Bangladesh Municipal Water Supply and Sanitation Project (BMWSSP)

Environmental Management Framework (EMF)

Final Report

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Department of Public Health Engineering (DPHE)

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The Environmental Management Framework (EMF) for the Bangladesh Municipal Water Supply and Sanitation Project (BMWSSP) has been prepared by Bureau of Research, Testing and Consultation (BRTC). Bangladesh University of Engineering and Technology (BUET), Dhaka

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ABBREVIATIONS

BDT	Bangladesh Taka
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
BOD_5	5-day Biochemical Oxygen Demand
BRTC	Bureau of Research Testing and Consultation
BUET	Bangladesh University of Engineering and Technology
CC	City Corporation
COD	Chemical Oxygen Demand
DEWATS	Decentralized Wastewater Treatment System
DoE	Department of Environment
DPHE	Department of Public Health Engineering
DTW	Deep Tubewell
EA	Environmental Assessment
ECA	Ecologically Critical Area
ECoP	Environmental Code of Practice
ECR	Environment Conservation Rules
EIA	Environmental Impact Assessment
EMIS	Environmental Management Information System
EMF	Environmental Management Framework
EMP	Environmental Management Plan
FGD	Focus Group Discussion
FSTP	Fecal Sludge Treatment Plant
GoB	Government of Bangladesh
GRC	Grievance Redress Committee
IDA	International Development Association
IEE	Initial Environmental Examination
IEF	Important Environmental Features
MoEF	Ministry of Environment and Forests
NGO	Non Government Organization
OHS	Occupational Health and Safety
OP	Operational Policy
PAP	Project Affected Person
PCAIP	Public Consultation and Access to information Plan
PD	Project Director
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter with aerodynamic diameter $\leq$ 2.5 micrometers
PM_{10}	Particulate Matter with aerodynamic diameter $\leq$ 10 micrometers
PMO	Project Management Office
RCC	Reinforced Cement Concrete
SECs	Special Environmental Clauses
SIA	Social Impact Assessment
SPM	Suspended Particulate Matter
TDS	Total Dissolved Solids
ToR	Terms of Reference
WB	World Bank
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

E1.0 Background

The World Bank (WB) is engaged in providing credit for urban governance and service delivery improvements in Municipalities (Paurashavas) and City Corporations of Bangladesh for a number of years. In 2012-13 the Bank undertook an in-depth analytical study which analyzed options for appropriate models of water supply and sanitation (WSS) service delivery, and made recommendations for operationalizing these models. Discussions were initiated on possible World Bank lending assistance to GoB for strengthening the WSS service delivery system along with infrastructure development at secondary town level, which resulted in the "Bangladesh Municipal Water Supply and Sanitation Project (MWSSP)".

The objective of the Bangladesh Municipal Water Supply and Sanitation Project (MWSSP) is to increase access to safe water supply and sanitation services in selected municipalities (Paurashavas), and to strengthen the institutional capacities of participating municipalities for delivering improved WSS services. The two major land based components of the project which will impact the environment are the following:

(a) Investment for Water Supply Infrastructure, and
(b) Improving Sanitation and Septage (fecal sludge) Management.

The IDA approval of the loan is contingent upon the GOB's compliance to the WB environmental safeguards requirements. In this regard, at least two Bank policies related to environment will be triggered: (a) OP/BP 4.01 Environmental Assessment; and (b) OP/BP 4.11 Physical Cultural Resources, to ensure that the project design and implementation are focused on reducing adverse impacts and enhancing positive impacts. Depending on the situation, a number of other Bank policies could also be triggered. Along with WB environmental safeguard requirements, the project also needs to comply with the national environmental regulations in accordance to the Environmental Conservation Act 1997 (GoB, 1997).

Hence, the PMU of DPHE has undertaken an initiative to carryout environmental assessment of the proposed BMWSS project such that it ensures the IDA requirements and also complies with GoB (DoE) environmental requirements. As specific project locations (i.e., Paurashavas) and the specific sub-projects (including sub-project sites) are yet to be identified, a "framework approach" has been adopted through the development of an Environmental Management Framework (EMF). The "framework" for carrying out environmental assessment of sub-projects to be implemented under the BMWSSP has been prepared based on an "overall environmental assessment" of the typical sub-projects in 5 Paurashavas where BMWSSP would be implemented. The five Paurashavas were selected in consultation with DPHE, considering geographic location and likely sub-projects to be implemented at the Paurashavas. The Paurashavas were:

(a) Tarabo, Narayanganj
(b) Homna, Comilla
(c) Chandanaish, Chittagong
(d) Dhaobari, Tangail

(e) Ullapara, Sirajganj

During field visits, discussions were held with the Mayors and other officials of the Paurashavas on different issues including major WASH (water supply, sanitation and hygiene) challenges faced by the Paurashavas, difficulties in project formulation, implementation and management. Discussions were also held with engineers and other officials of the Paurashavas on recently completed/ ongoing projects, proposed subprojects to be implemented under BMWSSP, and capacity and institutional arrangement for environmental management of the proposed subprojects. At each of these Paurashava, some of the sites tentatively selected for construction of infrastructure under BMWSSP were visited in order to obtain first-hand information and insight on the subproject baseline scenarios. Discussions were also held with Paurashava officials about environmental management of these projects. Apart from reconnaissance survey of these tentative subproject sites, noise level measurements were carried out. Surface water samples (typically from river/khal) and groundwater samples (typically from a randomly selected tubewell) were also collected for assessment of water quality. Focus Group Discussions (FGDs) were held at each of the five Paurashavas visited, which were participated by a wide range of stakeholders. The participants expressed their views on different aspects of the proposed subprojects to be implemented in their Paurashavas, including possible environmental impacts of the subprojects and possible mitigation/ abatement measures. In addition, public consultations (in the form of informal discussion) were also carried out at the Paurashavas.

Based on the overall environmental assessment and feedback from all stakeholders (including Paurashava, DPHE and the WB), the EMF has been prepared and presented in this report. The report also presents an overview of the major national environmental laws and regulations that are relevant and may apply to BMWSSP, institutional arrangement and national and sub-national level, and World Bank safeguard policies.

E 2.0 Project Description

The potential types of subprojects that could be implemented under the MWSSP include the following:

(a) Water Supply Infrastructure:

(1) Production well (DTW) with pump house and electrical works
(2) Water treatment plant (WTP), including raw water transmission line
(3) Clear water transmission line
(4) Water distribution network (including expansion and rehabilitation of distribution existing networks)
(5) Overhead tank
(6) Stand posts (street hydrant)
(7) Paurashava water office

(b) Sanitation and Septage (fecal sludge) Management:

(1) Latrine with septic tank and soakage pit
(2) Public toilet
(3) Fecal sludge treatment plant (FSTP)
(4) Procurement of fecal sludge desludging units (Vacutugs/vacuum tanker)

(5) Small-scale decentralized wastewater treatment system (DEWATS)

(c) Drainage system (storm drains)
(d) Solid Waste Management (SWM)

Most of the subprojects to be implemented under MWSSP have not been categorized in the ECR 1997. However, some of the subprojects (such as water transmission and distribution line, WTP) have been listed under Red category, which would require preparation of IEE and EIA reports. It should be noted that the project category in ECR 1997 is not based on scale of the project or its potential impact; rather it is based on only type of the project. Based on field visits of 5 Paurashavas and discussion with DPHE and Paurashava officials it appears that in many cases potential impacts of subprojects are likely to be insignificant. As a result, many subprojects (including WTP and transmission/distribution line) in the Paurashavas (especially where no private land would be required for project implementation) could be classified as "Orange B" or "Orange A". A decision to this effect should be based on specific "project description" and "environmental screening" of the subproject; the decision however needs to be confirmed by the Department of Environment (DoE). Table E.1 shows the category of subprojects (to be implemented under MWSSP), their classification according to ECR 1997, as well as possible classification of the subprojects based on "environmental screening".

Table E.1: Classification of subprojects according to ECR 1997 (GoB, 1997) and likely subproject category based on potential impact

Sub-projects	Likely Sub-project Category according to ECR 1997
Water Supply Infrastructure	
Production well (DTW) with pump house and electrical works	May be classified as "Orange A/B" depending on assessment of impact
Water treatment plant (WTP), including raw water transmission line	May be classified as "Red" or "Orange A/B" depending on assessment of impact (classified as Red in ECR 1997)
Clear water transmission line; Water distribution network (including expansion and rehabilitation of existing network)	May be classified as "Orange A/B" depending on assessment of impact (classified as Red in ECR 1997)
Overhead tank	May be classified as "Orange A" depending on assessment of impact
Stand post	May be classified as "Green" or "Orange A"
Paurashava water office	May be classified as "Orange A/B" depending on assessment of impact
Sanitation and Septage (Fecal Sludge Management)	
Latrine with septic tank and soakage pit	May be classified as "Orange A/B" depending on assessment of impact
Public toilet	May be classified as "Orange A/B" depending on assessment of impact
Fecal sludge treatment plant (including procurement of vacuum tanker)	May be classified as "Red" or "Orange A/B" depending on assessment of impact
Decentralized wastewater treatment plant	May be classified as "Red" or "Orange A/B" depending on assessment of impact
Drainage System	May be classified as "Red" or "Orange A/B" depending on assessment of impact

Sub-projects	Likely Sub-project Category according to ECR 1997
Solid waste management (SWM)	May be classified as "Red" or "Orange A/B" depending on assessment of impact (classified as Red in ECR 1997)

Notes:

(1) In the ECR 1997, project "category" for environmental assessment is based on nature of project, not on anticipated impact.

(2) The sub-projects under the BMWSSP have been classified as "Category B" based on expected impacts, according to WB OP4.01.

(3) If any sub-project poses significant adverse environmental impacts, it is likely to be excluded from the BMWSSSP.

Environmental Considerations in Design:

By incorporating/ considering certain features in the engineering design of a subproject, it is often possible to reduce or eliminate some of the possible adverse environmental impacts during both construction and operational phases of a subproject. Table E.2 identifies possible adverse environmental impacts and environmental considerations to be included in the design for reducing/ eliminating such impacts for some major sub-projects to be implemented under MWSSP. These issues should be adequately addressed during the design phase of the subprojects, as a part of environmental management.

Table E.2: Environmental impacts and environmental considerations to be included in design to reduce/ eliminate the impacts for some major subprojects

Sub-project	Environmental Impact	Design Considerations/ Actions to Reduce/Eliminate Impact
Water treatment plant	• Inadequate water during dry season • Poor quality of water during dry season (for surface water sources) • High concentration of Fe/Mn/As /Salinity in groundwater	• Proper assessment of water availability throughout the year • Proper water quality assessment before treatment process design • Identification of potential threat to water quality in the future from industrial/ other developments in surrounding areas • Provision for proper disposal of sludge generated from treatment processes.
Deep tubewell	• Contaminated water in tubewell • Poor availability of water due to lowering of groundwater table	• Adequate testing of water quality (specially for Fe, As, Mn, Salinity) • Assessment of groundwater level
Overhead Tank (OHT)	• Inadequate design/safety provision • Difficulties in cleaning and maintenance	• Ensuring adequate design considering soil characteristics, seismic vulnerability • Keeping provisions for easy cleaning and maintenance in the design of OHT • Taking adequate safety measures during construction
Fecal Sludge Treatment Plant (FSTP); Decentralized Wastewater Treatment	• Public opposition regarding site • Water pollution from effluent discharge • Environmental pollution from sludge from FSTP	• Proper site selection involving LGI leadership and local people. • Proper design of FSTP satisfying national effluent discharge standard. • Proper design of FSTP considering

Sub-project	Environmental Impact	Design Considerations/ Actions to Reduce/Eliminate Impact
Plant (DEWATS)	• Contribution to SWM through introduction of co-composting in the FSTP with solid waste.	Bangladesh Standards and Guidelines for Sludge Management (DoE, 2015)
Latrine, Public Toilet	• Poor access, especially for women, children, elderly, people with disability • Pollution and odor • Poor lighting	• Proper site selection, ensuring easy accessibility • Separate toilet blocks for men and women • Disable-friendly design • Water supply and hand wash facility • Provision for properly designed septic tank and soakage pit, considering easy desludging from septic tanks. • Proper venting system to address odor nuisance • Adequate floor height and lighting
Office building	• Water logging during rain • Flooding at ground floor level due to improper plinth level • Pollution from inadequate wastewater disposal • Fire hazard	• Provisions for storm water drainage; roof-top rain water harvesting system • Setting proper plinth level considering highest flood level • Separate plumbing system for black water; provision for septic tank system; designing soakage pit considering depth of water table. • Keeping adequate provisions (including fire/emergency exits) for fire safety in accordance with National Building Code
Drain	• Clogging/ stagnation of flow in the storm drain • Backflow of water through drain (e.g., due to high water level at downstream discharge point, such as khal/ river) • Pollution of downstream water body due to disposal of polluted water from drain.	• Designing drain considering reduced level (RL) of the downstream discharge point; adequate slope and x-sectional area; RCC cover for drain, where appropriate • Considering installation of regulator to control inflow/ outflow through drain • Not allowing direct connection to drain from sanitation facilities.
Solid waste management (SWM)	• Environmental pollution from leachate; • Odor generation • Scavenging by birds/ animals, and spreading of diseases	• Considering higher land requirement, land filling should be considered as the last option; other options such as composting and biomethanation should be considered first. • For landfills, provision for "daily cover" on deposited solid waste, and provision for restriction of entry by animals • The SWM project must incorporate the 3R (reduce, reuse recycle) strategy.

E 3.0 Environmental Management Procedures

E 3.1 Overview

Under the MWSSP, DPHE and the Paurashavas will be responsible for identification of subprojects, preparation of sub-project description, “environmental screening” and “analysis of alternatives”. The EMF presents guidelines (in the form of a simple format) for preparation of description of the subprojects. The EMF also presents a simple format for “environmental screening” of subprojects (see Chapter 4) and “analysis of alternatives” (see Chapter 4), to be carried out by the DPHE and Paurashava Authority. Based on these and other relevant documents, the Project Management Unit (PMU) of DPHE will assess the need for further environmental assessment (IEE/EIA).

The major activities to be carried out for IEE and EIA include: (i) identification of sub-project influence area; (ii) establishment of “baseline environment” against which impacts of the proposed sub-project would be evaluated; (iii) analysis of alternatives; (iv) identification of major sub-project activities during both construction and operational phases; (v) assessment, prediction and evaluation of impacts of major project activities on the baseline environment; (vi) carrying out public consultations; (vii) preparation of environmental code of practice (ECoP); and (viii) identification of mitigation measures and preparation of environmental management plan (EMP), including monitoring requirements, and grievance redress mechanism. The EMF presents detail guidelines for carrying out each of these major activities.

The EMF also presents occupational health and safety guidelines, guidelines for establishment of EMIS, and a set of special environmental clauses (SECs) for inclusion in Technical Specification and bidding document. The EMF also presents institutional framework for environmental management of the BMWSSP to be implemented by the DPHE. Finally, the EMF presents training requirements for ensuring successful environmental management of the BMWSSP.

E 3.2 Sub-project Descriptions and Environmental Screening

Following the format of the “DoE Form 3”, a “Sub-project Description Form (**Form 1**)” has been developed (**Appendix A-1**) for documenting description of sub-projects to be implemented under the BMWSSP. If a particular sub-project has multiple independent components (e.g., a water treatment plant and a Paurashava water office at a different location), then Form 1 could be filled separately for each component. Once a sub-project description using Form 1 is prepared by DPHE appointed Consultant and Paurashava, it will be easier to subsequently complete the “DoE Form 3” during submitting application for environmental/ site clearance certificate. The completed Sub-project Description Form 1 and the Environmental Screening Form 2 will be sent to DPHE PMU for review, based on which the need for further environmental assessment will be determined.

The purpose of “environmental screening” is to get a preliminary idea about the degree and extent potential environmental impacts of a particular sub-project, which would subsequently be used to assess the need for further environmental assessment. DPHE-appointed Consultant and the Paurashavas will be responsible for carrying out environmental screening. The environmental screening would involve: (i) reconnaissance of the sub-project area and its surroundings by the Consultant and Paurashava engineer(s); (ii) identification of the major sub-project activities; and (iii) preliminary assessment of the impacts of these activities on the ecological, physicochemical and socio-economic environment of the sub-project surrounding areas.

The Consultant and Paurashava engineers would carry out a reconnaissance survey surrounding the sub-project location in order to identify important environmental features close to the sub-project site. With a preliminary idea about the nature of the sub-project location and sub-project activities, the Consultant and the Paurashava would carry out the "environmental screening" of sub-projects by filling in the "**Environmental Screening Form 2**" presented in **Appendix A-2**, following the guideline presented in the EMF.

E 3.3 Need for Further Environmental Assessment

The level of EA of a sub-project would primarily depend on the class/category of the sub-project according to WB OP 4.01 and ECR 1997. For assessing the need for further EA, DPHE will categorize the sub-project (e.g., Green Orange A, Orange B, or Red) based on the sub-project description (Form 1), and environmental screening (Form 2). If a particular sub-project is listed in the ECR 1997, it will be indicated in the Sub-project Description Form 1, and it would be categorized accordingly. If a sub-project is not specifically listed in the ECR 1997, it would be categorized based on the level of impacts indicated in Form 2, and categorization of similar projects in ECR 1997. The nature of further EA would depend on the categorization of the sub-projects. For Green Category sub-projects, no further environmental assessment would be required; for Orange A Category sub-projects, no further environmental assessment would be required, but some additional information would be required; for Orange B category sub-projects IEE and EMP would be required; while for Red Category sub-projects, full-scale EIA would be required.

E 3.4 Guidelines for Carrying out IEE and EIA

The guideline for EA presented here cover both IEE and EIA. Both IEE and EIA would cover the same elements, but the level of details would be different; a full-scale EIA would require detailed and quantitative analysis of impacts.
The major activities involved in carrying out IEE and EIA include the following:

1) Identification of sub-project influence area;
2) Establishment of "baseline environment" within the sub-project influence area, against which impacts of the proposed sub-project would be evaluated;
3) Identification of major sub-project activities/ processes during construction phase and operational phase;
4) Assessment and evaluation of impacts of major project activities on the baseline environment during construction phase and operational phase;
5) Carrying out public consultations;
6) Identification of mitigation measures for reducing/ eliminating adverse impacts and enhancing positive impacts;
7) Preparation of environmental code of practice (ECoP), including cost of ECoP; and
8) Development of environmental management plan (EMP), including monitoring requirements and grievance redress mechanism, and cost of EMP.

The environmental assessment (i.e., IEE/ EIA) of sub-projects will be carried out by DPHE (through a hired Consultant). The following Section presents detail guidelines for carrying out each of the major activities listed above for carrying out environmental assessment.

Sub-project Influence Area

In order to establish a sub-project influence area, the activities to be carried out and processes that would take place during both construction phase and operational phase of the sub-project need to be carefully evaluated. Based on the field visits to sub-project sites in 5 Paurashavas, it is apparent that the sub-project influence area would depend not only on the type of sub-project, but also on the site/ area where it will be implemented. For example, for clear water transmission line and water distribution network sub-projects, the types of roads along which the water lines would be laid and traffic situation on these roads are important determinants for assessment of impacts. For fecal sludge management plant (FSTP), the effluent receiving water body (Khal/River) could experience impacts (e.g., water pollution/depletion, odor, air and noise pollution), and therefore the nature of the effluent receiving water body and its water quality would be important issues. For public toilet sub-projects, the sub-project impacts are not likely to be felt beyond the location, thus, sub-project influence area would be the catchment area of the public toilet. However, considering possible groundwater pollution from soakage pit leachates, the depth of groundwater and present use of shallow groundwater would be important considerations.

The EMF provides clear guidelines (in tabular form) for identification of sub-project specific influence area for all the sub-projects to be implemented under BMWSSP.

Environmental Baseline

For environmental assessment (IEE and EIA), it is very important to adequately define the “environmental baseline” against which environmental impacts of a sub-project would be subsequently evaluated. The characteristics of “environmental baseline” would depend on:

- Nature of the sub-project location,
- Nature/ extent of a sub-project and its likely impact,
- Level of environmental assessment (e.g., screening versus full scale EIA)

For systematic definition and recording, the baseline environment is usually classified into Physicochemical, biological, and socio-economic environment; and important features/ parameters under each category are identified and measured during baseline survey.

Physicochemical environment

The important Physicochemical parameters for defining Physicochemical baseline include: Important Environmental Features (IEFs), Climate, Topography and drainage, Geology and soil, Hydrology and water resources, Air quality, Noise level, Water quality, and Traffic. Depending on the nature of sub-project and its potential impacts, the required data/ information could be could be collected either from secondary sources or through primary survey/ measurement. Table E3 presents guidelines for collection of primary and secondary data on physicochemical environmental parameters for different types of sub-projects to be implemented under the BMWSSP.

Table E.3: Guideline for identifying influence area for different types of sub-projects

Sub-project	Influence Area
Deep Tubewell with Pump House	Areas and communities within about one kilometer surrounding the proposed location of the deep tubewell.
Water Treatment Plant with raw water transmission line	Areas and communities within about one kilometer surrounding the proposed WTP location; Areas and communities on either side of the raw water transmission alignment.
Drain	Areas and communities on either side of the drain alignment (i.e., catchment area of the drain section); Downstream section of the drain up to the discharge point; Discharge point (water body; e.g., river, khal, another major drain).
Clear water transmission line; Water distribution network (including expansion and rehabilitation of existing network)	Routes along which of the water distribution lines would be laid, and its surrounding areas (service area/influence area).
Office Building	Areas and communities within about one kilometer surrounding the proposed location of the building complex.
Public Toilet	Areas and communities within about half a kilometer surrounding the proposed location of the public toilet.
Overhead tank	Areas and communities within about a half kilometer surrounding the proposed location of overhead tank;
Decentralized wastewater treatment plant	Areas and communities within about one kilometer surrounding the proposed location of DWWTP;
Latrine with septic tank and soakage pit	Areas and communities within about a quarter kilometer surrounding the proposed location of latrine with septic tank and soakage pit.
Fecal Sludge Management (including FSTP)[1], and SWM	Areas (e.g., markets, communities) from where fecal sludge or solid waste will be collected; The entire route of transportation of the collected fecal sludge or solid waste from the point of generation/ collection to the points/locations of treatment and ultimate disposal[3]; Areas within about half a kilometer surrounding the points/ locations of treatment and ultimate disposal of fecal sludge or solid waste.
OH tank	Areas and communities within about one kilometer surrounding the proposed project location;

Biological environment

Important parameters for description of biological environment include:

- General bio-ecological features of the sub-project area and its surroundings (e.g., bio-ecological zone, rivers, wetlands, hills, agricultural lands)
- Wildlife sanctuary, game reserves, protected area, national park, ecologically critical area (ECA)
- Floral habitat and diversity (terrestrial and aquatic)
- Faunal (including fish) habitat and diversity (terrestrial and aquatic)
- Threatened flora and fauna

Most of the sub-projects under BMWSSP are likely to have minor ecological impacts, and for such sub-projects general bio-ecological description of the sub-project area would be sufficient for description of baseline biological environment. In most cases, the most significant direct impact would result from felling/clearing of trees/vegetation within the sub-project area. For a few sub-projects, a more detailed description of biological environment would be necessary. Table E.4 provides guideline for collection and presentation of data on biological environment for different sub-projects.

Table E.4: Guideline for collection of sub-project specific data/ information for describing biological environment

Sub-project	Data/ information from secondary source	Data from primary survey/ measurement
Deep tubewell with pump house; Water transmission line; water distribution network, Clear water transmission line construction /rehabilitation /expansion; Paurashava water office building; Public Toilet; Latrine with septic tank and soakage pit	General bio-ecological features; Wildlife sanctuary, game reserves, ECA, etc.	Number of trees to be felled; Area of be cleared of vegetation
Water treatment plant; fecal sludge treatment plant; decentralized wastewater treatment plant; Drain; SWM	General bio-ecological features; Wildlife sanctuary, game reserves, ECA, etc.	Number of trees to be felled; Area of be cleared of vegetation; Floral and faunal diversity; Endangered and threatened species (focusing on the water bodies receiving storm water discharge)

Socio-economic environment

For major sub-projects, it is important to have a clear understanding to the baseline socio-economic condition of people, especially those living within the sub-project influence areas. A common approach for quick assessment of baseline socio-economic condition is questionnaire survey. The primary objectives of a questionnaire survey are: (a) to understand people's socio-economic condition; (b) to understand extent of people's access to basic services; and (c) to understand people's perception regarding the sub-project.

The questionnaire used for the socio-economic survey may therefore cover five major themes: (a) Socio-economic background; (b) Basic services (water supply, sanitation, power, gas/fuel); (c) Education; (d) Economic situation, and (e) Attitude toward the proposed sub-projects.

Identification of Major Sub-project Activities

In order to assess environmental impacts of sub-projects, it is very import to identify the major sub-project activities during both construction and operational phases. The major activities would be different for different sub-projects. It should be noted that based on feasibility study of the DPHE and field visits carried out so far, it appears that no significant private land acquisition would be required for any of the sub-projects to be carried out in the Paurashavas. A common sub-project activity is mobilization of material and equipment and establishment of labor shed for carrying out the construction works. The actual construction activities would be different for different types of sub-projects. For example, the major construction activities for a water transmission line sub-project would include earth works (excavation and removal of excavated soil), installation of water pipeline of required specification, commissioning and testing of pipeline, and dismantling and removing all temporary structures (e.g., labor sheds), material and equipment from the site. During operational phase, important issue is maintenance of pipeline and ensuring its safety. Similarly, major activities during construction and operational phases of other sub-projects should be identified to assess their impacts on the baseline environment.

Assessment and Prediction of Impacts

Potential Significant Environmental Impacts during Construction Phase

After identification of the sub-project activities during construction phase, the next step in the IEE/EIA involves assessment/prediction of the impacts of these activities on the baseline environment. The potential environmental impacts during construction phase of sub-projects could be categorized into: (a) ecological impacts; (b) physicochemical impacts; and (c) socio-economic impacts.

<u>Ecological impacts:</u>

These sub-projects include: (i) Fecal sludge management, (ii) Water treatment plant with raw water transmission line, (iii) Clear water transmission line construction/ rehabilitation/ expansion, and (iv) Water distribution network. In general, the ecological impact should focus on:

(a) Impact on flora (aquatic and terrestrial);
(b) Impact on fauna (aquatic and terrestrial) including fish;

In all these cases, the assessment should focus primarily on the water quality. The EMF provides detail guideline for assessment of ecological impacts for these sub-projects.

<u>Physicochemical impacts:</u>

Possible physicochemical impacts from the sub-project activities to be carried out in different Paurashavas under the BMWSSP project may include the following:

- Drainage congestion,
- Noise pollution,
- Air pollution,
- Water pollution,
- Environmental pollution from solid/construction waste

Temporary drainage congestion often results from obstruction to natural flow of drainage water due to the storage of materials, piled up excavated material/soil, and temporary embankments constructed to keep the work area dry. Noise and air pollution could results from a wide range of construction activities, including movement of vehicles, operation of construction equipment and generators. Significant noise is generated from operation of pile drivers, bulldozers, dump trucks, compactors, mixing machines, and generators. Noise pollution is particularly important for sensitive establishment e.g., hospitals, educational/ religious institutions.

Water pollution may result from discharge of wastewater (e.g., liquid waste from labor sheds), spills and leaks of oils/chemical into water bodies (e.g., drain, pond, khal, river). For water treatment plant and FSTP sub-projects, construction activities would be related to water bodies (source and treated effluent disposal); hence these sub-projects are more likely to generate water pollution. For other sub-projects, the presence and existing use of water bodies surrounding the sub-project site would determine the level of impact.

Socio-economic impacts:

Possible socio-economic impacts from the sub-project activities to be carried out in different Paurashavas may include the following:

- loss of land,
- loss of income and displacement,
- traffic congestion,
- impact on top soil,
- health and safety,
- impact on archaeological and historical sites, and
- employment and commercial activities,

Based on feasibility study of the proposed BMWSSP and field visits carried out so far, it appears that significant land acquisition will not be required for any of the sub-projects to be implemented in different Paurashavas. Loss of income may result from inability to use a particular piece of land/ establishment (e.g., footpaths) during the construction phase for income generation activity. Some of the proposed sub-projects may cause temporary displacement of people. For example, during construction/ rehabilitation of clear water transmission line or water distribution network, road-side vendors or small temporary shops on footpaths may not be able to operate for a period of time.

During construction phase, traffic congestion may result from stock piling of material by the sides of roads, increased movement of people and vehicles. Some of the sub-projects, water transmission and distribution lines and drains may aggravate the existing traffic problem during construction phase. This should be addressed with proper traffic management, and avoiding stockpiling of materials in a way that could hamper traffic movement. General construction activities pose safety risks, which should be addressed as part of occupational health and safety plan.

Archeological and historical sites are protected resources. Damage of such sites by digging, crushing by heavy equipment, uprooting trees, exposing sites to erosion, or by making the sites more accessible to vandals are of particular concern. A guideline for archaeological impact assessment is presented in **Appendix C**. A guideline for identification of physical cultural resources (PCR) and determination of the suitability of the sub-projects from the perspective of PCR is provided in **Appendix D.** The likely impacts to PCR for typical activities of the sub-projects are also discussed in Appendix G. The “Chance Find” procedure for protection of cultural property is presented in **Appendix E**, following the World Bank Operational Policy OP 4.11 (Physical cultural resources). During construction phase, some beneficial impact at local level would come in the form of employment in sub-project related works, which would depend on the nature and extent of the sub-project. This in turn would induce some positive impacts on some other parameters including commercial activities in the sub-project areas.

Potential Significant Environmental Impacts during Operational Phase

After identification of the activities/processes during operational phase of a sub-project, their potential impacts on the baseline environment need to be assessed. The potential environmental impacts during operational phase could also be categorized into: (a) ecological impacts; (b) physicochemical impacts; and (c) socio-economic impacts.

Ecological impacts:

During operational phase, the possible impact of the sub-project activities on the biological environment would be insignificant, except for a few of sub-projects. These include: (a) water treatment plant; (b) fecal sludge management; (c) SWM (e.g., land filling), (d) DEWATS; and (d) storm drain. Discharge of effluents generated from FSTP, DEWATS or leachate from solid waste disposal sites could cause pollution of the receiving river/ khal, thereby affecting the aquatic ecology. Poor quality of drainage water (e.g., due to direct discharge of toilet wastewater into storm drain) could cause pollution of the receiving water body (e.g., river, khal) and thus adversely affect aquatic flora, fauna and associated terrestrial fauna.

Physicochemical impacts:

Depending on the type of sub-projects a number of Physicochemical parameters could experience both positive and negative impacts during operation phase of the sub-projects. Important issues and parameters include:

- Drainage,
- Water quality,
- Air quality and noise level, and
- Environmental pollution from solid waste

Implementation of FSTP, SWM disposal system and decentralized wastewater treatment (DEWATS) systems are likely to significantly improve overall environment, particularly surface water quality in the project areas, because fecal sludge and untreated domestic wastewater are currently being discharged in open water bodies and low-lying areas. Operation of public toilets would also contribute to improvement of water quality through discouraging open defecation. All these projects would contribute to the improvement of overall environmental condition in the project areas, and support achievement of SDG Target 6.2 (safely managed sanitation). However, discharge of poor quality effluent from FSTP and DEWATS could adversely affect the receiving water bodies. Poor quality drainage water could also adversely affect the receiving water bodies.

During operational phase, increased movement of service vehicles surrounding service facilities like water treatment plant, fecal sludge management plant and water office building could generate higher noise and air pollution.

Socio-economic impacts:

The proposed BMWSSP is aimed at bringing about improvement in the socio-economic conditions of the Paurashavas through improvement of basic infrastructure. Thus, implementation of the proposed sub-projects is likely to bring about significant improvement in the overall environmental and socio-economic conditions at the Paurashavas. Important socio-economic parameters that are likely to experience beneficial impacts due to implementation of the sub-projects include: water supply and sanitation, public health and safety, and employment

Analysis of Alternative

As a part of the IEE/EIA, analysis of alternatives, including alternative site(s) for sub-project, alternative technology for sub-projects (e.g., alternative technologies for water treatment or fecal sludge treatment), and "no project scenario" would be assessed.

Public Consultation

The EMF presents a guideline for carrying out consultation, including guidelines on nature (FGD/informal meetings) and number of consultation, location, and type of participants. As a part of IEE/ EIA, effective public consultation needs to be developed. The specific objectives of consultation, most often carried out in the form of focus group discussions (FGDs), are:

- To keep stakeholders informed about the sub-projects at different stages of implementation,
- To address the environmental and social concerns/ impacts, and device mitigation measures taking into account the opinion/ suggestions of the stakeholders,
- To generate and document broad community support for the sub-projects,
- To improve communications among interested parties, and
- To establish formal complaint submittal / resolution mechanisms.

Environmental Management Plan (EMP)

The primary objective of the EMP is to record environmental impacts resulting from sub-project activities and to ensure implementation of the identified "mitigation measures". Besides, it would address any unexpected or unforeseen environmental impacts that may arise during implementation of the sub-projects. The major components of the EMP include:

- Mitigation and enhancement measures
- Monitoring plan
- Grievance redress mechanism
- Estimation of cost of EMP
- Institutional arrangement for implementation of EMP

Mitigation and Enhancement Measures

The overall impact assessment of the proposed sub-projects to be implemented at the Paurashavas reveals that most of the adverse impacts could be minimized or eliminated by adopting standard mitigation measures; there is also scope to enhance some of the beneficial impacts to be generated from the proposed sub-projects. Table E.5 shows typical activities to be carried out under different sub-projects, corresponding "general impacts" and suggested mitigation and enhancement measures. Table E.6 shows "sub-project specific" impacts and corresponding mitigation/ enhancement measures. Table E.7 shows some important sub-project specific impacts during operational phase and corresponding mitigation measures.

Monitoring Plan

The objective of the environmental monitoring is to record environmental impacts resulting from the sub-project activities and to ensure implementation of the "mitigation measures". Table E.8 and Table E.9 present the guidelines for monitoring of environmental parameters during construction phase and operational phase, respectively.

Grievance Redress Mechanism

Grievance Redress Mechanism (GRM) is a valuable tool which will allows affected people to voice concerns regarding environmental and social impacts for sub-projects to be implemented under the BMWSSP. As a part of EMF, a grievance redress mechanism has been developed, including structure of a grievance redress committee.

Method for Estimation of Cost of EMP

Many of the activities to be carried out as a part of EMP would not involve any additional direct cost e.g., employing local work force; keeping sub-project vehicles in good operating condition; scheduling deliveries of materials/ goods in off-peak hours; good housekeeping, avoiding spills; prohibiting use of fuel wood for heating bitumen; etc. Environmental monitoring during both construction and operational phases would involve direct cost. At the same time, a number mitigation measures would also require additional cost; these include of installation of portable toilets, installation of health and safety signs, awareness documents (signs/ posters), water sprinkling on aggregates and unpaved surfaces, traffic control (e.g., deputing flagman), traffic light, plantation, and protective gear. Table E.10 provides basis/ method of estimation of costs of different items of EMP. Similar approach should be followed for estimation of cost of additional measures, if required.

E 3.5 Environmental Code of Practice (ECoP)

The ECoP is a guideline for reduce or eliminate environment risk due to various activities associated with different types of sub-projects considered in the BMWSSP. The ECoP outlines the following issues related to sub-project operation: (1) Planning and Design Phases of a Project; (2) Site Preparation; (3) Construction Camps; (4) Borrow Areas; (5) Topsoil Salvage, Storage, and Replacement; (6) 6. Slope Stability and Erosion Control; (7) Waste Management; (8) Water Bodies; (9) Water Quality; (10) Drainage; (11) Public Health and Safety; (12) Material Storage, Transport, and Handling; (13) Vegetation Management; and (14) Natural Habitats. A guideline has been developed for determining applicability of different ECoP activities for different sub-projects (**Appendix F**).

Table E.5: Typical "general impacts" during construction phase of sub-projects and corresponding mitigation and enhancement measures

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
Construction and operation of labor shed for workers	• Generation of sewage and solid waste; water/ environmental pollution	• Construction of sanitary latrine/ septic tank system. • Erection of "no litter" sign, provision of waste bins/cans, where appropriate • Proper disposal of solid waste	Contractor (Monitoring by Paurashava/ DPHE)
	• Health of workers	• Raising awareness about hygiene practices among workers. • Availability and access to first-aid equipment and medical supplies	
	• Possible development of labor camp into permanent settlement	• Contractor to remove labor camp at the completion of contract	
	• Outside labor force causing negative impact on health and social well-being of local people	• Contractor to employ local work force, where appropriate; promote health, sanitation and road safety awareness	
General construction works for sub-projects	• Drainage congestion and flooding	• Provision for adequate drainage of storm water • Provision of adequate diversion channel, if required • Provision for pumping of congested water, if needed • Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season.	Contractor (Monitoring by Paurashava/ DPHE)
	• Air pollution	• Ensure that all project vehicles are in good operating condition. • Spray water on dry surfaces/ unpaved roads regularly to reduce dust generation. • Maintain adequate moisture content of soil during transportation, compaction and handling. • Sprinkle and cover stockpiles of loose materials (e.g., fine aggregates). • Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter.	

