artificial hydrological entity, meaning it has no connection with outside water other than through manually operated devices. Bangladesh has 139 polders, of which 49 are sea-facing. These were constructed in the 1960s to protect the coast from tidal flooding and reduce salinity incursion. They reduce long-term flooding and waterlogging following storm surges from tropical cyclones.

2.3.3 Youth and Women
24. The target population includes both male and female in the 18-30 year age group of the community are defined as the youth. Especially the male members of the community are referred as youth, and the female of youth age groups and above up to 60 years are defined as women in this study.

David Grey and Claudia W. Sadoff, 2007 has defined water security as “the reliable availability of an acceptable quantity and quality of water for health, livelihoods and productions, coupled with an acceptable level of water-related risks. Furthermore, water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water related disasters, and for preserving ecosystems in a climate of peace and political stability (UN-Water, 2013).
3. **Approach and Methodology**

3.1 **Study Approach**

25. The present study follows an integrated approach including review of relevant literature, conceptualization with secondary data integration, primary data collection, validation of findings through workshop and final report preparation. The study approach is elaborated in the methodology and explained further. Following Figure 3.1 shows the details of the approach of the study:

![Figure 3-1: Approach of the Study](image)

3.2 **Methodology of the Study**

26. The present study employs the following methods and techniques with an intrinsic notion to meet the objectives. The following flow chart represents the steps of methodological framework of the study:
3.2.1 Selection of the Study Area

27. The study areas are situated in the south central and south west regions of Bangladesh. The criteria considered for selecting the study areas are as follows:
   - Sea facing coastal districts;
   - Lower natural flow of upstream water;
   - Higher salinity in water,
   - Scarcity of sweet water.

28. Considering the abovementioned criteria, six coastal districts were purposively selected as sample study areas from Khulna and Barisal districts, for conducting the study. The study areas for Khulna region were Polder 35/3 of Bagherhat, Polder 22 & 30 of Khulna and Polder 2 & 3 of Satkhira districts; whereas for Barisal region Polder 48, 43/2A and 43/2F of Patuakhali, Polder 41/1 of Barguna and Polder 39/2C of Pirojpur. Subsequently, two Unions from each of the polders were also selected in same manner.
3.2.2 Data Collection

29. All necessary data were collected from both primary and secondary sources. Secondary data were collected from published and unpublished reports, articles and research papers. The primary data were collected through Focus Group Discussion (FGD), key informant interview (KII), and informal discussion. A total number of twenty FGDs were conducted with the stakeholders like local government institution, civil societies, and most importantly, the youth and women from the selected study areas. Furthermore, ten KIIIs were conducted with the government officials, local government representatives, and NGO officials.

3.2.3 Reviewing Secondary Data

30. Relevant scientific publications, reports and statistics were carefully reviewed in identifying the present status and challenges to safe drinking water in the coastal area of southern Bangladesh and the relevant information has been incorporated in the study report.

3.2.4 Data Processing, Analysis and Report Preparation

31. Software such as Microsoft Excel and Microsoft Word were used in quantitative data analyses, and word processing, respectively. On the basis of analyzed data, draft study report has being prepared. The draft report will be sent to BWP for review and their feedback.
3.3 Findings Validation through Workshop

3.3.1 Consultation Workshops
32. Two regional workshops were conducted for disseminating the findings of the study to the stakeholders of the study areas of the respective districts, Khulna and Barguna. Feedback given by the stakeholders during open discussion sessions were collected, and incorporated in the report.

3.3.2 Issues of Consultation
33. There were specific issues (findings of the study) for validation in workshop. These are as follows:
   - Availability and accessibility of water
   - Quality of water
   - Health hazards related to water
   - Women and water

3.3.3 Feedback from Consultation
34. An open discussion was held after presenting the findings of the study to crosscheck misinformation and incorporate new comments from the stakeholders. Comments from these workshops have been accumulated in Chapter 4 of this report.

3.3.4 Finalization of Report
35. Final report will be prepared incorporating feedback (comments/suggestions) received from BW on the basis of their review of the draft report.
4. Drinking Water Availability and Security

4.1 Situation Analysis

36. Ground water i.e. tubewell water is the most preferred source of drinking water in the coastal areas of Bangladesh. But in most of the areas, tubewells are found to be the source of saline and iron contaminated water. Moreover, inadequate upstream flow in existing surface water bodies increases salinity in the both ground and surface water. Thus, people use unsafe water from unprotected rivers, ponds, and shallow tubewells. The problem of drinking water intensity is very acute near the coast. As a result, in spite of sinking a large number of hand tubewells, the water supply situation in many areas remains unsatisfactory. And even in this adverse situation, women are still responsible for collection of water for household usage.

37. This section concentrates on assessing present water condition with depended people on the basis of available data and perception of the people. Several drinking water-related problems and challenges that interrupt their wellbeing are outlined with a view to recommending expected measures so that they can adapt to adverse situations.

4.1.1 Sources of Water

38. Safe drinking water crisis is common in the polders of both Khulna and Barisal divisions. People of the study areas mainly depend on ground water for drinking purposes and the main source of ground water is shallow hand tube wells and deep set hand tube wells with an average depth of 30-50 feet and 700-1,200 feet, respectively; while for cooking and other household’s usage, they depend on surface water, like pond water. Besides, most people harvest rain water in the traditional way for cooking and drinking purposes during rainy season and preserve for a few days. Some of them harvest rainwater systematically at household level and preserve for 2-3 months. Figure 4.1 shows the present sources of water in the polders. The main sources of drinking water in polder areas are:

- Surface water like pond, canal (khal) and river;
- Ground water-deep tubewell water (700-1200 feet deep);
- Ground water-shallow tubewell water (20-100 feet deep);
- Rain water - in rainy season for two to four months;
- Supply water - from deep tube well
39. On the other hand, according to the database of BBS, 2011, the status of safe drinking water in sampled Barisal polder region is better than sampled Khulna polder region in terms of quality, quantity and availability. On average, 89% & 74% people can collect drinking water from tube well, while only 10% and 23% collects drinking water from other sources such as ponds, Pond sand filter (PSF); and rain water in Barisal and Khulna, respectively. The details are presented in Table 4.1 and Figure 4.2 shows that percentage of tube-well coverage is significant.

40. Although Bangladesh Bureau of Statistics, (BBS) 2011 findings show, a significant number of population are still depending on tube well water, though empirically, the quality of water is not at satisfactory level. Field findings show that, drinking water quality, quantity and availability is quite good where the internal and external connectivity of the rivers have adequate upstream flow.

<table>
<thead>
<tr>
<th>Drinking water sources</th>
<th>Sampled Barisal polders (%)</th>
<th>Sampled Khulna polders (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Tube well</td>
<td>89</td>
<td>74</td>
</tr>
<tr>
<td>Other (rain water, river water)</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Population census 2011
4.2 Demographic Profile of the Sampled Polders

It is evident that 25% of the total population of the country is living in the polder area of Bangladesh. This portion of the total population is living with low access to safe drinking water due to identifiable natural and anthropogenic vulnerability factors. Thus, a total number of 1,21,383 households of the study polder areas in sampled Khulna and Barisal regions have a total population of 4,15,778 of which 2,57,220 are male and 2,59,659 are female (Table 4.2). The female population is found to be higher than that of male population. The average male-female ratio is 97 i.e. there are 97 males per 100 females which is lower than the national figure of 100.3 (BBS 2011). The density of population in the study areas on average is 823 persons per square kilometer which is smaller than the national figure of 976 persons per sq. km (BBS 2011).

Table 4.2: Demographic Feature of the Studied Area

<table>
<thead>
<tr>
<th>Divisions</th>
<th>Polders</th>
<th>Total HHs</th>
<th>Total Population</th>
<th>Male</th>
<th>Female</th>
<th>Sex ratio</th>
<th>Population density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khulna</td>
<td>3</td>
<td>6,237</td>
<td>25,887</td>
<td>12,939</td>
<td>12,948</td>
<td>99</td>
<td>921</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>37,543</td>
<td>158,450</td>
<td>79,931</td>
<td>78,519</td>
<td>101</td>
<td>1043</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>2,285</td>
<td>9,310</td>
<td>4,637</td>
<td>4,674</td>
<td>99</td>
<td>1007</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>9,490</td>
<td>38,240</td>
<td>18,940</td>
<td>19,300</td>
<td>98</td>
<td>1007</td>
</tr>
<tr>
<td></td>
<td>35/3</td>
<td>6,668</td>
<td>27,494</td>
<td>13,660</td>
<td>13,834</td>
<td>97</td>
<td>1016</td>
</tr>
<tr>
<td><strong>Sub-total-Khulna/Average</strong></td>
<td><strong>62223</strong></td>
<td><strong>259381</strong></td>
<td><strong>130107</strong></td>
<td><strong>129275</strong></td>
<td><strong>99</strong></td>
<td><strong>999</strong></td>
<td></td>
</tr>
<tr>
<td>Barisal</td>
<td>48</td>
<td>9,846</td>
<td>44,168</td>
<td>22,516</td>
<td>21,652</td>
<td>99.7</td>
<td>384</td>
</tr>
<tr>
<td></td>
<td>39/2C</td>
<td>23,621</td>
<td>101,101</td>
<td>49,395</td>
<td>51,705</td>
<td>96</td>
<td>835</td>
</tr>
<tr>
<td></td>
<td>41/1</td>
<td>11,133</td>
<td>47,859</td>
<td>24,071</td>
<td>23,788</td>
<td>100</td>
<td>814</td>
</tr>
<tr>
<td></td>
<td>43/2A</td>
<td>8,160</td>
<td>36,250</td>
<td>17,673</td>
<td>18,577</td>
<td>94</td>
<td>641</td>
</tr>
<tr>
<td></td>
<td>43/2F</td>
<td>6400</td>
<td>28,120</td>
<td>13,458</td>
<td>14,662</td>
<td>91</td>
<td>563</td>
</tr>
<tr>
<td><strong>Sub-total-Barisal/Average</strong></td>
<td><strong>59160</strong></td>
<td><strong>156397</strong></td>
<td><strong>127113</strong></td>
<td><strong>130384</strong></td>
<td><strong>96</strong></td>
<td><strong>647</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total/average</strong></td>
<td><strong>1,21,383</strong></td>
<td><strong>4,15,778</strong></td>
<td><strong>2,57,220</strong></td>
<td><strong>2,59,659</strong></td>
<td><strong>97</strong></td>
<td><strong>823</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Bangladesh Bureau of Statistics (BBS), 2011
4.3 Water Quality, Quantity and Availability

42. Water of the tube wells is contaminated with arsenic, medium level of iron and saline round the year and people are facing problems to use water due to rusty color and bad odor. In the dry season (November-April) water of the ponds recede to a very low level and some ponds become dry and the quality of the residual water becomes very low to use. Moreover, insufficient number of ponds, and raised pond bed (due to many years of accumulation of clay, leaves and other dirt), have reduced the total capacity of water preservation. At the same time, the depths of the existing canals have reduced due to siltation.