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	• Traffic congestion, traffic problems	• Schedule deliveries of material/ equipment during off-peak hours. • Selection of alternative routes, where possible for sub-project vehicles • Depute flagman for traffic control • Arrange for signal light at night	
	• Noise pollution	• Use of noise suppressors and mufflers in heavy construction equipment. • Avoid using of construction equipment producing excessive noise at night. • Avoid prolonged exposure to noise (produced by equipment) by workers. • Regulate use of horns and avoid use of hydraulic horns in project vehicles.	
	• Water and soil pollution	• Prevent discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ khals/ drains. • Install sediment basins to trap sediments in storm water prior to discharge to surface water.	
	Felling of trees, clearing of vegetation	• Replant vegetation when soils have been exposed or disturbed. • Plantation to replace felled trees	
	• Accidents	• Following standard safety protocol. • Environmental health and safety briefing. • Provision of protective gear.	
	• Spills and leaks of oil, toxic chemicals	• Good housekeeping. • Proper handling of lubricating oil and fuel. • Collection, proper treatment, and disposal of spills.	
All construction works	• Beneficial impact on employment generation	• Employ local people in the project activities as much as possible. • Give priority to poor people living in slums within project area in sub-project related works (e.g., excavation and other works, which do not require skilled manpower).	Contractor (Monitoring by Paurashava/DPHE)

Table E.6: "Sub-project specific impacts" during construction phase and corresponding mitigation measures

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
DTW with Pump Hose Sub-project			
Setting up and operation of drilling rig and drilling for installation of DTW	• Air and noise pollution affecting nearby settlements	• Consider use of noise attenuator in drilling rigs	Contractor (Monitoring by Paurashava/ DPHE)
	• Stock-piling of earth	• Remove stock-piled earth following completion	
Pump House construction and Electrical works	• Air and noise pollution affecting nearby settlements • Water pollution from temporary labor shed toilets	• Ensure adequate number of portable toilets	
	• Discovery of historical items and cultural remains	• Follow "chance find procedure" (see Appendix E) for protection of cultural resources	DPHE, with support from Contractor, Paurashava/DPHE
Overhead Tank (OHT)			
Construction of OHT	• Safety of workers • Safety of surrounding neighborhood	• Taking adequate safety measures following the provisions included in the EMF • Discussion with local community on safety and other issues prior to commencement of construction works	Contractor (Monitoring by Paurashava/ DPHE)
WTP with Raw Water Transmission Line/Water Distribution Network Sub-project			
Construction activities near water: Setting up riverbank protection work and raw water intake & transmission line and Water Distribution Network	• Air and noise pollution affecting nearby settlements • Water pollution from temporary labor shed toilets	• Locate intake point away from the residential settlements • Ensure adequate number of portable toilets	
	• Ecological impacts including destruction of aquatic habitat	• Prevent discharge of leachate, chemicals, and fecal sludge into surface waters. • Preservation of aquatic habitats by restricting movement of people/ equipment into them and preventing entry of sediments into these	Contractor (Monitoring by Paurashava/ DPHE)

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
		water bodies. • Keep noise level (e.g., from equipment) to a minimum level, as certain fauna are very sensitive to loud noise.	
WTP construction and electromechanical works	• Air and noise pollution affecting nearby settlements	• Locate intake point away from the residential settlements	
Excavation of trenches/ Earth works	• Erosion of riverbank (for SWTP)	• Ensure appropriate Riverbank Protection measures at the intake point • Limit earthworks to the dry season as much as possible; protect exposed earthworks with mulch, fabric and plant cover	Contractor (Monitoring by Paurashava/ DPHE)
	• Unsightly spoil disposal from foundation works by simple side tipping, affecting drainage/ runoff	• Disposal of soil to designated tipping areas	
	• Interruption of traffic and pedestrian movement due to stockpiling of excavated earth on road/footpath	• Avoid stockpiling of excavated earth on road/footpath; quickly remove excavated earth. • Employ personnel for traffic management to ensure smooth traffic flow during excavation of trench and installation of water transmission and distribution lines.	
	• Discovery of historical items and cultural remains	• Follow "chance find procedure" (see Appendix E) for protection of cultural resources	DPHE, with support from Contractor, Paurashava/DPHE
Drain Sub-project			
Excavation/ Earth works	• Erosion	• Limit earthworks to the dry season as much as possible; protect exposed earthworks with mulch, fabric and plant cover	Contractor (Monitoring by Paurashava/ DPHE)
	• Interruption of traffic and pedestrian movement due to stockpiling of excavated earth on road/footpath	• Avoid stockpiling of excavated earth on road/footpath; quickly remove excavated earth. • Employ personnel for traffic management to ensure smooth traffic flow during excavation of drainage channel or trench for laying storm sewer.	
	• Unsightly spoil disposal from drain excavation by simple side tipping, affecting drainage/ runoff	• Disposal of soil to designated tipping areas	
	• Possible backflow of water through drainage canal causing	• Consider installing gates to control inflow and outflow through drainage canal	

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	flooding/ water logging		
	• Discovery of historical items and cultural remains	• Follow “chance find procedure” (see Appendix H) for protection of cultural resources	DPHE, with support from Contractor, Paurashava/DPHE
Fecal Sludge Management , DEWATS, SWM Sub-project			
Construction activities near water	• Ecological impacts including destruction of aquatic habitat • Air quality and noise problem	• Prevent discharge of leachate, chemicals into surface waters. • Preservation of aquatic habitats by restricting movement of people/ equipment into them and preventing entry of sediments into these water bodies. • Keep noise level (e.g., from equipment) to a minimum level, as certain fauna are very sensitive to loud noise. • Locate plant away from the residential settlement	Contractor (Monitoring by Paurashava/ DPHE)
Construction of FSTP, Solid waste disposal system	• Groundwater pollution due to discharge of liquid (during operational phase)	• Restrict construction at shallow water table area	DPHE, with support from Contractor, Paurashava/DPHE
DEWATS, SWM, Building complex, Public toilets, Latrine with septic tank and soakage pit			
Construction of wastewater/ sewage disposal system	• Groundwater pollution due to discharge of wastewater/ effluent in deep soakage well, leachate from solid waste disposal site, and decentralized wastewater treatment plant (during operational phase)	• Restrict construction of deep soakage well • Proper design of SWM disposal site • Proper design of DEWATS	DPHE, with support from Contractor, Paurashava/DPHE

Table E.7: "Sub-project specific impacts" during operational phase and corresponding mitigation measures

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
DTW with Pump House Sub-project			
Operation of the Pump House	• Increase in noise pollution	• Install noise attenuator and ensure proper maintenance of pump and motor	Paurashava
Overhead Tank (OHT) Sub-project			
O&M including cleaning of OHT	• Poor water quality • Damage to the structure • Poor aesthetics	• Regular cleaning of OHT • Removal of vegetation growth • Cleaning and painting of OHT	Paurashava
WTP with Raw Water Transmission Line/Water Distribution Network Sub-projects			
Operation WTP	• Pollution of downstream water body (for SWTP) due to disposal of effluent from WTP	• Ensure proper treatment appropriate for disposal according to ECR '97	Paurashava
	• Pollution from disposal of sludge generated from treatment of water	• Ensure proper treatment appropriate for disposal meeting the DoE requirements	
Drain Sub-project			
Operation of the drain	• Pollution of downstream water body due to disposal of polluted water from the drain	• Stop direction connection from sanitation facilities to storm drain; ensure installation of septic tank in all establishments	Paurashava (with support from
	• Blockage in the drain due to disposal of solid waste	• Creation of awareness; improve SWM system, installing cover in open manholes (if any) • Regular maintenance/ cleaning of the drain	
Fecal Sludge Management, SWM, Public toilets, DEWATS Sub-projects			
Operation of Fecal sludge management system (including FSTP), Solid waste disposal site, DEWATS	• Odor nuisance affecting nearby community • Health and safety of pit emptiers, solid waste handlers, waste pickers • Ecological impacts including	• Ensure collection of fecal sludge through mechanical means (using vacutugs), and use of protective gear by pit emptiers. • Proper training of pit emptiers. • Secured transport of fecal sludge • Ensure proper treatment appropriate for disposal meeting the DoE requirements	Paurashava

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	destruction of aquatic habitat due to poor quality effluent discharge, leachate from solid waste • Air quality and odor problem	• Prevent discharge of leachate, chemicals, and fecal sludge into surface waters.	
	• Groundwater pollution due to discharge of liquid/ effluent, leachate from solid waste disposal site, FSTP and DEWATS	• Ensure proper treatment appropriate for disposal meeting the DoE requirements • Restrict discharge of liquid effluent into shallow water table area	Paurashava

Table E.8: Guideline for monitoring of environmental parameters during construction phase

Sub-project	Monitoring Parameter and Scenario	Monitoring Frequency	Resource Required and Responsibility
WTP with raw water transmission line, Drain, Water Distribution Network, Clear water transmission/ rehabilitation/expansion, FSTP and DEWATS, SWM	If significant air pollution is suspected: Particulate Matter (PM_{10}/ $PM_{2.5}$)	As needed	Contractor, under the guidance of Paurashava/ DPHE
WTP with raw water transmission line, Drain, Water Distribution Network, Clear water transmission/ rehabilitation/expansion, FSM and DEWATS, SWM	Regular monitoring: Noise level	Once every week, particularly during operation of heavy equipment	Contractor, under the guidance of Paurashava/ DPHE
WTP, Drain, FSTP, SWM and DEWATS	Water quality (pH, BOD_5/ COD, Oil and Grease)	Once a month (at a location downstream of the work area)	Contractor, under the guidance of Paurashava/ DPHE
WTP with raw water transmission line, Drain, Water Distribution Network, Clear water transmission/ rehabilitation/expansion, FSTP, SWM and DEWATS	If pollution of an adjacent water body is suspected: Water quality (pH, BOD_5/ COD, Oil and Grease)	As needed	Contractor, under the guidance of Paurashava/ DPHE
All sub-projects	Visual observation of drainage congestion, traffic within around sub-project location	Once a week; when drainage/ traffic congestion suspected	Contractor, under the guidance of Paurashava/ DPHE

Note: Actual monitoring time and location should be decided by the PD depending on the location of specific activities.

Table E.9: Guideline for monitoring of environmental parameters during operational phase

Sub-project	Monitoring Parameter and Scenario	Monitoring Frequency	Resource Required and Responsibility
Strom drain, WTP, FSTP, SWM, DEWATS	Water quality (pH, BOD_5/ COD, Ammonia, Phosphate)	Once a month (at a location downstream of the discharge point)	Paurashava, with support from DPHE

Note: Actual monitoring time and location should be decided by the PD depending on the location of specific activities.

Table E.10: Method/ basis of estimation of cost of EMP

Item	Basis of cost / Estimated cost
Monitoring:	
Air Quality (PM_{10} or $PM_{2.5}$)*	Prevailing rate (~ Tk. 15,000/- per measurement)
Noise level	Prevailing rate (~ Tk. 10,000/- per measurement per day)
Water quality (pH, BOD_5 or COD, Oil and grease	Prevailing rate (~ Tk. 20,000/- per sample)
Water quality (pH, BOD_5 or COD, NH_3, PO_4)	Prevailing rate (~ Tk. 12,000/- per sample)
Installation of sanitary latrine/ portable toilet	Prevailing rate/ Latest PWD/ DPHE/ LGED rates
Health/ safety signs (size and number to be estimated)	Prevailing PWD/ DPHE/ LGED rate / Lump sum amount
Water sprinkling on aggregate	Latest PWD/ DPHE/ LGED rate (if available)/ A fixed rater per cubic meter of aggregate per day
Traffic control (estimate number of flagman needed and duration of work)	Latest PWD/ DPHE/ LGED rate (if available)/ A fixed rate per flagman per day/ Lump sum amount
Protective gear	Contractor to quote rate of different items of works considering the provision of adequate protective gear for workers, in accordance to the conditions of contract, specified in the Tender Document
Plantation (including protection/ fencing and conservation during project period)	Prevailing rate (~ Tk. 1,500/- per plant)

* Depending on availability of facility for measurement

E 3.6 Institutional Arrangements

For all sub-projects to be implemented under MWSSP, the Project Management Unit (PMU) of the DPHE will be responsible for overseeing overall environmental management including implementation of mitigation measures. During project preparatory stage, specific sub-projects to be implemented at a particular Paurashava will be identified by the DPHE-appointed Consultant and the Paurashava authority. The Consultant will also be responsible for carrying out feasibility study, detail design, and preparation of bid document. The activities will be verified by the PMU of DPHE.

During project implementation stage, both DPHE and Paurashava will be responsible for overall monitoring and supervision, while day to day monitoring and supervision of sub-projects will be carried out by TA Consulting Firm(s) appointed by the PMU of DPHE. DPHE will be primarily responsible for overall monitoring of some of the major sub-projects, such as water treatment plant (WTP), overhead tank, water transmission line, DEWATS, and FSTP; while Paurashava will be primarily responsible for monitoring of the remaining sub-projects, including drainage system, public toilet, solid waste management system. The activities of the TA Consulting Firm(s) will be supervised by the respective DPHE District Office and Paurashava. PMU will verify the quarterly progress and monitoring reports prepared for all sub-projects. Figure E.1 shows the institutional set up for implementation of the BMWSSP.

Activity	Responsibility
(1) Identification of Sub-projects (2) For each sub-project, prepare/ complete: • Sub-project Description (Form-1) • Environmental Screening (Form-2)	Paurashava and DPHE-appointed Consultant
(1) Review of Sub-project documents, including Forms-1, 2 (2) Screening and assessment	PMU, DPHE (with support from “Environmental Specialist”, TA Consultant)
If additional Environmental Assessment (EA) required	
Carry out environmental assessment (EA) of selected sub-projects (IEE/ EIA), following the EMF	PMU By Hired Consultant, to be supervised by “Environmental Specialist”
(1) Review of EA by DPHE (2) Obtaining necessary environmental clearance from the DoE and WB	PMU, DPHE (with support from “Environmental Specialist” and TA Consultant)
Implementation of EMP/ ECoP during sub-project “construction phase”	Implemented by the Contractor under the guidance of TA Consultant hired for supervision and monitoring; Supervised by DPHE (through District Office) for major sub-projects; and by Paurashava for remaining sub-projects
Preparation of quarterly progress and monitoring reports	TA Consultant under the supervision of DPHE District Office (for major sub-projects) and Paurashava (for remaining projects)
Implementation of EMP during sub-project “operational phase”, including monitoring and quarterly reporting	PMU, DPHE and Paurashava
Third Party Monitoring of the Environmental Management of sub-projects implemented	

Figure E.1: Institutional set up, including major activities and assignment of responsibility for their execution, for implementation of BMWSSP by the DPHE

E 3.7 Disclosure

Summary of the IEE/EIA report and impact mitigation measures will be translated into Bengali language and disseminated locally. Copies of the full report (in English) and the summary (in Bengali) will be sent to all the offices of the concerned Paurashavas and will be made available to the public. In accordance with the Bank's disclosure policy, the summary of the IEE/EIA report will also be uploaded in the website of Paurashavas/ DPHE and in the Bank InfoShop before appraisal. Any subsequent EMP will be discussed locally with the stakeholders and disseminated widely and made available on the project's portal and in the Bank InfoShop before awarding of civil works contract.

E 3.8 Occupational Health and Safety Guidelines

In general, the objectives of occupational health and safety (OHS) plan are: (a) To develop, in the workplace, a collaborative approach to managing Occupational health and Safety between management and workers; (b) To provide and maintain safe working procedures and operations; (c) To ensure awareness of all potential work related risks and hazards and to develop preventive strategies against these risks and hazard; (d) To provide appropriate training to all concerned to work safely and effectively; (e) To maintain a constant and continuing interest in the improvement of occupational health and safety performance and to provide the required resources necessary for the implementation and maintenance of the OHS plan. For the sub-projects to be implemented under the MWSSP, the occupational health and safety primarily focuses on work equipment and protective gear. The EMF provides guidelines/ directives for: (a) work equipment, (b) protective gear, and (c) safety and health signs.

E 3.9 Environmental Management and Information System (EMIS)

An Environmental Management Information System (EMIS) may be established for the BMWSSP. The purpose of establishing the EMIS is to manage the data of the DPHE project and monitor the progress and impact. The EMIS will be a central repository for data on variety of environmental indicators relevant to EMF, IEE and EIA and related to the sub projects. At the same time, it will perform as a storehouse and knowledge management tool for the sector and facilitate more analytical evaluation on available data.

E 3.10 Third Party Monitoring

Third party monitoring of environmental management, establishment of Environmental Management Information System (EMIS), Special Environmental Clauses (SECs) for inclusion in the bidding document, and training requirements for institutional strengthening have been presented separately in the EMF.

E 3.11 Training Requirement

Table E.11 summarizes the training requirements for Paurashavas and DPHE staff/officials.

Table E.11: Training requirements for successful environmental management of BMWSSP

Training Type/ Contents	Participants	Schedule
Basic Training: General environmental awareness, regulatory requirements, basic environmental practices.	DPHE: Staff from PMU, Relevant District Offices; Paurashava: At least two participants from each Paurashava)	Prior to commencement of sub-project activities
Training on EMF: EMF frameworks for BMWSSP, environmental impacts and mitigation, analysis of alternatives, grievance redress issues, as outlined in the EMF.	DPHE: Staff from PMU, Relevant District Offices; Paurashava: At least two participants from each Paurashava)	Immediately after project commencement
Advanced Training: Environmental management (EMP, ECoP), monitoring, reporting	DPHE: Staff from PMU, and relevant District Offices who would be involved in project management and monitoring; Paurashava: At least one participant from each Paurashava, who would be responsible for project monitoring.	After project commencement

1.0 INTRODUCTION

1.1 Background

1. The World Bank is engaged in providing credit for urban governance and service delivery improvements in Municipalities (Paurashavas) and City Corporations of Bangladesh for a number of years. In 2012-13 the Bank undertook an in-depth analytical study which analyzed options for appropriate models of water supply and sanitation (WSS) service delivery, and made recommendations for operationalizing these models. Discussions were initiated on possible World Bank lending assistance to GoB for strengthening the WSS service delivery system along with infrastructure development at secondary town level, which resulted in the "Bangladesh Municipal Water Supply and Sanitation Project (MWSSP)".

2. The objective of the Bangladesh Municipal Water Supply and Sanitation Project (MWSSP) is to increase access to safe water supply and sanitation services in selected municipalities (Paurashavas), and to strengthen the institutional capacities of participating municipalities for delivering improved WSS services. The two major land based components of the project which will impact the environment are the following:

(c) Investment for Water Supply Infrastructure, and
(d) Improving Sanitation and Septage (fecal sludge) Management.

3. Presently piped water supply systems in Paurashavas typically cover limited population. Investments for water supply infrastructure (referred to as "subprojects") will include construction of new water treatment plants, intake for raw water source, expansion and rehabilitation of distribution networks. Expansion of piped water supply to those Paurashavas that have limited piped water supply coverage will be also considered. In addition, some drainage and solid waste management (SWM) works would also be carried out in the selected Paurashavas.

4. In most Paurashavas, absence of fecal sludge management (FSM) services is causing severe environmental pollution, affecting both public health and local economies. Under the sanitation and septage (fecal sludge) management component, the proposed project will support the provision of facilities and services for the safe management and disposal of fecal sludge by financing infrastructure capital expenditure for the Municipalities (Paurashavas). This will include subprojects involving construction of public toilet, small scale FSTPs (Fecal Sludge Treatment Plants), decentralized waste water treatment systems in line with the Paurashava Master Plan and feasibility studies.

5. The IDA approval of the loan is contingent upon the GOB's (i.e., PMU's-Project Management Unit's) compliance to the WB environmental safeguards requirements. In this regard, at least two Bank policies related to environment will be triggered: (a) OP/BP 4.01 Environmental Assessment; and (b) OP/BP 4.11 Physical Cultural Resources, to ensure that the project design and implementation are focused on reducing adverse impacts and enhancing positive impacts. Depending on the situation, a number of other Bank policies could also be triggered; these include: (a) OP/BP 4.10: Indigenous People; (b) OP/BP 4.12: Involuntary Resettlement; (c) OP/BP 4.04: Natural Habitats. Along with WB environmental

safeguard requirements, the project also needs to comply with the national environmental regulations in accordance to the Environmental Conservation Act 1997 (GoB, 1997).

6. Hence, the PMU of DPHE has undertaken an initiative to carryout environmental assessment of the proposed BMWSS project such that it ensures the IDA requirements and also complies with GoB (DoE) environmental requirements. As specific project locations (i.e., Paurashavas) and the specific sub-projects (including sub-project sites) are yet to be identified, a “framework approach” has been adopted through the development of an Environmental Management Framework (EMF). The “framework” for carrying out environmental assessment of the specific sub-projects to be implemented under the BMWSSP has been prepared based on an “overall environmental assessment” of the typical sub-projects in selected project areas (i.e., Municipalities/Paurashavas). The “overall environmental assessment” including “overall project baseline”, evaluation of potential significant impacts of different sub-projects, and assessment of environmental practices in different ongoing and completed projects form the basis of the EMF. In summary, the EMF has been prepared based on:

(a) Assessment of overall baseline environmental condition in selected Municipalities/ Paurashavas;
(b) Assessment of environmental practices of the recently completed projects in different Municipalities/ Paurashavas;
(b) Evaluation of potential environmental impacts of different types of sub-projects to be implemented under the BMWSSP project at selected Municipalities/ Paurashavas;
(c) Identification of sub-project specific standard mitigation measures (for negative impacts), enhancement measures (for positive impacts), and monitoring plan; and
(d) Identification of institutional capacity needs for environmental management of all stakeholder organizations (including LGIs).

7. The EMF document is intended to provide general policies, guidelines and procedures to be integrated into the design and implementation of all subprojects under the proposed BMWSS project. It will serve as guide for preparation of subproject specific environmental assessment, including EMP (Environmental Management Plan); and their implementation will be done during project execution using the EMF guidelines.

1.2 WB Safeguard Policies and Basis of the EMF

8. Since the World Bank is financing the project, the environmental assessment of the proposed project needs to comply with the policies and legislative requirements of the World Bank. Thus, the proposed project requires carrying out an Environmental Assessment in accordance with the World Bank Safeguard Policies. The Bank classifies projects into three major categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts: Category A (The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented), Category B (The proposed project's potential adverse environmental impacts are less adverse than those of Category A projects, impacts are site-

specific, some irreversible, mitigatory measures can be defined more readily than category A projects), and Category C (The proposed project is likely to have minimal or no adverse environmental impacts).

9. The proposed project aims to enhance and strengthen the water supply network and sanitation systems in different Paurashavas to improve health and living standards. Given the present situation, it is reasonable to assume that the proposed project activities are not likely to cause any long-term or irreversible environmental impacts. Other than causing temporary inconvenience to the residents, social safeguard issues may or may not arise for works such as constructing underground water supply network. However, constructing water treatment plant and fecal sludge treatment plant may require small amounts of private land, where the Paurashavas do not have land under their ownership. Considering these issues, the project could be classified as "Category B" project (according to WB classification) requiring limited impact assessment.

10. According to the provisions of the Environmental Conservation Rules (ECR) 1997 of Bangladesh (GoB, 10997), some of the project components (e.g., construction of water treatment plant, fecal sludge treatment plant) fall under “Red Category” of projects, requiring preparation of IEE and EIA reports for getting environmental clearance.

11. As noted earlier, since project locations as well as specific subprojects have not yet been finalized, a framework approach has been adopted, and an Environmental Management Framework (EMF) has been prepared to ensure compliance with the World Bank's safeguard policies as well as national policies.

12. The EMF for the BMWSSP has been developed to:

- Establish clear procedures and methodologies for the environmental planning, review, approval and implementation of subprojects to be financed under the project;
- Evaluate the potential overall environmental impacts of the proposed project activities and suggest subproject specific standard environmental mitigation;
- Specify appropriate roles and responsibilities, and outline the necessary reporting procedures, for managing and monitoring environmental concerns related to subprojects;
- Identify the institutional barriers and determine the training, capacity building and technical assistance needed to successfully implement the provisions of the EMF; and
- Provide practical information and resources for implementing the EMF.

13. As noted earlier, the “overall environmental assessment” including assessment of environmental practices in different ongoing and completed projects in different Paurashavas is the basis of the EMF. To carry out “overall environmental assessment” of different sub-projects to be implemented under the BMWSSP, field visits were made to 5 Paurashavas where BMWSSP will be implemented. The five Paurashavas were selected in consultation with DPHE, considering geographic location and likely sub-projects to be implemented at the Paurashavas. The Paurashavas were:

(a) Tarabo, Narayanganj
(b) Homna, Comilla
(c) Chandanaish, Chittagong
(d) Dhaobari, Tangail
(e) Ullapara, Sirajganj

14. During field visits, discussions were held with the Mayors and other officials of the Paurashavas on different issues including major WASH (water supply, sanitation and hygiene) challenges faced by the Paurashavas, difficulties in project formulation, implementation and management. Discussions were also held with engineers and other officials of the Paurashavas on recently completed/ ongoing projects, proposed subprojects to be implemented under BMWSSP, and capacity and institutional arrangement for environmental management of the proposed subprojects. At each of these Paurashava, some of the sites tentatively selected for construction of infrastructure under BMWSSP were visited in order to obtain first-hand information and insight on the subproject baseline scenarios. Discussions were also held with Paurashava officials about environmental management of these projects. Apart from reconnaissance survey of these tentative subproject sites, noise level measurements were carried out. Surface water samples (typically from river/khal) and groundwater samples (typically from a randomly selected tubewell) were also collected for assessment of water quality. Focus Group Discussions (FGDs) were held at each of the five Paurashavas visited, which were participated by a wide range of stakeholders. The participants expressed their views on different aspects of the proposed subprojects to be implemented in their Paurashavas, including possible environmental impacts of the subprojects and possible mitigation/ abatement measures. In addition, public consultations (in the form of informal discussion) were also carried out at the Paurashavas. **Appendix H** of this Report presents the "overall environmental assessment" prepared based on field visits to five Paurashavas (mentioned above) where sub-projects under the BMWSSP would be implemented.

15. As a part of preparation of EMF, discussions were held with the DPHE officials on different aspects of project implementation and management, particularly focusing on existing capacity and institutional arrangement for environmental management of the proposed subprojects. Discussions were also held with the DPHE and the WB on the EMF.

1.3 Specific Objectives of EMF

16. The Environmental Management Framework (EMF) is intended to provide general policies, guidelines, and procedures to be integrated in the formulation, design, implementation, operation and monitoring of all subprojects to be implemented under the proposed MGS project. Its overall objective is to assist Paurashavas and DPHE to ensure that:

- Subprojects are formulated by the Paurashavas with active participation of people and peoples' representatives, especially those who would be directly benefited or impacted by the proposed subprojects;
- Sub-projects are designed considering unique socio-cultural and environmental situation prevailing at the Paurashava where the subprojects would be implemented;

- Possible impacts of all major subproject activities during both construction and operational phases are identified during project formulation and design, appropriate mitigation/ enhancement measures are devised and monitoring plan prepared, as a part of the overall environmental management plan (EMP);
- Environmental Management Plan (EMP) and Environmental code of practices (ECoP) are properly followed; and
- Subprojects comply with the relevant policies, rules and regulations of the GoB (e.g., Environmental Conservation Rules 1997) and safeguard policies of the WB.

The EMF will be a guiding document for sub-project specific:

- Environmental screening;
- Assessment of impacts (both positive and negative);
- Public consultation and disclosure;
- Environmental Management Plan (EMP);
- Implementation of EMP and ECoP; and
- Monitoring and reporting.

1.4 Overall Structure of the EMF

17. Under the BMWSSP, DPHE in consultation with Paurashavas will identify subprojects and will prepare relevant subproject documents. According to the EMF, DPHE and Paurashava will prepare an adequate description of each subproject (in accordance to the format provided in the EMF), including subproject layout and other relevant information. DPHE and Paurashavas will also carry out "environmental screening" and "analysis of alternatives" of each subproject in accordance to the formats provided in the EMF.

18. The sub-project description, "environmental screening", and "analysis of alternatives" prepared (in prescribed formats provided in the EMF), will be forwarded to the Project Management Unit (PMU) of DPHE for review. Based on review of these and other relevant information, the DPHE will assess the need for additional environmental assessment (IEE/EIA) for these subprojects. DPHE will arrange for additional environmental assessment, as necessary (e.g., through hiring a Consultant). The EMF presented in this report provides detail guideline for carrying out IEE/EIA (including preparation of EMP). The environmental assessment will be carried out following the EMF presented in this report. DPHE will also be responsible for getting necessary environmental clearance from the Department of Environment (DoE).

2.0 POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK

19. The proposed Municipal Water Supply and Sanitation Project (MWSSP) will be implemented in compliance with applicable environmental laws and regulations. Bangladesh has an environmental legal framework that is conducive to both environmental protection and natural resources conservation. This environmental legal framework applies to the proposed BMWSSP. In addition, a wide range of laws and regulations related to environmental issues are in place in Bangladesh. Many of these are cross-sectoral and partially related to environmental issues. The World Bank also has certain environmental safeguard policies, which needs to be adhered to for the purpose of the implementation of this project. This Section presents an overview of the major national environmental laws and regulations that are relevant and may apply to activities supported by the BMWSSP, institutional arrangement and national and sub-national level, and World Bank safeguard policies.

2.1 National Environmental Laws and Regulations

National Environmental Policy 1992

20. The concept of environmental protection through national efforts was first recognized and declared in Bangladesh with the adoption of the Environment Policy, 1992 and the Environment Action Plan, 1992. The major objectives of Environmental policy are to i) maintain ecological balance and overall development through protection and improvement of the environment; ii) protect country against natural disaster; iii) identify and regulate activities, which pollute and degrade the environment; iv) ensure environmentally sound development in all sectors; v) ensure sustainable, long term and environmentally sound base of natural resources; and vi) actively remain associate with all international environmental initiatives to the maximum possible extent.

National Environment Management Action Plan (NEMAP) 1995

21. NEMAP is an environmental planning exercise initiated by the government through the MoEF following the commitments made under Agenda 21 at UNCED in Rio de Janeiro in June 1992. The key element that distinguishes the NEMAP from the NCS is the commitment to full participation of the population at large interest groups, resource users and environmental stockholders, NEMAP identified the key environmental concerns to Bangladesh and provided an action plan to halt or reduce the rate of environmental degradation, improve the natural and manmade environment, conserve habitats and biodiversity, promoting sustainable development and improving quality indicators of human life. NEMAP has prioritized 57 actions on the environmental front and the government is in the process of creating a second-order priority list for immediate implementation. NEMAP outlines an Action Plan not only for the government, but for the community, the society and suggest what each and every citizen can do to protect the environment. The management actions considered in NEMAP are all essential to the sustainable development and environmental protection of the natural and human resources of Bangladesh. For the purpose of management, implementation, acquiring dedicated funds and enabling all different agencies to initiate or implement their own programs singly or in combination of agencies, all the action have been grouped under four heads: institutional, sectoral, location specific and long-term issues. Sectoral issues are: Health and Sanitation, Forest, Biodiversity,

Natural Hazards, Education and Awareness, Industry, Water, Agriculture, Energy, Fisheries, Land, Housing and Transport, etc.

Bangladesh Environmental Conservation Act (ECA), 1995 amended 2002

22. This umbrella Act includes laws for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. It is currently the main legislative framework document relating to environmental protection in Bangladesh, which repealed the earlier Environment Pollution Control ordinance of 1977.
The main provisions of the Act can be summarized as:

- Declaration of ecologically critical areas, and restrictions on the operations and processes, which can be carried or cannot be initiated in the ecologically critical area;
- Regulation in respect of vehicles emitting smoke harmful for the environment.
- Environmental Clearance;
- Regulation of industries and other development activities with regards to discharge permits;
- Promulgation of standards for quality of air, water, noises and soils for different areas for different purposes;
- Promulgation of standard limits for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines;

23. The first sets of rules to implement the provisions of the Act were promulgated in 1997 (see below: "Environmental Conservation Rules 1997"). The Department of Environment (DoE) implements the Act. DoE is headed by a Director General (DG). The DG has complete control over the DoE and the main power of DG, as given in the Act, may be outlined as follows:

- Identification of different types and causes of environmental degradation and pollution;
- Instigating investigation and research regarding environmental conservation, development and pollution.
- Power to close down the activities considered harmful to human life or the environment.
- Power to declare an area affected by pollution as an Ecologically Critical Area. Under the Act, operators of industries/projects must inform the Director General of any pollution incident. In the event of an accidental pollution, the Director General may take control of an operation and the respective operator is bound to help. The operator is responsible for the costs incurred and possible payments for compensation.

Environment Conservation Rules (ECR) 1997 amended 2003

24. These are the first set of rules, promulgated under the Environment Conservation Act 1995. Among other things, these rules set (i) the National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc., (ii) requirement for and procedures to obtain Environmental Clearance, and (iii) requirements for IEE/EIA according to categories of industrial and other development interventions.

25. However, the rules provide the Director General a discretionary authority to grant '*Environmental Clearance*' to an applicant, exempting the requirement of site/location clearance, provided the DG considers it to be appropriate.

26. Presently, "EIA Guidelines for Industries" published by the Department of Environment and the "Environment Conservation Rules 1997"are the formal documents providing guidance for conducting Environmental Assessment. Any proponent planning to set up or operate an industrial project is required to obtain an "*Environmental Clearance Certificate*" from the Department of Environment (DoE), under the Environment Conservation Act 1995 amended in 2002.

27. The first step of obtaining *Environmental Clearance* for the project the proponent is to apply for it in prescribed form, together with a covering letter, to the Director/Deputy Director of respective DoE divisional offices. The application should include a project feasibility study report, the EIA report, *No Objection Certificate* (NOC) of the local authority; Mitigation Plan for minimizing potential environmental impacts; and appropriate amount of fees in 'treasury chalan' (in the present case the amount is BDT 50,000). The DOE authority reserves the right to request additional information, supporting documents, or other additional materials for the proposed project. Under the conditions specified in the Environment Conservation Rules-1997, the DoE divisional authority must issue environmental site clearance certificates within 60 working days from the date of submitting the application, or the refusal letter with appropriate reasons for such refusal. The clearance issued remains valid for a one-year period and is required to be renewed 30 days prior to its expiry date.

28. Environment Conservation Rules-1997 ensures the right of any aggrieved party to appeal against the notice order or decision to the appellate authority. The appeal should be made to the appellate authority with clear justification and the attested copy of the specific notice, order, or decision of the respective DoE office against, which the appeal is to be made. Prescribed fee is to be paid through treasury Chalan of BDT 50,000 and the relevant papers for the appeal must be placed.

29. Rule 7 of Environment Conservation Rules (ECR) has classified the projects into following four categories based on their site conditions and the impacts on the environment; (a) Green, (b) Orange A, (c) Orange B and (d) Red. Various industries and projects falling under each category have been listed in schedule 1 of ECR 1997. According to the Rules, Environmental Clearance Certificate is issued to all existing and proposed industrial units and projects, falling in the Green Category without undergoing EIA. However, for category Orange A and B and for Red projects, require location clearance certificate and followed by issuing of Environmental Clearance upon the satisfactory submission of the required documents. Green listed industries are considered relatively pollution-free, and therefore do not require *site clearance* from the DoE. On the other hand, Red listed industries are those that can cause 'significant adverse' environmental impacts and are, therefore, required to submit an EIA report. These industrial projects may obtain an initial *Site Clearance* on the basis of an IEE based on the DoE's prescribed format, and subsequently submit an EIA report for obtaining *Environmental Clearance*. The ECR 1997

was amended in 2005 to incorporate new standards for ambient air quality and a variety of emissions.

National Land-use Policy, 2001

30. The Government of Bangladesh has adopted national Land use Policy, 2001. The salient features of the policy objectives relevant to the proposed are as follows:

- To prevent the current tendency of gradual and consistent decrease of cultivable land for the production of food to meet the demand of expanding population;
- To ensure that land use is in harmony with natural environment;
- To use land resources in the best possible way and to play supplementary role in controlling the consistent increase in the number of land less people towards the elimination of poverty and the increase of employment;
- To protect natural forest areas, prevent river erosion and destruction of hills;
- To prevent land pollution; and
- To ensure the minimal use of land for construction of both government and nongovernment buildings.

Environment Court Act, 2000

31. The aim and objective of the Act is to materialize the Environmental Conservation Act, 1995 through judicial activities. This Act established Environmental Courts (one or more in every division), set the jurisdiction of the courts, and outlined the procedure of activities and power of the courts, right of entry for judicial inspection and for appeal as well as the constitution of Appeal Court.

Bangladesh Labor Act, 2006

32. This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions. In the chapter VI of this law safety precaution regarding explosive or inflammable dust/ gas, protection of eyes, protection against fire, works with cranes and other lifting machinery, lifting of excessive weights are described. And in the Chapter VIII provision safety measure like as appliances of first aid , maintenance of safety record book, rooms for children, housing facilities, medical care, group insurance etc. are illustrated.

Public Procurement Rule (PPR), 2008

33. This is the public procurement rules of Bangladesh and this rule shall apply to the Procurement of Goods, Works or Services by any government, semi-government or any statutory body established under any law. The rule includes the adequate measure regarding the "Safety, Security and Protection of the Environment' in the construction works. This clause includes mainly, the contractor shall take all reasonable steps to (i) safeguard the health and safety of all workers working on the Site and other persons entitled to be on it, and to keep the Site in an orderly state and (ii) protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.

Bangladesh National Building Code

34. The basic purpose of this code is to establish minimum standards for design, construction, quality of materials, use and occupancy, location and maintenance of all buildings within Bangladesh in order to safeguard, within achievable limits, life, limb, health, property and public welfare. The design, construction or occupancy, alteration, moving, demolition, repair of any building or structure as well as installation and use of certain equipment, services and appurtenances related, connected or attached to such buildings are also regulated herein to achieve the same purpose. It covers planning administration and enforcement, general building controls and regulations, requirements for different uses, fire protection, building materials, design and services. It also covers the issue of safety of workmen during construction, the general duties of the employer to the public as well as workers, the constructional responsibilities of relevant authorities implementing civil works.

35. Part-7, Chapter-3 of the Code has clarified the issue of safety of workmen during construction and with relation to this, set out the details about the different safety tools of specified standard. In relation with the health hazards of the workers during construction, this chapter describes the nature of the different health hazards that normally occur in the site during construction and at the same time specifies the specific measures to be taken to prevent such health hazards. According to this chapter, exhaust ventilation, use of protective devices, medical checkups etc. are the measures to be taken by the particular employer to ensure a healthy workplace for the workers.

36. Section 1.4.1 of chapter-1, part-7 of the BNBC, states the general duties of the employer to the public as well as workers. According to this section, “All equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run way, barricade, chute, lift etc. shall be substantially constructed and erected so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them”.

37. Part-7, Chapter -1 of the Bangladesh National Building Code (BNBC) clearly sets out the constructional responsibilities according to which the relevant authority of a particular construction site shall adopt some precautionary measures to ensure the safety of the workmen. According to section 1.2.1 of chapter 1 of part 7, “in a construction or demolition work, the terms of contract between the owner and the contractor and between a consultant and the owner shall be clearly defined and put in writing. These however will not absolve the owner from any of his responsibilities under the various provisions of this Code and other applicable regulations and bye-laws. The terms of contract between the owner and the contractor will determine the responsibilities and liabilities of either party in the concerned matters, within the provisions of the relevant Acts and Codes (e.g.) the Employers' Liability Act, 1938, the Factories Act 1965, the Fatal Accident Act, 1955 and Workmen's Compensation Act 1923”. (After the introduction of the Bangladesh Labor Act, 2006, these Acts have been repealed).

38. To prevent workers falling from heights, the Code in section 3.7.1 to 3.7.6 of chapter 3 of part 7 sets out the detailed requirements on the formation and use of scaffolding. According to section 3.9.2 of the same chapter, “every temporary floor openings shall either have railing of at least 900 mm height or shall be constantly attended. Every floor hole shall be guarded by either a railing with toe board or a hinged cover. Alternatively, the hole may

be constantly attended or protected by a removable railing. Every stairway floor opening shall be guarded by railing at least 900 mm high on the exposed sides except at entrance to stairway. Every ladder way floor opening or platform shall be guarded by a guard railing with toe board except at entrance to opening. Every open sided floor or platform 1.2 meters or more above adjacent ground level shall be guarded by a railing on all open sides except where there is entrance to ramp, stairway or fixed ladder. The precautions shall also be taken near the open edges of the floors and the roofs".

Constitution of Bangladesh

39. Article 24 of the constitution of Bangladesh says that the state shall adopt measures for the protection against disfigurement, damage or removal of all monuments, objects or places of special artistic or historic importance or interest.

Antiquities Act, 1968

40. This Act provides the modes of protection and preservation of things, which are part of our national history and heritage. Article 24 states that if the Government is of the opinion that for the purpose of protecting or preserving any immovable antiquity it is necessary so to do, it may, by notification in the official Gazette, prohibit or restrict, within such area as may be specified therein, mining, quarrying, excavating, blasting and other operations of a like nature, or the movement of heavy vehicles, except under and in accordance with the terms of a license granted and rules, if any, made in this behalf.

Water Act, 2013

41. The Water Act 2013 has been promulgated with an aim to preserve and protect water resources as well as to exert control on water use in Bangladesh. Through different provisions under this Act, restrictions have been imposed in attempting to alter the natural flow in water by landfilling and other activities. The other issues that are addressed in this Act involve protection of potable water sources and management, provision for declaration of water stress areas, provision for declaration of flood control zone and its management, restrictions on storing natural water in artificial or natural reservoirs, restriction on abstraction of total water from any water source, water pollution control etc. Any violation of compliance or protection order will result in an offence, which would be punishable in various degrees including fines, compensation and imprisonment.

Safe drinking water supply and sanitation policy 1998

42. The policy calls for nationwide access to safe drinking water and sanitation services at an affordable cost. The policy sets out the basic framework for the improvement of public health quality and to ensure an improved environment, together with a set of broad sectoral action guidelines. The objective is to improve public health and produce a safer environment by reducing water-borne disease and contamination of surface water and groundwater. The key objectives of the policy are: (i) to ensure proper storage, management and use of surface water and preventing its contamination; (ii) emphasis on the use of surface water over ground water. According to the policy, it is desirable that water supply and sanitation works are considered within broader environmental considerations. As per the policy, provision for arsenic safe drinking water and adequate sanitation will have to be ensured for the proposed project. The water quality needs to be

monitored to ensure that the supplied water is safe for drinking. The sanitation services must be hygienic (confinement of feces away from the environment), blocking the pathways for flies and other insects, proper ventilation of foul gases, proper maintenance for continual use with improved hygiene practice.

National water policy

43. The objectives of national water policy are: (i) to facilitate availability of safe and affordable drinking water, (ii) to reduce or prevent the pollution of the groundwater by fertilizer (phosphorous and nitrogen) and biocides, (iii) prevention of fecal pollution of the aquifer. The activities associated with this project will be governed by this policy to keep the project area and its surrounding safe from water pollution.

Groundwater management ordinance

44. The ordinance specifies that no tube-well shall be installed in any place without a license granted by the upazila parishad and no application shall be entertained by the upazila parishad unless it is accompanied by fees and site clearance from the local authority.

National Policy for Arsenic Mitigation 2004

45. The policy provides a guideline for mitigating the effect of arsenic on people and environment in a holistic and sustainable way. This policy also supplements the National Water Policy 1998, National Policy for Safe Water Supply and Sanitation 1998 in fulfilling the national goals of poverty alleviation, public health and food security. Policy statement includes: access to safe water for drinking and cooking shall be ensured through implementation of alternative water supply options in all arsenic affected areas. All arsenicosis cases shall be diagnosed and brought under an effective management system. Impact of arsenic on agricultural environment shall be assessed and addressed. This policy gives preference to surface water over groundwater. The policy has set the target of providing arsenic free water by 2010 in the worst affected communities.

National Sanitation Strategy 2005

46. The goal of National Sanitation Strategy 2005 was to achieve 100% sanitation coverage by 2010. The strategy aims to delineate the ways and means of achieving the national target through providing a uniform guideline for all concerned. It defines 100% sanitation – at the very least, the term "100% sanitation" will mean to include all of the followings: (i) no open defecation; (ii) hygienic latrines available to all; (iii) use of hygienic latrines by all; (iv) proper maintenance of latrines for continual use, and (v) improved hygiene practice. The strategy also defines the Hygienic Latrine -A hygiene latrine would mean to include all of the following: (i) confinement of feces away from the environment; (ii) sealing of that passage between the squat hole and the pit to effectively block the pathways for flies and other insect vectors thereby breaking the cycle of disease transmission, and (iii) venting out foul gases generated in the pit through a properly positioned vent pipe to keep the latrine odor free and encourage continual use of the hygiene latrine. The key suggested strategies for sanitation improvement include: (i) creating effective demand through health education and hygiene promotion; (ii) ensuring individual and community actions; (iii) activating local government institutions to play the

key role for improving sanitation coverage; (iv) facilitating adequate supply chain of 'hygiene latrines'; (v) reaching the hardcore poor; (vi) improvement in urban sanitation; (vii) media campaign; (viii) strategies for sustainability; (ix) financing for sanitation programs; (x) monitoring and evaluation; and (xi) emergency response.

Local Government (Paurashava) Act, 2009

47. According to Sub-clause (2) of Clause 50 of the Local Government (Paurashava) Act, 2009 (amended in 2010), Paurashava shall be responsible for, among others, (a) Water supply for residential, industrial and commercial use; (b) Water and sanitation; and (c) Waste management, in areas within its jurisdiction. According to Schedule 2 of Paurashava Act 2009, which describes the detail functions of the Paurashava, "A Paurashava shall make adequate arrangements for the removal of refuse from all public streets, public latrines, urinals, drains, and all buildings and land vested in the municipality and for the collection and proper disposal of such refuse". A Municipality is also responsible for public toilets and according to Schedule 2 of the Paurashava Act 2009, "A municipality shall provide and maintain, in sufficient number and in proper condition, public latrines and urinals for both male and female users, and shall make arrangements for proper maintenance of these facilities and keep them clean". Although the term "fecal sludge" is not specifically mentioned in the Paurashava Act 2009 (primarily because this term was not widely used at that time), it is clear that the responsibility of management of "fecal sludge" lies with the Municipality. It is also clear that the Municipality shall perform these responsibilities in accordance with the provisions of the Paurashava Act 2009. However, for proper management of fecal sludge, if the Municipality deems it necessary, it could formulate necessary "rules", "regulations" and "by-laws" according to the provisions described in Schedule 6, Schedule 7, and Schedule 8, respectively, of the Act 2009.

Institutional and Regulatory Framework for Fecal Sludge Management 2017

48. The primary objective of this FSM framework is to facilitate proper fecal sludge management (FSM) throughout the country. There are four separate frameworks: one for Dhaka city, one for City Corporations, one for Paurashavas and one for Rural areas. Each framework:

(a) Identifies of ways and means of safe management of fecal sludge; and

(b) Defines specific roles and responsibilities of various institutions and stakeholders, particularly the local government institutions (i.e., Paurashavas and City Corporations), for effective management of fecal sludge.

2.2 Relevance of National Policies, Laws and Framework

49. Table 2.1 shows the relevance of the relevant national policies, laws and frameworks in the context of the proposed BMWSSP.

Table 2.1: Relevance of national policies, laws and framework in the context of the proposed Bangladesh Municipal Water Supply and Sanitation Project (MWSSP).

National Policies, laws and Frameworks	Relevance to the project
National Environmental Policy 1992 **National Environment Management Action Plan (NEMAP) 1995**	The overarching policy that stresses environmental considerations in all development activities in Bangladesh including the health and sanitation sector which is applicable for the proposed project. The action plan recommends sanitary latrines and safe drinking water supply as key actions in the health and sanitation sector.
Bangladesh Environmental Conservation Act (ECA), 1995 amended 2002	This umbrella Act includes laws for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution of the proposed project. The details of environmental clearance formalities are prescribed in ECR 1997 which is a specific Rule under this Act.
Environment Conservation Rules (ECR) 1997 amended 2003	As per Environmental Conservation Rules 1997, the components (subprojects) of the project will fall into any one of the four categories (i.e. Red, Orange-A, Orange-B and Green) and based on that environmental clearance need to be obtained from DoE for the corresponding category. According to ECR 1997, sewage treatment plant, water treatment plant and water distribution line laying/relaying/extension falls into "Red" category. However, site-specific conditions may dictate the risk and impact of the project, a guideline of which will be provided in this ESMF. The ECR 1997 also consists of drinking water quality standards and sewage discharge standards, the compliance of which is mandatory for water supply and wastewater treatment systems respectively.
National Land-use Policy, 2001	The policy states to take measures to prevent land pollution and to ensure the minimal use of land for construction of both government and nongovernment buildings which may be applicable for the proposed project
Environment Court Act, 2010	If project adversely affects the locality or an individual, the affected party can seek remedy in an environment court, the procedures of which are delineated in the Environment Court Act 2010
Bangladesh Labor Act, 2006 **Bangladesh National Building Code** **Public Procurement Rule (PPR), 2008**	The Bangladesh National Building Code, 2006 and PPR 2008 will also be important regarding the occupational health and safety of workers and laborers to be involved in the Project's infrastructure development. The Bangladesh Labor Act 2006 outlines guidelines for ensuring worker's health and safety during construction works, which would have direct implications in the proposed project. It would be the responsibilities of the contractors to make sure that these guidelines are followed in the workplace environment. The provisions of Bangladesh National Building Code shall

National Policies, laws and Frameworks	Relevance to the project
	be followed for checking design of septic tank system (i.e., septic tank and soakage pit).
Constitution of Bangladesh Antiquities Act, 1968	Preservation of physical cultural resources accidentally discovered during excavation works.
National water policy	This policy requires a project to facilitate availability of safe and affordable drinking water and to prevent fecal pollution of the aquifer. These two aspects are very much applicable for the proposed project
Groundwater management ordinance	Discusses institutional arrangements for installing tubewells in a locality for water supply.
National Policy for Arsenic Mitigation 2004	The project aims at providing safe (and arsenic-free) drinking water by installing water supply infrastructures and tubewells. The national policy for arsenic mitigation highlights the national priorities in choosing arsenic-safe water supply options.
National Sanitation Strategy 2005	The strategy advocates the national goal to achieve 100% sanitation, defines hygienic latrines in the context of Bangladesh and prescribes key strategies for sanitation improvement. One of the key components of the project is to construct sanitation infrastructures and therefore the abovementioned strategy is relevant.
Institutional and Regulatory Framework for Fecal Sludge Management 2017	Fecal sludge management will become a key issue in the proposed project and the fecal sludge management framework will be relevant.

2.3 Institutional Arrangements at National and Sub-national Levels

Role of MoEF and DoE

50. As outlined in the National Environment Policy (1992) and National Forest Policy (1994), the Ministry of Environment and Forests (MoEF) acts as the guide and custodian for the conservation and development of the environment and, in the pursuit of that goal, to ensure through appropriate laws and regulations that natural resources, including land, air, water and forests, are exploited and managed in an environmentally sustainable manner. The Department of Environment (DoE), formed in 1989 with a mandate for environmental management later formalized under the Environment Conservation Act, 1995 (ECA'95), acts as the technical arm of the Ministry and is responsible for environmental planning, management, monitoring and enforcement. The DoE is headed by a Director General, with Divisional offices in Dhaka, Chittagong, Bogra, Khulna, Barisal and Sylhet. The Environment Conservation Rules (1997) provide the Director General a discretionary authority to grant 'Environmental Clearance' to an applicant, exempting the requirement of site/location clearance, provided the DG considers it to be appropriate.

51. The mandate of the Department has expanded over time, evolving from an exclusive focus on pollution control to include natural resources and environmental management, now covering:

- monitoring environmental quality;
- promoting environmental awareness through public information programs;
- controlling and monitoring industrial pollution;
- reviewing environmental impact assessments and managing the environmental clearance process; and,
- establishing regulations and guidelines for activities affecting the environment

52. Thus, the GoB has well-defined legal/regulatory systems for safeguarding environment issues through the Ministry of Environment and Forest in the policy level and the Department of Environment in the implementation level. Although the environmental legal framework is relatively modern and is in an advanced state in connection with the environmental assessment, the main limitations are in the capabilities of the regulatory agencies to enforce and promulgate these legal tools. The existing resources (manpower, technical tools etc.) of regulatory agencies are deemed largely inadequate to monitor compliance with existing rules.

53. The environmental management system in Bangladesh constitutes an extremely centralized and partially de-concentrated model of environmental management. At the divisional level, there is a Divisional Environmental Advisory Committee headed by the Divisional Commissioner with representation from various government agencies. The DoE does not have any representation below this level. An important gap in existing formal rules (the Constitution and other laws) is that the divisions, districts, upazilas, unions do not have a clearly defined role to play in environmental management. Lack of an appropriate mandate and institutional arrangements below the divisional level is a key factor contributing to difficulties in implementing environmental policies and regulations.

Role of DPHE and Paurashavas

54. Except for large cities with City Corporations (Dhaka, Chittagong, Rajahahi, Khulna), DPHE is responsible for the Water Supply and Sanitation (human excreta and sullage disposal, drainage and solid waste management) of the whole country, both in rural and urban (City Corporation, Paurashava, Upazila HQs and growth centers) areas. In Urban areas the DPHE solely or jointly with the Paurashava be responsible for Water Supply and Sanitation services. Also DPHE is responsible for assisting the Paurashavas and City Corporations through infrastructure development and technical assistance. DPHE assists Local Government Institutions (City Corporations, Paurashavas, Union Parishads etc) in the Operation and Maintenance of the Water Supply and Sanitation infrastructure and services including technical assistance.

55. The other functions of the DPHE are:

- Ensure supply of adequate number of trained & skilled manpower in the Water Supply & Sanitation sector through HRD of the sector personnel & institutions for proper and sustainable management of infrastructure and services.
- Strengthen water testing facilities through establishment of laboratories at different levels in order to institutionalize Water Quality Monitoring and Surveillance program throughout the country both in rural and urban areas to ensure safe water for the people.

- Carryout Hydro-geological investigations in search of safe source (both surface & ground) of water supply.
- Social mobilization for creation of awareness towards proper management of water supply and sanitation infrastructure and promotion of personal hygiene practices.
- Develop safe water supply technologies in the Arsenic affected and other hydro-geologically difficult areas (Saline belt, stone problem areas, hilly regions and areas likely to be affected by other micro-pollutants).
- Research and Development activities in search of appropriate and affordable options including the indigenous ones of water supply and sanitation in the country.
- Ensure water supply and sanitation services/ facilities during and after the natural disasters/ calamities.
- Establish National Water Supply & Sanitation Information Center as a center of excellence for sectoral information management.
- Capacity building of the community, LGIs, private entrepreneurs and NGOs with technical know-how, information, training etc. in terms of water supply and sanitation.
- Monitoring and coordination of activities of the stakeholders including NGOs & private operators working in the Water Supply and Sanitation sector.
- Overall management of the Water Supply & Sanitation Sector Development Program.

56. In accordance to the provisions of the Institutional and Regulatory Framework for Fecal Sludge Management (Paurashava) 2017, the "Paurashava" shall be responsible for fecal sludge management (FSM) in areas within its jurisdiction, including planning for and implementation of FSM services (including financial/business model for service delivery). The Paurashava may collaborate with the Department of Public Health Engineering (DPHE), the Local Government Engineering Department (LGED), the private sector/ non-government organization in planning and implementation of FSM infrastructure and services (e.g., outsourcing) in accordance with Clauses 95 and 96 of Paurashava Act 2009. Paurashavas are also responsible for sustainable water supply in areas where WASAs do not exist (with the help of DPHE). According to the National Policy for Safe Water Supply and Sanitation 1998, monitoring of water quality for the purpose of ensuring an acceptable standard is the responsibility of DPHE, DOE, BSTI, Atomic Energy Commission (AEC) and CBOs and they will send their reports to the water quality control committee in the Local Government Division.

2.4 World Bank Environmental Safeguard Policies

57. The objective of these policies is to prevent and mitigate undue harm to people and their environment in the development process. Safeguard policies provide a platform for the participation of stakeholders in project design, and act as an important instrument for building ownership among local populations. The effectiveness and development impact of projects and programs supported by the Bank has substantially increased as a result of attention to these policies. The World Bank has ten environmental, social, and legal safeguard policies. The relevant policies for environmental safeguard are the following:

Environmental Policies
OP/BP 4.01 Environmental Assessment
OP/BP 4.04 Natural Habitats
OP/BP 4.09 Pest Management
OP/BP 4.11 Physical Cultural Resources
OP/BP 4.36 Forests
OP/BP 4.37 Safety of Dams

Legal Policies
OP/BP 7.50 International Waterways
OP/BP 7.60 Disputed Areas

58. Operational Policies (OP) are the statement of policy objectives and operational principles including the roles and obligations of the Borrower and the Bank, whereas Bank Procedures (BP) is the mandatory procedures to be followed by the Borrower and the Bank. Apart from these, the IFC guidelines for Environmental Health and safety have been adopted by the World Bank Group which is also relevant for environmental protection and monitoring. In addition to that the Policy on Access to Information of World Bank also relates to environmental safeguard. The environmental safeguard and access to information policy as well as the IFC guidelines are discussed below:

OP/BP 4.01 Environmental Assessment

59. This policy is considered to be the umbrella safeguard policy to identify, avoid, and mitigate the potential negative environmental and social impacts associated with Bank lending operations. In World Bank operations, the purpose of Environmental Assessment is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted. The borrower is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements. The Bank classifies the proposed project into three major categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts:

Category A: The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.

Category B: The proposed project's potential adverse environmental impacts on human population or environmentally important areas-including wetlands, forests, grasslands, or other natural habitats- are less adverse than those of Category A projects. These impacts are site specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than Category A projects.

Category C: The proposed project is likely to have minimal or no adverse environmental impacts.

OP/BP 4.04 Natural Habitats

60. The conservation of natural habitats is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing,

and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

OP/BP 4.09 Pest Management

61. The aim of the pest management policy is to minimize and manage the environmental and health risks associated with pesticide use and promote and support safe, effective and environmentally sound pest management. The procurement of any pesticide in a Bank-financed project is contingent on an assessment of the nature and degree of associated risks, taking into account the proposed use and the intended user. To manage pests that affect either agriculture or public health, the Bank supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. In Bank- financed projects, the borrower addresses pest management issues in the context of the project's environmental assessment. In appraising a project that will involve pest management, the Bank assesses the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management.

OP/BP 4.11 Physical Cultural Resources

62. Physical cultural resources are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Their cultural interest may be at the local, provincial or national level, or within the international community. Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements. The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process.

OP/BP 4.36 Forests

63. Forest is defined as an area of land of not less than 1.0 hectare with tree crown cover (or equivalent stocking level) of more than 10 percent that have trees with the potential to reach a minimum height of 2 meters at maturity in situ. A forest may consist of either closed forest formations, where trees of various stories and undergrowth cover a high proportion of the ground, or open forest. The definition includes forests dedicated to forest production, protection, multiple uses, or conservation, whether formally recognized or not. The definition excludes areas where other land uses not dependent on tree cover predominate, such as agriculture, grazing or settlements. In countries with low forest cover, the definition may be expanded to include areas covered by trees that fall below the 10 percent threshold for canopy density, but are considered forest under local conditions. The Bank's forests policy recognizes the importance of forests to reduce poverty in a sustainable

manner integrates forests effectively in economic development, aims to reduce deforestation, promote afforestation and enhance the environmental contribution of forested areas. The Bank assists borrowers with the establishment and sustainable management of environmentally appropriate, socially beneficial, and economically viable forest plantations to help meet growing demands for forest goods and services.

OP/BP 4.37 Safety of Dams

64. When the World Bank finances new dams, the Policy Safety on Dams requires that experienced and competent professionals design and supervise construction, and that the borrower adopts and implements dam safety measures through the project cycle. The policy also applies to existing dams where they influence the performance of a project. In this case, a dam safety assessment should be carried out and necessary additional dam safety measures implemented.

IFC Environmental, Health and Safety Guidelines

65. The Environmental, Health and Safety (EHS) Guidelines of the World Bank Group (WBG)/International Finance Corporation (IFC), 2008 is the safeguard guidelines for environment, health and safety for the development of the industrial and other projects. They contain performance levels and measures that are considered to be achievable in new facilities at reasonable costs using existing technologies. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

66. The section 4 of EHS Guidelines for “Construction and Decommissioning” provides additional, specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities.

World Bank Policy on Access to Information

67. In addition to the safeguard policies, the Access to Information Policy also relates to safeguards. To promote transparency and facilitate accountability, Bank Access to Information Policy supports decision making by the Borrower and Bank by allowing the public access to information on environmental and social aspects of projects in an accessible place and understandable form and language to key stakeholders. The Bank ensures that relevant project-related environmental and social safeguard documents, including the procedures prepared for projects involving subprojects, are disclosed in a timely manner before project appraisal formally begins. The policy requires disclosure in both English and Local language and must meet the World Bank standards.

2.5 Implications of World Bank Safeguard Policies on BMWSSP

68. According to WB Operational Policy (OP 4.01), the nature of environmental assessment to be carried out for a particular sub-project would largely depend on the category of the sub-project. As mentioned earlier, The World Bank Operational Policy (OP)

4.01 classifies projects into three major categories (category A, B and C), depending on the type, location, sensitivity and scale of the project, and nature and magnitude of potential impacts.

69. The proposed project will involve construction of water supply and sanitation infrastructures in Paurashavas. The proposed project aims to enhance and strengthen the water supply network and sanitation systems in different Paurashavas to improve health and living standards. Given the present situation, it is reasonable to assume that the proposed project activities are not likely to cause any long-term or irreversible environmental impacts. Other than causing temporary inconvenience to the residents, social safeguard issues may or may not arise for works such as constructing underground water supply network. However, constructing water treatment plant and fecal sludge treatment plant may require small amounts of private land, where the Paurashavas do not have land under their ownership. Considering these issues, the project could be classified as "Category B" project (according to WB classification) requiring limited impact assessment.

70. Environmental issues during the construction phase of physical infrastructure may include impacts on terrestrial and aquatic habitat. Therefore the World Bank policy related to conservation of Natural Habitats (OP/BP 4.04) has been triggered. The possible impact on natural habitats will be addressed through sub-project specific EMP.

71. Since the actual locations of these interventions are unknown at this stage, there is a possibility that these facilities are constructed near physical cultural resources. However, the impacts will be examined as part of the environmental screening/assessment of different subprojects and the criteria for assessment will be provided in the ESMF. In addition, ‘Chance find’ procedures conforming to local legislation on heritage would be evaluated so that any physical or cultural resources (included those that are buried that have suddenly explored as a result of excavation) are not impacted. Therefore, OP 4.11 (Physical Cultural Resources) has been triggered.

72. The activities of the project will not involve any pesticide application, include activities in forest areas or relate to protection of dams. So OP 4.09 will not be triggered.

73. The physical infrastructures will not be built in areas where indigenous people live. As such OP 4.10 will not be triggered for the project. The subprojects are not likely to require any land acquisition as these infrastructures will be built on Paurashava-owned lands. Thus OP 4.12 will not be triggered for the project.

74. The project does not involve any infrastructure development in international waterways or in disputed areas. Therefore OP 7.50 and OP 7.60 will not be triggered.

75. The IFC guidelines provide guidance on certain EHS issues, which include standards for environmental parameters (ambient air quality, water and wastewater quality, noise level, waste management), hazard and accident prevention, occupational and community health and safety (during commissioning and decommissioning works) etc. These guidelines will be directly applicable to the proposed project. As a general rule, the IFC guidelines should complement the existing Bangladesh guidelines or standards. In case the Bangladesh

guidelines or standards differ from the IFC guidelines, project is expected to follow the more stringent ones.

76. The World Bank access to information policy would be directly followed. The project will make the EMF documents available to the public by publishing it in their websites (with an executive summary in Bengali). In addition, Hard copies of these documents in English (including a summary in Bengali and English) will be made available in publicly accessible locations in the project area (e.g. DPHE and Paurashava offices) of influence.

3.0 PROJECT DESCRIPTION

3.1 Background

77. As noted earlier, the draft Environmental Management Framework (EMF) presented here has been prepared based on field visits to 5 Paurashavas, and consultation with all stakeholders including DPHE, representatives of LGIs and the WB. The environmental assessment of the sub-projects to be implemented under the BMWSSP needs to be carried out following the provisions of the Environment Conservation Rules 1997 (GoB, 1997), and the relevant World Bank Operational Policies [e.g., OP 4.01 Environmental Assessment; OP4.04Natural Habitats and OP 4.11 Physical Cultural Resources]. The environmental assessment requirements under these provisions vary significantly depending on the category of the sub-projects. The EMF presented here provides guidelines for categorizations of sub-projects according to GoB regulations and World Bank policies (see Section 3.2).

78. Under the MWSSP, DPHE and the Paurashavas will be responsible for identification of subprojects, preparation of sub-project description, "environmental screening" and "analysis of alternatives". The EMF presents guidelines (in the form of a simple format) for preparation of description of the subprojects (see Chapter 4). The EMF also presents a simple format for "environmental screening" of subprojects (see Chapter 4) and "analysis of alternatives" (see Chapter 4), to be carried out by the DPHE and Paurashava Authority. Based on these and other relevant documents, the Project Management Unit (PMU) of DPHE will assess the need for further environmental assessment (IEE/EIA).

79. This Chapter presents the types of subprojects to be implemented under the BMWSSP and attempts to categorize them in accordance to the GoB guidelines. As noted earlier, the WB has classified the subprojects under BMWSSP as "Category B", requiring limited impact assessment.

3.2 Sub-project Types and Categories

80. The category of a sub-project (according to WB and GoB guidelines) is an important determinant with regard to the requirements of its environmental assessment. As noted earlier, the types of subprojects to be implemented in a particular Paurashava would be decided by DPHE and the Paurashava Authority. Not all potential subprojects would be implemented in all Paurashavas. The potential types of subprojects that could be implemented under the MWSSP include the following:

(e) Water Supply Infrastructure:

- (8) Production well (DTW) with pump house and electrical works
- (9) Water treatment plant (WTP), including raw water transmission line
- (10) Clear water transmission line
- (11) Water distribution network (including expansion and rehabilitation of distribution existing networks)
- (12) Overhead tank
- (13) Stand posts (street hydrant)
- (14) Paurashava water office

(f) Sanitation and Septage (fecal sludge) Management:

   (6) Latrine with septic tank and soakage pit
   (7) Public toilet
   (8) Fecal sludge treatment plant (FSTP)
   (9) Procurement of fecal sludge desludging units (Vacutugs/vacuum tanker)
   (10) Small-scale decentralized wastewater treatment system (DEWATS)

(g) Drainage system (storm drains)
(h) Solid Waste Management (SWM)

81. The primary objective of the BMWSSP is to enhance and strengthen the water supply and sanitation systems in selected Paurashavas in order to improve health and living standards. Based on field visits to 5 Paurashavas and assessment of the nature, scale and extent of the proposed subprojects to be implemented at these Paurashavas, it appears that the subprojects are unlikely to cause significant adverse environmental impacts. However, constructing water treatment plant, FSTP and DEWATS may require small amounts of private land, where the Paurashavas do not have land under their ownership. Other than this, the subprojects are not likely to generate any significant adverse impact other than causing temporary inconvenience to the residents during construction phase. As noted earlier, considering these issues, the subprojects under MWSSP have been classified as "Category B" project according to WB classification, which require limited impact assessment.

82. As noted in Table 3.1, most of the subprojects to be implemented under MWSSP have not been categorized in the ECR 1997. However, some of the subprojects (such as water transmission and distribution line, WTP) have been listed under Red category, which would require preparation of IEE and EIA reports (including Environmental Management Plan and Resettlement Action Plan, as necessary). It should be noted that the project category in ECR 1997 is not based on scale of the project or its potential impact; rather it is based on only type of the project. Based on field visits of 5 Paurashavas and discussion with DPHE and Paurashava officials it appears that in many cases potential impacts of subprojects are likely to be insignificant. As a result, many subprojects (including WTP and transmission/distribution line) in the Paurashavas (especially where no private land would be required for project implementation) could be classified as “Orange B” or “Orange A”. A decision to this effect should be based on specific “project description” and “environmental screening” of the subproject; the decision however needs to be confirmed by the Department of Environment (DoE). As noted above, preparation of “subproject description” and “environmental screening” of subprojects would be carried out by DPHE and the relevant Paurashavas. Table 3.1 shows the category of subprojects (to be implemented under MWSSP), their classification according to ECR 1997, as well as possible classification of the subprojects based on “environmental screening”.

Table 3.1: Classification of subprojects according to ECR 1997 (GoB, 1997) and likely subproject category based on potential impact

Sub-projects	Likely Sub-project Category according to ECR 1997
Water Supply Infrastructure	
Production well (DTW) with pump house and electrical works	May be classified as "Orange A/B" depending on assessment of impact
Water treatment plant (WTP), including raw water transmission line	May be classified as "Red" or "Orange A/B" depending on assessment of impact (classified as Red in ECR 1997)
Clear water transmission line; Water distribution network (including expansion and rehabilitation of existing network)	May be classified as "Orange A/B" depending on assessment of impact (classified as Red in ECR 1997)
Overhead tank	May be classified as "Orange A" depending on assessment of impact
Stand post	May be classified as "Green" or "Orange A"
Paurashava water office	May be classified as "Orange A/B" depending on assessment of impact
Sanitation and Septage (Fecal Sludge Management)	
Latrine with septic tank and soakage pit	May be classified as "Orange A/B" depending on assessment of impact
Public toilet	May be classified as "Orange A/B" depending on assessment of impact
Fecal sludge treatment plant (including procurement of vacuum tanker)	May be classified as "Red" or "Orange A/B" depending on assessment of impact
Decentralized wastewater treatment plant	May be classified as "Red" or "Orange A/B" depending on assessment of impact
Drainage System	May be classified as "Red" or "Orange A/B" depending on assessment of impact
Solid waste management (SWM)	May be classified as "Red" or "Orange A/B" depending on assessment of impact (classified as Red in ECR 1997)

Notes:

(4) In the ECR 1997, project "category" for environmental assessment is based on nature of project, not on anticipated impact.

(5) The sub-projects under the BMWSSP have been classified as "Category B" based on expected impacts, according to WB OP4.01.

(6) If any sub-project poses significant adverse environmental impacts, it is likely to be excluded from the BMWSSSP.

Based on field visits to 5 Paurashavas throughout the country and assessment of the nature, scale and extent of the proposed sub-projects to be implemented at these Paurashavas, it appears that only the sub-project involving fecal sludge management would fall under "Red" Category (according to ECR 1997 classification). As shown in Table 3.1, two other sub-projects could also potentially fall under Red Category: Water treatment plant and Construction/ expansion/ rehabilitation of water distribution line. However, the scale of operation of these sub-projects being considered at the Paurashavas is relatively small. In reality the water treatment plants will be of small scale. As a result, the potential environmental impacts of these are not likely to be significant, and the sub-project could be categorized as Orange B.

3.3 Subproject Activities

83. Specific activities to be carried out for a subproject would depend on the nature of the subproject. Some typical/generic activities during construction phase of subprojects under MWSSP include the following:

- Securing land for the subproject
- Mobilization of material, equipment and personnel (including establishment of site office and labor shed)
- Civil construction (e.g., excavation trenches for laying water transmission/ distribution lines; foundation of structure including piling works, construction of superstructure (including those for OHT, FSTP, WTP), construction of toilet/public toilet, septic tank, soakage pit, installation of water supply system in building/toilet)
- Electro-mechanical works (e.g., electrical connection/wiring, installation of pumps)
- Installation raw water transmission line, clear water transmission line, and water distribution network; considering the scale of the subprojects, it is anticipated that open trench excavation method would be employed for installation of water pipelines.
- Test boring for tubewell design, testing of sediment and water quality; and finally installation of tubewell.
- Installation of small diameter sewer for carrying sewage to decentralized wastewater treatment plant; it is anticipated that open trench excavation method would be employed for installation of water pipelines.
- Construction of storm drains and sewers; it is anticipated that RCC sewers would be used for storm sewer system; RCC surface drains could also be constructed.

84. A number of activities, including monitoring activities, are very important for protection of environment, public health, and sustainability of the infrastructure to be established under the MWSSP. The important activities, including monitoring activities during operational phase of the project are listed below.

- Production well: Yield and quality of water
- WTP: Raw water quality; Yield; Treated water quality
- Stand Post: Easy accessibility by users
- Latrine and Public Toilet: Easy accessibility by users (especially women and people with disability), regular desludging of septic tank content and its proper disposal
- FSTP: Effluent quality; By-product quality; Disposal of sludge
- DEWATS: Effluent quality; Disposal of sludge
- Drainage system: Periodic maintenance/cleaning of drainage system
- Solid waste management: Proper day-to-day operation and maintenance of solid waste management facility.

3.4 Environmental Considerations in Design

85. By incorporating/ considering certain features in the engineering design of a subproject, it is often possible to reduce or eliminate some of the possible adverse environmental impacts during both construction and operational phases of a subproject. For example, availability (throughout the year) and quality (e.g., presence of a certain pollutant) water from a raw water source (river) need to be assessed properly before designing a water treatment plant. Identification of such features at the design stage of a subproject, and incorporation of these in the subproject design could greatly reduce adverse impacts and facilitate proper environmental management of a subproject. Table 3.2 identifies possible adverse environmental impacts and environmental considerations to be included in the design for reducing/ eliminating such impacts for some major sub-projects to be implemented under MWSSP. These issues should be adequately addressed during the design phase of the subprojects, as a part of environmental management.

Table 3.2: Environmental impacts and environmental considerations to be included in design to reduce/ eliminate the impacts for some major subprojects

Sub-project	Environmental Impact	Design Considerations/ Actions to Reduce/Eliminate Impact
Water treatment plant	• Inadequate water during dry season • Poor quality of water during dry season (for surface water sources) • High concentration of Fe/Mn/As /Salinity in groundwater	• Proper assessment of water availability throughout the year • Proper water quality assessment before treatment process design • Identification of potential threat to water quality in the future from industrial/ other developments in surrounding areas • Provision for proper disposal of sludge generated from treatment processes.
Deep tubewell	• Contaminated water in tubewell • Poor availability of water due to lowering of groundwater table	• Adequate testing of water quality (specially for Fe, As, Mn, Salinity) • Assessment of groundwater level
Overhead Tank (OHT)	• Inadequate design/safety provision • Difficulties in cleaning and maintenance	• Ensuring adequate design considering soil characteristics, seismic vulnerability • Keeping provisions for easy cleaning and maintenance in the design of OHT • Taking adequate safety measures during construction
Fecal Sludge Treatment Plant (FSTP); Decentralized Wastewater Treatment Plant (DEWATS)	• Public opposition regarding site • Water pollution from effluent discharge • Environmental pollution from sludge from FSTP • Contribution to SWM through introduction of co-composting in the FSTP with solid waste.	• Proper site selection involving LGI leadership and local people. • Proper design of FSTP satisfying national effluent discharge standard. • Proper design of FSTP considering Bangladesh Standards and Guidelines for Sludge Management (DoE, 2015)
Latrine, Public Toilet	• Poor access, especially for women, children, elderly, people with disability • Pollution and odor	• Proper site selection, ensuring easy accessibility • Separate toilet blocks for men and women • Disable-friendly design

Sub-project	Environmental Impact	Design Considerations/ Actions to Reduce/Eliminate Impact
	• Poor lighting	• Water supply and hand wash facility • Provision for properly designed septic tank and soakage pit, considering easy desludging from septic tanks. • Proper venting system to address odor nuisance • Adequate floor height and lighting
Office building	• Water logging during rain • Flooding at ground floor level due to improper plinth level • Pollution from inadequate wastewater disposal • Fire hazard	• Provisions for storm water drainage; roof-top rain water harvesting system • Setting proper plinth level considering highest flood level • Separate plumbing system for black water; provision for septic tank system; designing soakage pit considering depth of water table. • Keeping adequate provisions (including fire/emergency exits) for fire safety in accordance with National Building Code
Drain	• Clogging/ stagnation of flow in the storm drain • Backflow of water through drain (e.g., due to high water level at downstream discharge point, such as khal/ river) • Pollution of downstream water body due to disposal of polluted water from drain.	• Designing drain considering reduced level (RL) of the downstream discharge point; adequate slope and x-sectional area; RCC cover for drain, where appropriate • Considering installation of regulator to control inflow/ outflow through drain • Not allowing direct connection to drain from sanitation facilities.
Solid waste management (SWM)	• Environmental pollution from leachate; • Odor generation • Scavenging by birds/ animals, and spreading of diseases	• Considering higher land requirement, land filling should be considered as the last option; other options such as composting and biomethanation should be considered first. • For landfills, provision for "daily cover" on deposited solid waste, and provision for restriction of entry by animals • The SWM project must incorporate the 3R (reduce, reuse recycle) strategy.

4.0 ENVIRONMENTAL MANAGEMENT PROCEDURE

4.1 Introduction

86. As noted earlier, the draft Environmental Management Framework (EMF) presented here has been prepared based on field visits to 5 municipalities/Paurashavas from a list of 30 provided by the DPHE after consultation with the stakeholders. The environmental assessment of the sub-projects to be implemented under BMWSSP needs to be carried out following the provisions of the Environment Conservation Rules 1997 (GoB, 1997), and the relevant World Bank Operational Policies [e.g., OP 4.01 Environmental Assessment (World Bank, 1999a); and OP 4.11 Physical Cultural Resources (World Bank, 2006)]. The environmental assessment requirements under these provisions vary significantly depending on the category of the sub-projects. The EMF presented here provides guidelines for categorizations of sub-projects according to GoB regulations and World Bank policies (see Section 3.2).

87. Under the BMWSSP, the Consultant employed by DPHE and the Paurashavas are responsible for identification of sub-projects, preparation of sub-project description, “environmental screening” and “analysis of alternatives”. The EMF presents guidelines (in the form of a simple format) for preparation of description of the sub-projects (see Section 4.2). The EMF also presents a simple format for “environmental screening” of sub-projects (see Section 4.3), to be carried out by the DPHE-appointed Consultant and the respective Paurashavas. Based on these and other relevant documents, DPHE will assess the need for further environmental assessment (IEE/ EIA) (see Section 4.4).

88. The major activities to be carried out for IEE and EIA include: (i) identification of sub-project influence area; (ii) establishment of “baseline environment” against which impacts of the proposed sub-project would be evaluated; (iii) analysis of alternatives; (iv) identification of major sub-project activities during both construction and operational phases; (v) assessment, prediction and evaluation of impacts of major project activities on the baseline environment; (vi) carrying out public consultations; (vii) preparation of environmental code of practice (ECoP); and (viii) identification of mitigation measures and preparation of environmental management plan (EMP), including monitoring requirements, and grievance redress mechanism. The EMF presents detail guidelines for carrying out each of these major activities (see Section 4.6).

89. The EMF also presents occupational health and safety guidelines, guidelines for establishment of EMIS, and a set of special environmental clauses (SECs) for inclusion in Technical Specification and bidding document. The EMF also presents institutional framework for environmental management of the BMWSSP to be implemented by the DPHE. Finally, the EMF presents training requirements for ensuring successful environmental management of the BMWSSP.

4.2 Sub-project Description

90. For proper environmental assessment, it is important that a sub-project is clearly defined by the project proponent (in this case DPHE and Paurashavas). The key information required for describing a particular sub-project would vary depending on the type of sub-project. According to ECR 1997, a project proponent is required to apply to the Department of Environment (DoE) for environment clearance or site clearance certificate in a prescribed form (Form 3 of ECR 1997), furnishing key project information. Following the format of the "DoE Form 3", a "Sub-project Description Form (**Form 1**)" has been developed (**Appendix A-1**) for documenting description of sub-projects to be implemented under the BMWSSP. If a particular sub-project has multiple independent components (e.g., a water treatment plant and a Paurashava water office at a different location), then Form 1 could be filled separately for each component. Once a sub-project description using Form 1 is prepared by DPHE appointed Consultant and Paurashava, it will be easier to subsequently complete the "DoE Form 3" during submitting application for environmental/ site clearance certificate. The completed Sub-project Description Form 1 and the Environmental Screening Form 2 (see Section 4.3) will be sent to DPHE PMU for review, based on which the need for further environmental assessment will be determined.

91. The key information included in the "Sub-project Description Form (Form-1)" are:

- Type of the Sub-project
- Basic information on the source/design capacity/area/key treatment provisions for WTP/length of rehabilitated transmission, distribution line/number of latrines with soakage pits/ number of vacuum tankers for fecal sludge treatment plant/length and type of drainage conduit
- Important Environmental Features (IEF) within the influence area project sub-components
- Location of the sub-project (attach a mouza map and a location map)
- Layout of the sub-project (attach a layout map)
- Ownership of land on which the sub-project would be implemented
- Estimated cost of the sub-project
- Schedule of implementation of the sub-project (including estimated start date and completion date)

92. The location map of the proposed sub-project should cover the entire physical extent of the sub-project and its surrounding areas; the location of the sub-project could be identified on the map of the Paurashava.

4.3 Environmental Screening

93. The purpose of "environmental screening" is to get a preliminary idea about the degree and extent potential environmental impacts of a particular sub-project, which would subsequently be used to assess the need for further environmental assessment. As noted earlier, DPHE-appointed Consultant and the Paurashavas will be responsible for carrying out environmental screening. The environmental screening would involve: (i) reconnaissance of the sub-project area and its surroundings by the Consultant and Paurashava engineer(s); (ii) identification of the major sub-project activities; and (iii) preliminary assessment of the

impacts of these activities on the ecological, physicochemical and socio-economic environment of the sub-project surrounding areas.

94. The Consultant and Paurashava engineers would carry out a reconnaissance survey surrounding the sub-project location in order to identify important environmental features (e.g., human settlements, educational/ religious/ historical establishments, water bodies) close to the sub-project site. The major activities could be identified from the description of the sub-project prepared earlier (by completing Form 1). With a preliminary idea about the nature of the sub-project location and sub-project activities, the Consultant and the Paurashava would carry out the "environmental screening" of sub-projects by filling in the "**Environmental Screening Form 2**" presented in **Appendix A-2**.

95. As shown in Form 2 (Appendix A-2), the first step is to collect information on project siting related to the presence of cultural heritage, protected are, wetland, national park, wildlife sanctuary, etc. and possible impact of the project (if any). Information will have to be collected on the possible impact of the project on different the ecological components of the environment. The potential impacts of a sub-project have been divided into: (A) impacts during construction phase, and (B) impacts during operational phase. For each phase, the impacts have been further categorized into ecological impacts, physicochemical impacts and socio-economic impacts. A number of parameters have been identified for each of these categories. In general, as a part of environmental screening, the potential impact with respect to each parameter has to be classified as "significant", "moderate" and "insignificant" or "none".

96. The last part of the Form 2 involves categorization of sub-project following Environment Conservation Rules (ECR) 1997 of the DOE in order to identify the requirements for EIA/IEE/EMP. If the sub-project is not specifically listed in the ECR 1997, then the Consultant and Paurashava would identify a category based on the "assessment of impact" done as a part of environmental screening. On the other hand, for sub-projects listed in ECR 1997 under a particular category (e.g., Red or Orange A/B), the Consultant/Paurashava could propose alternative category (e.g., Orange A or B in place of Red) based on the outcome of the screening exercise.

97. The following Section provides guidelines for carrying out environmental screening of sub-projects using the Screening Form 2.