43. During monsoons, the salinity levels are very low because of the increased amount of fresh water in the water bodies. The level of salinity starts increasing from January due to reduction of upland discharge, and reaches the peak in April and then starts decreasing again. Saline water intrudes the areas near the breached embankments causing damage to agricultural practices.

44. In the dry season, the overall salinity levels both in the soil and the surface water are high and about 30 percent of the polder areas are thus affected. This happens because of the following reasons: (i) about 6 percent of the polder areas under golda (prawn) culture, (ii) saline water enter through breached embankments, and (iii) malfunctioning of sluices with/without gates. However, in the month of December, the salinity value was low (0-4 parts per thousand), since rain water inside the Polders was still present and tidal flow from the sea was yet to intrude.

45. So, it is evident that the availability of drinking water is rough due to limited number of saline free tubewell. In the wet season, collection of water is a major concern; especially women who face difficulties to get to the water sources due to distance and poor communication system. Sometimes, the distance to get to the source of drinking water is about 1 to 2 km or more. In comparison to the drinking water security in the study polders of Khulna, Bagerhat and Satkhira, the situation in Patuakhali, Barguna and Pirojpur is little better.

4.4 Water Accessibility

46. The existing numbers of tube wells are not sufficient to meet consumer demand and a very large number of poor families depend on common tube-wells, which are not conveniently located. Distance to get to the source of drinking water is about 1 to 2 km. Negative political influence and biasness on installation in terms of proper distribution and placement of tube wells are also causal for low access to water. Well-off families have installed deep tube well for family use whereas poorer families still depended on that neighbor's or common tube-well. These problems are creating worse accessibility challenges to water for poorer people.

47. As stated earlier, collecting water during wet season is a major concern; especially for women face difficulties to get to the water sources due to poor communication system. Generally, women of all age group, especially 15-30 years old girls and women collect water two to three times a day. Sometimes, the male members of the family engage themselves to collect water.

In Nangla village of Noapara union at Polder 3, women aged 22 to 25 years are suffering uterine diseases and more than 75 percent women cut off uterus due to risk of cancer. They cannot avail medical treatment due to poverty and social problem; as such divorce is increasing day by day.[Ref needed]
4.5 Water and Health

48. 70% of human body consists of water. But, in Section 4.3.2 we have seen that the quality of drinking water is rough in the study area. This makes the whole coastal belt’s water availability unsecured pushing poor people’s life to a more vulnerable position than before. Through interview with some people of the study area, it was revealed that people suffer from various diseases like diarrhea, fever, high blood pressure, gastric etc. due to drinking saline water. Children mainly suffer from diarrhea and fever. The women could strongly relate different health related problems to salinity. Cases of gastritis, heart disease due to salinity and iron, and uterine cancer among the women, are on the rise. Outsiders experienced different health hazards like rapid hair fall, graying of hair, and constipation due to iron and saline contaminated tube well water. Furthermore, improper storage of water, poorly maintained tube wells, and arsenic in shallow wells pose additional threats to health, especially on women and children.

4.6 Role of Youth and Women

49. A strong social belief and mental construction perceive at the community level that women are socially responsible for collection and storage of water for daily needs. In some areas, male members are found to helpful in water collection task. But the ratio of this number is very low. Socio-cultural attachment in the polders areas is strong. Therefore, women, generally, do not face social, cultural, religious and political constraints while going for collecting water but distance of water sources and poor communication system during wet season is problematic for women and they are less concerned about the relative health risks from the daily usage of unsafe water. Though the socio-cultural environment of the study areas is good but the young unmarried women are susceptible to harassment. And these hardship and deprivation of women are fundamentally caused by the lack of a number of factors: awareness, education, access to resources, empowerment, and institutional support and poverty.

4.7 Constraints and Challenges

50. By analyzing the present status, a number of specific constraints and challenges have been identified of drinking water security for each of the study areas. But most of the challenges are almost similar and apparent in all polder areas except some polders of Satkhira and Khulna districts. In Satkhira, the water crisis picture and its related problems are more vulnerable than other study areas. In this section of the report the overall constraints and challenges of drinking water is depicted with different aspects.

4.7.1 Purification Technology

51. As mentioned earlier, water in the coastal area is highly saline and that the presence of Iron is a regular phenomenon. So purification is the basic necessity for the study polder areas. But the constraint is that no purification system was found. Though some people use pond sand filters (PSF) for water purification. In some areas, management of PSF was found as a major constraint for water purification.

4.7.2 Natural Risk & Disaster

52. In a frequency study carried out by Hennon, P. et al. (2010), Bay of Bengal has been found to be the second most frequently visited place in the world by cyclones with about 20 cyclones per decade. From 1901-1957 only 11 cyclones have hit the coastal areas of
Bangladesh, while from 1957 to 2009, a total of 55 cyclones have hit the area. So, in the last 52 years, the number of cyclones hitting coastal areas of Bangladesh has increased 5 times compared to the previous 57 years. (Bangladesh Meteorological Department: BMD). It is, therefore, evident that the study area polders are frequently affected by tidal flooding, salinity intrusion and cyclones. Salinity intrusion is as well as cyclone and sea level rise is a constant challenge and threat to drinking water security in the coastal polders. At the same time, inundation of tubewells and ponds due to flood and tidal water intrusion is a big challenge for water security in the coastal area.

53. Details about the hazards which created disasters in the area are presented in the following table (Table:4-3).

Table 4-3: Natural Disaster Related Information of the Study Areas

<table>
<thead>
<tr>
<th>Disaster</th>
<th>Severely affected year</th>
<th>% of affected area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salinity</td>
<td>2007, 2009, 2011</td>
<td>50</td>
</tr>
<tr>
<td>Tidal flood</td>
<td>2007, 2009, 2010</td>
<td>100</td>
</tr>
<tr>
<td>Cyclone</td>
<td>2007 (Sidr), 2009 (Aila)</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: CEGIS field work, 2015

4.7.3 Poverty: Incapability of People

54. People of the study areas who are struggling to survive with low income, the scarcity of drinking water tends to throw them into another crisis to meet the demand with their present economic condition. It requires Tk. 50-60 thousand to install a deep set hand tube well, which is very difficult for the people of the coastal area to afford. Sometimes 10-15 households try to install a deep set hand tubewell but often most of the households fail to bear the minimum individual costs. On the other hand, ASA, a national NGO, is working for safe drinking water. The organization supply drinking water at the cost of Tk. 15 per 20 litre at Polder 3, which is found to be difficult for the people of the area to pay. They demand less price for water supply... In another case, it was found that in collaboration with GO-NGO partnership, some rain water harvesting system were installed in different areas at an estimated minimum cost of Tk. 22,000 and maximum cost of Tk. 70,000. It is thus evident that the water cost creates serious problems whereas most of the people could not get such opportunity to avail pure drinking water with their increasing demand.

4.7.4 Water and Health

55. There is no doubt that water is interlinked with health. Pure water makes people healthier while impure water causes serious health problems. Availability of pure water tended people to retain good health by avoiding water related diseases. Major health related challenges of safe drinking water are:

- Unhealthy living conditions especially for both women and children
- Lack of knowledge about health risk owing to use of unsafe water
- Unavailability of treatment for arsenicosis, and salinity and iron related problems
- Increasing family maintenance expenditure due to high diseases prevalence.

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3Salinity levels of ground water at shallow depths (65-70 ft) are low, where as salinity levels at deeper depths (840-1350 ft) are very high (3000-4000 µS/cm).
4.7.5 Water: Youth and Women

56. In the polder areas women are mainly responsible for collecting drinking water except Satkhira. In Satkhira, male members are found helpful in collecting water for household. But in the other areas, not more than 20% male members engage themselves to collect water. This is one of the main challenges in relation to household water management. The challenges to get pure water and participation of youth and women are as follows:

- Distance to the collection source of drinking water is about ½ to 1 km and some cases, 2 to 3 km
- In Nowapara, Satkhira women and even school going children spend 3 to 4 hours a day collecting water at a time
- Lack of awareness and adequate knowledge for water management
- Especially for women, the challenges lie in the following socio-cultural factors:

57. awareness, education, access to resources, empowerment, and institutional support.

4.7.6 Anthropogenic Issues

58. In Section 4.3 the overall drinking water situation of the study polders have been portrayed. Though, a maximum number of the people depend on hand set tubewells, a large portion of household usage depends on surface water, especially pond water. The challenges of this case are as follows:

- No easier alternative than to use water for cooking from the same pond which is also used for washing utensils and clothes
- Contamination of water by washing baby clothes and buffalos in the same pond which they use for their daily household activities.