Ecological Impacts:

98. In order to assess the possible impacts of sub-project on the ecology in and around the site a number of parameters have been considered for screening during construction phase; these include flora and fauna with felling of trees and impact on aquatic (water) environment. If the sub-project involves felling/ cutting of significant number of trees, the impact would be classified as "significant"; if the sub-project involves feeling/ cutting of only a few trees, the impact could be classified as "moderate", while if felling of trees is not involved, the impact would be "insignificant" or "none". A tree census by counting the types of tree likely to be cut would be helpful in planning re-plantation. If there is a water body (e.g., khal, pond) close to the sub-project location, then depending the potential risk of pollution of the water body (e.g., through discharge of waste/ wastewater from sub-project

activities, spills and leaks of oil/ chemical), the potential impact on aquatic environment would have to be classified as “significant’ or “moderate” or “insignificant” or “none”. As noted in the “screening form”, sub-projects that could generate substantial ecological impacts include fecal sludge treatment plant, decentralized wastewater treatment plant, public toilet, latrines with soakage pit and drains.

99. As noted in “Form 2”, sub-projects that could generate negative impact include drain, fecal sludge management plants and latrines with soakage pit with possibility of liquid effluent discharge into the surface water bodies. For other sub-projects, ecological impacts during operational phase are likely to be insignificant in nature. If the drainage water carried by the constructed storm drain is polluted (e.g., due to inflow of domestic wastewater), it will adversely affect the aquatic environment of the receiving water body. The nature of the receiving water body will also govern the possible extent of pollution; smaller water bodies with lower levels of flow would be more susceptible to pollution, compared to larger water bodies (e.g., a river) with higher flows. Considering the nature of the drainage water and the nature of the receiving water body, the Paurashava engineer would classify the impacts as “significant”, “moderate” or “insignificant” or “none”.

Physicochemical Impacts:

100. *Construction Phase:* The parameters considered for screening of physicochemical impacts during construction phase include drainage congestion, noise and air pollution, and water/ environmental pollution. If the sub-project involves use of equipment/ machines producing significant noise (e.g., generators, pile driver, heavy truck/ vehicle) and if the sub-project site is located close to human settlements/ schools/ hospitals, noise pollution would be significant. Similarly, use of stone crushers, burning of asphalt, excavation works and movement of vehicle would generate air pollution. Water stagnation, drainage congestion and blocking of narrow roads may occur due to stockpiling of construction materials and/or excavated earth. Depending on the extent of these activities for the proposed sub-project, the air pollution impact could be subjectively classified as “significant”, “moderate” or “insignificant” or “none”. Similar logic should be followed for classifying impacts related to drainage congestion, and water/ environmental pollution.

101. *Operational phase:* The parameters considered for screening of physicochemical impacts during operational phase would depend on the type of sub-project. As shown in “Form 2”, for a fecal sludge management sub-project, noise level, odor and air pollution (from vehicular movement) along with possible contamination of surface and ground water from liquid effluent discharge/leachate infiltration are important parameters; for a drain sub-project, drainage congestion (e.g., improvement of drainage congestion due to the sub-project), and water pollution (of receiving water body, as discussed above) are important parameters; water pollution from soakage pit overflow are important parameters for a latrine/public toilet sub-project; for a number of sub-projects (e.g., water treatment plant, latrine with soakage pit, public toilet, SWM), environmental pollution (e.g., from solid wastes, leachate, sludge generated from these facilities) is an important physicochemical parameter. Over-extraction of water from ground and/or surface water sources may also lead to depletion of the available resource. Depending on the nature and scale of the sub-project, the DPHE Consultant and Paurashava engineers would subjectively classify the

potential impacts with respect to these parameters as “significant”, “moderate” or “insignificant” or “none”.

Socio-economic Impacts:

102. *Construction Phase:* The parameters considered for screening of socio-economic impacts during construction phase include traffic congestion, health and safety, impact on archaeological/ historical sites, and employment. A number of projects, e.g., clear water transmission line, water distribution network and drain would involve excavation of trenches for laying of pipeline; this is likely to likely to generate traffic congestion and difficulties in pedestrian movement during the construction phase. Sub-projects that involve transportation and storage of significant construction materials (e.g., water treatment plant, office building complex, fecal sludge management plant) could also aggravate traffic congestion. Sub-projects that are likely to generate significant noise and air pollution are also likely to cause short-term health concerns. Sub-projects involving operation of significant vehicles and equipment in busy localities are likely to generate safety concerns. In addition, squatters and mobile vendors may be temporarily dislocated for drain and water transmission and distribution sub-projects. Labor-intensive sub-projects are likely to generate employment opportunities for some people. Archaeological and historical sites located at close proximity of a sub-project site would raise concern of adverse impacts on these sites/ establishments.

103. *Operational Phase:* The parameters considered for screening of socio-economic impacts during operational phase include traffic, health & safety, and employment. A number of sub-projects (such as water treatment plant, fecal sludge management plant, storm drain, office complex and public toilet) would modify the traffic situation in the sub-project surrounding areas. Some of the sub-projects such as office building, fecal sludge management plant may generate more traffic and aggravate the traffic situation. Depending on the type and extent of a sub-project, the DPHE Consultant and Paurashava engineer will classify the traffic impacts during operational phase. Depending on the nature and extent of the sub-project, the Consultant and Paurashava engineers would classify the impact of fecal sludge management, public toilet, and latrine/public toilet as “significant improvement” for the overall community health and safety. A number of sub-projects are likely to have significant positive impacts in terms of generation of employment and business opportunities; these include water treatment plant, fecal sludge management plant and decentralized wastewater treatment plant. Depending on the nature of the sub-project, the Paurashava engineer would classify the impact on employment generation as “significant”, “moderate” or “insignificant” or “none”.

104. Based on the guideline presented above, the Paurashavas should be able to carry out the “environmental screening” of sub-projects by filling Form 2. However, as discussed later in the Report, the capabilities of the Paurashava in carrying out these activities could be greatly improved through imparting training on environmental assessment and management.

4.4 Need for Further Environmental Assessment

105. The level of environmental assessment (EA) of a sub-project would primarily depend on the class/ category of the sub-project according to WB OP 4.01 and ECR 1997. As noted

earlier (Section 3.2), the sub-projects to be carried out under DPHE have been classified as "Category B" according to WB OP 4.01. On the other hand, as shown in Table 3.1, most of the DPHE sub-projects are not specifically listed in the ECR 1997; only a few are listed under Category "Red" and "Orange B". Based on field visits of 5 Paurashavas and discussion with DPHE and Paurashava officials it appears that in many cases potential impacts of most subprojects are likely to be insignificant. As a result, many subprojects (including WTP and transmission/distribution line) in the Paurashavas (especially where no private land would be required for project implementation) could be classified as "Orange B" or "Orange A". Some of the subprojects, such as fecal sludge treatment plant and decentralized wastewater treatment plant could fall under Orange A/B Category; overhead tank and production well could be classified under "Orange A" Category, while stand post could be classified under "Green Category".

106. For assessing the need for further environmental assessment (EA) for a particular sub-project, the DPHE will categorize the sub-project (e.g., Green, Orange A, Orange B, or Red) based on the sub-project description (Form 1), and environmental screening (Form 2). The basis of the assessment would be classification of the sub-project according to WB (OP 4.01) and GoB (ECR 1997) guidelines, and level of anticipated impacts, as indicated in Form 2. If a particular sub-project is listed in the ECR 1997 (see Table 3.1), it will be indicated in the Sub-project Description Form 1 (see Appendix A-1), and it would be categorized accordingly. If a sub-project is not specifically listed in the ECR 1997, it would be categorized based on the level of impacts indicated in Form 2, and categorization of similar projects in ECR 1997. As noted earlier (Table 3.1), most of the sub-projects to be implemented by DPHE would fall either under "Category A" or "Category B". The PMU of DPHE could consult with the DoE regarding classification of a particular subproject.

107. The nature of further environmental assessment would depend on the categorization of the sub-projects. According to ECR 1997, for Green Category sub-projects, no further environmental assessment would be required; for Orange A Category sub-projects, no further environmental assessment would be required, but some additional information would be required; for Orange B category sub-projects IEE and EMP would be required; while for Red Category sub-projects, full-scale EIA (including EMP) would be required.

4.5 Guidelines for Carrying Out IEE and EIA

108. As noted earlier, based on a review of the sub-project description (i.e., Form 1) and environmental screening (i.e., Form 2) prepared by the Paurashava, the DPHE will determine the need for further environmental assessment (i.e., carrying out IEE/ EIA, including EMP). As discussed in Section 3.1, two of the sub-projects (water treatment plant, water transmission line) to be implemented under the BMWSSP are likely to fall under "Red" Category, which would require full scale EIA; one (public toilet) falls under "Orange B" category; while the remaining subprojects are not specifically listed in ECR 1997. Since the exact locations, size and extent of the sub-projects are still unknown, the guideline for environmental assessment presented here cover both IEE and EIA (including EMP). Both IEE and EIA would cover the same elements. However, the level of details would be different; a full-scale EIA would present more detailed and quantitative (where appropriate) analysis of

impacts, e.g., through application of models (such noise model). The level of details would be determined through “scoping” at the onset of the environmental assessment process, considering the nature of the sub-project (Form 1) and level of anticipated impacts (Form 2).

109. The major activities involved in carrying out environmental assessment (IEE and EIA) include the following:

1) Identification of sub-project influence area;
2) Establishment of “baseline environment” within the sub-project influence area, against which impacts of the proposed sub-project would be evaluated;
3) Identification of major sub-project activities/ processes during construction phase and operational phase;
4) Assessment and evaluation of impacts of major project activities on the baseline environment during construction phase and operational phase;
5) Carrying out public consultations;
6) Identification of mitigation measures for reducing/ eliminating adverse impacts and enhancing positive impacts;
7) Preparation of environmental code of practice (ECoP), including cost of ECoP; and
8) Development of environmental management plan (EMP), including monitoring requirements and grievance redress mechanism, and cost of EMP.

The environmental assessment (i.e., IEE/ EIA) of sub-projects will be carried out by DPHE (through a hired Consultant). The following Section presents detail guidelines for carrying out each of the major activities listed above for carrying out environmental assessment.

4.5.1 Sub-project Influence Area

110. For properly carrying out IEE and EIA, it is important to have a clear understanding about the “sub-project influence area” and “baseline environment”. The EMF provides guidelines for identification of sub-project specific influence area and defining environmental baseline.

111. In order to establish a sub-project influence area, the activities to be carried out and processes that would take place during both construction phase and operational phase of the sub-project need to be carefully evaluated. Based on the field visits to sub-project sites in 5 Paurashavas, it is apparent that the sub-project influence area would depend not only on the type of sub-project, but also on the site/ area where it will be implemented. For example, for clear water transmission line and water distribution network sub-projects, the types of roads along which the water lines would be laid and traffic situation on these roads are important determinants for assessment of impacts. For fecal sludge management plant (FSTP), the effluent receiving water body (Khal/River) could experience impacts (e.g., water pollution/depletion, odor, air and noise pollution), and therefore the nature of the effluent receiving water body and its water quality would be important issues. For public toilet sub-projects, the sub-project impacts are not likely to be felt beyond the location, thus, sub-project influence area would be the catchment area of the public toilet. However, considering possible groundwater pollution from soakage pit leachates, the depth of groundwater and present use of shallow groundwater would be important considerations.

112. For a drain sub-project, the sub-project influence area would include: (a) catchment areas of the drain; (b) downstream areas of the drain, including the final discharge point (e.g., khal, river); (c) routes of transportation of construction materials (or construction wastes) to (or away from) the sub-project site; and (d) areas of material storage, and labor shed for sub-project works. Visual observation and water quality tests suggest that the water bodies (i.e., khals and rivers) receiving drainage water from the Paurashavas are heavily polluted at many Paurashavas. Therefore, for a drain sub-project, water quality of the receiving water bodies is of particular importance.

113. Based on field visits and discussions with DPHE Paurashava officials, it appears that for a number of sub-projects (e.g., deep tubewell, water treatment plant, fecal sludge management plant, public toilet, stand post, latrine with septic tank and soakage pit, water tank, decentralized wastewater treatment plant and office building complex), the major environmental impacts during both construction and operational phases (e.g., drainage congestion, noise/ air pollution, water/ environmental pollution, traffic congestion) are unlikely to impact areas beyond one kilometer from the sub-project site. Thus, for these sub-projects, areas and communities within about one kilometer surrounding the proposed sub-project location may be considered as the sub-project influence area.

114. For a FSTP sub-project involving collection and transportation of fecal sludge, the entire route of transportation of fecal sludge from the point of generation/ collection to the points/locations of treatment and ultimate disposal should be considered as the sub-project influence area. Also, improper collection, treatment and disposal of fecal sludge may aggravate the environmental condition surrounding the disposal location; such areas should therefore be considered as sub-project influence for an FSM project. Similarly, for a water supply pipeline or drainage line sub-project, the routes along which of the water distribution lines would be laid and the immediate surrounding areas are likely to experience impact of the sub-project activities and should be considered as sub-project influence area.

115. Table 4.1 provides general guideline for identification of influence area for different types of sub-projects to be implemented under the BMWSSP.

Table 4.1: Guideline for identifying influence area for different types of sub-projects

Sub-project	Influence Area
Deep Tubewell with Pump House	Areas and communities within about one kilometer surrounding the proposed location of the deep tubewell.
Water Treatment Plant with raw water transmission line	Areas and communities within about one kilometer surrounding the proposed WTP location; Areas and communities on either side of the raw water transmission alignment.
Drain	Areas and communities on either side of the drain alignment (i.e., catchment area of the drain section); Downstream section of the drain up to the discharge point; Discharge point (water body; e.g., river, khal, another major drain).
Clear water transmission line; Water distribution network (including expansion and rehabilitation of existing network)	Routes along which of the water distribution lines would be laid, and its surrounding areas (service area/influence area).

Sub-project	Influence Area
Office Building	Areas and communities within about one kilometer surrounding the proposed location of the building complex.
Public Toilet	Areas and communities within about half a kilometer surrounding the proposed location of the public toilet.
Overhead tank	Areas and communities within about a half kilometer surrounding the proposed location of overhead tank;
Decentralized wastewater treatment plant	Areas and communities within about one kilometer surrounding the proposed location of DWWTP;
Latrine with septic tank and soakage pit	Areas and communities within about a quarter kilometer surrounding the proposed location of latrine with septic tank and soakage pit.
Fecal Sludge Management (including FSTP)[1], and SWM	Areas (e.g., markets, communities) from where fecal sludge or solid waste will be collected; The entire route of transportation of the collected fecal sludge or solid waste from the point of generation/ collection to the points/locations of treatment and ultimate disposal[3]; Areas within about half a kilometer surrounding the points/ locations of treatment and ultimate disposal of fecal sludge or solid waste.
OH tank	Areas and communities within about one kilometer surrounding the proposed project location;

[1] Most Paurashavas do not have fecal sludge management facility; fecal sludge is typically disposed in low-lying areas and open ditches.

Note: For larger projects (e.g., water treatment plant, clear water transmission line, fecal sludge management water distribution network, drains, overhead tank with pump house) the routes of transportation of material/ equipment to the sub-project site should also be included under influence area.

4.5.2 Environmental Baseline

116. For proper environmental assessment (as a part of IEE and EIA), it is very important to adequately define the “environmental baseline” against which environmental impacts of a particular sub-project would be subsequently evaluated. The characteristics of “environmental baseline” would depend on:

- Nature of the sub-project location,
- Nature/ extent of a sub-project and its likely impact,
- Level of environmental assessment (e.g., screening versus full scale EIA)

117. For example, ambient air quality and noise level are important parameters for describing baseline scenario for sub-projects like clear water transmission line, water distribution network, drain, because these parameters are likely to be impacted by the project works. However, these parameters are not likely to be important for sub-projects like “stand post” or “public toilet”. Similarly, ecological parameters (e.g., diversity of flora and fauna) are not likely to be critical for a sub-project to be carried out within an urban setting (e.g., clear water transmission line, water distribution network of a Paurashava); but these could be important for a sub-project like water treatment plant, fecal sludge management plant, where aquatic floral and faunal habitat could be impacted by the sub-

project activities. Obviously, the depth of baseline information required for "environmental screening" for a "green" category sub-project would be significantly different from those required for environmental assessment (as a part of IEE or EIA) of an "orange B" or a "red" category sub-project.

118. For systematic definition and recording, the baseline environment is usually classified into physicochemical environment, biological environment, and socio-economic environment; and important features/ parameters under each category are identified and measured/ recorded during baseline survey. As noted above, the important features/ parameters would depend on the nature of sub-project location, category of sub-project, and level of environmental assessment. The following sections provide guideline on identification of important features/ parameters and collection of sub-project specific environmental baseline data.

4.5.2.1 Physicochemical environment

119. The important physicochemical parameters for defining baseline include:

- Important Environmental Features (IEFs),
- Climate,
- Topography and drainage,
- Geology and soil,
- Hydrology and water resources,
- Air quality,
- Noise level,
- Water quality, and
- Traffic

<u>IEFs and Maps:</u>

120. Typical Important Environmental Features (IEFs) include human settlements, educational institutions (school, college, madrassa, university), health care facilities (hospitals, clinics), commercial/ recreational establishments (markets, restaurants, parks, offices), religious establishments (mosques, temples, churches), major utility infrastructure (water/ wastewater treatment plants, water mains, sewers, power plants, sub-station, gas/ electricity transmission/ distribution lines), landfills, major ponds/ khals and rivers, and historical archaeological establishments, ecologically critical area (ECA), wildlife sanctuary, game reserve, protected area, and national park.

121. Under most circumstances, it is sufficient to identify IEFs within the sub-project influence area (see Section 4.5.1), based on a survey, covering the sub-project influence area (see Table 4.1). All the sub-projects to be implemented under the MWSSP could be categorized as small- to medium scale and have relatively small influence area. Therefore, the IEFs within the sub-project influence area could be identified through a quick physical survey. It should be noted that many of the IEFs present in the Paurashava (e.g., historical/ archaeological sites, wildlife sanctuary, and national park) should already be identified and recorded in the Paurashava documents. These maps and documents should be utilized during identification of IEFs. For carrying out detailed environmental assessment (IEE or EIA), it may be necessary to identify the IEFs through a detailed survey and record their positions (GPS coordinates).

122. The sub-project layout and the identified IEFs within the sub-project influence area should be presented in a suitable map. For this purpose, the GIS maps (e.g., land-use maps) of Paurashavas (if available) could be used; the sub-project location(s) and IEF locations should be identified in this map. Maps available at the Paurashavas could also be used for this purpose.

Climate:

123. It is important to have a general idea about the climate of the area where the sub-project would be implemented. Important climatic parameters include precipitation, temperature, relative humidity, wind speed and direction. These data should be collected from secondary sources (e.g., from the nearest station of Bangladesh Meteorological Department, BMD). It has been found that climatic data from 11 meteorological stations would be required to characterize climate of the 30 Paurashavas where the sub-projects will be implemented by the DPHE. In fact, some of the required climatic data have already been collected from the Bangladesh Meteorological Department (BMD) and presented in the "overall environmental assessment" report. These climatic data could be readily used for environmental assessment of any sub-project, as required. The format used in the "overall environmental assessment" (Appendix H) may be followed for presentation of climatic data.

Topography and drainage:

124. Data and information on topography are very important for the design of certain sub-projects, such as drain, and water distribution line. For example, it is important to know whether the area where the WTP or FSTP would be constructed suffers from water-logging or inundation problems, which could aggravate during the implementation of these projects. For environmental assessment (IEE and EIA), secondary information on topography and drainage should be sufficient. The format used in the "overall environmental assessment" could be followed for presentation of necessary data/ information on topography/ drainage.

Geology and soil:

125. Characteristics of soil could be important if a particular sub-project involves significant excavation/ earthworks, because wind-blown dust from these activities could contribute to air pollution. In such cases, characteristics of soils (particularly heavy metal content) are often determined as a part of baseline survey. However, considering the nature and scale of the sub-projects to be implemented under the MWSSP, geology and soil characteristics do not appear to be critical for environmental assessment, except possibly for water transmission/distribution lines and drain sub-project. For such projects, heavy metal contents (Pb, Cr, Cd, Hg) of at a few soil samples (collected from a location along the alignment of the water/drainage line) should be determined. For water treatment plant and fecal sludge management plant at least three soil samples should be collected and analyzed. The format used in the "overall environmental assessment" could be followed for presentation of general data/ information on geology and soil.

Hydrology and water resources:

126. For the design of some sub-projects such as water treatment plant, FSTP, drain, information such as water level/ highest flood level are very important. For a deep tubewell sub-project information on groundwater table during the dry and wet seasons are very important. For public toilet, latrine with septic tank-soakage pit and FSTP sub-projects

highest water table data is important. In general, information on highest flood level is also an important design consideration for most sub-project types. Information on water resources is important in the design of water supply system. For environmental assessment (IEE and EIA), information on hydrology (e.g., river network, flow, highest water level) and water resources (e.g., discharge, groundwater level) may be collected from secondary sources (e.g., from Bangladesh Water Development Board, BWDB). The format used in the "overall environmental assessment" could be followed for presentation of necessary data/ information on hydrology and water resources.

Air quality:

127. Data on ambient air quality is not likely to be available for any of the Paurashavas covered under the MWSSP project. Particulate matter (particularly PM10 and PM2.5) is the most important air quality parameter from health perspective. However, measurement of air quality is relatively expensive and facilities for air quality measurement are not widely available. Therefore, baseline air quality data (PM) should be collected only for carrying out detailed environmental assessment (IEE/ EIA) and only for sub-projects that could aggravate air quality significantly (see Table 3).

128. Air pollution is likely to be generated from operation of machines/ equipment (e.g., concrete mixers, generators), movement of sub-project vehicles to and from sub-project site, and earth works (excavation and filling). The extent/ scale of the sub-project is also an important consideration in this case. The sub-projects which could result in deterioration of air quality include water treatment plant (due to concrete preparation, earth works); drains, clear water transmission line, water distribution network, and office building complex (due to earth works, and possible use of heavy equipment/ machines). Particulate matter concentration (SPM/ PM10/ PM2.5) should be measured under baseline survey for carrying out IEE/ EIA for these sub-projects (by the consultant engaged for this purpose). Considering the physical extent of the sub-projects and based on an understanding of the baseline situation from field visits to 5 Paurashavas, it appears that air quality (PM) measurement at a single point should be sufficient for characterization of baseline air quality.

Noise level:

129. Noise is typically generated from operation of machines and equipment (e.g., pile drivers, excavators, concrete mixing machine), and movement of sub-project vehicles. Noise is of particular importance if the sub-project is located close to sensitive installations such as educational institutions, health care facilities, religious establishments, and human settlements. Activities to be carried out during construction phase of many sub-projects would generate noise. For these sub-projects, baseline noise level should be measured and recorded, so that these could be compared with those generated during construction/ operation phase of the sub-projects. The location and frequency of baseline noise level measurements would depend on physical extent of project, and presence of sensitive installations within sub-project influence area, as noted above. The consultant engaged for carrying out IEE/ EIA should be responsible for measurement of baseline noise level at location(s) within the sub-project influence area. Both day-time and night-time noise levels should be measured, using a calibrated noise level meter.

Water quality:
130. A number of sub-projects are likely to have impacts on ground and surface water quality. For deep tubewell sub-project groundwater quality will be the primary concern. For surface water treatment plant, information on quality of the surface water source will be of utmost importance. The public toilet and fecal sludge treatment plant sub-projects may impart negative impact water on receiving water body, thus requires baseline information. For these sub-projects, baseline water quality of the relevant water body should be measured, as a part of baseline survey (by the consultant engaged for carrying out IEE/ EIA).

131. With respect to water quality, the dry season is the critical period, and hence water samples for water quality characterization should be collected during the dry season. Important water quality parameters include pH, TDS, TSS, ammonia, nitrate, phosphate, BOD5, and COD. If industrial installations are present within a Paurashava (e.g., Tarabo), color and selected heavy metals (depending on the type of industrial installation present at the Paurashava) should also be measured.

Traffic:
132. Information on road traffic is important for environmental assessment of a number of sub-projects such as water transmission/distribution line, drain and public toilet. For relatively larger projects, such as WTP, FSTP, traffic information along roads to be used for transportation of construction materials and equipment is also important. It would be necessary to collect traffic data from primary survey, as a part of carrying out IEE/ EIA (by the consultant engaged for this purpose); both number and composition of traffic are important. For other sub-projects, traffic data are not critical.

133. Table 4.2 presents a guideline for collection of primary and secondary data on physicochemical environmental parameters for different types of sub-projects to be implemented under the DPHE.

Table 4.2: Guideline for collection of sub-project specific physicochemical data/ information

Sub-project	Data/ information from secondary source	Data from primary survey/ measurement
Deep Tubewell with Pump House	IEFs; Hydrology; Seasonal variation of groundwater Level; Topography and drainage	IEFs; Noise level; Groundwater quality
Water treatment plant with raw water transmission line	IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources	IEFs; Air quality; Noise level; Traffic; Water Quality of source water
Clear water transmission line; Water distribution network (including expansion and rehabilitation of existing network)	IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources	IEFs; Air quality; Noise level; Traffic; Soil characteristics (heavy metal)
Paurashava Water Office Building	IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water	IEFs; Air quality; Noise level; Traffic

Sub-project	Data/ information from secondary source	Data from primary survey/ measurement
	resources	
Overhead Tank	IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources	IEFs; Air quality; Noise level; Traffic
Public Toilet	IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources; Groundwater table	IEFs; Air quality; Noise level
Latrine with septic tank and soakage pit	IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources; Groundwater table	IEFs; Air quality; Noise level
Fecal Sludge Management and SWM	IEFs; Climate; Geology and soil; Topography and drainage; Groundwater Table	IEFs; Noise level, Air Quality, Surface and Groundwater Quality
Drain	IEFs; Climate; Geology and soil; Hydrology and water resources; Topography and drainage	IEFs; Soil characteristics (heavy metal); Air quality (PM); Noise level; Water quality (drainage water and receiving water bodies)
Decentralized Wastewater Treatment Plant	IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources	IEFs; Air quality; Noise level; Traffic; Water Quality of Groundwater/Surface Water Source

4.5.2.2 Biological environment

134. Important parameters for description of biological environment include:

- General bio-ecological features of the sub-project area and its surroundings (e.g., bio-ecological zone, rivers, wetlands, hills, agricultural lands)
- Wildlife sanctuary, protected area, park, ecologically critical area (ECA)
- Floral habitat and diversity (terrestrial and aquatic)
- Faunal (including fish) habitat and diversity (terrestrial and aquatic)
- Threatened flora and fauna

135. It should be noted that most of the sub-projects to be carried out under DPHE are likely to have minor ecological impacts. In most cases, the most significant direct impact would result from felling/ cutting of trees/ plants within the sub-project area. A number of sub-projects could result in water pollution and as such impact aquatic fauna including fish. Most of the sub-projects are not likely to have any significant ecological impacts, and for such sub-projects general bio-ecological description of the sub-project area would be sufficient for description of baseline biological environment. It should be noted that such bio-ecological descriptions have already been developed for the 5 Paurashavas visited as a part of this study. These descriptions could be readily used for environmental assessment of any sub-project at these Paurashavas; similar description should be developed for other

Paurashavas, as required. For a few sub-projects, a more detailed description of biological environment would be necessary for environmental assessment. Table 4.3 provides guideline for collection and presentation of data for biological environment for different sub-projects to be implemented under the BMWSSP.

Table 4.3: Guideline for collection of sub-project specific data/ information for describing biological environment

Sub-project	Data/ information from secondary source	Data from primary survey/ measurement
Deep tubewell with pump house; Water transmission line; water distribution network, Clear water transmission line construction /rehabilitation /expansion; Paurashava water office building; Public Toilet; Latrine with septic tank and soakage pit	General bio-ecological features; Wildlife sanctuary, game reserves, ECA, etc.	Number of trees to be felled; Area of be cleared of vegetation
Water treatment plant; fecal sludge treatment plant; decentralized wastewater treatment plant; Drain; SWM	General bio-ecological features; Wildlife sanctuary, game reserves, ECA, etc.	Number of trees to be felled; Area of be cleared of vegetation; Floral and faunal diversity; Endangered and threatened species (focusing on the water bodies receiving storm water discharge)

4.5.2.3 Socio-economic environment

136. For major sub-projects, it is important to have a clear understanding to the baseline socio-economic condition of people, especially those living within the sub-project influence areas. A common approach for quick assessment of baseline socio-economic condition is questionnaire survey. The primary objectives of a questionnaire survey are:

(a) to understand people's socio-economic condition;
(b) to understand extent of people's access to basic services; and
(c) to understand people's perception regarding the sub-project.

137. The questionnaire used for the socio-economic survey may therefore cover five major themes:

(a) Socio-economic background
(b) Basic services (water supply, sanitation, power, gas/fuel)
(c) Education
(d) Economic situation, and
(e) Attitude toward the proposed sub-projects.

4.5.3 Identification of Major Sub-project Activities

138. In order to assess environmental impacts of sub-projects, it is very import to identify the major sub-project activities during both construction and operational phases. The major

activities would be different for different sub-projects. It should be noted that based on feasibility study of the DPHE and field visits carried out so far, it appears that no significant private land acquisition would be required for any of the sub-projects to be carried out in the Paurashavas. Hence, land acquisition is not likely to be a sub-project activity.

139. A common sub-project activity is mobilization of material and equipment and establishment of labor shed for carrying out the construction works. The actual construction activities would be different for different types of sub-projects. For example, the major construction activities for a water transmission line sub-project would include earth works (excavation and removal of excavated soil), installation of water pipeline of required specification, commissioning and testing of pipeline, and dismantling and removing all temporary structures (e.g., labor sheds), material and equipment from the site. During operational phase, important issue is maintenance of pipeline and ensuring its safety. Similarly, major activities during construction and operational phases of other sub-projects should be identified to assess their impacts on the baseline environment.

4.5.4 Assessment and Prediction of Impacts

4.5.4.1 Potential Significant Environmental Impacts during Construction Phase

140. After identification of the sub-project activities during construction phase, the next step in the IEE/EIA involves assessment/prediction of the impacts of these activities on the baseline environment. The potential environmental impacts during construction phase of sub-projects could be categorized into: (a) ecological impacts; (b) physicochemical impacts; and (c) socio-economic impacts.

Ecological impacts:

141. Based on primary assessment of the nature and scale of the proposed sub-projects and assessment of sub-project locations (based on field visits), it appears that ecological impacts are not likely to be significant for most of the proposed sub-projects. However, for a few sub-projects the significance of ecological impacts needs to be assessed. These sub-projects include: (i) Fecal sludge management, (ii) Water treatment plant with raw water transmission line, (iii) Clear water transmission line construction/rehabilitation/expansion, and (iv) Water distribution network.

In general, the ecological impact should focus on:

(c) Impact on flora (aquatic and terrestrial);
(d) Impact on fauna (aquatic and terrestrial) including fish;

142. Commonly, the significance of an ecological impact is determined by: (i) Ecological "consequence" of the activity, (ii) "Likelihood of occurrence" of the activity, and (iii) Calculating the product of these two parameters. Consequence and likelihood of ecological impacts resulting from project activities are discussed below.

143. Table B-1 of **Appendix B** (Criteria for assessment of ecological impacts) presents the criteria for estimating "consequence" of any particular "sub-project" activity. As shown in Table B-1, for adverse/ negative ecological impacts, the "consequence" has been divided into six categories (critical, major, moderate, minor, low, and none), with corresponding numerical ranking ranging from 5 (for "critical") to 0 (for "none"). If a sub-project activity

falls into multiple categories, it is assigned the highest ranking category for assessment of ecological impact.

144. Table B-2 of **Appendix B** presents criteria for "likelihood of occurrence" of an activity/ impact. The likelihood of each identified impact is determined by estimating the probability of the activity occurring. The likelihood is divided into five categories (almost certain, very likely, likely, unlikely, and very unlikely), with corresponding ranking ranging from 5 (for "almost certain") to 1 (for "very unlikely").

145. The "significance" of ecological impact for a particular sub-project activity is determined by multiplying the "consequence ranking" and the "likelihood ranking" of the sub-project activity, as follows:

$$\textit{Significance} = \textit{Consequence} \times \textit{Likelihood}$$

146. Table 4.4 shows "significance" ranking of ecological impacts, and Table 4.5 shows a risk assessment matrix that could be used for estimating "significance" and "risk", respectively of ecological impacts for a particular sub-project activity. Table B-3 of **Appendix B** presents examples of estimating ecological impacts of some typical sub-project activities.

Table 4.4: Ecological impact significance rankings

Significance (Consequence × Likelihood)	Significance Level
>16	Critical
9-16	High
6-8	Medium
2-5	Low
<2	Negligible

Table 4.5: Risk assessment matrix

Likelihood / Frequency	Consequence Severity				
	Low	Minor	Moderate	Major	Critical
Almost certain	High	High	Extreme	Extreme	Extreme
Very Likely	Moderate	High	High	Extreme	Extreme
Likely	Low	Moderate	High	Extreme	Extreme
Unlikely	Low	Low	Moderate	High	Extreme
Very Unlikely	Low	Low	Moderate	High	High

Physicochemical impacts:

Possible physicochemical impacts from the sub-project activities to be carried out in different Paurashavas under the BMWSSP project may include the following:

- Drainage congestion,
- Noise pollution,
- Air pollution,
- Water pollution,
- Environmental pollution from solid/construction waste

Drainage congestion:

147. During execution of civil engineering projects, temporary drainage congestion often results from obstruction to natural flow of drainage water due to the storage of materials, piled up excavated material/ soil (e.g., from excavation of trenches for laying of pipe), and temporary embankments constructed to keep the work area dry. Such drainage congestions could create significant discomfort to people living in sub-project areas.

Noise pollution:

148. Noise pollution could results from a wide range of construction activities, including movement of vehicles (carrying equipment/material to and from site), operation of construction equipment and generators. Significant noise is generated from operation of pile drivers, bulldozers, dump trucks, compactors, mixing machines, and generators, etc. Demolition activities, if required, also generate noise. Such noise may cause discomfort to the people living in the surrounding areas at close proximity of the sub-project site, especially if such activities are continued during the night. Noise pollution is particularly important for sensitive establishment e.g., hospitals, educational/religious institutions.

149. Among noise generating activities, operation of pile drivers produces the most significant noise. Figure 4.1 shows attenuation of noise level from a source (e.g., a particular machine) as a function of distance, for different initial noise level. The prediction was made following the New York State Department of Environmental Conservation (NYSDEC) screening-level noise analyses. For full-scale EIA (if needed), similar noise level predictions could be made for major equipment is these are used in the sub-project works, considering the noise level generated by these equipment. Such noise predictions could be conveniently used to assess noise pollution impacts in areas surrounding the sub-project site. However, noise modeling should be considered only for sub-projects that involve use of heavy equipment like pile drivers, bulldozers, etc, and require a full-scale EIA.

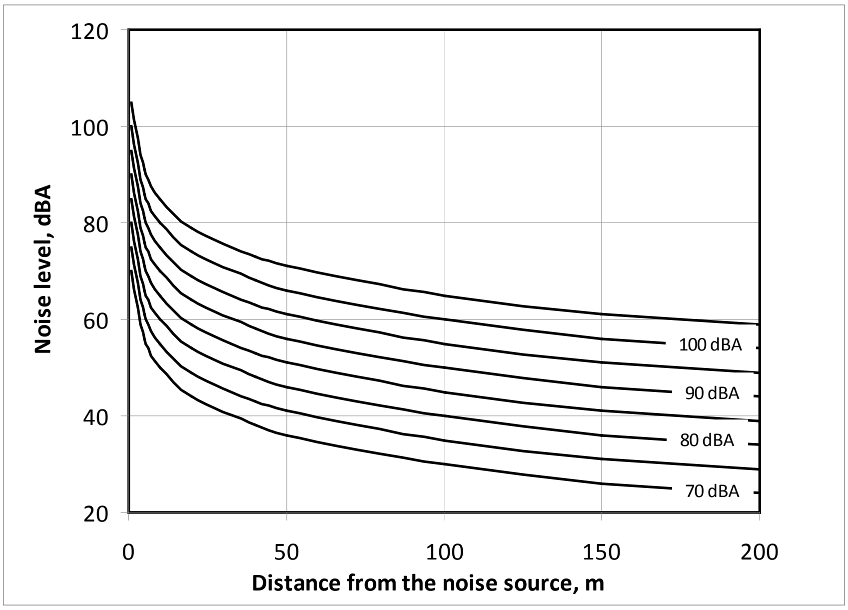

Figure 4.1: Attenuation of noise level with distance from the source.

Air pollution:
150. During construction phase, air pollution may result from emissions from machines and equipment (e.g., drilling rig, mixing machines, generators, asphalt plants) used for different sub-project activities; movement of vehicles (carrying material and equipment) to and from the site; and wind-blown dust from excavation works (including excavation of trenches for laying of water transmission/distribution pipes). Sub-projects that could generate appreciable air pollution include clear water transmission construction/ rehabilitation/expansion, water distribution network, drain, water treatment plant with raw water transmission, and fecal sludge management). For the sub-projects to be implemented under the MWSSP, adverse impacts of air pollution are likely to be limited to the areas surrounding the sub-project sites.

Water pollution:
151. Water pollution may result from discharge of wastewater (e.g., liquid waste from labor sheds), spills and leaks of oils/ chemical into nearby water bodies (e.g., drain, pond, khal, drain, river). For water treatment plant and FSTP sub-projects, construction activities would be related to water bodies (source and treated effluent disposal); hence these sub-projects are more likely to generate water pollution. For other sub-projects, the presence and existing use of water bodies surrounding the sub-project site would determine the level of impact. For example, if a pond/lake located close to a sub-project site is used for washing/ bathing or for fish farming; pollution of the pond/lake from sub-project activities would generate significant adverse impacts.

Environmental pollution from solid/ construction waste:
152. In many sub-projects, construction debris (e.g., demolition of existing structures) is likely to be generated from different sub-project activities. Solid wastes will also be generated from labor sheds, particularly for labor-intensive sub-projects. Improper management of construction debris and solid waste could cause blockage of drainage line/ path and environmental pollution.

Socio-economic impacts:

153. Possible socio-economic impacts from the sub-project activities to be carried out in different Paurashavas may include the following:

- loss of land,
- loss of income and displacement,
- traffic congestion,
- impact on top soil,
- health and safety,
- impact on archaeological and historical sites, and
- employment and commercial activities,

Loss of land:
154. Acquisition of private land is often necessary for implementation of projects, and loss of land is one of the most significant socio-economic impacts. However, based on feasibility study of the proposed BMWSSP and field visits carried out so far, it appears that significant land acquisition will not be required for any of the sub-projects to be implemented in different Paurashavas. Many of the sub-projects involve rehabilitation/

improvement/ expansion of existing infrastructure/ facilities, and sub-projects involving new construction would be carried out in government/ Paurashava owned land. Therefore, loss of land is not likely to be an issue of concern for the proposed MWSSP. However, if significant land acquisition becomes necessary for implementation of any sub-project, the issue should be addressed in light of the Government regulations and relevant WB operational guideline OP 4.12: Involuntary Resettlement (World Bank, 2001).

Loss of income and displacement:

155. Loss of income may result from inability to use a particular piece of land/ establishment (e.g., footpaths) during the construction phase for income generation activity. Some of the proposed sub-projects may cause temporary displacement of people. For example, during construction/ rehabilitation of clear water transmission line or water distribution network, road-side vendors or small temporary shops on footpaths may not be able to operate for a period of time. However, considering the extent and scale of the sub-projects, it appears that such impacts would not be significant; for example, in most cases, the affected road-side vendors or footpath shops would be able to operate by just moving a short distance away from the sub-project site.

Traffic congestion:

156. During construction phase of sub-projects, traffic congestion may result from stock piling of materials (including excavated soil from excavation of trenches for laying of water transmission/distribution pipes) by the sides of roads, increased movement of people and vehicles carrying material and equipment. Field visits carried out reveal that traffic congestion is a major problem in most Paurashavas. Some of the sub-projects, such as clear water transmission line, water distribution network and drain, may aggravate the existing traffic problem during construction phase. This should be addressed with proper traffic management and avoiding stockpiling of materials in a way that could hamper traffic movement. It should be noted that open excavation method is likely to be followed for laying water transmission/distribution pipelines. Considering the scale of the sub-projects and the nature of typical roads along which pipelines would be laid, trenchless technology of pipe-laying does not appear to be practical or cost-effective for the water transmission/ distribution sub-projects to be implemented under BMWSSP.