4.7.7 Socio-Political Issues

59. Many people lack water security because of their political affiliation, disability, gender, age or social status. In some situations, communities that do not support ruling political party, are not prioritized for service provision. Socio political issues also play a vital role to get safe drinking water. Here are some instances:

- Poor governance and/or weak political will to commit the necessary financial and human resources to water supply development and water resource management
- Negative political influence and biasness on installation, distribution and placement of tube wells
- Improper management and maintenance for the broken PSF, tube wells

4.7.8 Institutional Issues

60. The challenges to get pure water have already mentioned where institutional challenges are also strongest among them. Effective monitoring on access, quantity and quality of water are key considerations to implement the policy to ensure water for all. Increasing problems of water quality or poor maintenance leading to defunct infrastructure, weaken the policy that also creates hindrance to prepare a roadmap for ensuring equitable access to drinking water from the very grass root level. The major institutional challenges are as follows:

- Poor infrastructure
• Inadequate test to check the Iron and Arsenic levels in drinking water
• Lack of co-ordination between Local people, GOs and NGOs
• Increased complexities in terms of bureaucratic hierarchy and institutional position
• Lack of people’s participation with the implementing agencies
5. Expected Solutions and Conclusions

5.1 Solutions and Interventions

It is clear from the earlier discussion that expected measures of solutions the major concerns to improve drinking water security in polder area. Based on the field information, the expected solutions against challenges may be categorized as Hardware measures and Software measures. **Hardware** measures mean those involving the construction of various infrastructures or any other physical actions while the **software** measures are those involving policy review and reforms, institutional arrangement, people’s participation, awareness raising programs etc.

5.1.1 Software Measures

- Establish linkage with Microfinance Institutions (MFIs) to receive finance for installing tube well and rain water system
- Build awareness about the negative impact of salinity, iron and arsenic contamination
- Increase awareness and knowledge of water born diseases, impact of salinity, iron and arsenic to the community
- Develop awareness among male members to collect water from distance
- Arrange training for the polder areas community on information of good source of product and technology, desalination, water purification process, proper rain water harvesting process, water related health hazards, responsibility of the male members to collect water, impact of salinity, iron as well as arsenic.

5.1.2 Hardware Measures

- Introduce new technologies and products with low cost/interest to the polder area people.
- Excavate ponds with the share of beneficiaries for reserving much water
- Install deep tube well as much as with the technology of filter process of Iron and Salinity.
- Introduce modern rain water harvesting system and provide this technology to some beneficiaries.
- Test contamination of arsenic, level of Iron and Salinity.
- Ensure medical treatment facility for affected people
5.2 Conclusions

62. Safe drinking water is a worldwide problem. Bangladesh is no exception to it and coastal areas are more vulnerable to it. Inadequate upstream flow in existing surface water bodies increases salinity in the both ground and surface water which makes the water availability and accessibility difficult to the people. In the study areas ground water is the most preferred source of drinking water. But in most of the areas, tube wells are found to be the source of saline and iron contaminated water which hampers the drinking water security as well as the socio-economic and health condition of the people of the study areas.

63. Furthermore, cyclone and sea level rise is a constant challenge and threat to drinking water security in the coastal polders. At the same time, inundation of tube wells and ponds due to flood and tidal water intrusion is a big challenge for water security in the coastal areas. These are increasing the scarcity of safe drinking water in the polder areas. This scarcity of safe drinking water is mainly affected the women, as women mainly collect water for drinking other household usage. Peoples from all age groups are suffering from various diseases, especially women and children are more susceptible to such diseases. To solve the scarcity of safe drinking water some challenges are identified such as unavailability of water purification technology, frequency of natural risk and disaster, poverty incidence, anthropogenic issues, and socio-political and institutional issues.

64. Some measures can be taken such as, (i) introducing new technologies and products for water purification; (ii) excavating ponds with the share of beneficiaries for reserving much water, and (iii) introducing modern rain water harvesting system to solve the constraints and challenges of drinking water scarcity. Besides, some awareness building programs and trainings can be run for the people of the polder areas on desalination, water purification process, proper rain water harvesting process, water related health hazards, responsibility of the male members to collect water, impact of salinity, iron as well as arsenic contamination in water to increase drinking water security in the polder areas.
References


12. Khan, AE; Ireson, A; Kotvas, S; Mojumder, SK; Khusru, A; Rahman, A; Vineis, P, Labrese Ej, VP; 2011, “Drinking Water Salinity and Maternal Health in Coastal Bangladesh: Implications of Climate Change”, London School of Hygiene & Tropical Medicine, LSHTM Research Online.


**Annex A: Checklist for Primary Data Collection**

<table>
<thead>
<tr>
<th>1. এলাকায়পরিদর্শনমানবিশ্বা</th>
<th>অক্ষৌহীন</th>
<th>বর্ষাকৃতি</th>
</tr>
</thead>
<tbody>
<tr>
<td>আপনাদেরপানিরধারাউৎসরকার?</td>
<td>নলকুপে পুকুর/ খাল/ নদী/ বৃটিশপানি/ pond sand filter/iron removal plant/VSST/SST/SSF/</td>
<td>নলকুপে পুকুরে খালে নদী/ বৃটিশপানি/ pond sand filter/iron removal plant/VSST/SST/SSF/</td>
</tr>
<tr>
<td>বর্তমান (উপলব্ধকরণ):</td>
<td></td>
<td>বর্তমান (উপলব্ধকরণ):</td>
</tr>
<tr>
<td>বৃটিশপানিরবারজন্যকল্পনাৎসংস্কারকারা?</td>
<td></td>
<td>বৃটিশপানিরবারজন্যকল্পনাৎসংস্কারকারা?</td>
</tr>
<tr>
<td>খাবারপানিরপণ্যানবাজায় রাখতে খাবারপানিতে কিরণরেসিম্যান?</td>
<td>মান বজায় রাখতে:</td>
<td>মান বজায় রাখতে:</td>
</tr>
<tr>
<td>পানিসৃষ্টি:</td>
<td>পানিসৃষ্টি:</td>
<td></td>
</tr>
<tr>
<td>কোনক্ষেত্রেপানিরউৎসরায়ারায়েবিনিম্যানীলী?</td>
<td>1) তু-উপলব্ধি</td>
<td>1) তু-উপলব্ধি</td>
</tr>
<tr>
<td>2) তু- তল</td>
<td>2) তু- তল</td>
<td></td>
</tr>
<tr>
<td>পাপিলগুচ্ছালিকাজেন্দরলেগুণরপানিবামেরকারা?</td>
<td>উৎসরমানঃ</td>
<td>উৎসরমানঃ</td>
</tr>
<tr>
<td>খাবারজন্যকোনউৎসরকেপানিরনিম্যানীলী?</td>
<td>উৎসরমানঃ</td>
<td>উৎসরমানঃ</td>
</tr>
<tr>
<td>এলাকায়খাবারপানিরনিম্যানীলীকিস্তা?</td>
<td>1) ভাল০) মোটামুটি৩ খারাপ</td>
<td>1) ভাল০) মোটামুটি৩ খারাপ</td>
</tr>
<tr>
<td>দৈনন্দিনচেষ্টাতে পরিমানকারণের প্রয়োজনহীনহীন?</td>
<td>ক্রান্তীয়:</td>
<td>ক্রান্তীয়:</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>খাবারপানিগ্রহণেরকাঠামোতে সত্ত্বাউতাত্ত্বিক দিষ্টবাহুল্যের কর্মসময়ের অনুযায়ী?</td>
<td>১) কর্মসময়(মিনিট):</td>
<td>১) কর্মসময়(মিনিট):</td>
</tr>
<tr>
<td>২) সময়(মিনিট):</td>
<td>২) সময়(মিনিট):</td>
<td></td>
</tr>
<tr>
<td>দিনেরকাঠামোয় খাবারপানিগ্রহণের কাঠামোতে আরক্ষিত হওয়ার অবসর</td>
<td>১) একবার(দুইবার) তিনবার(৪) অবসর</td>
<td>১) একবার(দুইবার) তিনবার(৪) অবসর</td>
</tr>
<tr>
<td>আপনারায়নের ক্ষেত্রে পানিপ্রদান কাঠামোতে অবসর -</td>
<td>১) লবানক: ১) হাঁ(২) না</td>
<td>১) লবানক: ১) হাঁ(২) না</td>
</tr>
<tr>
<td>২) আরণ্য মুখ: ১) হাঁ(২) না</td>
<td>২) আরণ্য মুখ: ১) হাঁ(২) না</td>
<td></td>
</tr>
<tr>
<td>৩) আরসেনিক মুখ: ১) হাঁ(২) না</td>
<td>৩) আরসেনিক মুখ: ১) হাঁ(২) না</td>
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</tr>
</tbody>
</table>

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<td>২</td>
<td>কাজের পরিকল্পনা লম্বিত করা হয় না।</td>
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<td>৩</td>
<td>কর্মচারীদের প্রশিক্ষণ না হয়।</td>
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Kodomtola village at Ayla Patakata Union

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Ikri Bazar at Ikri Union

Khulna region

Workshop in Batiaghata Upazila of Khulna District
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Kheagrghat Village at Dema Union, Bagherhat
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Dewan Ali Arshad (Value Chain Expert)
Mobasher Bin Ansari (Anthropologist)
Md. Ashis Mawla ((Anthropologist))
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Muhammad Azizur Rahman (Junior Sociologist)
Muhammad Shahidur Rahman (Junior Sociologist)
Fatima Tuz Zohora (Junior Environmentalist)
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<th>Description</th>
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<td>ASA</td>
<td>Association for Social Advancement</td>
</tr>
<tr>
<td>BBS</td>
<td>Bangladesh Bureau of Statistics</td>
</tr>
<tr>
<td>BMD</td>
<td>Bangladesh Meteorological Department</td>
</tr>
<tr>
<td>BUET</td>
<td>Bangladesh University of Engineering and Technology</td>
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<td>BWP</td>
<td>Bangladesh Water Partnerships</td>
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<td>CCSLR</td>
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<td>Dhaka University</td>
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<td>FGD</td>
<td>Focus Group Discussion</td>
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<tr>
<td>GOs</td>
<td>Government Organizations</td>
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<td>IG</td>
<td>Infiltration Gallery</td>
</tr>
<tr>
<td>IWFM</td>
<td>Institute of Water and Flood Management</td>
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<td>National Adaptation Program of Action</td>
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<td>NGOs</td>
<td>Non-Government Organizations</td>
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<td>Shallow Shrouded Tube Wells</td>
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<td>VSST</td>
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1. Introduction

1.1 Statement of the Problem

1. Water is the foundation of life. Still today in this 21st Century, all around the world, too many people spend their entire day searching for clean and safe drinking water. Water scarcity is either lack of enough water (quantity) or lack of access to safe water (quality) (thewaterproject.org/water-scarcity). Polluted water is not just dirty—it is deadly (National Academy of Sciences, 2007). depict

2. The clean, safe drinking water scarcity is a growing problem at coastal Bangladesh. In spite of having a large number of natural streams, ponds and good ground water storage, the scarcity of potable water is acute in the coastal area especially in the polders. The river water, for most of the time in the year, is highly turbid and saline. The low saline pond water is used for many domestic purposes, but it is regarded completely unsuitable for drinking. Unlike other areas of Bangladesh, ground water with acceptable quality is not available in most parts of coastal area at relatively shallow depths for easy withdrawal by conventional hand pumped tube wells. The use of easily available water as source of domestic water supply requires extensive costly treatment which is not a practical proposition for scattered rural population nor affordable in the context of rural economic condition.

3. The water supply situation in the coastal area of Bangladesh in terms of coverage, quality and quantity is very poor, though water is one of the basic human needs. In general each person on Earth requires at least 20 to 50 liters of clean, safe water a day for drinking, cooking, and simply keeping clean (National Academy of Sciences, 2007). Different research works depicted that the water security in the coastal area is very poor. Most of the studies showed that salinity is one of the major problems that the coastal region of Bangladesh has been facing over the last couple of decades. Due to sea level rise, frequent natural disasters, changes of climate patterns and man-made alteration of natural settings, the situation of water security is becoming more vulnerable day by day (Bashar, 2012).

4. A good number of research works has been conducted before, both by individuals and institutions, where most of the studies have emphasized upon salinity intrusion and overlooked other challenges to safe drinking water, and the responsibilities of youth and women in that regards. It has also been stated that the women of all age groups are more vulnerable in any hazardous environment. In this context, a study needed to be conducted to identify the real challenges to drinking water security in coastal areas with special emphasis on youth and women. In line with this realization, BWP has taken the initiative to conduct a study to find out the current situation of the drinking water security and challenges in selected polder areas.

1.2 Rationale of the Study

5. The coastal belt of Bangladesh is crisscrossed by rivers and their tributaries which are under active tidal influence. Due to this reason, in 1960s, 123 polders (at present 139), including 49 sea-facing polders were constructed to protect low-lying coastal areas from tidal floods and salinity intrusion in southern Bangladesh. The entire coastal belt, which extends
over 76 upazilas, is identified as the problem area where complex hydro-geological conditions and adverse water quality make water supply difficult compared to other parts of the country.

6. Adverse water quality due to lack of upstream water flow, increases the salinity of ground water and surface water because of the rise in sea level, makes the drinking water situation of coastal area highly problematic. Besides extreme weather condition and ongoing climate change are increasing the vulnerability of drinking water security of the coastal area of southern Bangladesh. To identify the role of youth and women in relation to the challenges of safe drinking water in this hazardous situation, demands an integrated study to be conducted.

7. The subject study, thus undertaken, focuses on the present status of drinking water and the role and participation of youth, particularly women, in safe drinking water management and identifies effective measures to improve water security in the coastal areas. It helps better understanding of water resource management, and constraints and challenges regarding access to safe drinking water in the selected study areas. It will also help to explore policy, institutional, technical and financing options, to address the issues of water security in coastal areas of southern Bangladesh, which still is a major concern.

1.3 Objective of the Study

8. The broad objective of the study is to know the challenges to safe drinking water and responsibilities of youth and women in the selected coastal polders of Bangladesh.

9. The specific objectives are as follows:
   ✓ To assess the present status of drinking water in the study area,
   ✓ To find the constraints regarding access to water,
   ✓ To know the challenges to safe drinking water in the localities,
   ✓ To find out the role and participation of youth particularly women in safe drinking water management,
   ✓ To identify the health risks related to water, and
   ✓ To find out the GOs and NGOs interventions to solve the problem.

1.4 Scope of work

10. The major scope of work to understand the present situation of water security, its challenges and to identify the role of women along with the youth of the study areas are described in following:
   ✓ Collection and analysis of available statistical data and other information at polder level on water quality and quantity;
   ✓ Identification and description of drinking water collection and management constraints, and challenges for youth and for women in drinking water collection and management;
   ✓ Identification of the extent of security of water used for drinking and other purposes and its impacts on health;

1\(^{1}\)Upazila is an administrative sub-district of Bangladesh.
✓ Organization of a regional workshop before finalizing the draft report, for data and mapping validation and obtaining feedback on approach, methodology and preliminary findings.

1.5 Limitation of the study

11. This research has been an exploratory study, conducted basically to find linkages among water, women and youth, and health in the context of southern Bangladesh coastal area with special attention to the selected polders. The field, this study ventured into, is less traveled thus there was scarcity of data and information. Therefore, it appears as a challenge to draw generalization of the research findings for the study area within short time. However, the study, perhaps first of its kind, reveals the challenges of drinking water and participation of youth and women in coastal region of Bangladesh.
2. Literature Review and Conceptual Framework

2.1 Review of Literature

12. Khanom & Salehin (2012) conducted a study under Department of Soil, Water and Environment, DU and Institute of Water and Flood Management (IWFM), BUET, cooperatively in 2012 on “Salinity Constraints to Different Water Uses in Coastal Area of Bangladesh”. In their study they tried to delineate the salinity related problems in multi-purpose uses of water and asses better water management options in a small scale water resources subproject in southwest coastal region of Bangladesh. They showed that from the end of April till the beginning of June, salinity levels both in the river and in the canal are considerably higher than the drinking water standards as well as the standards for irrigation water. Salinity levels of ground water at shallow depths (65-70 ft) are low, whereas salinity levels at deeper depths (840-1350 ft) are very high (3000-4000 µS/cm). They furthermore argued that salinity in the canal has been a constraint to irrigation water use and it caused considerable yield reduction over the last 4 years and the reduction rate was 5-5.5 to 2-2.5 ton/ha for boro and from 4.5-5 to 2.5 ton/ha for aus. Again, a number of health related problems like diarrhea, fever, high blood pressure, gastric problem, skin problems had been identified as caused by salinity. In their study they recommended repairing of the regulator gate and other possible management options such as application of gypsum, plantation of leguminous crops, and selection of more salt-tolerant crops, harvesting rainwater, exploring suitable locations for tube-wells which need to be tested and monitored on a regular basis.

13. Faisal and Kabir (2005) jointly published an article in Sage Journal on “An Analysis of Gender–Water Nexus in Rural Bangladesh.” In their article they presented a comprehensive analysis of the gender–water nexus in rural Bangladesh based on extensive field survey, focus group discussion, and interview with key informants. They carried out the study at seven field areas across Bangladesh. The authors presented their findings in four key areas: household water management, health and well-being, irrigation water management, and water related vulnerability. It was observed in their study that water for household use is collected by women and children, who face an array of physical, psychological and social problems. They showed that the water collection process depends on income/social class, location of water source, time of the day, and religious/cultural factors. They identified that the time spent for water collection imposes significant opportunity costs as loss of income and education opportunities. They identified that tube well water is widely used for drinking, but pond and river water is extensively used for other purposes. This, along with the lack of sanitation, causes frequent outbreak of water-borne diseases. There found that improper storage of water, poorly maintained tube wells, and arsenic in shallow wells pose additional threats to health especially on women and children. Women in arsenic affected areas face excommunication if detected with arsenicosis. The authors showed in their findings that the women of coastal areas are more in vulnerable situation as they are forced into fry(fish) collection labor under very unhealthy and unsafe conditions. These difficulties are exacerbated during natural disasters such as floods and droughts. At the same time there is very little participation of women in agricultural water management as ‘right to water’ is perceived as linked with ‘right to land’, over which women have little control. These hardships and deprivations are fundamentally caused by the lack of a number of factors: awareness, education, access to resources, empowerment, and institutional support.
14. Basar (2010) conducted another study on "Water Security in Coastal Region of Bangladesh: Would Desalination be a Solution to the Vulnerable Communities of the Sundarbans?" In his study he pointed issues like climate change and sea level rise (CCSLR) and man-made destruction due to widespread commercial shrimp farming which are the reasons of water salinity, decrease of soil productivity and finally decrease of water and food security in the coastal areas of Bangladesh. Basaris very specific in his study and showed the impact of the salinity intrusion in the coastal areas. At the same time he discussed about Government policy and finally recommended techniques for desalination which are as follows-

1. Impact of Water Salinity on Livelihood Operation: First, he showed that salinity intrusion makes the whole coastal belt’s water availability unsecured and pushing poor people’s lives to a more vulnerable position than before. Second, Water salinity causes an increase in soil salinity which further decreases the agricultural productivity and brings enormous pressure on food security, and last it destroys the ecosystem.

2. Government and development organizations: What is their observation? In this section Basar takes a critical view of the role of GO and NGOs. He cited from the policy paper, which briefly explained the causes and impacts of water salinity on the coastal economy and the coping strategy for Bangladesh government whereas much greater focus was given on climate change and sea level rise. But the future of water security for the poor coastal inhabitants was much neglected.

3. He provided a brief and clear idea about desalination, in which he claimed a new prospect towards water security. Desalination is the process of removing salt and other minerals, especially from sea water to produce potable water for household or irrigation purpose (AHSD, 2002). Here he furthermore included some techniques of desalination.