Impact on top soil:

157. For sub-projects involving significant excavation (e.g., installation of transmission line), conservation of top soil is an important issue. Utmost care should be taken to protect the topsoil (and thus maintain soil fertility) during excavation and backfilling. First 12 to 18 inches of topsoil should be excavated and stored on one side and the rest of the excavated soil on the other side. During back filling of trench, the top soil should be placed on the top again.

Health and safety:

158. Safety is an important issue during construction phase. General construction activities pose safety risks, which should be addressed as part of occupational health and safety plan. Section 4.8 provides guideline on occupational health and safety issues.

Impact on archeological and historical sites:

159. Archeological and historical sites are protected resources. Damage of such sites by digging, crushing by heavy equipment, uprooting trees, exposing sites to erosion, or by making the sites more accessible to vandals are of particular concern. While there are archaeological and historical sites at many of the 5 Paurashavas visited, none of these would be directly affected by the sub-project activities. Nevertheless, a guideline has been prepared for identification of physical cultural resources at the Paurashavas, assessment of possible impact of sub-project activities on these resources (if any), and for preparation of mitigation plans (if needed). The guideline for archaeological impact assessment is presented in Appendix C.

Employment and Commercial Activities:

160. During construction phase, some beneficial impact at local level would come in the form of employment in sub-project related works, which would depend on the nature and extent of the sub-project. For example, labor-intensive sub-project works (e.g., manual excavation) could generate employment for considerable number semi-skilled workforce. This in turn would induce some positive impacts on some other parameters including commercial activities in the sub-project areas.

Safeguarding physical cultural resources (PCR):

161. Since the exact locations of the sub-projects to be implemented under BMWSSP are not known at this moment, a guideline for identification of physical cultural resources (PCR) and determination of the suitability of the sub-projects from the perspective of PCR is provided in **Appendix D.** The likely impacts to PCR for typical activities of the sub-projects are also discussed in Appendix D. The "Chance Find" procedure for protection of cultural property is presented in **Appendix E**, following the World Bank Operational Policy OP 4.11 (Physical cultural resources).

4.5.4.2 Potential Significant Environmental Impacts during Operational Phase

162. After identification of the activities and processes that would take place during operational phase of a sub-project, the potential impacts of these activities/processes on the baseline environment need to be assessed. The potential environmental impacts during operational phase could also be categorized into: (a) ecological impacts; (b) physic-chemical impacts; and (c) socio-economic impacts.

Ecological impacts:

163. During operational phase, the possible impact of the sub-project activities on the biological environment would be insignificant, except for a few of sub-projects. These include: (a) water treatment plant; (b) fecal sludge management; (c) SWM (e.g., land filling), (d) DEWATS; and (d) storm drain.

164. Discharge of effluents generated from FSTP, DEWATS or leachate from solid waste disposal sites could cause pollution of the receiving river/ khal, thereby affecting the aquatic ecology. Monitoring of water quality (for river/ khal) is therefore necessary to detect possible adverse ecological at an early stage. As explained earlier, poor quality of drainage water (e.g., due to direct discharge of toilet wastewater into storm drain) could cause

pollution of the receiving water body (e.g., river, khal) and thus adversely affect aquatic flora, fauna and associated terrestrial fauna.

Physicochemical impacts:

165. Depending on the type of sub-projects a number of Physicochemical parameters could experience both positive and negative impacts during operation phase of the sub-projects. Important issues and parameters include:

- Drainage,
- Water quality,
- Air quality and noise level, and
- Environmental pollution from solid waste

Drainage:
166. The proposed sub-projects involving construction and rehabilitation of storm drains are likely to bring about improvement in the drainage condition in the sub-project areas, which is a major problem in many Paurashavas. However, blockage of the drains (e.g., by solid wastes due to improper maintenance) could aggravate drainage problem. Better management of solid waste could significantly facilitate the maintenance of storm drains.

Water quality:
167. Implementation of fecal sludge treatment plant (FSTP), SWM disposal system and decentralized wastewater treatment (DEWATS) systems are likely to significantly improve surface water quality in the project areas because fecal sludge and untreated domestic wastewater are currently being discharged in open water bodies and low-lying areas. Operation of public toilets would also contribute to improvement of water quality through discouraging open defecation. All these projects would contribute to the improvement of overall environmental condition in the project areas, and support achievement of SDG Target 6.2 (safely managed sanitation).

168. However, discharge of poor quality effluent from FSTP and DEWATS could adversely affect the receiving water bodies. Poor quality drainage water could also adversely affect the receiving water bodies.

Air quality and noise level:
169. During operational phase, vehicular movement would be the principal sources of air pollutants and noise. Increased movement of service vehicles surrounding service facilities like water treatment plant, fecal sludge management plant and water office building could generate higher noise and air pollution.

Environmental pollution:
170. Implementation of the sub-project involving fecal sludge management (collection of fecal sludge using vacuum trucks, transport to plant, etc.), SWM and DEWATS would significantly improve overall environmental condition and reduce the risk of widespread environmental pollution from indiscriminate disposal of fecal sludge and wastewater. However, lack of solid waste disposal facility at the Paurashavas is a concern.

Socio-economic impacts:

171. The proposed BMWSSP is aimed at bringing about improvement in the socio-economic conditions of the Paurashavas through improvement of basic infrastructure. Thus, implementation of the proposed sub-projects is likely to bring about significant improvement in the overall environmental and socio-economic conditions at the Paurashavas. Important socio-economic parameters that are likely to experience beneficial impacts due to implementation of the sub-projects include:

- water supply and sanitation,
- public health and safety,
- employment

Water Supply:
172. Implementation of a number of sub-projects is likely to bring about significant improvement in the water supply and sanitation situation at the Paurashavas. These include deep tube well with pump house, water treatment plant with raw water transmission line, clear water transmission line, water distribution network, pit, and overhead tank. However, efforts should be made to properly manage these facilities which will improve the overall water supply condition of the community.

Sanitation and Public Health:
173. Subprojects like fecal sludge treatment system including construction of FSTP, decentralized wastewater treatment system (DEWASTS), SWM system, and public toilets would significantly improve the sanitation situation in the project areas, and would support attainment of SDT Target 6.2 (safely managed sanitation). Improvement of sanitation services together with improvement of water supply situation is likely to contribute significantly to the improvement of public health in the Paurashavas where these subprojects would be implemented.

Employment and commercial activities:
174. A number of basic infrastructures to be developed under the MWSSP are likely to generate opportunity for employment water treatment plant and fecal sludge management plant.

4.5.5 Analysis of Alternative

175. As a part of the IEE/EIA, analysis of alternatives, including alternative site(s) for sub-project, alternative technology for sub-projects (e.g., alternative technologies for water treatment or fecal sludge treatment), and "no project scenario" would be assessed.

4.5.6 Public Consultation

176. Consultation is a regulatory process by which opinion from public is sought on matters affecting them. Public consultation is generally a continuous process aimed at engaging the stakeholder efforts throughout the planning, design, construction, and operation a project. The objectives of consultation and disclosure are to generate public awareness by providing information about a sub-project to all stakeholders, particularly the sub-projects affected persons (PAPs) in a timely manner, and to provide opportunity to the stakeholders to voice their opinions and concerns on different aspects of the project. The

opinions and suggestions of the stakeholders would assist the Paurashavas/ DPHE/ WB in taking appropriate decisions for effective environmental management of the sub-projects. Therefore, consultation and disclosure would be a useful tool for maintaining communications between Paurashavas/ DPHE/ WB and stakeholders. It would help facilitate and streamline decision making whilst fostering an atmosphere of understanding among individuals, groups and organizations, who could affect or be affected by the sub-projects.

177. As a part of IEE/ EIA, effective public consultation needs to be developed. The specific objectives of consultation, most often carried out in the form of focus group discussions (FGDs), are:

- To keep stakeholders informed about the sub-projects at different stages of implementation,
- To address the environmental and social concerns/ impacts, and device mitigation measures taking into account the opinion/ suggestions of the stakeholders,
- To generate and document broad community support for the sub-projects,
- To improve communications among interested parties, and
- To establish formal complaint submittal / resolution mechanisms.

178. The following are the guidelines for carrying out consultation and disclosure:

(1) At least one consultation will be organized with stakeholders at a Paurashava focusing on a sub-project or the sub-projects to be implemented simultaneously. The mode of consultation will be either public consultation (PC) or focus group discussion (FGD). The consultative meeting or discussion will be organized at an independent venue. Independent venue will provide opportunity to the participants to raise their voices and concerns freely about the sub-projects and their impacts on their life, livelihood and their community as a whole, from environmental point of view.

(2) Some informal consultative meetings or discussions will be organized focusing on a specific sub-project or all sub-projects to be implemented together, so that stakeholders can contribute their knowledge on the environmental issues toward better environmental management.

(3) The composition of stakeholders at the PC/ FGD may differ depending on the nature and location of the sub-projects. For a road sub-project, important stakeholders would include people living in the sub-project surrounding areas; drivers of different types of vehicles using the road; students; businessmen; doctors; and representatives of educational/ religious institutions, CBOs, and NGOs. For a community center sub-project, important stakeholders include people living in the sub-project surrounding areas; representatives from businesses related to community center, e.g., decorators, kitchen market shop owners; and representatives of educational/ religious institutions, CBOs, and NGOs. A stakeholder analysis needs to be carried out to identify the key stakeholders and Project Affected Persons (PAPs).

179. Information on the PC/ FGD needs to be published in national/ local newspapers 7 to 10 days prior to the consultations. In general, it must be ensured that the PAPs and other stakeholders are informed and consulted about the sub-project, its impact, their entitlements and options, and allowed to participate actively in the development of the sub-project. This should be done particularly in the case of vulnerable PAPs. This exercise should be conducted throughout the sub-project preparation, implementation, and monitoring stages. An open-door policy should be maintained for community people, so that stakeholders feel comfortable approaching Paurashavas directly to ask questions and raise concerns on environmental and social issues. Create a responsive management system should be created for recording and responding to comments and concern on environmental and social issues. It should be ensured that the Paurashavas are capable of responding to questions/comments, appropriately.

4.5.7 Environmental Management Plan (EMP)

180. The primary objective of the environmental management plan (EMP) is to record environmental impacts resulting from the sub-project activities and to ensure implementation of the identified “mitigation measures”, in order to reduce adverse impacts and enhance positive impacts. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operational phases of the sub-projects.

181. The EMP should clearly lay out: (a) the measures to be taken during both construction and operation phases of a sub-project to eliminate or offset adverse environmental impacts, or reduce them to acceptable levels; (b) the actions needed to implement these measures; and (c) a monitoring plan to assess the effectiveness of the mitigation measures employed.

182. The environmental management program should be carried out as an integrated part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as a sub-project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected. For all sub-projects to be implemented under BMWSSP, the EMP should be a part of the Contract Document.

183. The major components of the EMP include:

- Mitigation and enhancement measures
- Monitoring plan
- Grievance redress mechanism
- Estimation of cost of EMP
- Institutional arrangement for implementation of EMP

184. In addition, establishment of Environmental Management Information System (EMIS) (Section 4.9), Special Environmental Clauses (SECs) for inclusion in the bidding document (Section 4.10), institutional arrangement for environmental management (Section 4.11), third party monitoring of environmental management (Section 4.12), and

training requirements for institutional strengthening (Section 4.13) have been presented separately in the EMF.

4.5.7.1 Mitigation and Enhancement Measures

Construction Phase:

185. The “overall impact assessment” (see Appendix H) of the proposed sub-projects to be implemented at the Paurashavas reveals that most of the adverse impacts could be minimized or eliminated by adopting standard mitigation measures; there is also scope to enhance some of the beneficial impacts to be generated from the proposed sub-projects. This section describes the standard mitigation and enhancement measures that could be applied to the sub-project under BMWSSP.

186. In order to identify mitigation/ enhancement measures, the potential impacts have been categorized into: (a) “general impacts”, which are typical common impacts to be experienced in most sub-projects, and (b) “sub-project specific impacts”. Table 4.6 shows typical activities to be carried out under different sub-projects, corresponding “general impacts” and suggested mitigation and enhancement measures. It also assigns responsibility for implementation of mitigation and enhancement measures. Obviously, all sub-projects would not generate all the impacts listed in Table 4.6 at the same level/ magnitude. Table 4.6 provides general guidelines of mitigation and enhancement measures for the most significant “general impacts”. Table 4.7 shows “sub-project specific” impacts and corresponding mitigation/ enhancement measures.

Operational Phase:

187. During the operational phase, the Paurashavas will be responsible for the operation and maintenance of the infrastructure to be developed under the BMWSSP. Apart from regular operation and maintenance, a number of issues would require special attention for reducing/ avoiding possible adverse environmental impacts. These include regular maintenance and management of WTP, FSTP, DEWATS, public toilets, septic tank and soakage pit, and drains to reduce risk of water pollution.

188. With respect to drains, utmost efforts must be made to keep it operational (i.e., flowing) by restricting discharge of solid wastes into it and by periodically cleaning the drain. Adequate monitoring is also needed to make sure that the storm drain does not receive direct discharge of toilet wastewater from households, markets and commercial establishments. Such discharges would contaminate the drainage water and eventually the receiving water body (river or khal) and would bring about a wide range of adverse environmental and health outcomes.

189. Disposal of sludge from water and wastewater treatment plants, FSTP, public toilet and septic tank could also cause environmental pollution. Leachate generated at FSTP, if not treated properly treated and disposed, may contaminate both the surface and groundwater sources. Table 4.8 shows some important sub-project specific impacts during operational phase and corresponding mitigation measures.

Table 4.6: Typical "general impacts" during construction phase of sub-projects and corresponding mitigation and enhancement measures

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
Construction and operation of labor shed for workers	• Generation of sewage and solid waste; water/ environmental pollution	• Construction of sanitary latrine/ septic tank system. • Erection of "no litter" sign, provision of waste bins/cans, where appropriate • Proper disposal of solid waste	Contractor (Monitoring by Paurashava/ DPHE)
	• Health of workers	• Raising awareness about hygiene practices among workers. • Availability and access to first-aid equipment and medical supplies	
	• Possible development of labor camp into permanent settlement	• Contractor to remove labor camp at the completion of contract	
	• Outside labor force causing negative impact on health and social well-being of local people	• Contractor to employ local work force, where appropriate; promote health, sanitation and road safety awareness	
General construction works for sub-projects	• Drainage congestion and flooding	• Provision for adequate drainage of storm water • Provision of adequate diversion channel, if required • Provision for pumping of congested water, if needed • Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season.	Contractor (Monitoring by Paurashava/ DPHE)
	• Air pollution	• Ensure that all project vehicles are in good operating condition. • Spray water on dry surfaces/ unpaved roads regularly to reduce dust generation. • Maintain adequate moisture content of soil during transportation, compaction and handling. • Sprinkle and cover stockpiles of loose materials (e.g., fine aggregates). • Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter.	
	• Traffic congestion, traffic problems	• Schedule deliveries of material/ equipment during off-peak hours. • Selection of alternative routes, where possible for sub-project vehicles • Depute flagman for traffic control • Arrange for signal light at night	

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	• Noise pollution	• Use of noise suppressors and mufflers in heavy construction equipment. • Avoid using of construction equipment producing excessive noise at night. • Avoid prolonged exposure to noise (produced by equipment) by workers. • Regulate use of horns and avoid use of hydraulic horns in project vehicles.	
	• Water and soil pollution • Water pollution from temporary labor shed toilets	• Prevent discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ khals/ drains. • Install sediment basins to trap sediments in storm water prior to discharge to surface water. • Ensure adequate number of portable toilets	
	Felling of trees, clearing of vegetation	• Replant vegetation when soils have been exposed or disturbed. • Plantation to replace felled trees	
	• Accidents	• Following standard safety protocol. • Environmental health and safety briefing. • Provision of protective gear.	
	• Spills and leaks of oil, toxic chemicals	• Good housekeeping. • Proper handling of lubricating oil and fuel. • Collection, proper treatment, and disposal of spills.	
All construction works	• Beneficial impact on employment generation	• Employ local people in the project activities as much as possible. • Give priority to poor people living in slums within project area in sub-project related works (e.g., excavation and other works, which do not require skilled manpower).	Contractor (Monitoring by Paurashava/DPHE)

Table 4.7: "Sub-project specific impacts" during construction phase and corresponding mitigation measures

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
DTW with Pump Hose Sub-project			
Setting up and operation of drilling rig and drilling for installation of DTW	• Air and noise pollution affecting nearby settlements	• Consider use of noise attenuator in drilling rigs	Contractor (Monitoring by Paurashava/ DPHE)
	• Stock-piling of earth	• Remove stock-piled earth following completion	
Pump House construction and Electrical works	• Air and noise pollution affecting nearby settlements • Water pollution from temporary labor shed toilets	• Ensure adequate number of portable toilets	
	• Discovery of historical items and cultural remains	• Follow "chance find procedure" (see Appendix E) for protection of cultural resources	DPHE, with support from Contractor, Paurashava/DPHE
Overhead Tank (OHT)			
Construction of OHT	• Safety of workers • Safety of surrounding neighborhood	• Taking adequate safety measures following the provisions included in the EMF • Discussion with local community on safety and other issues prior to commencement of construction works	Contractor (Monitoring by Paurashava/ DPHE)
WTP with Raw Water Transmission Line/Water Distribution Network Sub-project			
Construction activities near water: Setting up riverbank protection work and raw water intake & transmission line and Water Distribution Network	• Air and noise pollution affecting nearby settlements • Water pollution from temporary labor shed toilets	• Locate intake point away from the residential settlements • Ensure adequate number of portable toilets	
	• Ecological impacts including destruction of aquatic habitat	• Prevent discharge of leachate, chemicals, and fecal sludge into surface waters. • Preservation of aquatic habitats by restricting movement of people/ equipment into them and preventing entry of sediments into these	Contractor (Monitoring by Paurashava/ DPHE)

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
		water bodies. • Keep noise level (e.g., from equipment) to a minimum level, as certain fauna are very sensitive to loud noise.	
WTP construction and electromechanical works	• Air and noise pollution affecting nearby settlements	• Locate intake point away from the residential settlements	
Excavation of trenches/ Earth works	• Erosion of riverbank (for SWTP)	• Ensure appropriate Riverbank Protection measures at the intake point • Limit earthworks to the dry season as much as possible; protect exposed earthworks with mulch, fabric and plant cover	Contractor (Monitoring by Paurashava/ DPHE)
	• Unsightly spoil disposal from foundation works by simple side tipping, affecting drainage/ runoff	• Disposal of soil to designated tipping areas	
	• Interruption of traffic and pedestrian movement due to stockpiling of excavated earth on road/footpath	• Avoid stockpiling of excavated earth on road/footpath; quickly remove excavated earth. • Employ personnel for traffic management to ensure smooth traffic flow during excavation of trench and installation of water transmission and distribution lines.	
	• Discovery of historical items and cultural remains	• Follow "chance find procedure" (see Appendix E) for protection of cultural resources	DPHE, with support from Contractor, Paurashava/DPHE
Drain Sub-project			
Excavation/ Earth works	• Erosion	• Limit earthworks to the dry season as much as possible; protect exposed earthworks with mulch, fabric and plant cover	Contractor (Monitoring by Paurashava/ DPHE)
	• Interruption of traffic and pedestrian movement due to stockpiling of excavated earth on road/footpath	• Avoid stockpiling of excavated earth on road/footpath; quickly remove excavated earth. • Employ personnel for traffic management to ensure smooth traffic flow during excavation of drainage channel or trench for laying storm sewer.	
	• Unsightly spoil disposal from drain excavation by simple side tipping, affecting drainage/ runoff	• Disposal of soil to designated tipping areas	
	• Possible backflow of water through drainage canal causing	• Consider installing gates to control inflow and outflow through drainage canal	

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	flooding/ water logging		
	• Discovery of historical items and cultural remains	• Follow "chance find procedure" (see Appendix H) for protection of cultural resources	DPHE, with support from Contractor, Paurashava/DPHE
Fecal Sludge Management , DEWATS, SWM Sub-project			
Construction activities near water	• Ecological impacts including destruction of aquatic habitat • Air quality and noise problem	• Prevent discharge of leachate, chemicals into surface waters. • Preservation of aquatic habitats by restricting movement of people/ equipment into them and preventing entry of sediments into these water bodies. • Keep noise level (e.g., from equipment) to a minimum level, as certain fauna are very sensitive to loud noise. • Locate plant away from the residential settlement	Contractor (Monitoring by Paurashava/ DPHE)
Construction of FSTP, Solid waste disposal system	• Groundwater pollution due to discharge of liquid (during operational phase)	• Restrict construction at shallow water table area	DPHE, with support from Contractor, Paurashava/DPHE
DEWATS, SWM, Building complex, Public toilets, Latrine with septic tank and soakage pit			
Construction of wastewater/ sewage disposal system	• Groundwater pollution due to discharge of wastewater/ effluent in deep soakage well, leachate from solid waste disposal site, and decentralized wastewater treatment plant (during operational phase)	• Restrict construction of deep soakage well • Proper design of SWM disposal site • Proper design of DEWATS	DPHE, with support from Contractor, Paurashava/DPHE

Table 4.8: "Sub-project specific impacts" during operational phase and corresponding mitigation measures

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
DTW with Pump House Sub-project			
Operation of the Pump House	• Increase in noise pollution	• Install noise attenuator and ensure proper maintenance of pump and motor	Paurashava
Overhead Tank (OHT) Sub-project			
O&M including cleaning of OHT	• Poor water quality • Damage to the structure • Poor aesthetics	• Regular cleaning of OHT • Removal of vegetation growth • Cleaning and painting of OHT	Paurashava
WTP with Raw Water Transmission Line/Water Distribution Network Sub-projects			
Operation WTP	• Pollution of downstream water body (for SWTP) due to disposal of effluent from WTP	• Ensure proper treatment appropriate for disposal according to ECR '97	Paurashava
	• Pollution from disposal of sludge generated from treatment of water	• Ensure proper treatment appropriate for disposal meeting the DoE requirements	
Drain Sub-project			
Operation of the drain	• Pollution of downstream water body due to disposal of polluted water from the drain	• Stop direction connection from sanitation facilities to storm drain; ensure installation of septic tank in all establishments	Paurashava (with support from
	• Blockage in the drain due to disposal of solid waste	• Creation of awareness; improve SWM system, installing cover in open manholes (if any) • Regular maintenance/ cleaning of the drain	
Fecal Sludge Management, SWM, Public toilets, DEWATS Sub-projects			
Operation of Fecal sludge management system (including FSTP), Solid waste disposal site, DEWATS	• Odor nuisance affecting nearby community • Health and safety of pit emptiers, solid waste handlers, waste pickers • Ecological impacts including	• Ensure collection of fecal sludge through mechanical means (using vacutugs), and use of protective gear by pit emptiers. • Proper training of pit emptiers. • Secured transport of fecal sludge • Ensure proper treatment appropriate for disposal meeting the DoE requirements	Paurashava

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	destruction of aquatic habitat due to poor quality effluent discharge, leachate from solid waste • Air quality and odor problem	• Prevent discharge of leachate, chemicals, and fecal sludge into surface waters.	
	• Groundwater pollution due to discharge of liquid/ effluent, leachate from solid waste disposal site, FSTP and DEWATS	• Ensure proper treatment appropriate for disposal meeting the DoE requirements • Restrict discharge of liquid effluent into shallow water table area	Paurashava

4.5.7.2 Monitoring Plan

190. The primary objective of the environmental monitoring is to record environmental impacts resulting from the sub-project activities and to ensure implementation of the "mitigation measures" identified earlier in order to reduce adverse impacts and enhance positive impacts from project activities.

Monitoring during Construction Phase:

191. During implementation of all sub-projects, the DPHE and Paurashava, with support from the Technical Assistance (TA) consulting firm, will be responsible to monitor and make sure that the environmental mitigation/ enhancement measures (including health and safety measures) outlined in the EMP for the particular sub-project are implemented in accordance to the provisions of the Tender Document. DPHE will be primarily responsible for monitoring of some of the major sub-projects, such as water treatment plant (WTP), overhead tank, water transmission line, DEWATS, and FSTP; while Paurashava will be primarily responsible for monitoring of the remaining sub-projects, including drainage system, public toilet, solid waste management system.

192. Apart from general monitoring of mitigation/ enhancement measures, important environmental parameters to be monitored during the construction phase of the sub-projects include air quality, noise level, water quality, drainage congestion, and traffic problems. However, the requirement and frequency of monitoring would depend on the type of sub-project and field situation. For certain sub-projects (e.g., stand post), monitoring of these parameters is not critical; while monitoring of some of these parameters (e.g., air quality) would be needed only if significant pollution is suspected. Table 4.8 presents a guideline for monitoring of specific environmental parameters during construction phase of different sub-projects.

Table 4.8: Guideline for monitoring of environmental parameters during construction phase

Sub-project	Monitoring Parameter and Scenario	Monitoring Frequency	Resource Required and Responsibility
WTP with raw water transmission line, Drain, Water Distribution Network, Clear water transmission/ rehabilitation/expansion, FSTP and DEWATS, SWM	If significant air pollution is suspected: Particulate Matter (PM_{10}/ $PM_{2.5}$)	As needed	Contractor, under the guidance of Paurashava/ DPHE
WTP with raw water transmission line, Drain, Water Distribution Network, Clear water transmission/ rehabilitation/expansion, FSM and DEWATS, SWM	Regular monitoring: Noise level	Once every week, particularly during operation of heavy equipment	Contractor, under the guidance of Paurashava/ DPHE
WTP, Drain, FSTP, SWM and DEWATS	Water quality (pH, BOD_5/ COD, Oil and Grease)	Once a month (at a location downstream of the work area)	Contractor, under the guidance of Paurashava/ DPHE

Sub-project	Monitoring Parameter and Scenario	Monitoring Frequency	Resource Required and Responsibility
WTP with raw water transmission line, Drain, Water Distribution Network, Clear water transmission/ rehabilitation/expansion, FSTP, SWM and DEWATS	If pollution of an adjacent water body is suspected: Water quality (pH, BOD_5/ COD, Oil and Grease)	As needed	Contractor, under the guidance of Paurashava/ DPHE
All sub-projects	Visual observation of drainage congestion, traffic within around sub-project location	Once a week; when drainage/ traffic congestion suspected	Contractor, under the guidance of Paurashava/ DPHE

Note: Actual monitoring time and location should be decided by the PD depending on the location of specific activities.

Monitoring during Operational Phase

193. During operational phase, monitoring of environmental parameters would be required for certain sub-projects. Table 4.9 presents a guideline for monitoring of specific environmental parameters during operational phase of selected sub-projects.

Table 4.9: Guideline for monitoring of environmental parameters during operational phase

Sub-project	Monitoring Parameter and Scenario	Monitoring Frequency	Resource Required and Responsibility
Strom drain, WTP, FSTP, SWM, DEWATS	Water quality (pH, BOD_5/ COD, Ammonia, Phosphate)	Once a month (at a location downstream of the discharge point)	Paurashava, with support from DPHE

Note: Actual monitoring time and location should be decided by the PD depending on the location of specific activities.

4.5.7.3 Grievance Redress Mechanism

194. Grievance Redress Mechanism (GRM) is a valuable tool which will allows affected people to voice concerns regarding environmental and social impacts of sub-project to be implemented under BMWSSP. Relevant organizations including Paurashavas, DPHE and WB would ensure that grievance redress procedures are in place and would monitor those procedures to ensure that grievance are handled properly. The DPHE / Paurashava offices will establish a procedure to answer sub-project-related queries and address complaints, disputes, and grievances about any aspect of the sub-project, including disagreements regarding the assessment and mitigation of environmental and social impacts. Generally, the grievance redress committees (GRC) are of two types (i) formal courts of appeal and (ii) a locally constitutes GRC for dispute resolution. The second may not totally avoid but may reduce the problem significantly.

195. A locally constitutes Grievance Redress Committee (GRC) will be formed in each Paurashava office. The tentative structure of the Committee, presented in Table 4.10, is

aimed at ensuring proper presentation of complaints and grievances, as well as impartial hearings and transparent decisions. Membership composition for GRCs in hilly areas municipalities / Paurashavas will take into account any traditional conflict resolution arrangements that indigenous people (IP) communities may practice.

196. The sub-project-affected persons can register their grievances at the complaint cell. All cases will be registered, categorized and prioritized by the Paurashava authority. The GRCs will meet periodically to discuss the merit of each case and fix a date for hearing and notify the PAP to submit necessary documents in proof of her/his claim/case; resolve grievances within one month of receipt of complaint.

197. If grievance resolution attempts at the Paurashava fail, the Paurashava will refer the complaints to DPHE along with the minutes of the hearings. DPHE will provide an independent arbitrator or expert to conduct further hearings, after obtaining agreement from both sides that the decision would be binding.

Table 4.10: Composition of Grievance Redress Committee

Committee	Designation
Paurashava Mayor	Convener
Representative of DPHE	Member
Representative of a Local/National NGO	Member
Professor of a local College (Nominated by Principal)	Member
Headmaster of a local High and / or Primary School	Member
Imam of a local mosque / leader of other religion	Member
Representative of Business Community	Member
CEO/Secretary of the Paurashava	Member Secretary

Note: If the aggrieved person/complainant is a woman, the GRC convener will ask a female Union Parishad / Paurashava Member to participate in the hearing. If the complainant is an indigenous person, a member of his/her community will be asked to be present at the hearing.

4.5.7.4 Method for Estimation of Cost of EMP

198. Cost of implementing environmental management plan (EMP) including monitoring activities needs to be estimated as a part of the preparation of EMP. Many of the activities to be carried out as a part of EMP would not involve any additional direct cost e.g., employing local work force; keeping sub-project vehicles in good operating condition; scheduling deliveries of materials/ goods in off-peak hours; good housekeeping, avoiding spills; prohibiting use of fuel wood for heating bitumen; etc. On the other hand, a number of activities would require additional cost. Environmental monitoring during both construction and operational phases would involve direct cost. At the same time, a number mitigation measures (including health and safety measures) would also require additional cost; these include of installation of portable toilets, installation of health and safety signs, awareness documents (signs/ posters), water sprinkling on aggregates and unpaved surfaces, traffic control (e.g., deputing flagman), traffic light, plantation, and protective gear. Table 4.11 provides basis/ method of estimation of costs of different items of EMP. Similar approach should be followed for estimation of cost of additional measures, if required.

Table 4.11: Method/ basis of estimation of cost of EMP

Item	Basis of cost / Estimated cost
Monitoring:	
Air Quality (PM_{10} or $PM_{2.5}$)*	Prevailing rate (~ Tk. 15,000/- per measurement)
Noise level	Prevailing rate (~ Tk. 10,000/- per measurement per day)
Water quality (pH, BOD_5 or COD, Oil and grease	Prevailing rate (~ Tk. 20,000/- per sample)
Water quality (pH, BOD_5 or COD, NH_3, PO_4)	Prevailing rate (~ Tk. 12,000/- per sample)
Installation of sanitary latrine/ portable toilet	Prevailing rate/ Latest PWD/ DPHE/ LGED rates
Health/ safety signs (size and number to be estimated)	Prevailing PWD/ DPHE/ LGED rate / Lump sum amount
Water sprinkling on aggregate	Latest PWD/ DPHE/ LGED rate (if available)/ A fixed rater per cubic meter of aggregate per day
Traffic control (estimate number of flagman needed and duration of work)	Latest PWD/ DPHE/ LGED rate (if available)/ A fixed rate per flagman per day/ Lump sum amount
Protective gear	Contractor to quote rate of different items of works considering the provision of adequate protective gear for workers, in accordance to the conditions of contract, specified in the Tender Document
Plantation (including protection/ fencing and conservation during project period)	Prevailing rate (~ Tk. 1,500/- per plant)

* Depending on availability of facility for measurement

4.5.7.5 Institutional Arrangement for Implementation of EMP

199. For all sub-projects to be implemented under MWSSP, the Project Management Unit (PMU) of the DPHE will be responsible for overseeing overall environmental management including implementation of mitigation measures. During project preparatory stage, specific sub-projects to be implemented at a particular Paurashava will be identified by the DPHE-appointed Consultant and the Paurashava authority. The Consultant will also be responsible for carrying out feasibility study, detail design, and preparation of bid document. The activities will be verified by the PMU of DPHE. It is recommended that the PMU hire one "environmental specialist" for facilitating overall environmental management of the BMWSSP.

200. During project implementation stage, both DPHE and Paurashava will be responsible for overall environmental management, monitoring and supervision, while day to day monitoring and supervision of sub-projects will be carried out by TA Consulting Firm(s) appointed by the PMU of DPHE. DPHE will be primarily responsible for overall environmental and monitoring of some of the major sub-projects, such as water treatment plant (WTP), overhead tank, water transmission line, DEWATS, and FSTP; while Paurashava will be primarily responsible for monitoring of the remaining sub-projects, including drainage system, public toilet, solid waste management system. The activities of the TA Consulting Firm(s) will be supervised by the respective DPHE District Office and Paurashava. PMU will verify the quarterly progress and monitoring reports prepared for all sub-projects.

Figure 4.2 shows the overall institutional arrangement for overall management, including implementation of EMP, of BMWSSP.

Activity	Responsibility
(3) Identification of Sub-projects (4) For each sub-project, prepare/ complete: • Sub-project Description (Form-1) • Environmental Screening (Form-2)	Paurashava and DPHE-appointed Consultant
(3) Review of Sub-project documents, including Forms-1, 2 (4) Screening and assessment	PMU, DPHE (with support from "Environmental Specialist", TA Consultant)
If additional Environmental Assessment (EA) required	
Carry out environmental assessment (EA) of selected sub-projects (IEE/ EIA), following the EMF	PMU By Hired Consultant, to be supervised by "Environmental Specialist"
(3) Review of EA by DPHE (4) Obtaining necessary environmental clearance from the DoE and WB	PMU, DPHE (with support from "Environmental Specialist" and TA Consultant)
Implementation of EMP/ ECoP during sub-project "construction phase"	Implemented by the Contractor under the guidance of TA Consultant hired for supervision and monitoring; Supervised DPHE (through District Office) for major sub-projects; and by Paurashava for remaining sub-projects
Preparation of quarterly progress and monitoring reports	TA Consultant under the supervision of DPHE District Office (for major sub-projects) and Paurashava (for remaining projects)
Implementation of EMP during sub-project "operational phase", including monitoring and quarterly reporting	PMU, DPHE and Paurashava
Third Party Monitoring of the Environmental Management of sub-projects implemented	

Figure 4.2: Institutional set up for overall project management and implementation of EMP, including assignment of responsibility, for of BMWSSP

4.6 Environmental Code of Practice (ECoP)

201. The main objective of an Environmental Code of Practice (ECoP) is to manage construction operations in harmony with the environment in an effort to contribute to the well-being of the community and the environment by:

- Minimizing pollution
- Sustaining eco-systems
- Conserving cultural heritage
- Enhancing amenity

202. The ECoP is designed to be used during the construction of different types of urban infrastructure (e.g., WTP, FSTP, DEWATS, DTW) under the BMWSSP. The Code is also applicable to water supply and waste management systems where management of minor construction activities is addressed. The purpose of the Code of Practice is to ensure that construction activities are conducted in a manner that minimizes impacts on the environment. It promotes awareness and use of best practice in environmental management. ECoP is applicable to the construction sites and associated activities such as stockpile sites, disposal sites for clean excavated materials, etc. Responsibility lies with all the people involved in any given project to adopt environmentally responsible work practices. Best environmental management practice requires environmental awareness, and appreciation of one's environmental responsibilities. Measures taken to prevent environmental impacts are preferred to those designed to control the impact.

203. Different types of infrastructure development sub-projects will be implemented in different Paurashavas under the BMWSSP. The Environmental Code of Practice (ECoP) includes a list of activities associated with different types of infrastructure development considered in the BMWSSP. The ECoP outlines activities on different issues related to project implementation. The ECoP developed will address the following issues related to sub-project operation:

1. Planning and Design Phases of a Project
2. Site Preparation
3. Construction Camps
4. Borrow Areas
5. Topsoil Salvage, Storage, and Replacement
6. Slope Stability and Erosion Control
7. Waste Management
8. Water Bodies
9. Water Quality
10. Drainage
11. Public Health and Safety
12. Material Storage, Transport, and Handling
13. Vegetation Management
14. Natural Habitats

204. A particular sub-project within the BMWSSP may involve all or some of these issues. Table 4.12 outlines applicability of different ECoP activities for different sub-projects. Appendix F presents the ECoPs, along with methods of estimation of cost for each ECoP.

Table 4.12: Possible Application of Environmental Code of Practice (ECoP) relating to different types of Infrastructures

Different activities related to ECoP	**Sub-project Name**									
	DTW+P+E	WTP+RTW	CWT+WDN/E/R	OHT	PWO	LT+ST+SP	PT	FSM	DWWTP	SP
Project Planning and Design	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Site Preparation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Construction Camps	✓	✓	✓	✓	✓		✓	✓	✓	
Topsoil Salvage, Storage and Replacement		✓	✓					✓		
Slope Stability and Erosion Control		☑		☑	☑	☑		☑	☑	
Waste Management	✓	✓		☑	✓	✓	✓	✓	✓	
Water Bodies	✓	✓			✓	✓	✓	✓	✓	
Water Quality	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Drainage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Public Health and Safety	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Material Storage, Transport & Handling	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Tree Plantation		☑	✓		☑			☑	☑	
Natural Habitats	✓	✓	✓			✓	✓	✓	✓	

Legend: DTW+P+E = Deep Tubewell+Pump House+Electrical Works, WTP+RWT = Water Treatment Plant+Raw Water Transmission Line, CWT+WDN/E/R, OHT = Overhead Tank, PWO = Paurashava Water Office, LT+ST+SP = Latrine with Septic Tank and Soakage Pit, PT = Public Toilet, FSM = Fecal Sludge Management, DWTP = Decentralized Wastewater Treatment Plant, SP = Stand post; ✓= ECoP required; ☑ = ECoP may be required depending on the site condition.

4.7 Disclosure

205. Summary of the IEE/EIA report and impact mitigation measures will be translated into Bengali language and disseminated locally. Copies of the full report (in English) and the summary (in Bengali) will be sent to all the offices of the concerned Paurashavas and will be made available to the public. In accordance with the Bank's disclosure policy, the summary of the IEE/EIA report will also be uploaded in the website of Paurashavas/ DPHE and in the Bank InfoShop before appraisal. Any subsequent EMP will be discussed locally with the stakeholders and disseminated widely and made available on the project's portal and in the Bank InfoShop before awarding of civil works contract.

4.8 Occupational Health and Safety Guidelines

206. In general, the objectives of occupational health and safety (OHS) plan are: (a) To develop, in the workplace, a collaborative approach to managing Occupational health and Safety between management and workers; (b) To provide and maintain safe working procedures and operations; (c) To ensure awareness of all potential work related risks and hazards and to develop preventive strategies against these risks and hazard; (d) To provide appropriate training to all concerned to work safely and effectively; (e) To maintain a constant and continuing interest in the improvement of occupational health and safety performance and to provide the required resources necessary for the implementation and maintenance of the OHS plan.

207. For the sub-projects to be implemented under the MWSSP, the occupational health and safety primarily focuses on work equipment and protective gear. The following section provides guidelines/ directives for: (a) work equipment, (b) protective gear, and (c) safety and health signs.

4.8.1 Suggested Safety Directives for Work Equipment

208. It is employer's obligation that every possible measure is taken to ensure the safety of the work equipment made available to workers. During the selection of the work equipment the employer shall pay attention to the specific working conditions which exist at the workplace, especially in relation of safety and health of the workers. A brief list of work equipment safety issues is given below:

- Work equipment control devices which affect safety must be clearly visible and identifiable and appropriately marked where necessary.
- All work equipment must be fitted with a control to stop it completely and safely. Where appropriate and depending on the hazards the equipment presents and its normal stopping time, work equipment must be fitted with an emergency stop device.
- Work equipment presenting hazards due to emissions of gas, vapor, liquid or dust must be fitted with appropriate containment and/or extraction devices near the sources of the hazard.
- Where there is a risk of mechanical contact with moving parts of work equipment which could lead to accidents, those parts must be provided with guards or devices to prevent access to danger zones or to halt movements of dangerous parts before the danger zones are reached.