4. At the end of his study he recommended techniques for desalination which could be a solution for salinity-prone coastal region. Whereas, Bangladesh facing lack of energy supply, to recover the lack of energy sufficiency renewable sources of energy can be used. Besides, small reactor (CAREM) based nuclear desalination plant (IAEA Proceedings, 2007:383) might become workable for Bangladesh. He pointed that Tunisian Model of small-scale desalination plant could be the most viable desalination solution for Bangladesh (Elfil, H. et al, 2006: 320).

15. Khan, et al (2011) conducted a study on "Drinking Water Salinity and Maternal Health in Coastal Bangladesh: Implications of Climate Change" at Dacope. The objective of the study was to estimate salt intake from drinking water sources and examine environmental factors that may explain a seasonal excess of hypertension in pregnancy. The data was collected in October 2009 through March 2010. In their paper they showed that the average estimated sodium intakes from drinking water ranged from 5 to 16 g/day in the dry season, compared with 0.6-1.2 g/day in the rainy season. Average daily sodium excretion in urine was 3.4 g/day (range, 0.4-7.7 g/day). Women who drank shallow tube-well water were more likely to have urine sodium > 100 mmol/day than women who drank rainwater [odds ratio (OR) = 2.05; 95% confidence interval (CI), 1.11-3.80]. The annual hospital prevalence of hypertension in pregnancy was higher in the dry season (OR = 12.2%; 95% CI, 9.5 -14.8) than in the rainy season (OR = 5.1%; 95% CI, 2.91-7.26). In the conclusion they showed that the estimated salt intake from drinking water in this population exceeded recommended limits. The problem of saline intrusion into drinking water has multiple causes and is likely to be exacerbated by climate change-induced sea-level rise.

16. Ahmed (1996) M. submitted a paper on “Reaching the Unreached: Challenges for the 21st Century, Coastal Water Supply in Bangladesh” on 22nd WEDC conference at New Delhi,
India. In his paper he first discussed the hydrological condition of the coastal area. He pointed that the entire coastal area is underlain by thick water bearing formations of varying depths and the regional hydrogeology is very complex. He found that in the coastal area, brackish ground water is available within 0 to 2.5m below the ground surface. In some regions low saline ground water is available in deep aquifers at a depth greater than 200m. So, the low saline water in and around most of 81,000 ponds in the coastal area is considered as a potential source for low-cost water supply in the coastal area.

17. Second, Ahmed argued that the quality of water is the main constraint affecting water supply system in the coastal area. He discussed about the challenges of safe water management in the coastal area. These are- salt water intrusion in the surface and ground waters in dry season, the indiscriminate use and unhygienic sanitary practices, the application of organic and inorganic fertilizers for fish cultivation, and the presence of chlorides, and dissolved iron in excess of acceptable limits is the main water supply problem.

18. Third, he described the present water supply situation of the coastal area. The ground water supply in the coastal area is based on manually operated shallow tubewells, 20m to 75m in depth and deep tubewells, 75m to 350m in depth. This is again based on the availability of fresh groundwater.

19. At the end, Firoz discussed the alternative water supply systems in the coastal area. Here he showed that at present the people of coastal area managed their water from some alternative sources. Such as- Very shallow shrouded tube wells (VSST); Shallow shrouded tubewells (SST); slow sand filters (SSFs); Infiltration gallery (IG); Rain water collection system and solar desalination.

20. Sultana, (2007) conducted a research on “Suffering for Water, Suffering from Water: Political Ecologies of Arsenic, Water and Development in Bangladesh.” In her dissertation she looked into the socio-ecological implications of a drinking water crisis in Bangladesh, within the context of broader development processes. In that case she imposed a particular attention to gendered and classed differences in how people cope with, respond to and adapt to changing water conditions, uses, and rights. In the findings of her thesis she showed that women are marginalized and suffer the most from the drinking water crisis; this has a strong class and locational dimension to it. Then she pointed out that the discourses of ‘community’ and ‘participation’ is problematically used in water management. It has observed that there is greater water hardship, exposure to poisoning from arsenic, and conflicts over water as a result of not only the contamination of erstwhile safe water sources and ensuing water scarcity and poisoning, but also from the ways ‘community’ and ‘participation’ notions are practiced. Furthermore, the thesis shows that attempts at privatization of water in the wake of arsenic is likely to further marginalize those without access to safe water, and thereby unlikely to reduce the poisoning of millions of people.

2.2 Conceptual Framework

21. As water moves in time and space consistent with the hydrological cycle, the term water management covers a variety of activities and disciplines. Again, many factors contribute to water security, ranging from biophysical to infrastructural, institutional, political, social and financial – many of which lie outside the realm of water. In this respect, water security lies at the centre of many security areas, each of which is intricately linked to water. The water security mainly depends on water availability, quality and its management, which are influenced by economic condition, politics and culture. The following Figure 2.1 shows the linkages of water security drivers at a glance:
2.3 Operational Definition of Terms

2.3.1 Drinking Water Security

22. This study deals with drinking water only, as such it focuses on security of drinking water (as per Terms of Reference). This study captures definition of “drinking water security” on the basis of definitions of water security given by David Grey and Claudia W. Sadoff (2007) and UN-Water (2013). In this study drinking water security refers to “the reliable availability of an acceptable quantity and quality of water for health, the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining human well-being, for ensuring protection against water-borne pollution and water related disasters.

2.3.2 Polder

23. A polder is a low-lying tract of land enclosed by embankments that forms an artificial hydrological entity, meaning it has no connection with outside water other than through manually operated devices. Bangladesh has 139 polders, of which 49 are sea-facing. These were constructed in the 1960s to protect the coast from tidal flooding and reduce salinity incursion. They reduce long-term flooding and waterlogging following storm surges from tropical cyclones.

2.3.3 Youth and Women

24. The target population includes both male and female in the 18-30 year age group of the community are defined as the youth. Especially the male members of the community are referred as youth, and the female of youth age groups and above up to 60 years are defined as women in this study.

David Grey and Claudia W. Sadoff, 2007 has defined water security as “the reliable availability of an acceptable quantity and quality of water for health, livelihoods and productions, coupled with an acceptable level of water-related risks. Furthermore, water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water related disasters, and for preserving ecosystems in a climate of peace and political stability (UN-Water, 2013).
3. **Approach and Methodology**

3.1 **Study Approach**

25. The present study follows an integrated approach including review of relevant literature, conceptualization with secondary data integration, primary data collection, validation of findings through workshop and final report preparation. The study approach is elaborated in the methodology and explained further. Following Figure 3.1 shows the details of the approach of the study:

![Study Approach Diagram](image)

**Figure 3-1: Approach of the Study**

3.2 **Methodology of the Study**

26. The present study employs the following methods and techniques with an intrinsic notion to meet the objectives. The following flow chart represents the steps of methodological framework of the study:
3.2.1 Selection of the Study Area

The study areas are situated in the south central and south west regions of Bangladesh. The criteria considered for selecting the study areas are as follows:

- Sea facing coastal districts;
- Lower natural flow of upstream water;
- Higher salinity in water,
- Scarcity of sweet water.

Considering the abovementioned criteria, six coastal districts were purposively selected as sample study areas from Khulna and Barisal districts, for conducting the study. The study areas for Khulna region were Polder 35/3 of Bagherhat, Polder 22 & 30 of Khulna and Polder 2 & 3 of Satkhira districts; whereas for Barisal region Polder 48, 43/2A and 43/2F of Patuakhali, Polder 41/1 of Barguna and Polder 39/2C of Pirojpur. Subsequently, two Unions from each of the polders were also selected in same manner.
3.2.2 Data Collection

29. All necessary data were collected from both primary and secondary sources. Secondary data were collected from published and unpublished reports, articles and research papers. The primary data were collected through Focus Group Discussion (FGD), key informant interview (KII), and informal discussion. A total number of twenty FGDs were conducted with the stakeholders like local government institution, civil societies, and most importantly, the youth and women from the selected study areas. Furthermore, ten KIIs were conducted with the government officials, local government representatives, and NGO officials.

3.2.3 Reviewing Secondary Data

30. Relevant scientific publications, reports and statistics were carefully reviewed in identifying the present status and challenges to safe drinking water in the coastal area of southern Bangladesh and the relevant information has been incorporated in the study report.

3.2.4 Data Processing, Analysis and Report Preparation

31. Software such as Microsoft Excel and Microsoft Word were used in quantitative data analyses, and word processing, respectively. On the basis of analyzed data, draft study report has being prepared. The draft report will be sent to BWP for review and their feedback.
3.3 Findings Validation through Workshop

3.3.1 Consultation Workshops

32. Two regional workshops were conducted for disseminating the findings of the study to the stakeholders of the study areas of the respective districts, Khulna and Barguna. Feedback given by the stakeholders during open discussion sessions were collected, and incorporated in the report.

3.3.2 Issues of Consultation

33. There were specific issues (findings of the study) for validation in workshop. These are as follows:
   - Availability and accessibility of water
   - Quality of water
   - Health hazards related to water
   - Women and water

3.3.3 Feedback from Consultation

34. An open discussion was held after presenting the findings of the study to crosscheck misinformation and incorporate new comments from the stakeholders. Comments from these workshops have been accumulated in Chapter 4 of this report.

3.3.4 Finalization of Report

35. Final report will be prepared incorporating feedback (comments/suggestions) received from BW Po on the basis of their review of the draft report.
4. Drinking Water Availability and Security

4.1 Situation Analysis

36. Ground water i.e. tubewell water is the most preferred source of drinking water in the coastal areas of Bangladesh. But in most of the areas, tubewells are found to be the source of saline and iron contaminated water. Moreover, inadequate upstream flow in existing surface water bodies increases salinity in the both ground and surface water. Thus, people use unsafe water from unprotected rivers, ponds, and shallow tubewells. The problem of drinking water intensity is very acute near the coast. As a result, in spite of sinking a large number of hand tubewells, the water supply situation in many areas remains unsatisfactory. And even in this adverse situation, women are still responsible for collection of water for household usage.