- Work equipment may be used only for operations and under conditions for which it is appropriate.
- Work equipment must bear the warnings and markings essential to ensure the safety of workers.
- All work equipment must be appropriate for protecting workers against the risk of the work equipment catching fire or overheating, or of discharges of gas, dust, liquid, vapor or other substances produced, used or stored in the work equipment.
- All work equipment must be appropriate for preventing the risk of explosion of the work equipment or of substances produced, used or stored in the work equipment.
- All work equipment must be appropriate for protecting exposed workers against the risk of direct or indirect contact with electricity.
- Mobile work equipment such as Bulldozer or Road Rollers with ride-on workers must be designed to restrict, under actual conditions of use, the risks arising from work equipment roll-over.
- Fork-lift trucks carrying one or more workers must be adapted or equipped to limit the risk of the fork-lift truck overturning.
- Self-propelled work equipment, such percussion drills, which may, when in motion, engender risks for persons must have facilities for unauthorized start-up.
- Machinery for lifting loads, such as Crane, must be clearly marked to indicate its nominal load, and must where appropriate be fitted with a load plate giving the nominal load for each configuration of the machinery.
- Work equipment must be erected or dismantled under safe conditions, in particular observing any instructions which may have been furnished by the manufacturer.

4.8.2 Safety Directives for Protective Gears

209. Personal protective equipment must be used when the risks cannot be avoided or sufficiently limited by technical means. All personal protective equipment must:

- be appropriate for the risks involved, without itself leading to any increased risk
- correspond to existing conditions at the workplace
- fit the wearer correctly after any necessary adjustment.

210. The Contractor must provide the appropriate equipment to the workers and must ensure that it is in good working order. The Contractor shall organize training and demonstrate the use of personal protective equipment. Workers shall be informed of all measures to be taken. Consultation and participation shall take place on the matters related to the use of these protective equipment. A partial list of protective gears to be worn by the workers at designated work areas is given below; Table 4.13 presents the list in tabular form.

Head Protection: Protective helmets must be worn at all times in hard-hat areas, such as the building and bridge construction sites, under scaffolds, erection and stripping of formworks, etc., where there are possibilities of head injuries from falling/flying objects.

Hearing Protection: Ear plugs or ear muffs or full acoustic helmets, whichever is appropriate, should be worn in areas where exposure to high noise level is expected. Examples of such activities include percussion drill, bolt driving, etc.

Eye and Face Protection: Spectacles, Goggles, Face Shield or Arc-welding Mask with Hand Masks, whichever is appropriate, should be worn at times when percussion drilling, spray painting, welding or similar activities are in progress at the field.

Respiratory Protection: In work areas such as septic tanks, dump sites, sewers etc., where exposure to harmful or toxic gases is likely the workers should wear gas masks, dust filters, or insulating appliances with air supply, whichever is appropriate.

Hand and Arm Protection: Gloves must be worn at all times when, machineries are used which involve piercing, cutting or vibration. For protection against toxic chemicals special chemical resistant gloves should be worn. Over sleeves must be worn to protect ones arms.

Foot Protection: In road and bridge constructions, working on or under scaffolds, roof works, formwork erection and dismantling safety shoes/boots are essential protective measures. When working with chemicals special chemical resistant shoes may be necessary. Electrical works require insulated and antistatic shoes/boots.

Trunk, Abdomen and Body Protection: Where heavy loads need to be lifted and/or physical force becomes necessary body belts are the appropriate protective measure. Safety aprons are essential when welding works are in progress or when handling chemicals. Body harness along with safety ropes and nets are required when working at higher elevation or where possibilities of accidental falls exist.

Table 4.13: Brief list of protective gears to be worn during the use of some equipment

Works/ Equipment Use	Safety Measures for Workers and/or Work Areas
Common Construction Works	HH, STB, HG
Earth-works	HH, STB, HG
Electric-works	RSB, HG
Wood-works	HH, STB, HG
Road Paving	HH, STB, HG, BP, FM
Cranes	HH, STB, HG, WB
Pile Driver	HH, STB, HG, EP, WB
Arc Welder	HH, WV, HG
Bull Dozer	HH, STB, WB
Heavy Roller	HH, STB, HG, WB
Concrete Mixer	HH, STB, HG, WB
Fork Lift	HH, HG, STB, WB
Percussion Drill	HH, STB, HG, WB, EG, EP, WB
Sledge/Pick Hammer	HH, STB, HG, WB
Vibrator	HH, STB, HG, WB
Vacuum Truck	HG, FM, BP, EG
Pick Axe	HH, STB, HG, WB
Electric Saw	HG, EG, EM
Working on Scaffolds	HH, STB, HG, WB

Note: HH = Hard Hat, STB = Steel-tipped Boot, HG = Hand Gloves, BH = Body Harness WB = Waist Belt, EM = Ear Muff, EP = Ear Plug, WV = Welding Visor, FM = Face Mask, BP = Body Protective Apron, RSB = Rubber Soled Boot, EG = Eye protection Glasses

4.8.3 *Safety and Health Signs*

211. Safety signs, health signs, prohibition sign, warning sign, mandatory sign, emergency escape sign, first-aid sign, information sign, signboard, supplementary signboard, safety color, symbol, pictogram, illuminated sign, acoustic signal, verbal communication and hand signal are essential tools for preventing accidents by providing information in advance.

212. The Contractor must provide or ensure that appropriate safety and/or health signs are in place at their work sites where hazards cannot be avoided or reduced. Workers and their representatives must be informed of all the measures taken concerning health and safety signs at work and must be given suitable instruction about these signs.

4.9 Environmental Management and Information System (EMIS)

213. An Environmental Management Information System (EMIS) may be established for the BMWSSP. The purpose of establishing the EMIS is to manage the data of the DPHE project and monitor the progress and impact. The EMIS will be a central repository for data on variety of environmental indicators relevant to EMF, IEE and EIA and related to the sub projects. At the same time, it will perform as a storehouse and knowledge management tool for the sector and facilitate more analytical evaluation on available data.

214. Key activities in establishing the EMIS are as below:

- Assessment of information need of the project, donor and the stakeholders;
- Designing of necessary databases and user-end software customized for different category of users;
- Installation and administration of databases, network system and users;
- Compilation of primary and secondary data relevant to the project and ensure regular updating of those;
- Design and implementation of data processing modules to generate reports and outputs as desired;
- Establishment of facilities for data storage, regular data backup and maintenance.
- Establish a mechanism for regular data flow, necessary for the project, from the sector stakeholders and information centers;
- Development and maintenance of website and other web applications for information collection and sharing;
- Procurement of necessary hardware and software for the EMIS.

Proposed outline of the EMIS

215. Data on different subprojects will be collected manually (as outlined in the EMP) at the field level and the local level supervisors (DPHE) will authorize the collected datasets for entry in the EMIS. The entry may be made at local level over internet or the data will be sent at the EMIS anchorage point (DPHE) for data entry. The entered data will be validated for further processing at the anchorage level. The validated data will be automatically processed by the EMIS and different reports and outputs will be generated for use. The authorized user can use the data, reports or generate customs report according to their credentials. The reports and data may also be made available in the web for use by third

party users and other stakeholders. A diagram of the systems architecture is depicted in Figure 4.3.

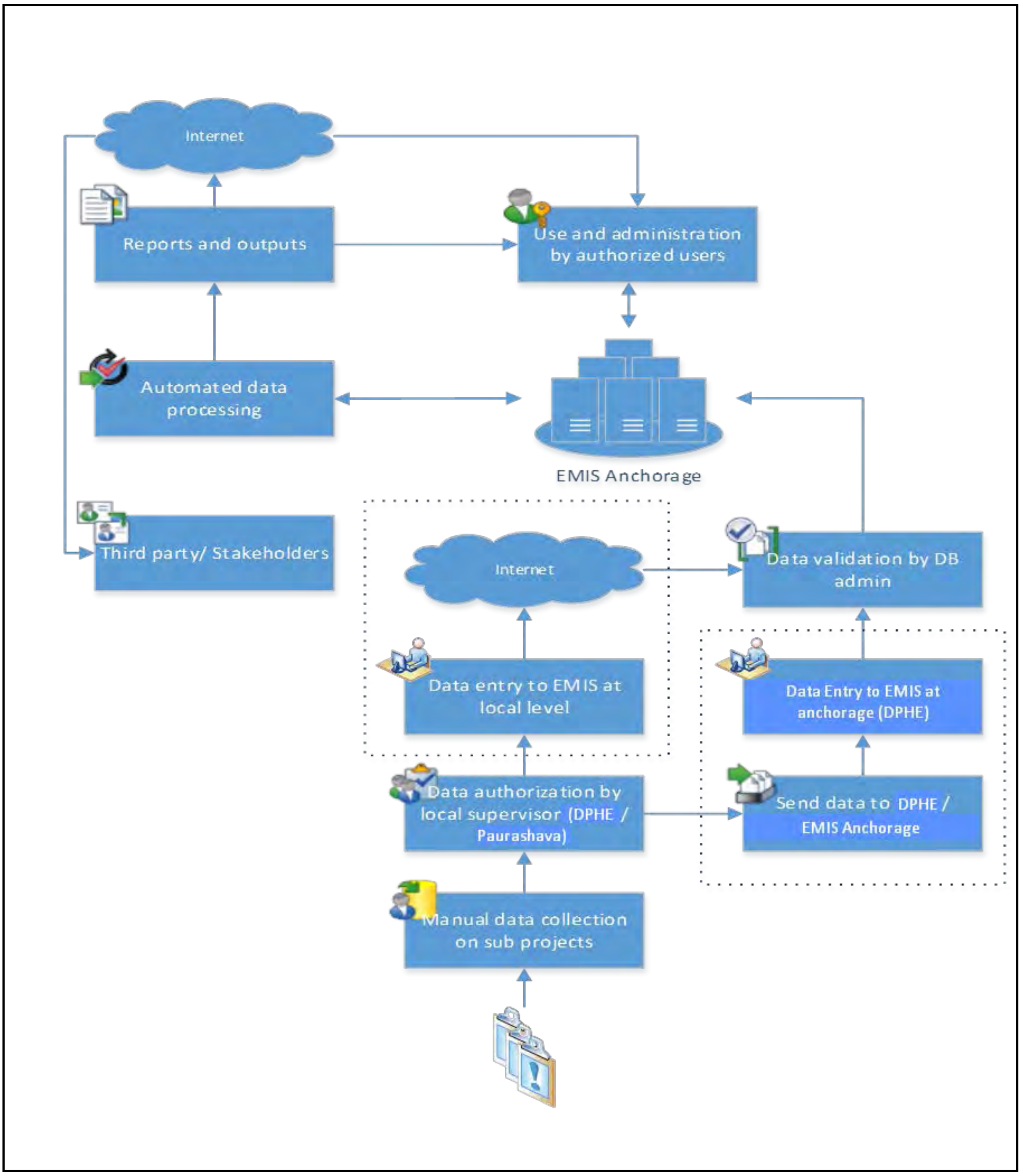

Figure 4.3: Proposed system architecture of the EMIS

4.10 Special Environmental Clauses (SECs) for Tender Document

216. Apart from the provisions under "General Specification" and "Particular Specification" for different sub-project components, the following special environmental clauses (SECs) shall be included in the Tender Document under General/Particular

Specification. These clauses are aimed at ensuring that the Contractor carries out his responsibility of implementing the EMP and other environmental and safety measures.

Environmental Management Plan (EMP):
217. The Contractor shall carry out all mitigation and enhancement measures (including those related to mitigation of air/noise/water pollution; drainage/traffic congestion) as specified in the Environmental Management Plan (EMP), annexed to this Contract.

Temporary Works:
218. The Contractor shall make sure that all equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run away, barricade, chute, lift, etc. are substantially constructed and erected, so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them.

Health and Safety:
219. The Contractor shall observe and maintain standards of Health and Safety towards all of his employees not less than those laid down by the national standards or statutory regulations.

220. Where appropriate, to prevent workers falling from heights, the Contractor shall make sure that every temporary floor openings shall either have railing of at least 900 mm height or shall be constantly attended; every floor hole shall be guarded by either a railing or a hinged cover, or constantly attended; every stairway floor opening shall be guarded by railing at least 900 mm high on the exposed sides; every ladder way floor opening or platform shall be guarded by a guard railing; every open sided floor or platform 1.2 m or more above adjacent ground level shall be guarded by a railing on all open sides.

221. The Contractor shall provide all appropriate protective clothing and equipment for the work to be done and ensure its proper use. Where required, safety nets, belts, harnesses and lines shall be provided by the contractor. The "safety directives for work equipment" and "safety directives for protective gears", as specified in the Occupational Health and Safety Guidelines (attached) shall be followed.

222. The Contractor shall provide and maintain in prominent and well-marked positions all necessary first-aid equipment, medical supplies and other related facilities. A sufficient number of trained personnel will be required to be available at all times to render first aid.

223. The Contractor must provide or ensure that appropriate safety and/or health signs are in place at their work sites where hazards cannot be avoided or reduced.

224. The Contractor shall report to the Engineer promptly and in writing particulars of any accident or unusual or unforeseen occurrences on the site, whether these are likely to affect progress of the work or not.

Disposal and Pollution:

225. The Contractor shall not dispose any waste, rubbish or offensive matter in any place not approved by the Engineer or Statutory Authority having jurisdiction. The Contractor shall not discharge into any watercourse oil, solids, noxious or floating materials.

226. The Contractor shall take all reasonable precautions to keep public or private roads clean of any spillage or droppings from his vehicles or equipment. Any spillage or droppings which accrue shall be cleaned without delay to the satisfaction of the Engineer.

227. The Contractor shall construct sanitary latrine or septic tank system or install portable cabin toilet for disposal of human waste in the site office and temporary labor sheds for workers/ employees; the Contractor shall provide waste bins/ cans for collection of solid waste at appropriate locations (as directed by the Engineer), and ensure proper transfer/ disposal of solid waste with support from the local government authority (Paurashava or City Corporation).

Earthworks:

228. During excavation of trenches in natural soils, the Contractor shall make sure that the first 300 mm to 450 mm of topsoil be excavated and stored on one side of the trench and the rest of the excavated soil is stored separately/ on the other side; during back filling of trench, the topsoil should be placed on the top again.

4.11 Institutional Arrangement

229. Under the BMWSSP, DPHE will implement different types of sub-projects (primarily in the area of water supply and sanitation/septage management) in about 30 Paurashavas. Figure 4.4 shows the institutional set up, including major activities and assignment of responsibility for their execution, for implementation of MWSSP by DPHE.

230. According to the EMF, the Paurashavas and DPHE-appointed Consultant are responsible for the identification of sub-projects, and preparation of relevant sub-project documents (including feasibility study and detail design). For the purpose of environmental assessment of the sub-projects, the Paurashava and the Consultant will:

(1) Prepare Sub-project description by filling "Form 1: Sub-project Description" (see Appendix A-1)
(2) Carry out environmental screening of the sub-project by filling "Form 2: Environmental Screening" (see Appendix A-2)

231. The sub-project description, and "environmental screening" prepared by the Paurashava and Consultant will be forwarded to the PMU of DPHE for review. At DPHE, the Project Management Unit (PMU) will be responsible for overall management of all sub-projects. It is recommended that the PMU hire one "environmental specialist" for facilitating overall environmental management of the BMWSSP. The PMU, with support from the "environmental specialist" will review of the documents (project description and environmental screening) and based on the review the PMU will determine the need for further environmental assessment (i.e., IEE/ EIA).

232. If further environmental assessment (EA) is necessary, the PMU of DPHE will employ a Consultant for carrying out the EA following the EMF presented in this report; the

“environmental specialist” of PMU will supervise this work. After completion of the EA, PMU of DPHE will be responsible for getting necessary clearance from the DoE and the WB.

233. The PMU of the DPHE will be responsible for implementing the EMP and ECoP of a sub-project by the respective contractor with support from TA Consultant, appointed by PMU of DPHE.

234. During implementation of all sub-projects, the DPHE and Paurashava, with support from the Technical Assistance (TA) consulting firm, will be responsible to monitor and make sure that the environmental mitigation/ enhancement measures (including health and safety measures) outlined in the EMP for the particular sub-project are implemented in accordance to the provisions of the Tender Document. DPHE will be primarily responsible for monitoring of some of the major sub-projects, such as water treatment plant (WTP), overhead tank, water transmission line, DEWATS, and FSTP; while Paurashava will be primarily responsible for monitoring of the remaining sub-projects, including drainage system, public toilet, solid waste management system.

235. A “third party” for monitoring of overall environmental management of BMWSSP will be appointed by the DPHE. The ToR for third party monitoring is presented in Appendix G. Figure 4.3 shows the institutional set up for implementation of the BMWSSP.

4.12 Third Party Monitoring

236. In order to ensure proper environmental management of BMWSSP, a third party consulting firm (to be hired by PMU, DPHE) will be given the responsibility to independently monitor the overall performance of environmental management of BMWSSP, including compliance with relevant GoB and WB regulations and the provision of the environmental management framework (EMF) developed for the project. **Appendix G** presents a ToR for a third party consulting firm to independently monitor the overall performance of environmental management of BMWSSP. As a part of the monitoring, the consulting firm will prepare a comparison of monitoring outcomes of same/similar sub-projects carried out in different Paurashavas, so that lessons learned and best practices could be replicated.

Activity	Responsibility
(5) Identification of Sub-projects (6) For each sub-project, prepare/ complete: • Sub-project Description (Form-1) • Environmental Screening (Form-2)	Paurashava and DPHE-appointed Consultant
(5) Review of Sub-project documents, including Forms-1, 2 (6) Screening and assessment	PMU, DPHE (with support from “Environmental Specialist”, TA Consultant)
If additional Environmental Assessment (EA) required	
Carry out environmental assessment (EA) of selected sub-projects (IEE/ EIA), following the EMF	PMU By Hired Consultant, to be supervised by “Environmental Specialist”
(5) Review of EA by DPHE (6) Obtaining necessary environmental clearance from the DoE and WB	PMU, DPHE (with support from “Environmental Specialist” and TA Consultant)
Implementation of EMP/ ECoP during sub-project “construction phase”	Implemented by the Contractor under the guidance of TA Consultant hired for supervision and monitoring; Supervised by DPHE (through District Office) for major sub-projects; and by Paurashava for remaining sub-projects
Preparation of quarterly progress and monitoring reports	TA Consultant under the supervision of DPHE District Office (for major sub-projects) and Paurashava (for remaining projects)
Implementation of EMP during sub-project “operational phase”, including monitoring and quarterly reporting	PMU, DPHE and Paurashava
Third Party Monitoring of the Environmental Management of sub-projects implemented	

Figure 4.4: Institutional set up, including major activities and assignment of responsibility for their execution, for implementation of BMWSSP by the DPHE

4.13 Training Requirements

237. As a part of the "overall environmental assessment", existing environmental practices in recently completed and ongoing projects and capacities of the organizations concerned (i.e., Paurashavas, DPHE) have been evaluated through analysis of organizational set up and interviewing officials/ engineers. Details of the evaluation are presented under "Overall Environmental Assessment". It appears that the engineers at the Paurashavas have limited or no exposure to environmental assessment and management. For the BMWSSP, at each Paurashava, the senior Paurashava engineer will act as the environmental focal point. As discussed above, the Paurashavas and DPHE-appointment Consultant will be responsible for preparation of "project description" and carrying out "environmental screening", and guidelines have been provided in the EMF for carrying out these activities. However, basic training on regulatory requirements, environmental impacts, and environmental assessment and management would greatly improve the capability of the Paurashavas in carrying out their responsibilities under the BMWSSP.

238. The DPHE has considerable experience in environmental management of a wide range of projects. As noted earlier, most of the works to be carried out under the BMWSSP will be supported by the hired consultant. However, the overall responsibility of environmental management lies with DPHE. For this purpose, it is important that the DPHE engineers receive advanced training on environmental management and monitoring. Such training will assist them in properly overseeing the activities of the consultant engaged in environmental management of the BMWSSP, following the EMF.

239. Trainings needed for enhancing capacity of relevant DPHE and Paurashava official/staff in environmental management could be divided into three categories: (a) Basic training; (b) Training on EMF; and (c) Advanced training. The "basic training" would focus on general environmental awareness, regulatory requirement, and basic environmental practices; the basic trainings should be carried out at the outset of the project. In order to ensure proper environmental management of BMWSSP and implementation of EMP (as outlined in the EMF), it is important to organize training/orientation on the EMF of BMWSSP for DPHE and Paurashava staff/official would be directly involved in project implementation. In addition, "advanced training" will be needed in the area of environmental management, monitoring and reporting. Table 4.14 summarizes the training requirements for Paurashavas and DPHE staff/officials.

240. From logistic point of view, the trainings should be organized on a regional basis, with maximum number of participant in each training event limited to about 20. At least two participants from each Paurashava should participate in "basic training" and "training on EMF"; at least one participant from each Paurashava should participate in the "advanced training" on environmental management and monitoring. From DHPE end, officials/staff from PMU as well as from relevant District offices (who would be involved in management/ monitoring of project works) should participate in the trainings. Resource persons for trainings would include individual consultants, experts from academia and DoE, and senior staff from DPHE having experience in environmental management; senior staff from other Government Organization, such as LGED, with considerable experience in environmental management of major projects could also be invited as resource person in the trainings. The

"environmental specialist" of the PMU should be responsible for organizing the trainings in consultation with PMU and Paurashava authority.

Table 4.14: Training requirements for successful environmental management of BMWSSP

Training Type/ Contents	Participants	Schedule
Basic Training: General environmental awareness, regulatory requirements, basic environmental practices.	DPHE: Staff from PMU, Relevant District Offices; Paurashava: At least two participants from each Paurashava)	Prior to commencement of sub-project activities
Training on EMF: EMF frameworks for BMWSSP, environmental impacts and mitigation, analysis of alternatives, grievance redress issues, as outlined in the EMF.	DPHE: Staff from PMU, Relevant District Offices; Paurashava: At least two participants from each Paurashava)	Immediately after project commencement
Advanced Training: Environmental management (EMP, ECoP), monitoring, reporting	DPHE: Staff from PMU, and relevant District Offices who would be involved in project management and monitoring; Paurashava: At least one participant from each Paurashava, who would be responsible for project monitoring.	After project commencement

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APPENDIX - A1: FORM 1: SUB-PROJECT DESCRIPTION

Name of Paurashava :
Name of Sub-project :
Brief description of Sub-project :

FORM 1: SUB-PROJECT BASIC INFORMATION

PARTICULARS SUB-PROJECT COMPONENTS:

Water Supply Infrastructure		
Production well (DTW) with pump house and electrical works	☐ Yes	☐ No
If yes, the depth of the tubewell: capacity of the pump and generator: capacity of the tubewell (MLD): Area of the pumphouse: *(attach borelog and tubewell design drawing, if available)*		
Water treatment plant (WTP), including raw water transmission line	☐ Yes	☐ No
If yes, surface water or groundwater treatment: Capacity of the treatment plant (MLD): Treatment provisions: (Arsenic/Iron/Settling/Filtration/Disinfection) If surface water source, name of the river: If surface water source, type of intake structure: Length and diameter of raw water transmission pipe: *(attach layout drawings of WTP, if available)*		
Clear water transmission line; Water distribution network (including expansion and rehabilitation of existing network) If yes, length of new transmission/distribution line: length of rehabilitated transmission/distribution line: Are there any gas lines, electricity lines or any other cables along the proposed layout of the distribution line:	☐ Yes	☐ No
Overhead tank	☐ Yes	☐ No
If yes, capacity of the tank:		
Stand post	☐ Yes	☐ No
If yes, number of stand posts:		
Paurashava water office	☐ Yes	☐ No
If yes, the land area of the office: (attach layout drawing, if available)		

Sanitation and Septage (Fecal Sludge Management)		
Latrine with septic tank and soakage pit	☐ Yes	☐ No
If yes, number of latrines:		
Public toilet	☐ Yes	☐ No
If yes, number of latrines:		
Fecal sludge treatment plant (FSTP, including procurement of vacuum tanker)	☐ Yes	☐ No
If yes, number of vacuum tankers: Location of FSTP: (FSTP, attach layout drawing of the treatment plant, if available)		
Solid waste management system (including procurement dump truck, etc.)	☐ Yes	☐ No
If yes, number of dump trucks: Location of solid waste disposal site: Method of solid waste processing and treatment:		
Decentralized wastewater treatment system (DEWATS)	☐ Yes	☐ No
If yes, capacity of the treatment plant: type of treatment employed: location of the treatment plant:		
Drainage System If yes, length of drains (km): Type (pipe, open drain)	☐ Yes	☐ No

IMPORTANT ENVIRONMENTAL FEATURES (IEF) WITHIN THE INFLUENCE AREA PROJECT SUB-COMPONENTS:
(ex. Archaeological sites, protected areas, religious institutes, national parks etc.) (Please collect GPS location of the IEFs)

Water Supply Infrastructure		
Production well (DTW) with pump house and electrical works	☐ Yes	☐ No
If yes, names, GPS Coordinates and distance from the facility:		
Water treatment plant (WTP), including raw water transmission line	☐ Yes	☐ No
If yes, names, GPS Coordinates and distance from the facility:		
Clear water transmission line; Water distribution network (including expansion and rehabilitation of existing network) If yes, names, GPS Coordinates and distance from the pipeline:	☐ Yes	☐ No
Overhead tank	☐ Yes	☐ No
If yes, names, GPS Coordinates and distance from the facility:		
Paurashava water office	☐ Yes	☐ No

If yes, names, GPS Coordinates and distance from the facility:		
Sanitation and Septage (Fecal Sludge Management)		
Latrine with septic tank and soakage pit	☐ Yes	☐ No
If yes, names, GPS Coordinates and distance from the facility:		
Public toilet	☐ Yes	☐ No
If yes, names, GPS Coordinates and distance from the facility::		
Fecal sludge treatment plant (FSTP)	☐ Yes	☐ No
If yes, names, GPS Coordinates and distance from the facility:		
Solid waste management system (SWM)	☐ Yes	☐ No
If yes, names, GPS Coordinates and distance proposed disposal site:		
Decentralized wastewater treatment system (DEWATS)	☐ Yes	☐ No
If yes, names, GPS Coordinates and distance from the facility:		
Drainage System	☐ Yes	☐ No
If yes, names, GPS Coordinates and distance from the drains:		

LAND OWNERSHIP AND PERMISSIONS :

(a) Will land acquisition be required for any part of the sub-project components?

☐ Yes ☐ No

(b) Names of the govt. agencies owning the land :

(c) Area of land to be acquired (acre) :

(attach a copy of the agency's permission to use their land, if available)

LOCATION OF THE SUB-PROJECT:

(attach mouza map and location map)

LAY-OUT OF THE SUB-PROJECT:

(attach a layout map)

ESTIMATED COST OF SUB-PROJECT : (BDT)

SCHEDULE OF IMPLEMENTATION :

(a) Sub-project duration (months) :

(b) Tentative start date :

(c) Tentative completion date :

Prepared by: (Name, designation, mobile number, signature, date)

Reviewed by: (Name, designation, mobile number, signature, date)

APPENDIX - A2: FORM 2: ENVIRONMENTAL SCREENING

Name of Paurashava :
Name of Sub-project :
Brief description of Sub-project :

FORM 2: ENVIRONMENTAL SCREENING CHECKLIST

SCREENING INFORMATION

Sl	Screening Questions	Yes	No	Not Aware	Remarks/ Possible Negative Impact and assessment (S/M/I/N)*
(a) Project Siting					
	Cultural heritage site				
	Protected Area (Forest)				
	Wetland (Beel, Haor)				
	National Park				
	Wildlife sanctuary				
	Buffer zone of protected area				
	Special area for protecting biodiversity				
(b) Environmental conditions:					
	Is the construction being carried out in an ecologically sensitive area?				
	Will there be loss in agricultural land?				
	Is there a possibility of loss of natural floral or faunal habitats?				
	Will there be negative effects on rare (vulnerable), threatened or endangered species of flora or fauna?				
	Will the project affect fish sanctuary (in case of SWTPs)?				
	Will the project be carried out in a groundwater depleted zone (in case of deep tubewells)?				
	Will there be negative effects on designated wetlands?				
	Is there water logging in the municipality?				
	Will the construction activities hinder natural storm water drainage?				
	Will there be a loss of existing means of livelihood?				
	Will there be negative impacts on wildlife habitat, corridor of movement?				
	Is GW contaminated with Arsenic?				
	Is GW contaminated with Manganese?				
	Does GW have high Iron?				
	Is GW or SW affected by salinity in the municipality?				

Sl	Screening Questions	Yes	No	Not Aware	Remarks/ Possible Negative Impact and assessment (S/M/I/N)*
(c) Potential Environmental impacts during construction:					
	Will dust and vibration-generating equipment be used?				*(mention what kind of equipment be used)*
	Will the excavation/ trenching works and movement of vehicles generate air pollution?				
	Will there be noise pollution during the operation?				
	Will fuel and/or hazardous goods be used in construction activities?				
	Will fuel and/or hazardous substances be stored at the construction site?				
	Is there a possibility of discharging liquid effluent from the construction site?				
	Will construction materials be stockpiled near surface waters, and natural water courses?				
	Will construction activities affect the natural drainage pattern of the site (e.g. filling up low-lying land)?				
	Is earthwork (earth excavation, backfilling, stockpiling of excavated soil) involved in construction activities?				
	Is there a possibility of water stagnation at the construction site?				
	Will the construction involve blocking of narrow roads (e.g. pipeline laying)?				
	Will any archaeological and historical structures be affected?				
	Will any structure(s)/ entity(s) (e.g., shops) be temporarily affected during sub-project activity?				
	Will any squatter(s) be temporarily displaced during sub-project activity?				
	Will any mobile vendor(s) be affected potentially?				
(d) Environmental and Social Risks					
	Is significant movement of vehicles involved during construction activities?				
	Will child and pregnant women be used in construction activities?				
	Is there a safe source of drinking water and adequate sanitation facilities available for the workers at or near the construction site?				

Sl	Screening Questions	Yes	No	Not Aware	Remarks/ Possible Negative Impact and assessment (S/M/I/N)*
	Is there a risk to safety and human health to people other than workers?				
	Will the sub-project affect the way of life adversely and restrict access to common property resources of any indigenous people?				
(e) Potential Operational Risks					
	Is there enough capacity in the municipality to monitor water supply and sanitation infrastructure?				
	Is there a facility to regularly monitor routine drinking water quality parameters in treated water?				
	Is there sufficient maintenance staff in the municipality to monitor the operation of water supply and sanitation infrastructure?				
	Is there a risk for lowering of groundwater level to a point that the tubewell becomes inoperable?				
	Will there be any negative effect on neighborhood or community character?				
	Will there be any negative effect on business, institutions and public facilities?				

Note: S = Significant; M = Moderate; I = Insignificant; and N = None

CATEGORY OF SUB-PROJECT :

Sub-Project Type	Project Category, according to ECR 1997 (Red/Orange-A/Orange--B/Green)	Suggested Project Category
Water Supply Infrastructure		
Production well (DTW) with pump house and electrical works		
Water treatment plant (WTP), including raw water transmission line		
Clear water transmission line; Water distribution network (including expansion and rehabilitation of existing network)		
Overhead tank		
Paurashava water office		
Sanitation and Septage (Fecal Sludge Management)		
Latrine with septic tank and soakage pit		
Public toilet		
Fecal sludge treatment plant (including procurement of vacuum tanker)		
Solid waste management (SWM) system		
Decentralized wastewater treatment system		
Drainage System		

Prepared by: (Name, designation, mobile number, signature, date)

Reviewed by: (Name, designation, mobile number, signature, date)

APPENDIX B: CRITERIA FOR ASSESSMENT OF ECOLOGICAL IMPACTS

Table B-1: Categories and definition of "Consequence" levels for ecological impacts

Category	Ranking	Definition
Critical	5	• Very serious environmental effects with impairment of ecosystem function. • Long-term, widespread effects on significant environment (e.g. habitat, national park) • Habitat restitution time >100 years and requiring extreme substantial intervention.
Major	4	• Serious environmental effects with some impairment of ecosystem function (e.g. displacement of species). • Relative widespread medium–long term impacts. • Habitat restitution time >10 years and requiring substantial intervention. • Potential for continuous non-compliance with environmental regulations
Moderate	3	• Moderate effects on biological environment but not affecting ecosystem function. • Moderate short-medium term widespread impacts • Habitat restitution time 1-5 years (possible limited and local areas up to 10 years) with potential for full recovery and limited or no intervention required. • Potential for short to medium term noncompliance with environmental regulations and/or company policy.
Minor	2	• Minor effects on biological environment. • Minor short-medium term damage to small area of limited significant • Full recovery in < 1 year without intervention required. • Any potential non-compliance with environmental regulations and/or company policy would be minor and short-term.
Low	1	• No lasting effect. • Low-level impacts on biological environment. • Limited damage to minimal area of low significant. • Compliance with environmental regulations and/or company policy at all times. • Possible beneficial effect or ecosystem improvement.
None	0	• No impact on ecosystem damage. • No compliance required for environmental regulations and/or company policy at all times. • Possible beneficial effect or ecosystem improvement.
Limited Positive	+	• Some beneficial improvement to ecosystem. • Benefits to specific flora and / or fauna.
Modest Positive	++	• Moderate beneficial improvement to ecosystem. • Medium benefits to specific flora and / or fauna.
Significant Positive	+++	• Major beneficial improvement to ecosystem. • Large scale benefits to specific flora and / fauna.

Table B-2: "Likelihood of occurrence" and corresponding rankings

Impact Likelihood	Ranking	Definition
Almost Certain (80 – 100%)	5	The activity will occur under normal operating conditions.
Very Likely (60 - 80%)	4	The activity is very likely to occur under normal operational conditions.
Likely (40 - 60%)	3	The activity is likely to occur at some time under normal operating conditions.
Unlikely (20 - 40%	2	The activity is unlikely to occur, but may occur at some time under normal operating conditions.
Very Unlikely (0 - 20%)	1	The activity is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances.

Example: A WTP with raw water transmission line will be constructed near a tree planted area. The construction activity is unlikely casue damage of adjacent biological environment and the result will be Low-level impacts.

For this scenario, Consequence is Low with ranking 1 (Table B-1) and the Likelihood of occurrence is Unlikely with ranking 2 (Table B-2), the "Significance" of ecological impact of this sub-project activity will be as follows:

Significance = Consequence × Likelihood
Significance = 1 × 2= 2

So, the Significance Level is Low (Table 4.4) and the Risk is Low (Table 4.5)

Table B-3: Example of estimating ecological impacts of typical sub-project activities

Potential Impacts Source / Project Activities	Impact	Ecological Receptor Type	Description	Likelihood	Consequence	Risk Rating
Material storage or placement	Habitat destruction of terrestrial flora (herb, shrub) and borrowing fauna; and disturbance in movement of terrestrial fauna (amphibia, reptile and mammal)	Flora and Fauna	• Direct, Negative • Short term, Local • Reversible	Likely	Low	Low
Vehicle movement	Impairment of terrestrial flora (herb and shrub), terrestrial fauna (amphibia, reptile & mammal)	Flora and Fauna	• Direct, Negative • Short term, Local • Reversible	Likely	Low	Low
Soil excavation	Habitat destruction of aquatic flora (herb, shrub) and movement disturbance / habitat destruction of terrestrial (burrow) fauna (amphibia, reptile, bird and mammal)	Flora and Fauna	• Direct, Negative • Short term, Local • Reversible	Unlikely	Minor	Low
Noise disturbance	Disturbance of terrestrial faunal livelihood (movement, foraging, breeding) (amphibia, reptile, bird and mammal)	Fauna	• Direct, Negative • Short term, Local • Reversible	Unlikely	Minor	Low
Exhaust from generators	Disturbance in movement of terrestrial fauna (e.g. aves)	Fauna	• Direct, Negative • Short term, Local • Reversible	Unlikely	Minor	Low

APPENDIX C: GUIDELINE FOR ARCHAEOLOGICAL IMPACT ASSESSMENT

Bangladesh has long cultural history right from 3rd century BC onwards. Enormous major and minor historical records are scattered in different parts of the country. The features of these antiquities have separated values and identities. During implementation of large-scale infrastructural development work/s an archaeologist needs to be present to rescue or recover any cultural resources present at the site.

To reduce the possibility of damaging archaeological objects, in case they are found while undertaking excavation works for different types of constructions, an authorized archaeological unit or at least an archaeologist should be asked to monitor the site periodically. The archaeologist, according to the Rules and Regulation of the Government of Bangladesh will study, make inventory and record it for the future.

Tasks:

(i) Conduct archaeological impact assessment for development programs at ULBs.
(ii) Execute sampling excavation and assess the significance of the materials found, propose mitigation measures to safeguard buried archaeology or erected/surface remains and suggest future research activity.
(iii) Assess risks to these archaeological materials by the proposed infrastructure and suggest changes to the infrastructural works.
(iv) Identify suitable mitigation measures and prepare environmental management plan.

Investigation

Archaeological impact assessment in the project area and its vicinity to identify impacted sites/remains in relation to the infrastructural work proposed. A team of experts need to conduct an extensive study and survey at the sub-project areas. The objective of this survey will also be to develop proposal of appropriate mitigation measures to be undertaken to safeguard the buried or surface archaeology. The other objective is to suggest for changes, if any, to the proposed infrastructure works which could better assure the safeguarding of archaeological materials of cultural and historical significance and also suggest for future archaeological research and excavation of the buried archaeology.

The team can adopt three different methods for this purpose.

a. Examination of available cartographic and other photographic records.
b. Review of available literature, reports of archaeological researches and explorations conducted at the Pourashava/ CC and surrounding areas.
c. Combing the city block by block or lane by lane through site inspection to unveil the historical facts.
d. On-site interaction with local people and to investigate clues if any in their traditions and legends.

APPENDIX D: IMPACT SCREENING AND ASSESSMENT GUIDELINE FOR PHYSICAL CULTURAL RESOURCES (PCR)

(Ref: Physical Cultural Resources Safeguard Policy Guidebook, World Bank, 2009)

As stated in the World Bank PCR Safeguard Policy Guidebook, The PCR policy applies to projects having any one or more of the following three features:

(i) Projects involving significant excavations, demolition, movement of earth, flooding or other major environmental changes

(ii) Projects located within or in the vicinity of a recognized PCR conservation area or heritage site

(iii) Projects designed to support the management or conservation of PCR

The sub-projects under the BMWSSP will involve significant excavation works, movement of earth and temporary flooding. The Paurashavas and City Corporations have religious institutions (mosques, temples, Buddhist temples), few sites of archaeological importance, public libraries, cinema halls, community centers, which can be considered PCRs. However, the sub-project area of influence may or may not intersect these regions (since the sub-projects are generic in nature, actual locations of most of them still undetermined). Therefore a generic impact assessment of Physical Cultural Resources is outlined in this section.

Guidance on identification of PCR

In the context of BMWSSP, the probable examples of PCR may be the following:

1. Human made: Religious buildings such as temples, mosques, churches, exemplary indigenous or vernacular architecture Buildings, or the remains of buildings of architectural or historic interest, Historic or architecturally important townscapes Archaeological sites (unknown or known, excavated or unexcavated), Commemorative monuments
2. Natural: historic trees, natural landscapes of outstanding aesthetic quality
3. Combined man-made or natural: Sites used for religious or social functions such as weddings, funerals, or other traditional community activities (community centres), burial grounds, family graves, cultural landscapes
4. Movable: registered or unregistered artifacts in temples or mosques, paintings, statues of important historical figures, religious artifacts, cultural artifacts etc.

Assessment of probable impacts due to activities:

Below is a list of project activities or features under the context of BMWSSP which may commonly give rise to negative impacts on PCR, divided into two periods: construction phase and operational phase.

Construction phase:

1. Establishment of work camps:
   - Vandalism, theft and illegal export of movable PCR, and of pieces of monumental PCR accessible directly or indirectly to migrant laborers,
   - Desecration of sacred sites.

2. Excavation, construction and soil compaction:
   - Direct physical damage to natural, manmade and buried PCR on site

3. Construction traffic:
   - Vibration, soil, air and water pollution causing damage to natural or manmade PCR on site.
   - Noise pollution can interfere with the use and enjoyment of PCR such as tourist destinations, historic buildings, religious establishments and cemeteries.