37. This section concentrates on assessing present water condition with depended people on the basis of available data and perception of the people. Several drinking water-related problems and challenges that interrupt their wellbeing are outlined with a view to recommending expected measures so that they can adapt to adverse situations.

4.1.1 Sources of Water

38. Safe drinking water crisis is common in the polders of both Khulna and Barisal divisions. People of the study areas mainly depend on ground water for drinking purposes and the main source of ground water is shallow hand tube wells and deep set hand tube wells with an average depth of 30-50 feet and 700-1,200 feet, respectively; while for cooking and other household’s usage, they depend on surface water, like pond water. Besides, most people harvest rain water in the traditional way for cooking and drinking purposes during rainy season and preserve for a few days. Some of them harvest rainwater systematically at household level and preserve for 2-3 months. Figure 4.1 shows the present sources of water in the polders. The main sources of drinking water in polder areas are:

- Surface water like pond, canal (khal) and river;
- Ground water-deep tubewell water (700-1200 feet deep);
- Ground water-shallow tubewell water (20-100 feet deep);
- Rain water- in rainy season for two to four months;
- Supply water- from deep tube well
39. On the other hand, according to the database of BBS, 2011, the status of safe drinking water in sampled Barisal polder region is better than sampled Khulna polder region in terms quality, quantity and availability. On an average, 89% & 74% people can collect drinking water from tube well, while only 10% and 23% collects drinking water from other sources such as ponds, Pond sand filter (PSF); and rain water in Barisal and Khulna, respectively. The details are presented in Table 4.1 and Figure 4.2 shows that percentage of tube-well coverage is significant.

40. Although Bangladesh Bureau of Statistics, (BBS) 2011 findings show, a significant number of population are still depending on tube well water, though empirically, the quality of water is not at satisfactory level. Field findings show that, drinking water quality, quantity and availability is quite good where the internal and external connectivity of the rivers have adequate upstream flow.

### Table 4-1: Source of Drinking Water in the Study Polder Areas

<table>
<thead>
<tr>
<th>Drinking water sources</th>
<th>Sampled Barisal polders (%)</th>
<th>Sampled Khulna polders (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Tube well</td>
<td>89</td>
<td>74</td>
</tr>
<tr>
<td>Other (rain water, river water)</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Source: Population census 2011*
Figure 4-2: Hand Tube Well (left) and Pond Sand Filter (PSF) in the Polder area (right)

4.2 Demographic Profile of the Sampled Polders

It is evident [pl cite ref] that 25% of total population of the country is living in the polder area of Bangladesh. This portion of the total population is living with low access to safe drinking water due to identifiable natural and anthropogenic vulnerability factors. Thus, a total number of 1,21,383 households of the study polder area in sampled Khulna and Barisal regions have a total population of 4,15,778 of which 2,57,220 are male and 2,59,659 are female (Table 4.2). The female population is found to be higher than that of male population. The average male-female ratio is 97 i.e. there are 97 males per 100 females which is lower than the national figure of 100.3 (BBS 2011). The density of population in the study areas on average is 823 persons per square kilometer which is smaller than the national figure of 976 persons per sq. km (BBS 2011).

Table 4-2: Demographic Feature of the Studied Area

<table>
<thead>
<tr>
<th>Divisions</th>
<th>Polders</th>
<th>Total HHs</th>
<th>Total Population</th>
<th>Male</th>
<th>Female</th>
<th>Sex ratio</th>
<th>Population density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khulna</td>
<td>3</td>
<td>6,237</td>
<td>25,887</td>
<td>12,939</td>
<td>12,948</td>
<td>99</td>
<td>921</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>37,543</td>
<td>158,450</td>
<td>79,931</td>
<td>78,519</td>
<td>101</td>
<td>1043</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>2,285</td>
<td>9,310</td>
<td>4,637</td>
<td>4,674</td>
<td>99</td>
<td>1007</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>9,490</td>
<td>38,240</td>
<td>18,940</td>
<td>19,300</td>
<td>98</td>
<td>1007</td>
</tr>
<tr>
<td></td>
<td>35/3</td>
<td>6,668</td>
<td>27,494</td>
<td>13,660</td>
<td>13,834</td>
<td>97</td>
<td>1016</td>
</tr>
<tr>
<td>Sub-total-Khulna/Average</td>
<td></td>
<td>62223</td>
<td>259381</td>
<td>130107</td>
<td>129275</td>
<td>99</td>
<td>999</td>
</tr>
<tr>
<td>Barisal</td>
<td>48</td>
<td>9,846</td>
<td>44,168</td>
<td>22,516</td>
<td>21,652</td>
<td>99.7</td>
<td>384</td>
</tr>
<tr>
<td></td>
<td>39/2C</td>
<td>23,621</td>
<td>1,01,101</td>
<td>49,395</td>
<td>51,705</td>
<td>96</td>
<td>835</td>
</tr>
<tr>
<td></td>
<td>41/1</td>
<td>11,133</td>
<td>47,859</td>
<td>24,071</td>
<td>23,788</td>
<td>100</td>
<td>814</td>
</tr>
<tr>
<td></td>
<td>43/2A</td>
<td>8,160</td>
<td>36,250</td>
<td>17,673</td>
<td>18,577</td>
<td>94</td>
<td>641</td>
</tr>
<tr>
<td></td>
<td>43/2F</td>
<td>6400</td>
<td>28120</td>
<td>13458</td>
<td>14,662</td>
<td>91</td>
<td>563</td>
</tr>
<tr>
<td>Sub-total-Barisal/Average</td>
<td></td>
<td>59160</td>
<td>156397</td>
<td>127113</td>
<td>130384</td>
<td>96</td>
<td>647</td>
</tr>
<tr>
<td>Total/average</td>
<td></td>
<td>1,21,383</td>
<td>4,15,778</td>
<td>2,57,220</td>
<td>2,59,659</td>
<td>97</td>
<td>823</td>
</tr>
</tbody>
</table>

Source: Bangladesh Bureau of Statistics (BBS), 2011
4.3 Water Quality, Quantity and Availability

42. Water of the tube wells is contaminated with arsenic, medium level of iron and saline round the year and people are facing problems to use water due to rusty color and bad odor. In the dry season (November-April) water of the ponds recede to a very low level and some ponds become dry and the quality of the residual water becomes very low to use. Moreover, insufficient number of ponds, and raised pond bed due to many years of accumulation of clay, leaves and other dirt, have reduced the total capacity of water preservation. At the same time, the depths of the existing canals have reduced due to siltation.

43. During monsoons, the salinity levels are very low because of the increased amount of fresh water in the water bodies. The level of salinity starts increasing from January due to reduction of upland discharge, and reaches the peak in April and then starts decreasing again. Saline water intrudes the areas near the breached embankments causing damage to agricultural practices.

44. In the dry season, the overall salinity levels both in the soil and the surface water are high and about 30 percent of the polder areas are thus affected. This happens because of the following reasons: (i) about 6 percent of the polder areas under golda (prawn) culture, (ii) saline water enter through breached embankments, and (iii) malfunctioning of sluices with/without gates. However, in the month of December, the salinity value was low (0-4 parts per thousand), since rain water inside the Polders was still present and tidal flow from the sea was yet to intrude.

45. So, it is evident that the availability of drinking water is rough due to limited number of saline free tubewell. In the wet season, collection of water is a major concern; especially women who face difficulties to get to the water sources due to distance and poor communication system. Sometimes, the distance to get to the source of drinking water is about 1 to 2 km or more. In comparison to the drinking water security in the study polders of Khulna, Bagerhat and Satkhira, the situation in Patuakhali, Barguna and Pirojpur is little better.

4.4 Water Accessibility

46. The existing numbers of tube wells are not sufficient to meet consumer demand and a very large number of poor families depend on common tube-wells, which are not conveniently located. Distance to get to the source of drinking water is about 1 to 2 km. Negative political influence and biasness on installation in terms of proper distribution and placement of tube wells are also causal for low access to water. Well-off families have installed deep tube well for family use whereas poorer families still depended on that neighbor’s or common tube-well. These problems are creating worse accessibility challenges to water for poorer people.

47. As stated earlier, collecting water during wet season is a major concern; especially for women face difficulties to get to the water sources due to poor communication system. Generally, women of all age group, especially 15-30 years old girls and women collect water two to three times a day. Sometimes, the male members of the family engage themselves to collect water.
4.5 Water and Health

48. 70% of human body consists of water. But, in Section 4.3.2 we have seen that the quality of drinking water is rough in the study areas. This makes the whole coastal belt’s water availability unsecured pushing poor people’s life to a more vulnerable position than before. Through interview with some people of the study area, it was revealed that people suffer from various diseases like diarrhea, fever, high blood pressure, gastric etc. due to drinking saline water. Children mainly suffer from diarrhea and fever. The women could strongly relate different health related problems to salinity. Cases of gastritis, heart disease due to salinity and iron, and uterine cancer among the women, are on the rise. Outsiders experienced different health hazards like rapid hair fall, graying of hair, and constipation due to iron and saline contaminated tube well water. Furthermore, improper storage of water, poorly maintained tube wells, and arsenic in shallow wells pose additional threats to health, especially on women and children.

4.6 Role of Youth and Women

49. A strong social belief and mental construction perceive at the community level that women are socially responsible for collection and storage of water for daily needs. In some areas, male members are found to helpful in water collection task. But the ratio of this number is very low. Socio-cultural attachment in the polders areas is strong. Therefore, women, generally, do not face social, cultural, religious and political constraints while going for collecting water but distance of water sources and poor communication system during wet season is problematic for women and they are less concerned about the relative health risks from the daily usage of unsafe water. Though the socio-cultural environment of the study areas is good but the young unmarried women are susceptible to harassment. And these hardship and deprivation of women are fundamentally caused by the lack of a number of factors: awareness, education, access to resources, empowerment, and institutional support and poverty.