4. Mobilization of heavy construction equipment:

- Damage to natural or manmade PCR on site
- Soil compaction, damaging buried PCR (archaeological) onsite, and damaging pipelines and drains serving built PCR in the vicinity.

5. Flooding and Inundation:
   - Submergence or destruction of human-made, natural or buried PCR.
   - Barrier to access of all types of PCR.
   - Raised water table can lead to damage to all types of PCR.
   - Damage to aesthetics of scenic landscapes.

6. Waste disposal or landfill:
   - Burial or damage to natural, buried or underwater PCR.

Operation phase:

1. New and upgraded Roads:
   - Increased human traffic enjoying improved access to PCR of public interest leading to increased wear and damage, sacrilege of sacred sites, theft and vandalism of movable and, breakable PCR.
   - New highways cutting off access to living-culture PCR by residents of settlements on other side of the highway.
   - Increased air pollution and vibration from traffic causing damage to man-made PCR, particularly monuments and buildings.
   - Increased noise pollution interfering with enjoyment of people in tourist destinations, historic buildings, religious establishments and cemeteries.
   - In scenic areas, obtrusive highways having a negative visual impact on the landscape.
   - Roads and bridges which themselves constitute PCR being damaged by increased traffic.
   - Positive impacts may also occur, through the discovery of hitherto unknown sites and artifacts and generation of tourism.

2. Induced development:
   - Induced development leading to increased wear and damage, sacrilege of sacred sites, theft and vandalism of movable and breakable PCR, and damage to the aesthetics of scenic landscapes and townscapes.

3. Urban development:
   - Changes in demography or settlement patterns leading to decay of inner cities and abandonment and neglect of older residential areas containing built PCR such as vernacular architecture.
   - Developments which are out-of-character with their surroundings diminishing the aesthetic value of the townscape, decline in property values and ultimately, neglect of built PCR in the area.
   - Damage to the aesthetics of scenic landscapes and townscapes.

Guidelines for ToR for the PCR component:

In case of a sub-project which is not expected to have any impacts on PCR, it may be sufficient to include procedures for chance finds (Appendix H). In case of Category "B" project where there may be a likely impact on PCR due to activities carried out under any of the sub-projects, the ToR may be tailor-made to the specific requirements. The ToR is expected to include potential major PCR issues, the likely impacts on PCR, the PCR impact areas, which will set boundaries for collecting the PCR baseline data along with any specialized PCR knowledge or skills required. In projects such as the BMWSSP, since the subproject locations are not yet determined, it will not be possible at this stage to identify the PCR impact areas and the type of PCR data that should be collected. In such cases, the ToR should require the EA team to establish these parameters at the beginning of the assignment, and propose provisions for identifying and managing PCR during project implementation. The EA report for the corresponding sub-projects should be modified accordingly to incorporate the issues related to PCR in those cases. The investigations and findings with respect to PCR should form an integrated part of the EA report since OP 4.11 does not call for a separate report. Therefore the ToR for consultants for the generic EA assessment of sub-projects would still be valid with a few additional assignments on behalf of the consultants with respect to PCR:

- Regulatory environment: (Identification of any regulations and guidelines which will govern the conduct of the assessment) This section should also list any relevant national acts or regulations pertaining to the safeguarding of PCR
- Background information: (description of the physico-chemical, ecological and socioeconomic environment) All registered and unregistered, movable or immovable PCRs in the sub-project areas need to be identified in this part preferably using visual identification, consulting with local people. The report should have descriptions and visual illustrations of the PCRs.
- Impact assessment: (the consultant will identify the likely biophysical and social impacts in sufficient detail to be able to design suitable mitigation measures). Impacts on all types of PCR should be considered, both natural and man-made, registered and unregistered, movable an immovable.
- Analysis of alternatives: (the consultant will include PCR aspects when considering alternative projects or project locations)
- Environmental Management Plan including institutional arrangement for implementation and monitoring: (The ToR should state that mitigating measures arising from PCR impacts should be agreed to by the concerned and affected parties before they are submitted as recommendations in the EMP.)
- Public Participation (The ToR should point out the importance of the consultative process for the physical cultural resources component)

Appendix E: Chance Find Procedures

(Ref: The World Bank Operational Manual, 1999 OP4.11)

Works could impact sites of social, sacred, religious, or heritage value. "Chance find" procedures would apply when those sites are identified during the design phase or during the actual construction period and the related activity will not be eligible for financing under the project.

(1) Cultural property includes monuments, structures, works of art, or sites of significant points of view, and are defined as sites and structures having archaeological, historical, architectural, or religious significance, and natural sites with cultural values. This includes cemeteries, graveyards and graves.

(2) The list of negative subproject attributes which would make a subproject ineligible for support includes any activity that would adversely impact cultural property.

(3) In the event of finding of properties of cultural value during construction, the following procedures for identification, protection from theft, and treatment of discovered artifacts should be followed and included in standard bidding document.

(a) Stop the construction activities in the area of the chance find;
(b) Delineate the discovered site or area;
(c) Secure the site to prevent any damage or loss of removable objects.
(d) Notify the supervisory Engineer who in turn will notify the responsible local authorities;
(e) Responsible local authorities and the relevant Ministry would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures.
(f) Decisions on how to handle the finding shall be taken by the responsible authorities and the relevant Ministry. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance), conservation, restoration and salvage.
(g) Implementation of the authority decision concerning the management of the finding shall be communicated in writing by the relevant Ministry.
(h) Construction work could resume only after permission is given from the responsible local authorities and the relevant Ministry concerning safeguard of the heritage.

(4) These procedures must be referred to as standard provisions in construction contracts. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered.

(5) Relevant findings will be recorded in World Bank Supervision Reports and Implementation Completion Reports will assess the overall effectiveness of the project's cultural property mitigation, management, and activities, as appropriate.

Appendix F: Environmental Code of Practice (ECoP)

The Environmental Code of Practice (ECoP) is a guideline for reduce or eliminate environment risk due to various activities associated with different types of sub-projects considered in the BMWSSP.

ECoP 1.0: Planning and Design Phases of a Project

1.1 General

This code of practice details the factors to be considered during project preparation to avoid/address environmental concerns through modifications in project design and incorporation of mitigation measures.

1.2 Finalization of Alignment/Project Location

- Adequate consultations with the communities to identify the concerns and preferences need to be taken up during selection of the alignment.
- Alignment shall conform to the natural topography as far as possible to avoid excessive cut and fill.
- Special care should be taken to align the roads along the hillside, which is stable and where cutting on hillside causes least disturbance.
- Consultations with the local communities are to be conducted to obtain their suggestions and incorporate their concerns to address the potential environmental impacts.
- In case of flood prone areas and/or areas with very flat slopes, hydrological surveys have to be conducted before alignment finalization.

1.3 Compliance to Legal Requirements

The bid document shall include the various applicable clearances pertaining to environmental management and shall contain the necessary procedures for compliance of the same.

1.5 Cost Estimation

Some activities included in ECoP 1.0 have certain monetary involvement. These activities are outlined below:

1. There will be one Focus Group Discussion (FGD), with at least 15 participants from different communities of the society, for adequate consultations to identify the concerns and preferences related to a particular infrastructure development project.
2. Two surveyors will carry out a Key Informant Information (KII) of at least 50 participants from different communities of the society affected by the infrastructure development project.
3. Two surveyors will carry out a hydrological survey before finalizing alignments and/or reduced levels for infrastructure development projects in a flood prone area and/or with very flat slopes.

ECoP 2.0: Site Preparation

2.1 General

The preparation of site for construction involves:

i. Marking and clearance of the required project area of all encroachments by the ULBs prior to mobilization of Contractor;
ii. Informing the local community about construction schedule; and
iii. Site preparation by the contractor prior to commencement of construction. Scope of this ECoP includes only the measures to address environmental concerns expected during the site preparation.

2.2 Site Preparation Activities by the ULBs

- Informing the community and local village councils about the likely schedule of construction
- After obtaining the consent of the community the ULBs shall be responsible to stake out the subproject locations.

2.3 Site Preparation Activities by the Contractor

- The contractor shall submit the schedules and methods of operations for various items during the construction operations to the ULBs for approval.
- The clearance of site shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures:
- To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed.
- In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.
- The disposal of wastes shall be in accordance with the provisions of ECoP 7.0, "Waste Management".
- All regulatory clearances shall be obtained before actual start of work.

ECoP 3.0: Construction Camps

3.1 General

ECoP 3.0 provides guidelines on the selection, development, maintenance and restoration of construction camp sites in order to avoid or mitigate against significant adverse environmental effects, both transient and permanent.

3.2 Construction Camp Siting

During planning of the works consideration shall be given to the location of construction camps for the sub-project. Construction camps and areas identified that may be suitable for the development of such camps shall be raised in consultation with the Engineer of the concerned ULB. Areas those are not suitable for reasons such as environmental, cultural or social sensitivity shall also be identified.Wherever possible, construction camps shall be planned in areas that will have minimal adverse environmental effects. In identifying such areas particular care shall be taken to evaluate the adverse affects of water, noise and air pollution, which, although transient, will preclude the use of some areas as construction camp sites.

3.3 Construction Camp Location

Construction camp sites shall be located such that permanent adverse environmental effects can be avoided or mitigated against and transient adverse environmental effects are minimized. Camp sites shall not be located in areas identified during the planning stage as unsuitable for such use. The site or sites shall be selected such that mitigation measures stipulated in this ECoP can be implemented with reasonable facility.

3.4 Private Land

Where construction camps are to be located on land outside the road reserve the contractor shall obtain the approval of the landowner to establish the camp site on such land and pay agreed compensation as per the *Resettlement and Rehabilitation Framework.* Environmental protection measures established by this ECoP shall apply to all land regardless of ownership.

3.5 Construction Camp Facilities

The construction camp shall be provided with the following minimum facilities:

- A perimeter security fence at least 1.5m in height constructed from appropriate materials.
- Ablution block with a minimum of one water closet toilet or Pota-cabin, one urinal and one shower for personnel engaged either permanently or temporarily on the project. Pota-cabins or separate toilet and wash facilities shall be provided for male and female employees.
- A sickbay and first aid station.
- Areas for the storage of fuel or lubricants and for a maintenance workshop. Such an area shall be bounded and have a compacted/impervious floor to prevent the escape of accidental spillage of fuel and or lubricants from the site. Surface water drainage from bounded areas shall be discharged through purpose designed and constructed oil traps. Empty fuel or oil drums may not be stored on site.
- Storm water drainage system to discharge all surface run off from the camp site to a silt retention pond which shall be sized to provide a minimum of 20 minutes retention for storm water flow from the whole site that will be generated by a 20 year return period rainfall having a duration of at least 15 minutes. The run-off coefficient to be used in the calculation of the silt pond volume shall be 0.9. Silt ponds shall be maintained in an efficient condition for use throughout the construction period with trapped silt and soil particles being regularly removed and transported and placed in waste material disposal areas as per ECoP7.0.
- All discharge from the silt retention pond shall be channeled to discharge to natural water via a grassed swale at least 10 meters in length with suitable longitudinal gradient.
- All camp facilities shall be maintained in a safe clean and or appropriate condition throughout the construction period.

3.5.1 Construction Camp Development Plan

A development plan of the construction camp shall be prepared describing the following:

- Perimeter fence and lockable gates
- Workshop
- Accommodation
- Ablutions
- Water supply
- Wastewater disposal system
- Bounded fuel storage area
- Proposed power supply
- Proposed all weather-surfaced areas.

3.6 Site Restoration

At the completion of the construction work, all construction camp facilities shall be dismantled and removed from the site and the whole site restored to a similar condition to that prior to the commencement of the works or to a condition agreed to with the owner of the land.

All oil or fuel contaminated soil shall be removed from the site and transported and buried in waste soil disposal areas.

ECoP 4.0: Borrow Areas

4.1 General

Embankment or filling material is to be procured from borrow areas designated for the purpose. The scope of this ECoP extends to measures that need to be incorporated during borrow area identification, material extraction and rehabilitation with regard to environment management.

4.2 Pre-construction Stage

The contractor shall identify the borrow area locations in consultation with the owners, after assessing the suitability of the material. The suitable sites shall be selected and finalized in consultation with the ULBs.

4.3 Construction Stage

The contractor should adopt the following precautionary measures to minimize any adverse impacts on the environment:

i. Borrow pits situated less than 0.5 km (if unavoidable) from villages and settlements should not be dug for more than 30 cm after removing 15cm of topsoil and should be drained.
ii. The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation.
iii. In case the borrow pit is on agricultural land, the depth of borrow pits shall not exceed 45 cm and may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside.
iv. In case of riverside, borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood.

4.4 Post Construction Stage

It needs to be ensured that all reclamation has been carried out in accordance with the restoration plan. Certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that “the land is restored to his satisfaction”. The final payment shall be made after the verification by ULBs.

ECoP 5.0: Topsoil Salvage, Storage and Replacement

5.1 General

Loss of topsoil will be a long-term impact along implementation of different infrastructure development projects by different ULBs under the BMWSSP due to,

i. Site clearance and excavation for road, markets, embankment and other infrastructures
ii. Development of borrow areas
iii. Temporary construction activities as material storage locations, diversion routes etc.

Scope of this ECoP includes removal, conservation and replacement of topsoil.

5.2 Pre-construction Stage

The arrangements for temporary usage of land, borrowing of earth and materials by the Contractor with the land owner shall include the conservation/preservation of topsoil.

5.3 Construction Stage

- The stockpiles for storing the topsoil shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile is restricted to 2m.
- In cases where the topsoil has to be preserved for more than a month, the stockpile is to be stabilized within 7 days. The stabilization shall be carried out through temporary seeding. It consists of planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control.
- After spreading the topsoil on disturbed areas, it must be ensured that topsoil is seeded, and mulched within 30 days of final grading.
- During construction, if erosion occurs from stockpiles due to their location in small drainage paths, the sediment-laden runoff should be prevented from entering nearby watercourses.

- The Contractor shall preserve the stockpile material for later use on slopes or shoulders.

5.4 Post Construction Stage

- The topsoil shall be re-laid on the area after taking the borrow earth to maintain fertility of the agricultural field, finishing it to the required levels and satisfaction of the farmer.
- All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material.

ECoP 6.0: Slope Stability and Erosion Control

6.1 General

- Stability of slopes is a major concern in hill areas and locations of high embankment.
- Soil erosion is consequent to high runoff on hill slopes, high wind velocities cause erosion of embankments made up of cohesion-less sandy soils.
- Embankments made up of silty and sandy soils are eroded, in the absence of vegetative cover, when the slopes are steep, say more than 20 degrees.
- Erosion control is provided to prevent soil damage done by moving water.
- The scope of this ECoP includes measures to minimize the adverse environmental impacts on slope stability and soil erosion due to the construction of embankments. The adverse environmental impact can be:
    i. damage to adjacent land,
    ii. silting of ponds and lakes disturbing the aquatic habitat
    iii. erosion of rich and top fertile top layer of soil
    iv. contamination of surface water bodies and
    v. reduction in road formation width due to erosion of shoulders/berms.

6.2 Pre-construction Stage

- Interceptor ditches are constructed in hill areas to protect the road bench and hillside slope from erosion due to heavy rainfall and runoff.
- Interceptor ditches are very effective in the areas of high intensity rainfall and where the slopes are exposed.

6.3 Construction Stage

- The vegetative cover should be planted in the region where the soil has the capacity to support the plantation and at locations where meteorological conditions favors vegetative growth.
- On side slopes in hills, immediately after cutting is completed and debris is removed, vegetative growth has to be initiated by planting fast growing species of grass.
- In regions of intensive rainfall, locations of steep slopes, regions of high soil erosion potential and regions of short growing seasons, erosion control matting should be provided.
- Adequacy of drainage for erosion control

6.4 Post Construction Stage

All the exposed slopes shall preferably be covered with vegetation using grasses, bushes etc. Locally available species possessing the properties of (i) good growth (ii) dense ground cover and (iii) deep root shall be used for stabilization.

ECoP 7.0: Waste Management

7.1 General

This code of practice describes procedures for handling, reuse and disposal of waste materials during construction. The waste materials generated can be classified into

i. Construction Waste and
ii. Domestic waste.

7.2 Pre-construction Stage

- The contractor shall identify the activities during construction that have the potential to generate waste and work out measures for the same in the construction schedule.
- The Contractor shall educate his workforce on issues related to disposal of waste, the location of disposal site as well as the specific requirement for the management of these sites.

7.3 Construction Stage

- The contractor shall either re-use or dispose the waste generated during construction depending upon the nature of waste.
- The contractor shall dispose off wastes that could not be re-used safely.
- The waste management practices adopted by the Contractor shall be reviewed by the ULBs during the progress of construction.

7.4 Post Construction Stage

- After decommissioning of construction sites, the Contractor shall hand over the site after clearing the site of all debris/wastes to the ULBs.
- In case of disposal of wastes on private land, certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is restored to his satisfaction".

ECoP 8.0: Water Bodies

8.1 General

Water bodies may be impacted when the infrastructure development project activities are adjacent to it or the runoff to the water body is affected by change of drainage pattern due to construction of embankment. The following activities are likely to have an adverse impact on the ecology of the area:

i. Earth moving
ii. Removal of vegetation
iii. Waste disposal from construction works

8.2 Pre-Construction Stage

When there is interruption to regular activities of Pourashava inhabitants near water body due to construction or rehabilitation work, following are the Contractor's responsibilities:

i. Restriction on use of water during construction, if any, should be intimated to the community in advance.
ii. Alternate access to the water body is to be provided in case there is interruption to use of exiting access.
iii. If the water body affected is a drinking water source for a habitation, alternate sources of water are to be provided to the users during the period for which its use is affected.

8.3 Construction Stage

- It should be ensured by the contractor that the runoff from construction site entering the water body is generally free from sediments.
- Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated.
- Cutting of embankment reduces the water retention capacity and also weakens it, hence:
  i. The contractor should ensure that the decrease in water retention should not lead to flooding of the construction site and surroundings causing submergence and interruption to construction activities.
  ii. Any perceived risks of embankment failure and consequent loss/damage to the property shall be assessed and the contractor should undertake necessary precautions as

provision of toe protection, erosion protection, sealing of cracks in embankments. Failure to do so and consequences arising out of embankment failure shall be the responsibility of the contractor. The ULBs shall monitor regularly whether safe construction practices near water bodies are being followed.

- Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body.
- Movement of workforce shall be restricted around the water body, and no waste from construction sites shall be disposed into it.

8.4 Post Construction Stage

- The zones of the water body have to be left clean and tidy with the completion of construction.
- Engineers of the ULBs will check if drainage channels of adequate capacity have been provided for the impacted water body.

ECoP 9.0: Water Qualities

9.1 General

- Small-scale road construction, small-scale drainage, and small-scale embankment construction may affect the aquatic environment, by lowering or raising water levels, and decreasing water quality.
- Deterioration of water quality and disturbance of aquatic environment by lowering or rising of water levels.

9.2 Pre-Construction Stage

Following measures are to be undertaken by the contractor prior to the commencement of construction:

- Base line data of the water quality is necessary.
- In addition, the availability of enough water during the lean season needs to be assessed as part of the baseline data collection.

9.3 Construction Phase

- Improper disposal of solid and liquid waste including excreta generate from sites will pollute the water quality and proper prevention measure should be taken.
- Wastewater disposal, sanitation/latrines may have positive cumulative effects on human health, but if not improperly implemented may affect ground and surface and ground water quality; the contractor should give proper attention on it during construction stage.
- Protect water bodies from sediment loads by silt screen or bubble curtains or other barriers.

9.4 Post Construction

- Inspection of water quality shall be done regularly.

ECoP 10.0: Drainage

10.1 General

- Drainage is designed for and installed on roads to direct surface or subsurface flow away to a safe outfall without damage to the structure, adjoining property or agricultural fields.
- A road with good drainage is a good road. Inadequate and faulty drainage arrangements result in obstruction to natural drainage pattern. Provision of cross-drainage and longitudinal drainage increases the life of the road and consequently reduces water logging and related environmental impacts.
- The present code seeks to address the environmental concerns related to drainage aspects during different stages of the project execution.

10.2 Pre-Construction Stage

- Following measures are to be undertaken by the contractor prior to the commencement of construction:
    i. The downstream as well as upstream user shall be informed one month in advance
    ii. The contractor shall schedule the activities based on the nature of flow in the stream.
    iii. The contractor should inform the concerned departments about the scheduling of work. This shall form part of the overall scheduling of the civil works to be approved by ULBs.
    iv. Erosion and sediment control devises, if site conditions so warrant, are to be installed prior to the start of the civil works.
    v. All the safety/warning signs are to be installed by the contractor before start of construction
- In case of utilization of water from the stream, for the construction, the contractor has to take the consent from the concerned department.

10.3 Construction Phase

- Drainage structures at construction site shall be provided at the earliest to ensure proper compaction
- In hill areas sub-surface drains, if required, shall be provided immediately after cutting the slopes and forming the roadbed (sub grade).
- Safety devises and flood warning signs to be erected while working over streams and canals.

10.4 Post Construction

- Inspection and cleaning of drain shall be done regularly to remove any debris or vegetative growth that may interrupt the flow.
- Temporary structures constructed during construction shall be removed before handing over to ensure free flow through the channels.

ECoP 11.0: Public Health and Safety

11.1 General

The safety and health of the public is impacted due to the hazards created during the construction period. This code of practice describes the measures that need to be taken to mitigate the impacts.

11.2 Pre-construction Stage

- In order to incorporate public health and safety concerns, the ULBs and the Contractor shall disseminate the following information to the community:
    i. Location of subproject activities,
    ii. Borrow areas,
    iii. Extent of work
    iv. Time of construction
    v. Involvement of local labors in the road construction
    vi. Health issues - exposure to dust, communicable diseases etc.

11.3 Construction Stage

- The Contractor shall schedule the construction activities taking into consideration factors such as:
    i. Sowing of crops
    ii. Harvesting
    iii. Local hindrances such as festivals etc.
    iv. Availability of labor during particular periods

- Proper safety/warning signs are to be installed by the contractor to inform the public of potential health and safety hazard situations during the construction phase in the vicinity of the project.
- The ULBs shall carry out periodic inspections in order to ensure that all the measures are being undertaken as per this ECoP.

11.3 Post-construction Stage

The construction site shall be cleaned of all debris, scrap materials and machinery on completion of construction for the safety of public and users.

ECoP 12.0: Material Storage, Transport and Handling

12.1 General

Activities related to materials storage, handling, and transfer that are considered to potentially have negative environmental effects include:

- Transportation, storage, handling and of construction materials;
- Storage, handling, and transfer of petroleum, oil, and lubricant (POL) products;
- Application of asphaltic concrete and asphalt binder;
- Storage and handling of hazardous materials other than POL products; and
- Storage and application of road salt and sand.

Some materials used during implementation of projects associated with BMWSSP may have potentially hazardous effects on the environment if not properly stored and handled.

12.2 Transportation, Handling and Storage of Cement and Aggregates

- The Contractor shall be responsible for ensuring that all trucks and carriers are clean and dry prior to loading them with cement or aggregates. All trucks and carriers for transporting cement/aggregates shall be equipped with weather proof closures on all openings.
- All cement/aggregates that will be brought to the site shall be kept free from contact with deleterious matter.
- All cement/aggregates shall be placed on impervious mat spread over the storage area to prevent direct contamination of top soil in the storage area. Stockpiling of cement/aggregates should be limited to minimum space and should be covered with weatherproof closures.
- Stockpiles shall be built up in horizontal or gently sloping layers. Overlap of different materials shall be prevented by suitable walls of ample distance between stockpiles.
- The Engineer shall approve the site for the storage of all aggregates.
- The Engineer shall approve the methods of handling aggregates and the equipment used.

12.3 Environmental Concerns with Materials used for Construction and Maintenance of Infrastructure Development Projects. Concerns are related to accidental releases into the environment, such as spills, refueling losses, and leakage from equipment that could result in contamination of soil, groundwater, or surface waters.

Groundwater may transport the contaminants off-site to down-gradient aquifers or water supplies, or discharge them into surface waters. Therefore, release of potential contaminants on the ground surface could have significant environmental impacts that could ruin groundwater (well supplies).

12.3.1 Petroleum, Oil, and Lubricants

The toxic effect of a petroleum product in the aquatic environment varies considerably due to the different chemical composition of each petroleum product. The toxicity of petroleum products is related largely to its solubility in water. Petroleum pollution from accidental spills may affect aquatic birds, fish and vegetation. The effect of oil on birds’ feathers (loss of insulation) is an important cause of death. Oil polluting the water may also be toxic to birds if they ingest it. Plants in marshes or in wetlands (haor, baor, ponds and others) and steams may die off for short periods. Long-term impacts of spilled petroleum products are associated with the portion, which sinks and becomes incorporated into bottom sediments. This causes the petroleum products to degrade very slowly and they may persist for many years.

Petroleum products can stick to the gills of fish and interfere with normal respiration. Under relatively mild pollution, fish may produce mucus as a defensive mechanism to remove the oil. However, in heavy pollution, this mechanism is inefficient and the oil tends to accumulate on the gills and smother the fish. Petroleum products contain soluble materials, which can be ingested by fish. The flavor of the fish flesh may, therefore, become tainted, or if ingested in enough quantity, may become lethal.Groundwater sources contaminated with petroleum products may have potentially toxic effects on consumers.

12.3.2 Asphalt Products

Environmental concerns with tack asphalt binder, and asphaltic concrete are also related to the hydrocarbon components, which are toxic to aquatic life, wildlife, and humans. As mentioned above, if these materials sink to the bottom, they may destroy the fish's source of food supply and smother the eggs or emerging fry.

12.3.3 Other Hazardous Materials

The following hazardous materials are used in structures construction or maintenance activities and have potential environmental concerns:

- Paints;
- Solvents; and
- Fresh concrete and admixtures.

Paint materials, which are lead – or oil-based, may affect aquatic life if significant amounts enter a watercourse. Specific concern exists with lead, as this compound may have a direct toxic effect on young fish. Toxins can accumulate over time in aquatic fish, bugs, and plants. Upon consumption by animals such as birds and small mammals, some metals could be transferred to the consumer and affect their health.

Some solvents used for cleaning purposes may contain components, which are toxic to aquatic life, wildlife, and humans. If solvents enter a watercourse/water supply, and significant concentrations occur in the water, this cold be harmful to users.

Concrete, which is typically made up of aggregates, cement, water, and possibly admixtures, is very alkaline because of its calcium (lime) content**.** If concrete enters a watercourse in significant amounts, the pH of the water may be affected locally over the short-term. If the pH of the receiving water is altered, this may cause physiological stress in fish, which may result in death.

12.4 Storage, Transport and Handling of POL Products

Care must be taken with the storage, transfer, handling of POL products to prevent potential environmental damage. All empty containers and drums shall be returned to the maintenance depot. It shall be ensured that all drums and containers are closed and not tipped over and all waste oil, lubricants, and solvents shall be stored in closed containers.

12.4.1 Storage

Any container, drum, or tank that is dented, cracked, or rusted will probably eventually leak. Make sure all containers, drums, and tanks that are used for storage are in good condition. Check for leakage regularly to identify potential problems before they occur.

The proper storage of materials will greatly reduce the risk of accidental spills or discharges into the environment.

For temporary outdoor storage, put containers and drums in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area should preferably slope or drain to a safe collection area in the event of a spill. Tanks should have appropriate secondary containment (i.e. double-walled or surrounded by a dyke) that will collect spilled material in case of a leak. Permanent storage areas for containers or drums should be on an impermeable floor that slopes to a safe collection area in the event of a spill or leak.

12.4.2 Transport and Handling

At all times when products are being handled or transported, care must be taken to prevent any product from being spilled, misplaced, or lost and possibly entering and contaminating the soil or a natural waterway. When equipment and vehicle maintenance or repair is required in the field, it should be undertaken at least 30 m away from any watercourse. Minimize the potential for entry of hydraulic fluids or oil into a watercourse by using sorbent materials to collect spilled petroleum products. Return all used sorbent materials to the appropriate storage yards for safe disposal.

Return all diesel or fuel used to wash asphalt emulsion pumps to the maintenance depot for safe storage or disposal. Also return all solvents used to wash spray-painting or other equipment to the appropriate storage yards for safe disposal.

Wash equipment in maintenance areas equipped with oil/water separators so that any petroleum products can be removed prior to discharge of the wastewater. Oil/water separators are only effective if they are properly maintained. At sites without oil/water separators, minimize the amount of wash water used and wash in areas where the potential for entry of wash water into a waterway is minimized by proper grading or curbing.

Tankers should not be washed near watercourses. Wash out should be done in places where proper grading or curbing minimizes the potential for entry of wash water into a waterway. Re-fuelling or servicing of equipment and vehicles to be done at least 30 m away from any watercourse. Re-fuelling over liner material with an absorbent pad (e.g. sand bed) will help to contain potential spills. If re-fuelling is done from a bulk tanker, the hose/nozzle assembly should be replaced to its proper position upon completion.

12.5 Spills and Spill Cleanup

Quick action in the event of a spill of hazardous materials is important in order to prevent environmental damage.

Things to do when a spill occurs:

1. Identify the material Involved and make a quick assessment:
    - How extensive is the spill?
    - Are there any watercourses nearby?
    - Are the watercourses down gradient from the spill?
    - Are there drainage systems down gradient from the spill, which lead toa nearby watercourse?
2. Stop the flow of product, if it can be done safely.
3. Notify the Engineer and Authorities immediately.
4. Control and contain spilled product until expert help arrives, if it can be done safely.

12.5.1 How to Control and Contain a Spill

When a limited oil spill occurs on level land, scoop up the affected soil and dispose at a site approved by the Engineer and the Department of Environment. When an extensive oil spill occurs on level land, dig sump hole and pump excess oil into a temporary container. The remaining

contaminated soil must be scooped up and disposed of at a site approved by the Engineer and the Department of Environment.
When an extensive spill occurs on a slope or hillside, a trench can be dug downhill from the spill to intercept the spilt material.
Should petroleum products reach a watercourse, several temporary spill containment measures can be sued to help stop the spreading of products.

12.6 Storage and Handling of Dangerous Materials
Workers may be at risk from exposure to dust particles or toxic fumes from chemicals used in road works and materials testing.

Specific measures to reduce risks include limiting time of exposure to dust particles, chemicals and noise; enhancing safety and inspection procedures; and improving materials safe handling.

ECoP 13.0: Vegetation Management
13.1 General
- Besides improving aesthetics and ecology of the area, the vegetation provide fuel wood, act as noise barriers, provide visual screen for sensitive areas and also generate revenue by sale of its produce.
- This code of practice elaborates on the approach towards planting trees. Emphasis has been laid on a greater involvement of communities in planting and maintenance of trees.

13.2 Project Planning and Design Stage
- Tree felling, if unavoidable, shall be done only after compensatory plantation of at least three saplings for every tree cut is done.
- The species shall be identified in consultation with officials of forest department/local community, giving due importance to local flora. It is recommended to plant mixed species in case of both avenue or cluster plantation.
- The plantation strategy shall suggest the planting of fruit bearing trees and other suitable trees.

13.3 Post-construction Stage
- The project proponents would take up the planting of fruit bearing and other suitable trees, on both sides of the roads or other infrastructure development projects location from their own funds.
- Watering of trees during the initial period of two to three years shall be the responsibility of the ULBs or the agency designated by it.

ECoP 14.0: Natural Habitats
14.1 General
- This code of practice envisages measures to be undertaken during implementation of BMWSSP infrastructure development projects by the ULBs near natural habitats. These measures shall be undertaken in addition to the measures laid down in the other ECoPs.
- As per the World Bank OP 4.04, the conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. A precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development has been adopted for the project.

14.2 Pre-construction Stage
Contractor in consultation with forest ranger or any other concerned authority shall prepare a schedule of construction within the natural habitat. Due consideration shall be given to the time of

migration, time of crossing, breeding habits and any other special phenomena taking place in the area for the concerned flora or fauna.

14.3 Construction Stage

- Collection of any kind of construction material from within the natural habitat shall be strictly prohibited.
- Disposal of construction waste within the natural habitat shall be strictly prohibited.

14.4 Post Construction Stage

- The infrastructure development projects near the natural habitat shall be declared as a silence zone.
- Compensatory tree plantation within the project area shall be done.
- The ULBs must ensure maintenance of drainage structure as per ECoP 10.0.

The Cost Estimation of ECoPs

Some activities included in ECoPs have certain monetary involvement. The generic method of determining the cost of the ECoP is outlined below:

1. The Engineer of the ULB will carry out a survey of the intended project site to identify appropriate locations and also identify sites unsuitable in terms of topography, proximity to water courses, and environmental sensitive areas such as forests, wetlands, or other sensitive area.
2. Survey and monitoring works must be carried out, by Engineer appointed by the ULB authorities, throughout the pre-construction, construction, and post-construction phases to make sure the items and specifications (e.g low cost sanitation facilities, top soil management, waste disposal, tree plantation, storm water drainage etc) provided in this ECoP are properly addressed and estimated the cost.

APPENDIX G: SAMPLE TERMS OF REFERENCE (TOR) FOR THIRD PARTY MONITOR

BACKGROUND

The World Bank is engaged in providing credit for urban governance and service delivery improvements in Municipalities (Paurashavas) and City Corporations of Bangladesh for a number of years. In 2012-13 the Bank undertook an in-depth analytical study which analyzed options for appropriate models of water supply and sanitation (WSS) service delivery, and made recommendations for operationalizing these models. Discussions were initiated on possible World Bank lending assistance to GoB for strengthening the WSS service delivery system along with infrastructure development at secondary town level, which resulted in the "Bangladesh Municipal Water Supply and Sanitation Project (MWSSP)".

The objective of the Bangladesh Municipal Water Supply and Sanitation Project (MWSSP) is to strengthen the institutional capacities of participating municipalities for delivering improved WSS services. The two major land based components of the project which will impact the environment are the following:

(a) Investment for Water Supply Infrastructure, and
(b) Improving Sanitation and Septage (fecal sludge) Management.

The potential types of subprojects that could be implemented under the MWSSP include the following:

(a) Water Supply Infrastructure:
   (1) Production well (DTW) with pump house and electrical works
   (2) Water treatment plant (WTP), including raw water transmission line
   (3) Clear water transmission line
   (4) Water distribution network (including expansion and rehabilitation of distribution existing networks)
   (5) Overhead tank
   (6) Stand posts (street hydrant)
   (7) Paurashava water office

(b) Sanitation and Septage (fecal sludge) Management:
   (1) Latrine with septic tank and soakage pit
   (2) Public toilet
   (3) Fecal sludge treatment plant (FSTP)
   (4) Procurement of fecal sludge desludging units (Vacutugs/vacuum tanker)
   (5) Small-scale decentralized wastewater treatment system (DEWATS)

(c) Drainage system (storm drains)
(d) Solid waste management (SWM)

The DPHE intends to ensure that the proposed infrastructure takes environmental concerns into account, in accordance with GoB regulations and WB operational policies. The details of the sub-projects to be implemented under BMWSSP will be finalized during project implementation phase and therefore, the exact locations, size and extent of the sub-projects will remain unknown during carrying out of the environmental assessment (EA). Therefore, a framework approach has been adopted for EA of the BMWSSP; a detailed Environmental Management Framework (EMF) has been developed for effective environmental management of all sub-projects to be implemented under BMWSSP. The EMF provides guidelines for selection, environmental screening and analysis of alternatives of sub-projects. It also provides detail guidelines for carrying out environmental assessment (IEE/ EIA/ EMP) of sub-projects. During implementation of the sub- projects (both construction and operational phases), the DPHE and Paurashavas (with support from TA Consultant) will be responsible for implementation of sub-project specific EMP/ ECoP, as well as preparation of progress and environmental monitoring reports. In order to ensure proper environmental management of BMWSSP, a third party consulting firm will be given the responsibility to independently monitor the overall performance of environmental management of BMWSSP, including compliance with relevant GoB and WB regulations and the provision of the EMF developed for the project.

A. OBJECTIVES OF THE CONSULTANCY SERVICES

The main objective of the consultancy services under this terms of reference (ToR) is to allow a third party team to monitor performance of the overall environmental management of the BMWSSP; specifically, the third party will monitor compliance of the project activities with the Environment and Safeguards documents, including the relevant GoB regulations, WB operational policies, and provisions of the EMF developed for the BMWSSP.

B. SCOPE OF WORK

The consultant will work with the concerned experts/ officials of the World Bank, and DPHE to monitor and assess environmental management issues of the BMWSSP. The Consultant will carry out the tasks in accordance with accepted professional standards, utilizing sound engineering, economic, financial, and management practices. For all sub-projects to be implemented at the selected Paurashavas by the DPHE, the third party Consulting firm will monitor the following:

- Sub-projects are selected and approved by the Paurashavas following the standard practice (e.g., with discussion and approval in WLCC, TLCC and PouraParishad Meetings), in line with the feasibility study (if carried out)/ Paurashava master plan (if present).
- Sub-project description is prepared properly, and sub-project and "environmental screening" are carried out properly by the Paurashavas and DPHE-appointed Consultant following the formats and guidelines provided in the EMF.
- Decision regarding environmental assessment (EA) of the sub-project is taken by DPHE following the provisions of the relevant GoB regulations (ECR 1997) and WB operational policies.
- Environmental assessment (EA) of the sub-projects (i.e., IEE/ EIA/ EMP) is prepared following the EMF, and satisfying the relevant provisions of the GoB and WB; and necessary environmental clearance/ approval are taken from the DoE and WB for sub-project execution.
- Specific environmental requirements/ clauses are included in the bidding document and they are being met.
- The sub-project activities meet the EMP and ECoP requirements.
- Implementation and effectiveness of the mitigation and enhancement measures specified in the EMP.
- Actual and predicted changes to the environment, so that immediate actions could be taken to mitigate unanticipated impacts.
- Actual and predicted impacts, so that better prediction/ assessment of impacts could be made in the future;
- Environmental monitoring is carried out in the field as outlined in the EMP, monitoring and progress reports are regularly prepared and shared with DPHE/ WB; the monitoring reports are recorded and evaluated (by DPHE/ WB), and adequate feedbacks are provided to the field management.

In addition, for any observation of non-compliance, the third party consultant will provide specific recommendations for improvement of environmental management.

C. DELIVERABLES

The consultant shall prepare the reports as described below. The reports will be provided in soft and hard copies (five hard copies).

(i) Inception Report

The consultant will submit an inception report based on the initial findings, describing the work program at the end of third week after commencement of work. The consultant will identify any constraint and suggest solutions, together with any action required by DPHE/ WB to facilitate the successful implementation of the work.

(ii) Quarterly Report

The consultant will submit quarterly reports, summarizing monitoring activities (as outlined in the scope of works). The reports will summarize the sub-project specific monitoring outcomes for each Paurashava separately. A comparison of monitoring outcomes of same/similar sub-projects carried out in different ULBs should be provided, so that lessons learned and best practices could be replicated.

(iii) Final/ Completion Report

This report will be prepared at the end of the project. It will be a comprehensive report on the consultancy services throughout the contract. This report will summarize the major findings, constraints, lessons learnt; and provide recommendation for proper environmental management and monitoring in future projects. The Table of Contents of the Report will be submitted for the clearance by DPHE/ WB six months before completion of the contract. The draft report will be provided to DPHE one month before completion of the contract.

D. TEAM COMPOSITION

Professional Staff Input:

Team Leader (Environmental Management Specialist): Must have at least Masters Degree in environmental engineering/ management/ science from a reputed university with at least 20 years of experience in unban infrastructure related projects, some of which should be in projects funded by multilateral financial institutions;

Environmental Specialist (1): Must have at least Masters Degree in environmental engineering from a reputed university with at least 10 years of experience in unban infrastructure related projects, some of which should be in projects funded by multilateral financial institutions.

Civil Engineers (2): Must have B.Sc. degree in civil engineering from reputed university with at least 8 years of experience in unban infrastructure related projects.

Junior Field Engineers (5): Must have B.Sc. degree in civil/ water resources/ environmental engineering from a reputed university with at least 2 years of experience in urban infrastructure related projects.

Socio-economic Specialist (1): Must have at least Masters degree in social science or related discipline from a reputed university with at least 8 years of experience in socio-economic issues of urban infrastructure related projects.

Junior Sociologist (3): Must have at least Bachelor degree in social science or related discipline from a reputed university with at least 2 years of experience in socio-economic issues of urban infrastructure related projects.