4.7 Constraints and Challenges

50. By analyzing the present status, a number of specific constraints and challenges have been identified of drinking water security for each of the study areas. But most of the challenges are almost similar and apparent in all polder areas except some polders of Satkhira and Khulna districts. In Satkhira, the water crisis picture and its related problems are more vulnerable than other study areas. In this section of the report the overall constraints and challenges of drinking water is depicted with different aspects.

4.7.1 Purification Technology

51. As mentioned earlier, water in the coastal area is highly saline and that the presence of Iron is a regular phenomenon. So purification is the basic necessity for the study polder areas. But the constraint is that no purification system was found. Though some people use pond sand filters (PSF) for water purification. In some areas, management of PSF was found as a major constraint for water purification.

4.7.2 Natural Risk & Disaster

52. In a frequency study carried out by Hennon, P. et al. (2010), Bay of Bengal has been found to be the second most frequently visited place in the world by cyclones with about 20 cyclones per decade. From 1901-1957 only 11 cyclones have hit the coastal areas of
Bangladesh, while from 1957 to 2009, a total of 55 cyclones have hit the area. So, in the last 52 years, the number of cyclones hitting coastal areas of Bangladesh has increased 5 times compared to the previous 57 years. (Bangladesh Meteorological Department: BMD). It is, therefore, evident that the study area polders are frequently affected by tidal flooding, salinity intrusion and cyclones. Salinity intrusion\(^3\) as well as cyclone and sea level rise is a constant challenge and threat to drinking water security in the coastal polders. At the same time, inundation of tubewells and ponds due to flood and tidal water intrusion is a big challenge for water security in the coastal area.

53. Details about the hazards which created disasters in the area are presented in the following table (Table 4-3).

<table>
<thead>
<tr>
<th>Disaster</th>
<th>Severely affected year</th>
<th>% of affected area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salinity</td>
<td>2007, 2009, 2011</td>
<td>50</td>
</tr>
<tr>
<td>Tidal flood</td>
<td>2007, 2009, 2010</td>
<td>100</td>
</tr>
<tr>
<td>Cyclone</td>
<td>2007 (Sidr), 2009 (Aila)</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: CEGIS field work, 2015

4.7.3 Poverty: Incapability of People

54. People of the study areas who are struggling to survive with low income, the scarcity of drinking water tends to throw them into another crisis to meet the demand with their present economic condition. It requires Tk. 50-60 thousand to install a deep set hand tube well, which is very difficult for the people of the coastal area to afford. Sometimes 10-15 households try to install a deep set hand tubewell but often most of the households fail to bear the minimum individual costs. On the other hand, ASA, a national NGO, is working for safe drinking water. The organization supply drinking water at the cost of Tk. 15 per 20 litre at Polder 3, which is found to be difficult for the people of the area to pay. They demand less price for water supply... In another case, it was found that in collaboration with GO-NGO partnership, some rain water harvesting system were installed in different areas at an estimated minimum cost of Tk. 22,000 and maximum cost of Tk. 70,000. It is thus evident that the water cost creates serious problems whereas most of the people could not get such opportunity to avail pure drinking water with their increasing demand.

4.7.4 Water and Health

55. There is no doubt that water is interlinked with health. Pure water makes people healthier while impure water causes serious health problems. Availability of pure water tended people to retain good health by avoiding water related diseases. Major health related challenges of safe drinking water are:

- Unhealthy living conditions especially for both women and children
- Lack of knowledge about health risk owing to use of unsafe water
- Unavailability of treatment for arsenicosis, and salinity and iron related problems
- Increasing family maintenance expenditure due to high diseases prevalence.

\(^3\)Salinity levels of ground water at shallow depths (65-70 ft) are low, where as salinity levels at deeper depths (840-1350 ft) are very high (3000-4000 µS/cm).
4.7.5 Water: Youth and Women

56. In the polder areas women are mainly responsible for collecting drinking water except Satkhira. In Satkhira, male members are found helpful in collecting water for household. But in the other areas, not more than 20% male members engage themselves to collect water. This is one of the main challenges in relation to household water management. The challenges to get pure water and participation of youth and women are as follows:
   • Distance to the collection source of drinking water is about \( \frac{1}{2} \) to 1 km and some cases, 2 to 3 km
   • In Nowapara, Satkhira women and even school going children spend 3 to 4 hours a day collecting water at a time
   • Lack of awareness and adequate knowledge for water management
   • Especially for women, the challenges lie in the following socio-cultural factors:

57. awareness, education, access to resources, empowerment, and institutional support.

4.7.6 Anthropogenic Issues

58. In Section 4.3 the overall drinking water situation of the study polders have been portrayed. Though, a maximum number of the people depend on hand set tubewells, a large portion of household usage depends on surface water, especially pond water. The challenges of this case are as follows-
   • No easier alternative than to use water for cooking from the same pond which is also used for washing utensils and clothes
   • Contamination of water by washing baby clothes and buffalos in the same pond which they use for their daily household activities.

4.7.7 Socio-Political Issues

59. Many people lack water security because of their political affiliation, disability, gender, age or social status. In some situations, communities that do not support ruling political party, are not prioritized for service provision. Socio political issues also play a vital role to get safe drinking water. Here are some instances:
   • Poor governance and/or weak political will to commit the necessary financial and human resources to water supply development and water resource management
   • Negative political influence and biasness on installation, distribution and placement of tube wells
   • Improper management and maintenance for the broken PSF, tube wells

4.7.8 Institutional Issues

60. The challenges to get pure water have already mentioned where institutional challenges are also strongest among them. Effective monitoring on access, quantity and quality of water are key considerations to implement the policy to ensure water for all. Increasing problems of water quality or poor maintenance leading to defunct infrastructure, weaken the policy that also creates hindrance to prepare a roadmap for ensuring equitable access to drinking water from the very grass root level. The major institutional challenges are as follows:
   • Poor infrastructure
• Inadequate test to check the Iron and Arsenic levels in drinking water
• Lack of co-ordination between Local people, GOs and NGOs
• Increased complexities in terms of bureaucratic hierarchy and institutional position
• Lack of people’s participation with the implementing agencies
5. Expected Solutions and Conclusions

5.1 Solutions and Interventions

61. It is clear from the earlier discussion that expected measures of solutions the major concerns to improve drinking water security in polder area. Based on the field information, the expected solutions against challenges may be categorized as Hardware measures and Software measures. **Hardware** measures mean those involving the construction of various infrastructures or any other physical actions while the **software** measures are those involving policy review and reforms, institutional arrangement, people’s participation, awareness raising programs etc.

5.1.1 Software Measures

- Establish linkage with Microfinance Institutions (MFIs) to receive finance for installing tube well and rain water system
- Build awareness about the negative impact of salinity, iron and arsenic contamination
- Increase awareness and knowledge of water born diseases, impact of salinity, iron and arsenic to the community
- Develop awareness among male members to collect water from distance
- Arrange training for the polder areas community on information of good source of product and technology, desalination, water purification process, proper rain water harvesting process, water related health hazards, responsibility of the male members to collect water, impact of salinity, iron as well as arsenic.

5.1.2 Hardware Measures

- Introduce new technologies and products with low cost/interest to the polder area people.
- Excavate ponds with the share of beneficiaries for reserving much water
- Install deep tube well as much as with the technology of filter process of Iron and Salinity.
- Introduce modern rain water harvesting system and provide this technology to some beneficiaries.
- Test contamination of arsenic, level of Iron and Salinity.
- Ensure medical treatment facility for affected people
5.2 Conclusions

62. Safe drinking water is a worldwide problem. Bangladesh is no exception to it and coastal areas are more vulnerable to it. Inadequate upstream flow in existing surface water bodies increases salinity in the both ground and surface water which makes the water availability and accessibility difficult to the people. In the study areas ground water is the most preferred source of drinking water. But in most of the areas, tube wells are found to be the source of saline and iron contaminated water which hampers the drinking water security as well as the socio-economic and health condition of the people of the study areas.

63. Furthermore, cyclone and sea level rise is a constant challenge and threat to drinking water security in the coastal polders. At the same time, inundation of tube wells and ponds due to flood and tidal water intrusion is a big challenge for water security in the coastal areas. These are increasing the scarcity of safe drinking water in the polder areas. This scarcity of safe drinking water is mainly affected the women, as women mainly collect water for drinking other household usage. Peoples from all age groups are suffering from various diseases, especially women and children are more susceptible to such diseases. To solve the scarcity of safe drinking water some challenges are identified such as unavailability of water purification technology, frequency of natural risk and disaster, poverty incidence, anthropogenic issues, and socio-political and institutional issues.

64. Some measures can be taken such as, (i) introducing new technologies and products for water purification; (ii) excavating ponds with the share of beneficiaries for reserving much water, and (iii) introducing modern rain water harvesting system to solve the constraints and challenges of drinking water scarcity. Besides, some awareness building programs and trainings can be run for the people of the polder areas on desalination, water purification process, proper rain water harvesting process, water related health hazards, responsibility of the male members to collect water, impact of salinity, iron as well as arsenic contamination in water to increase drinking water security in the polder areas.
References


12. Khan, AE; Ireson, A; Kotvas, S; Mojumder, SK; Khusru, A; Rahman, A; Vineis, P, Labrese Ej, VP; 2011, “Drinking Water Salinity and Maternal Health in Coastal Bangladesh: Implications of Climate Change”, London School of Hygiene & Tropical Medicine, LSHTM Research Online.


# Annex A: Checklist for Primary Data Collection

## উপকূলীয় এলাকায় (পৌরান) পানীয় জলের নিরাপত্তা চালান

### প্রশ্নাবলী

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<th>নম্বর</th>
<th>প্রশ্ন</th>
<th>ক্ষেত্র পৌরসংস্থা</th>
<th>বর্ষা পৌরসংস্থা</th>
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<tbody>
<tr>
<td>1.</td>
<td>এলাকায় পানির বর্তমান অবস্থা</td>
<td>নলকৃপ/ পুকুর/ খান/ নদী/ বৃহত পানি / pond sand filter/iron removal plant/VSSST/SST/SSF/ অন্যান্য (উল্লেখ করুন)। বৃহত পানি খাবার জন্য কিপর্য সংগ্রহ করা হয়?</td>
<td>নলকৃপ/ পুকুর/ খান/ নদী/ বৃহত পানি/ pond sand filter/iron removal plant/VSSST/SST/SSF/ অন্যান্য (উল্লেখ করুন)। বৃহত পানি খাবার জন্য কিপর্য সংগ্রহ করা হয়?</td>
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<td>2.</td>
<td>খাবার পানির সম্পদতত্ত্ব ন ভুজিয় রাখতে ও খাবার পানি সংগ্রহ কি ভ্রমন্তর সম্মেলন হয়?</td>
<td>মান ভুজিয় রাখে: পানি সংগ্রহে:</td>
<td>মান ভুজিয় রাখে: পানি সংগ্রহে:</td>
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<td>3.</td>
<td>কোন জন্য জন্য পৌর আনারা সবচেয়ে কনে নিভবশীল?</td>
<td>1) উ-উপরিনিভ 2) উ-তল</td>
<td>1) উ-উপরিনিভ 2) উ-তল</td>
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<td>4.</td>
<td>দৈনন্দিন গুরুত্বপূর্ণ কাজ কোন উৎসের পানি ব্যবহার করা হয়?</td>
<td>উৎসের নামঃ</td>
<td>উৎসের নামঃ</td>
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<td>5.</td>
<td>খাবার জন্য কোন উৎস থেকে পানি সংগ্রহ করা হয়?</td>
<td>উৎসের নামঃ</td>
<td>উৎসের নামঃ</td>
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<td>6.</td>
<td>এলাকায় খাবার পানির প্রাপ্তিক কিপর্য?</td>
<td>1) ভাল 2) মোটামুটি 3) খাবার</td>
<td>1) ভাল 2) মোটামুটি 3) খাবার</td>
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<td>7.</td>
<td>দৈনন্দিনপাড়াপোর্না পানির প্রাপ্তিক কিপর্য?</td>
<td>লিটার:</td>
<td>লিটার:</td>
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<td>8.</td>
<td>খাবার পানি সংগ্রহের জন্য কত দূর থেকে হয় কেমন সময় লাগে?</td>
<td>1) কতদূর (মিটার): 2) সময়(মিনিট):</td>
<td>1) কতদূর (মিটার): 2) সময়(মিনিট):</td>
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<td>সংগ্রহ করেন?</td>
<td>2)পৃষ্ঠা: ১০-১৫; ২৬-২০; ২১-২৫; ২৬-৩০; ৩১-৪০; ৪১-৫০</td>
<td>2) পৃষ্ঠা: ১০-১৫; ২৬-২০; ২১-২৫; ২৬-৩০; ৩১-৪০; ৪১-৫০</td>
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<td>দিনে কতবার খাবার পানি সংগ্রহের জন্য যেতে হয়?</td>
<td>1) একবার 2)দুইবার 3) তিনবার 4) অদিক</td>
<td>1) একবার 2)দুইবার 3) তিনবার 4) অদিক</td>
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<td>আপনারা যে নলকেপের পানি পান করেন তা কি -</td>
<td>1) লবানাকঃ 1) হা 2) না</td>
<td>1) লবানাকঃ 1) হা 2) না</td>
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<td>2) আয়রন মূল্যঃ 1) হা 2) না</td>
<td>2) আয়রন মূল্যঃ 1) হা 2) না</td>
<td>3) আয়রনিক মূল্যঃ 1) হা 2) না</td>
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<td>পানিতে লবানাক তার উপায়িতি কেমন?</td>
<td>1) পরিমাণঃ 1)অক্ষ 2) মধ্য 3) বেশী</td>
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<td>পানিতে আয়রনের উপায়িতি কেমন?</td>
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<td>পানিতে আয়রনিকের উপায়িতি কেমন?</td>
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<td>পানির লবানাকতা/ আয়রন/ আয়রনিক দূষীকরণের আপনারা কোন পক্ষে গ্রহণ করেছেন কি?</td>
<td>1) লবানাকতা দূষীকরণঃ 1)হা 2) না</td>
<td>1) লবানাকতা দূষীকরণঃ 1)হা 2) না</td>
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<td>2) আয়রন দূষীকরণঃ 1) হা 2) না</td>
<td>2) আয়রন দূষীকরণঃ 1) হা 2) না</td>
<td>3) আয়রনিক দূষীকরণঃ 1) হা 2) না</td>
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<td>পানিরলবানাকতা/ আয়রন/ আয়রনিক দূষীকরণের আপনারা কি পখতি গ্রহণ করেছেন?</td>
<td>1)লবানাকতা দূষীকরণঃ 2)আয়রন দূষীকরণঃ 3) আয়রনিক দূষীকরণঃ</td>
<td>1)লবানাকতা দূষীকরণঃ 2)আয়রন দূষীকরণঃ 3) আয়রনিক দূষীকরণঃ</td>
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<td>2. বাণিজ্য সংজ্ঞায়ক</td>
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<td>লবানাকতা/ আয়রন/ আয়রনিকের প্রভাবে কি কি ধরনের রোগ-বাণিজ্য হয়?</td>
<td>লবানাকতাজনিত রোগের নামঃ আয়রনজনিত রোগের নামঃ</td>
<td>লবানাকতাজনিত রোগের নামঃ আয়রনজনিত রোগের নামঃ</td>
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<td>মৌসুমভেদে রোগসংক্রামনের ভারত্তম হয় কি? (রোগের নাম লিখে উত্তর লিখুন)</td>
<td>অস্বীকারজনিত রোগের নামঃ</td>
<td>অস্বীকারজনিত রোগের নামঃ</td>
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<td>কত বৎসর যাবত জনগণ এইরোগ -বালাইয়ে আক্রান্ত হয়েছে?</td>
<td>বয়সঃ মহিলা:</td>
<td>বয়সঃ মহিলা:</td>
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<td>গত ৫ বছরে কতজন কোন রোগে মৃত্যুবরণ করেছে?</td>
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### ৩. পানিভূক্ত

| পানি সংগ্রহে নারীদের কি ধরনের সমস্যা হচ্ছে? | ১) সামাজিক  ২) সাংস্কৃতিক  ৩) রাজনৈতিক  ৪) ধর্মীয়  ৫) বাস্তু সংক্রামক | সামাজিক  সাংস্কৃতিক  রাজনৈতিক  ধর্মীয়  বাস্তু সংক্রামক |
| বিখ্যাত পানির অভাবে নারীরা কি ধরনের বাস্তু সমস্যার সম্মুখীন হচ্ছে? | ১)  ২)  ৩) | ১)  ২)  ৩) |

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Annex A

25
4. পানির সমস্যা সমাধানে অংশগ্রহণকারী প্রতিষ্ঠানসমূহ

পানীয় জলের সমস্যার প্রভাব এবং তা প্রতিকারের জন্য কোন সরকারি/বেসরকারি সংগঠন করছে কি?  
1) হাঁ 2) না

| কোন কোন সংগঠন এই সেবায় নিয়োজিত? | সংস্থা সমূহের নামস্থান
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| সংস্থা সমূহ কি ধরনের সেবা প্রদান করছে? |
|------------------------------------------|-----------------------------|
| সেবার ধরনঃ                              |
| 1)                                       |
| 2)                                       |
| 3)                                       |

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<tr>
<th>সংস্থা সমূহ যে ধরনের সেবা প্রদান করছে তাতেক্ষণিক অপনারাসমূহ?</th>
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<tbody>
<tr>
<td>1) হাঁ 2) না</td>
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| আর কি ধরনের সেবা পেতে আপনারা আগ্রহী? |
|---------------------------------------------|-----------------------------|
| সেবার ধরনঃ                                  |
| 1)                                          |
| 2)                                          |
| 3)                                          |

5. আলোচনার প্রভৃতি বেরিয়ে আসা সমস্যা পুনর্নির্দেশ তালিকা তৈরী করুন এবং তার সমাধান কি ভাবে হবে তা লিখুন

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<tr>
<th>সমস্যা</th>
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## Annex B: Reflections of Study Activities through Photographs

### Barisal region

Workshop in Amtali Upazila of Barguna District

![Workshop in Amtali Upazila of Barguna District](image1)

![Workshop in Amtali Upazila of Barguna District](image2)

### Polder 48

![Polder 48](image3)

![Polder 48](image4)
Alipur village at Latachapli Union

Nawripara village Latachapli Union

Polder 43/2A

Pukurjana village at Itabaria Union

Polder 41/1
Annex B

Langolkatha village at Ayla Patakata Union

Kodomtola village at Ayla Patakata Union

Polder 43/2F
Kukua Bazar at Kukua Union
Polder 39/2C

Ikri Bazar at Ikri Union

Khulna region
Workshop in Batiaghata Upazila of Khulna District
Annex B

Field level data collection

Polder-2

Chutipur Village at Noapara Union, Satkhira

Noapara and DokhinNangla at Noapara Union, Satkhira

Polder-3
Budhata village at Budhata Union, Satkhira

Noapara village at Budhata Union, Satkhira

Polder-22

Hatbari village at Deluti Union, Khulna

Telikhali village at Deluti Union, Khulna
Annex B

Polder-30

Telikhali Village at Gongrarampur Union, Khulna

Moshiyardanga Village at Gongrarampur Union, Khulna

Polder-35/3

Kashipur Village at Dema Union, Bagherhat
Kheagraghat Village at Dema Union, Bagherhat