Ecologist (1): Must have at least M.Sc. degree in biological science or related discipline from a reputed university with at least 8 years of experience in biological / ecological issues of urban infrastructure related projects.

Junior Ecologist (2): Must have B.Sc. degree in biological science or related discipline from a reputed university with at least 2 years of experience in biological / ecological issues of urban infrastructure related projects.

Support Staff:
The Consultant will provide necessary support staff (draftsmen, surveyors, enumerators and office support staff) needed in order to carry out their tasks and fulfill their responsibilities effectively.

E. SUPPORT SERVICES

The Consultant will include cost of office accommodation, operating costs for vehicles and communication services for effectively conducting their assignment.

APPENDIX H: OVERALL ENVIRONMENTAL ASSESSMENT

Chapter 1
INTRODUCTION

1.1 Background

The World Bank is engaged in providing credit for urban governance and service delivery improvements in Municipalities (Paurashavas) and City Corporations of Bangladesh for a number of years. In 2012-13 the Bank undertook an in-depth analytical study which analyzed options for appropriate models of water supply and sanitation (WSS) service delivery, and made recommendations for operationalizing these models. Discussions were initiated on possible World Bank lending assistance to GoB for strengthening the WSS service delivery system along with infrastructure development at secondary town level, which resulted in the "Bangladesh Municipal Water Supply and Sanitation Project (MWSSP)".

The objective of the Bangladesh Municipal Water Supply and Sanitation Project (MWSSP) is to strengthen the institutional capacities of participating municipalities for delivering improved WSS services. The two major land based components of the project which will impact the environment are the following:

(a) Investment for Water Supply Infrastructure, and
(b) Improving Sanitation and Septage (fecal sludge) Management.

Presently piped water supply systems in Paurashavas typically cover limited population. Investments for water supply infrastructure (referred to as "subprojects") will include construction of new water treatment plants, intake for raw water source, expansion and rehabilitation of distribution networks. Expansion of piped water supply to those Paurashavas that have limited piped water supply coverage will be also considered. In addition, some drainage works would also be carried out in the selected Paurashavas.

In most Paurashavas, absence of fecal sludge management (FSM) services is causing severe environmental pollution, affecting both public health and local economies. Under the sanitation and septage (fecal sludge) management component, the proposed project will support the provision of facilities and services for the safe management and disposal of fecal sludge by financing infrastructure capital expenditure for the Municipalities (Paurashavas). This will include subprojects involving construction of public toilet, small scale FSTPs (Fecal Sludge Treatment Plants), decentralized waste water treatment systems in line with the Paurashava Master Plan and feasibility studies.

The IDA approval of the loan is contingent upon the GOB's (i.e., PMU's-Project Management Unit's) compliance to the WB environmental safeguards requirements. In this regard, at least two Bank policies related to environment will be triggered: (a) OP/BP 4.01 Environmental Assessment; and (b) OP/BP 4.11 Physical Cultural Resources, to ensure that the project design and implementation are focused on reducing adverse impacts and enhancing positive impacts. Depending on the situation, a number of other Bank policies could also be triggered; these include: (a) OP/BP 4.10: Indigenous People; (b) OP/BP 4.12: Involuntary Resettlement; (c) OP/BP 4.04: Natural Habitats. Along with WB environmental safeguard requirements, the project also needs to comply with the national environmental regulations in accordance to the Environmental Conservation Act 1997 (GoB, 1997).

Hence, the PMU of DPHE has undertaken an initiative to carryout environmental assessment of the proposed BMWSS project such that it ensures the IDA requirements and also complies with GoB (DoE) environmental requirements. As specific project locations (i.e., Paurashavas) and the specific sub-projects (including sub-project sites) are yet to be identified, a "framework approach" has been adopted through the development of an Environmental Management Framework (EMF). The "framework" for carrying out environmental assessment of the specific sub-projects to be implemented under the BMWSSP has been prepared based on an "overall environmental assessment" of the typical sub-projects in selected project areas (i.e., Municipalities/Paurashavas). The "overall environmental assessment" including "overall project baseline", evaluation of potential significant impacts of different sub-projects, and assessment of environmental practices in different ongoing and completed projects form the basis of the EMF. In summary, the environmental assessment has been prepared based on:

(a) Assessment of overall baseline environmental condition in selected Municipalities/ Paurashavas;
(b) Assessment of environmental practices of the recently completed projects in different Municipalities/ Paurashavas;
(b) Evaluation of potential environmental impacts of different types of sub-projects to be implemented under the BMWSSP project at selected Municipalities/ Paurashavas;
(c) Identification of sub-project specific standard mitigation measures (for negative impacts), enhancement measures (for positive impacts), and monitoring plan; and
(d) Identification of institutional capacity needs for environmental management of all stakeholder organizations (including LGIs).

The EMF document is intended to provide general policies, guidelines and procedures to be integrated into the design and implementation of all subprojects under the proposed BMWSS project. It will serve as guide for preparation of subproject specific environmental assessment, including EMP (Environmental Management Plan); and their implementation will be done during project execution using the EMF guidelines.

1.2 Approach and Methodology

The "overall environmental assessment" forms the basis of the EMF. In accordance to the ToR for Environmental Assessment (**Appendix H-1**), for carrying out "overall environmental assessment" of the BMWSSP, field visits were made to 5 Paurashavas, which were selected for implementation of the BMWSSP. The Paurashavas were:

(a) Tarabo, Narayanganj
(b) Homna, Comilla
(c) Chandanaish, Chattogram
(d) Dhaobari, Tangail
(e) Ullapara, Sirajganj

During field visits, discussions were held with the Mayors and other officials of the Paurashavas on different issues including major WASH (water supply, sanitation and hygiene) challenges faced by the Paurashavas, difficulties in project formulation, implementation and management. Discussions were also held with engineers and other officials of the Paurashavas on recently completed/ ongoing projects, proposed subprojects to be implemented under BMWSSP, and capacity and institutional arrangement for environmental management of the proposed subprojects. At each of these Paurashava, some of the sites tentatively selected for construction of infrastructure under BMWSSP were visited in order to obtain first-hand information and insight on the subproject baseline scenarios. Discussions were also held with Paurashava officials about environmental management of these projects. Apart from reconnaissance survey of these tentative subproject sites, noise level measurements were carried out. Surface water samples (typically from river/khal) and groundwater samples (typically from a randomly selected tubewell) were also collected for assessment of water quality. Focus Group Discussions (FGDs) were held at each of the five Paurashavas visited, which were participated by a wide range of stakeholders. The participants expressed their views on different aspects of the proposed subprojects to be implemented in their Paurashavas, including possible environmental impacts of the subprojects and possible mitigation/ abatement measures. In addition, public consultations (in the form of informal discussion) were also carried out at the Paurashavas.

1.3 Overall Structure of the Report

The overall environmental assessment (presented in Appendix H of the Report) has been presented in five chapters. Chapter 1 (Introduction) presents the background of the project and the approach and methodology followed for overall environmental assessment. Chapter 2 presents an assessment of the existing environmental practices, and institutional set up and capacity of Paurashavas and DPHE, focusing on environmental management of projects. Chapter 3 presents the overall baseline of the project areas, based on data and information collected from field visits to 5 Paurashavas as well as secondary sources. Chapter 4 presents an assessment of the overall environmental impacts of the proposed sub-projects to be implemented under BMWSSP at different Paurashavas, along with generic mitigations measures to reduce or eliminate adverse impacts. Finally, Chapter 5 presents an analysis of stakeholders and outcomes of public consultations carried out as a part of overall environmental assessment.

Chapter 2
ENVIRONMENTAL PRACTICE AND CAPACITY ASSESSMENT

2.1 Introduction

As a part of the overall environmental assessment, discussions were held with the DPHE and Paurashava officials on different aspects of project implementation and management (including experience from recently completed projects), particularly focusing on existing environmental management practices. Based on these discussions and evaluation of available documents, institutional and staff capacity of DPHE and Paurashavas have been assessed with respect to proper environmental management of the BMWSSP. Staff requirement and training needs have also been evaluated. This Chapter summarizes theses assessments and evaluations.

2.2 Environmental Practices

Based on discussions with the relevant stakeholders (DPHE, Paurashava), it appears that there is significant scope for improvement in environmental assessment and management practices of projects/ sub-projects implemented by these organizations. The Paurashavas have not been found to be particularly aware of the environmental regulations/ requirements with regard to implementation of a project. The Paurashavas primarily carryout small-scale projects (e.g., local road, drain, culvert), and the requirements of environmental clearance (from the DoE), and environmental management/ monitoring for such projects are not clear to them; the Paurashavas usually do not consult the DoE office during implementation of such projects.

The DPHE has considerable experience in environmental management of a wide range of projects. However, DPHE does not have its own environmental guideline. Environmental assessment of projects is usually carried out by hiring Consultants. A number of other organizations have been found to have guidelines for environmental assessment. For example, Local Government Engineering Department (LGED) has its own environmental assessment guidelines (LGED, 2008); LGED has also developed detailed environmental and social management frameworks (EMF and SMF) for the Municipal Governance and Services Project (MGSP) (LGED, 2013), through the Bureau of Research Testing and Consultation (BRTC, BUET). Power Cell, Ministry of Power Energy and Mineral Resources also developed an Environment and Social Management Framework (ESMF) (Power Cell and BRTC-BUET, 2014) for implementation of the "rural electricity transmission and distribution project". Discussion and LGED and Power Cell officials suggest that these frameworks are greatly facilitating environmental management of projects.

2.3 Institutional and Staff Capacity

Based on assessment of institutional and staff capacity, it appears that the Paurashavas have limited staff (engineers) and capacity for environmental management and monitoring of projects. The Engineering Department of a "Category A" Paurashava is led by an Executive Engineer, while that of "Category B or C" Paurashava is led by an Assistant Engineer. The Engineering Department of all Paurashavas has two sections – (a) water supply and waste management section, and (b) Civil, electrical and mechanical section. In all Paurashavas one

Sub-assistant Engineer looks after the water supply and waste management section. For a "Category A" Paurashava, there are 5 posts for engineers in the "civil, electrical and mechanical section", including one Assistant Engineer (civil), two Sub-assistant Engineers (civil), one Sub-assistant Engineer (electrical), and one Sub-assistant Engineer (mechanical). On the other hand, for a "Category B or C" Paurashava, there are only three posts for engineers, which include two Sub-assistant Engineers (civil), and one Sub-assistant Engineer (electrical).

There is limited scope for increasing the number of staff (engineer) in the Paurashavas at the moment. Hence for ensuring proper environmental management of sub-projects under the BMWSSP, the focus should be on capacity building of Paurashava engineers. Currently, the Paurashava engineers have very little exposure to regulatory requirements, and environmental management and monitoring of projects. The senior engineer of an Paurashava (Executive Engineer for a "Category A" Paurashava, and Assistant Engineer for a "Category B or C" Paurashava) should take the responsibility of environmental management together with DPHE and DPHE appointed Consultants, and carry out responsibilities in accordance to the environmental management framework (EMF) developed for the BMWSSP.

As noted earlier, the DPHE has experience in environmental management and monitoring, primarily through appointment of Consultants. However, advanced training on environmental management and monitoring, particularly emphasizing on the modalities of the BMWSSP (i.e., framework approach) would be useful for engineers of PMU of DPHE in successfully implementing environmental management, following the EMF.

2.4 Training Requirements

As noted earlier, it appears that the engineers at the Paurashavas have limited or no exposure to environmental assessment and management. For the BMWSSP, at each Paurashava, the senior Paurashava engineer could act as the environmental focal point. Hence, basic training on regulatory requirements, environmental impacts, and environmental assessment and management would greatly improve the capability of the Paurashavas in carrying out their responsibilities under the BMWSSP. From logistic point of view, the trainings may be organized on a regional basis.

The DPHE has considerable experience in environmental management of a wide range of projects. As noted earlier, most of the works to be carried out under the BMWSSP will be supported by the hired consultant. However, the overall responsibility of environmental management lies with DPHE. For this purpose, it is important that the DPHE engineers receive advanced training on environmental management and monitoring. Such training will assist them in properly overseeing the activities of the consultant engaged in environmental management of the BMWSSP, following the EMF. Table 2.1 summarizes the training requirements of Paurashavas and DPHE.

Table 2.1: Training requirements for successful environmental management of BMWSSP

Training Type/ Contents	Participants	Schedule
General environmental awareness, regulatory requirements, EMF frameworks for BMWSSP, environmental impacts and mitigation, analysis of alternatives, environmental management	Engineers of Paurashavas (at least one engineer from each ULB)	Prior to commencement of sub-project activities
Advanced training on environmental assessment, management (EMP, ECoP), monitoring, including details on EMF framework	Participants from: PMU or other relevant Departments of DPHE	Immediately after project commencement

Chapter 3
OVERALL PROJECT BASELINE

3.1 Introduction

In order to develop a comprehensive Environmental Management Framework (EMF) for the BMWSSP, an environmental baseline study was carried out in areas within and surrounding 5 selected Paurashavas out of the 30 Paurashavas tenatively selected for implementation of BMWSSP. The specific objectives of the baseline study were to gather information on the existing physical environment of the areas within and around the project sites, and to assess peoples' perception on different aspects of the proposed project. The data and information gathered during the baseline study provide a clear understanding of the existing conditions of physical, biological and socio-economic environment in and around the project areas in the 5 selected Paurashavas.

This Chapter describes the existing physical, biological, and socio-economicenvironment of areas in and around the project sites in the 5Paurashavas based on the baseline surveys and other studies carried out as a part of the present study. Relevant information on climate, geology and soils, water supply and sanitation, solid waste management, hydrology and water resources, noise level, and water quality has been described in this Chapter. The possible environmental impacts of the sub-projects under BMWSSP have been evaluated against these baseline environmental conditions.

3.2 Physical Environment

As a part of Environmental Assessment for the formulation of Environmental Management Framework (EMF) of the proposed Bangladesh Municipalities Water Supply and Sanitation Project (BMWSSP), an environmental baseline survey was conducted at five relevant municipalities on the February and March months of 2018. The visited municipalities are Dhanbari in Tangail District, Ullahpara in Sirajganj District, Tarabo in Narayanganj District, Homna in Comilla District and Chandanaish in Chattogram District. The locations and respective Upazila maps are shown in Figure 3.1.

3.2.1 General Features of Paurashavas

Dhanbari Municipality (Tangail District), located in between 23°37' and 24°45' north latitudes and 90°10' and 90°00' east longitudes with an area of 24.89 sq km, 9 Wards and 25 villages, was established in 1996. It is bounded by Jamalpur Sadar upazila on the north, Gopalpur and Madhupur upazilas on the south, Madhupur upazila on the east and Sarishabari upazila on the west. Water bodies are Bangshi, Jhinai and Banar Rivers and notable beels are Dublai Beel and Hamil Beel. The municipality has a population of 36,008 (reference: Census 2011) with a density of 1887per sq. km, 9128 families and sex ratio of 98: 100 (M:F).

Ullahpara Municipality (Sirajganj district), is located in between 24°12' and 24°26' north latitudes and 89°24' and 89°38' east longitudes. It is bounded by Raiganj upazila on the north, Shahjadpur upazila on the south, Kamarkhanda and Belkuchi upazilas on the east and

Bhangura and Tarash upazilas on the west. Main water bodies in this area are Karatoya, Goala and Bilsuriya Rivers.

Tarabo Municipality, situated at Rupganj, Narayanganj district, is 14 kilometers east to Dhaka. The "Dhaka-Sylhet" highway, adjacent to the Sultana Kamal Bridge, has passed through Tarabo Municipality. It has an area of 24.60 sq kilometers. It has 9 wards, 20 Moujas and a population of 1,50,709 people. In 2002, it was first established as a "C" Class municipality and gradually it ranked up to "A" class in 3rd July, 2013. It is a heavily industrialized municipality. Many factories and mills of renowned organizations are situated here. As it has grown into a "Satellite city" near Dhaka city, it is becoming popular to people both for residential and commercial purposes. Tarabo municipality is well known for the production of traditional Jamdani Sarees having Jamdani producers' community situated over an area of 20 acres which includes 418 plots. Jamdani Industry and Research Center is situated within two Moujas, Noapara and South Rupshi. The administrative council of Tarabo Municipality consists of 1 elected Mayor, 9 male commissioners for 9 wards, 3 female commissioners (1 female commissioner for 3 wards). To perform the regular day to day activities and functions of the municipality smoothly, there are three divisions, Engineering division, Administration Division and Health, Family planning and Cleaning division. The municipality has 1 Chief Executive Officer who coordinates, supervises and directs the 3 divisions as per the instruction of the Mayor.

Homna Municipality (Comilla District), comprises with an area of 11.71 sq km, 9 Wards and 08 villages, was established in 2002. It is bounded by Bancharampur Upazila, Brammanbaria on the north, Titas upazila on the south, Muradnagar upazila on the east and Meghna upazila on the west. Water bodies are Titas and Meghna Rivers among which, Titas river divides Homna and Bancharampur Upazila. The municipality has a population of 28,193 with a density of 1910 per sq. km and sex ratio of 99: 100 (M:F). It has 2 colleges, 4 primary schools, 1 health center, 4 bus/ tempo stands, 1 bazar, 54 mosques, 03 temples, 28 Bridges with a length of 179 meters and 1 water pump.

Chandanaish Municipality, situated at Chattogram District, is an important township formed by the insertion of the hill and plain land of southern Chattogram. The Chandanaish upazila is located by Bandarban Hill district on the east and Cox's Bazar district on its south. The municipality is bounded by Shatkaniya Union on the south, Joyara Union on the north and Borokal and Barama Union on the east side. The Sangu River flows by the north to south of the Chandanaish Upazila. The municipality has an area of 17.08 sq. km, a population of 35000 with a density of 1154 per sq. km. The area has a number of mosques, temples, buddist bihars, post offices, bazars, educational institutes, hospitals. The area has 32 km of pavement roads,22 km of non-pavement roads and half pavement roads with a length of 41 km. There are 175 nos of deep tubewells and 90 nos of shallow tubewells in the municipality.

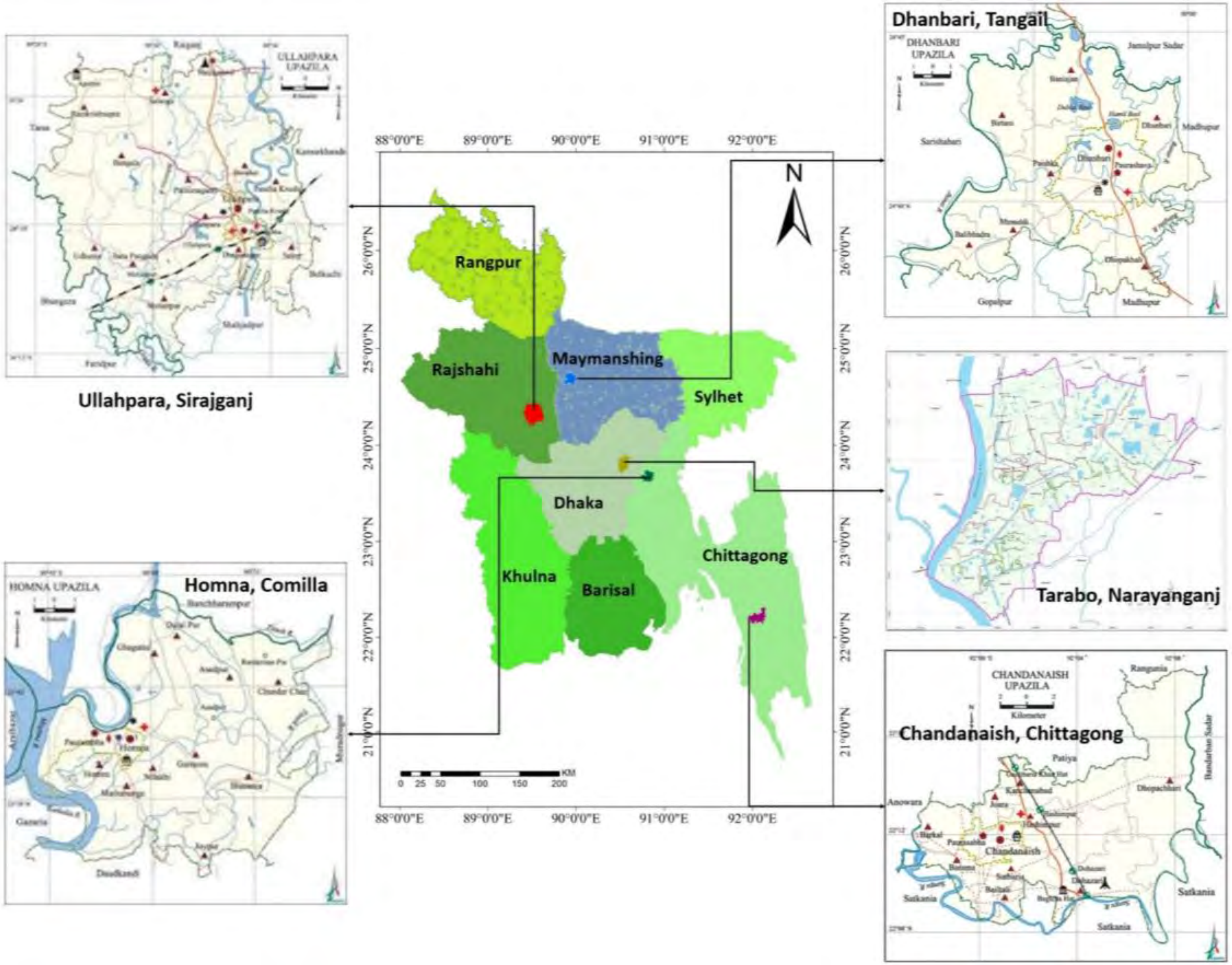


Figure 3.1: Visited Municipalities maps on Bangladesh map.

3.2.2 Physicochemical Environment

Climate

Bangladesh is located in the tropical monsoon region and its climate is characterized by high temperature, heavy rainfall, often excessive humidity, and fairly marked seasonal variations. From the climatic point of view, three distinct seasons can be recognized in Bangladesh - the cool dry season from November through February, the pre-monsoon hot season from March through May, and the rainy monsoon season which lasts from June through October. The month of March may also be considered as the spring season, and the period from mid-October through mid-November may be called the autumn season. The dry season begins first in the west-central part of the country by mid-December, where its duration is about four months, and it advances toward east and south, reaching the eastern and southern margins of the country by mid-March where its duration is about one month. The pre-monsoon hot season is characterized by high temperatures and the occurrence of thunderstorms. April is the hottest month when mean temperatures range from 27°C in the east and south to 31°C in the west-central part of the country. In the western part, summer temperature sometimes reaches up to 40°C. After the month of April, the temperature dampens due to increased cloud cover. The pre-monsoon season is the transition period when the northerly or northwesterly winds of the winter season gradually changes to the southerly or southwesterly winds of the summer monsoon or rainy season (June-September). During the early part of this season, the winds are neither strong nor persistent. However, with the progression of this season wind speed increases, and the wind direction becomes more persistent. The rainy season, which coincides with the summer monsoon, is characterized by southerly or southwesterly winds, very high humidity, heavy rainfall, and long consecutive days of rainfall which are separated by short spells of dry days. Rainfall in this season is caused by the tropical Depressions that enter the country from the Bay of Bengal.

Temperature:January is the coldest month in Bangladesh. Average temperatures in January vary from about 17'C in the northwestern and northeastern parts to 20°-21°C in the coastal areas. In late December and early January, minimum temperature in the extreme northwestern and northeastern parts of the country reaches within 4 to 7 degrees of freezing point. As the winter season progresses into the pre-monsoon hot season, temperature rises, reaching the maximum in April, which is the middle of the pre-monsoon hot season. Average temperatures in April vary from about 27°C in the northeast to 30°C in the extreme west central part of the country. After April, temperature decreases slightly during the summer months, which coincides with the rainy season. Widespread cloud covers causes dampening of temperature during the later part of the pre-monsoon season. Average temperatures in July vary from about 27°C in the southeast to 29°C in the northwestern part of the country.

Humidity: March and April are the least humid months over most of the western part of the country. The lowest average relative humidity (57%) has been recorded in Dinajpur in the month of March. The least humid months in the eastern areas are January to March. Here the lowest monthly average of 58.5% has been recorded at Brahmanbaria in March. The relative humidity is everywhere over 80% during June through September. The average relative humidity for the whole year ranges from 78.1% at Cox's Bazar to 70.5% at Pabna.

Figure 3.2 shows the locations of visited municipalities on Bangladesh climatic elements map.

Figure 3.2: Locations of visited municipalities on Bangladesh climatic elements map.

Rainfall: The rainfall in Bangladesh varies, depending upon season and location. Winter (November through February) is very dry and accounts for only less than 4% of the annual rainfall. Rainfall in this season varies from 20 mm in the west and south to 40 mm in the northeast, which is caused by the westerly disturbances that enter the country from the northwestern part of India. Rainfall in the pre-monsoon hot season (March-May) accounts for 10-25% of the total annual rainfall. The rain in this period is caused by convective storms (thunderstorms) or nor'westers (locally called Kalbaishakhi). Average rainfall of this season varies from 200 mm in the west-central part of the country to 800 mm in the northeast. The rainy season (June through October) accounts for 70 to 85% of the annual rainfall, which varies from 70% in the eastern part of the country to about 80% in the southwest, and 85% in the northwest. The amount of rainfall during this season varies from 1000 mm in the west-central part of the country to over 2000 mm in the south and northeast. The average annual rainfall in Bangladesh varies from 1500 mm in the west-central part to over 3000 mm in the northeast and southeast.

Figure 3.3 shows the locations of visited municipalities on Bangladesh rainfall map. Table 3.1 shows the site-specific climatic data of the five municipalities which are represented by the BMD stations of Dhaka, Chattogram and Tangail.

Figure 3.3: Locations of visited municipalities on Bangladesh rainfall map.

Geology and Seismicity

Geology of Bangladesh is generally dominated by poorly consolidated sediments deposit over the past 10,000 to 15,000 years (Holocene age). It is mostly characterized by the rapid subsidence and filling of a basin in which a huge thickness of deltaic sediments were deposited gradually from the north to south. The delta building is still continuing in the present Bay of Bengal and a broad fluvial front of the Ganges-Brahmaputra-Meghna river system gradually follows it from behind.

Soil Characteristics

The soil formation in Bangladesh is remarkably homogeneous in appearance, both vertically and laterally. It comprises layer of unconsolidated clay, about 10m thick near Dhaka, but apparently thinner to the east and possibly much thicker in the west of the Rajshahi district. The sand mineralogy in this area is broadly similar to that of the tertiary hill sediments. Mineral contents of the soil are high in quartz, relatively low in feldspar and mica, and with zircon, tourmaline, kyanite, staurolite, sillimanite, and epidote dominating the heavy mineral fractions. The content of easily weatherable minerals ranges from 4 to 9%. The soil of Bangladesh can broadly be classified into seven tracts: (1) Madhupur Tract or Red Soil Tract, (2) Barind Tract, (3) Tista Silt, (4) Brahmaputra Alluvium, (5) Gangetic Alluvium, (6) Coastal Saline Tract, and (7) Hill Tracts. Figure 3.4(a) shows the positions of the Municipality Areas on the soil tract map of Bangladesh.

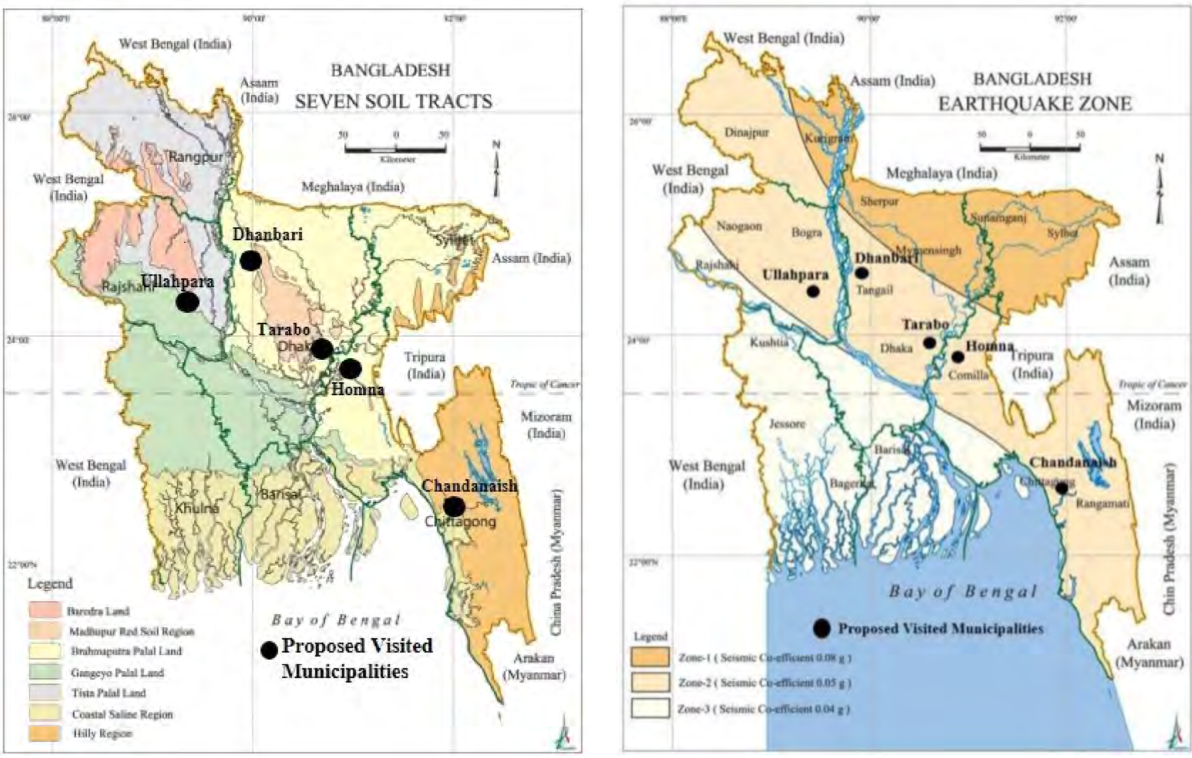
Table 3.1: Temporal variation of climatic variables in 2016 for Dhaka, Chattogram and Tangail BMD stations which represents the weather of the 5 municipalities

		Unit	January	February	March	April	May	June	July	August	September	October	November	December
Dhaka (represents Tarabo, Narayanganj and Homna, Comilla)														
	Temperature (Max)	?C	24.1	28.9	32.2	34.1	32.8	33.0	31.4	32.5	32.1	32.4	29.0	27.3
	Temperature (Min)	?C	14.2	19.1	22.6	26.9	24.9	27.0	26.5	26.8	26.6	25.3	20.2	17.0
	Wind Speed	Knot	2.3	2.1	2.5	2.9	2.8	2.2	2.1	2.1	1.6	2.0	1.4	1.6
	Rainfall	mm	0.1	0.4	1.8	1.8	6.8	7.1	13.1	5.5	4.6	2.5	0.8	0.0
	Relative Humidity	(%)	68.0	63.0	59.0	72.0	74.0	75.0	82.0	77.0	82.0	74.0	73.0	72.0
Chittagong (represents Chandanaish, Chattogram)														
	Temperature (Max)	?C	25.6	29.4	32.4	32.7	33.0	33.0	31.3	31.9	32.8	32.6	29.5	28.6
	Temperature (Min)	?C	14.7	19.4	22.8	26.3	25.7	26.0	26.0	26.0	26.1	25.3	20.7	18.1
	Wind Speed	Knot	6.1	7.3	7.4	11.1	8.7	8.6	7.7	7.1	6.2	5.3	6.6	4.5
	Rainfall	mm	0.2	0.2	2.5	1.3	8.2	6.7	18.3	12.8	10.8	8.0	3.0	0.0
	Relative Humidity	(%)	75.0	72.0	72.0	77.0	78.0	79.0	84.0	82.0	81.0	79.0	76.0	75.0
Tangail (represents Dhanbari, Tangail and Ullahpara, Sirajgonj)														
	Temperature (Max)	?C	24.5	29.3	32.9	35.5	33.8	33.9	32.6	33.6	33.2	33.2	30.1	27.4
	Temperature (Min)	?C	11.3	16.5	19.9	24.8	23.6	25.6	25.5	25.9	25.3	24.3	18.6	14.8
	Wind Speed	Knot	1.4	1.7	1.7	2.3	2.0	2.0	2.2	2.1	1.7	1.5	1.3	1.4
	Rainfall	mm	0.3	0.5	0.8	1.5	5.9	4.2	11.6	3.3	4.7	4.0	0.1	0.0
	Relative Humidity	(%)	79.0	74.0	69.0	75.0	75.0	79.0	85.0	81.0	84.0	81.0	77.0	82.0

Dhanbari, Homna and Tarabo Municipality is situated on the Brahmaputra Alluvium soil tract. It covers an area of 40,000 sq km. The dominant soil texture is sandy loam. The soils are acidic in character and the pH ranges from 5.5 to 6.8. The soils are naturally fertile and are recharged every year by fresh deposition by the floodwaters.

Ullahpara Municipality falls under Tista Silt soil tract covering an 16,000 sq. km. area of parts of the former greater districts of Rangpur, Dinajpur, Bogra and Pabna. It covers an area of approximately 16,000 sq km. The predominant soil texture is sandy loam. The pH of the topsoils ranges from 5.5 to 6.5. The soils are in general fertile and are rich in potassium and phosphorus.

Chandanaish Municipality is situated on the Coastal Saline Tract, which Comprises parts of the former Barisal, Patuakhali, Khulna, Noakhali and Chattogram districts. A total of around 20,000 sq km area is under this tract. It represents the flat low-lying areas along the coastal belt and the estuarine islands. The soils are saline and the pH values are neutral to slightly alkaline. The soils are well supplied with potassium and phosphorus. The sundarbans is located in this tract.



(a) (b)

Figure 3.4: Location of the visited municipality sites on the (a) soil tract map and (b) seismic map of Bangladesh.

To assess the heavy metal contents of the natural soil in the study areas soil samples were collected from the representative sites for the proposed BMWSSP project. Samples were collected from about 0.15 m below the top of the original soil layer, using a split spoon. A total extraction of heavy metal from soil samples following the USEPA guidelines has been performed to determine the selected heavy metal contents. The Sampling locations along with their coordinates are shown in Table 3.2(a) and the results along with the typical concentrations of different heavy metals usually found in natural soils are presented in Table 3.2(b).

Table 3.2(a): Soil Sampling Locations

Sample ID	Municipality	District	Location
SS-1	Dhanbari	Tangail	24°41'7.08"N 89°58'9.07"E
SS-2	Ullahpara	Sirajganj	24°17'50.64"N 89°35'35.16"E
SS-3	Tarabo	Narayanganj	23°45'53.22"N 90°32'0.93"E
SS-4	Homna	Comilla	23°40'58.41"N 90°46'39.52"E
SS-5	Chandanaish	Chattogram	22°11'31.46"N 92° 00'19.34"E

Table 3.2(b) : Heavy metal content of the soils from the BMWSSP sites.

Sl. No	Parameters	Unit	Concentration Present					Typical content in natural soil[a]
			SS-1	SS-2	SS-3	SS-4	SS-5	
1	Lead, Pb	mg/kg	21.8	14.3	23.0	12.6	18.3	2 – 200 (avg 10)
2	Cadmium, Cd	mg/kg	0	0	0.1	0	0.2	0.1 – 0.7 (avg 0.6)
3	Chromium, Cr	mg/kg	30.1	15.4	26.9	19.5	21.1	1 – 1000 (avg 100)
4	Zinc, Zn	mg/kg	65.7	63.1	83.5	67.2	50.4	100-300 (avg 50)
5	Mercury, Hg	mg/kg	ND	ND	ND	ND	0.02	0.01 – 0.3 (avg 0.03)
6	Copper, Cu	mg/kg	34.0	16.6	28.5	21.0	15.0	2 – 100 (avg 30)
7	Arsenic, As	mg/kg	11.43	5.61	10.97	6	6.53	-

[a]USEPA Office of Solid Waste & Emergency Response, Hazardous WasteLand Treatment, SW-874 (April 1983, Page 273); ND = Not Detectable

Seismicity

Bangladesh is possibly one of the most vulnerable to potential earthquake threat and damage. Earthquake vulnerability of any place largely depends on its geology and topography, population density, building density and quality, and finally the coping strategy of its people and it shows clear spatial variations. The whole of Bangladesh is divided into three seismic zones. The northern part of the country that includes the greater districts of Rangpur, Mymensingh, and Sylhet are in the Zone-I where earthquake shock of maximum intensity of IX of the Modified Mercalli Scale is possible. The Zone-II includes the greater districts of Dinajpur, Bogra, Dhaka and Chattogram and the shocks of intensity of VIII are possible. The southern part of the country, the least active region, where the maximum intensity is not likely to exceed VII, is in the Zone-III.

All 5 Municipalities fall under Zone II on the earthquake zone map [Figure 3.4(b)], which implies that earthquakes of moderate intensities are expected in these areas.

Cyclone and Tidal Surge

Bangladesh very often becomes the landing ground of cyclones formed in the Bay of Bengal. This is because of the funnel shaped coast of the Bay of Bengal, Most of the damage occurs in the coastal regions of Khulna, Patuakhali, Barisal, Noakhali and Chattogram and the offshore islands of Bhola, Hatiya, Sandwip, Manpura, Kutubdia, Maheshkhali, Nijhum Dwip, Urir Char and other newly formed islands. The coastal zone of Bangladesh is disaster prone. A cyclone risk map, prepared by the Management Information & Monitoring (MIM) Division of the Disaster Management Bureau (DMB) in 2001 (Figure 3.5(a)), distinguishes between the risk zones of no risk, wind risk, low risk and high risk. **Dhanbari, Ullahpara, Tarabo, Homna Municipality** areas falls under risk free zone. While some parts of **Chandanaish Municipality** project area falls under low risk area (where surge height is less than 1m), some parts fall under high wind area.

Floods

Bangladesh is prone to flooding; the coastal flooding as well as the bursting of Bangladesh's riverbanks is common and severely affects the landscape of the country. 75% of Bangladesh is less than 10m above sea level and 80% is flood plain, therefore rendering Bangladesh as a nation very much at risk of further widespread damage. Flooding normally occurs during the monsoon season from June to September during the monsoon. The convectional rainfall of the monsoon is added to by relief rainfall caused by the Himalayas. Melt-water from the Himalayas is also a significant input and flood every year. Figure 3.5(b) shows the positions of the visited municipalities on the flood risk map of Bangladesh. Tarabo municipality is located in the flood risk free zone. Ullahpara, Dhanbari and Homna municipalities are located in the monsoonal flooding zone while the Chandanaish municipality is within the flash flood zone. Figure 3.6 shows the water levels of the nearest surface water bodies during the period 2011-2017. Table 3.2(c) presents the highest and lowest water levels at these stations.

Figure 3.5(a): Location of the visited municipality sites on the cyclone affected area map of Bangladesh

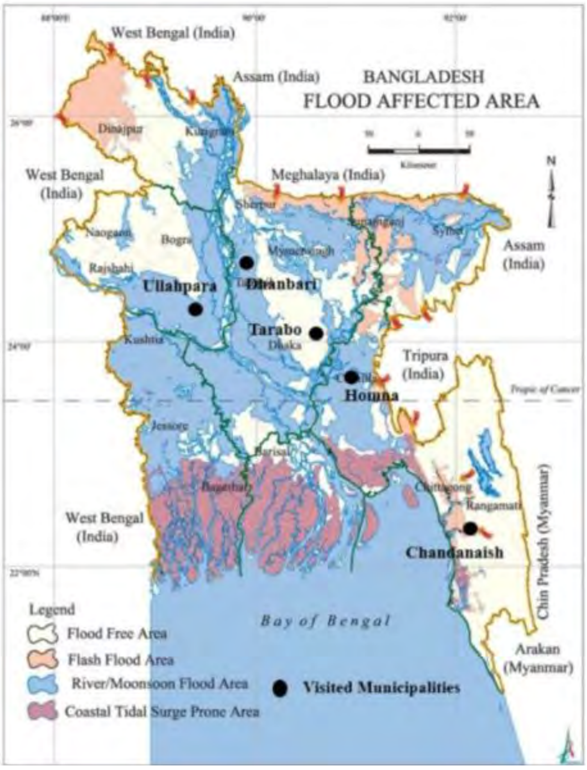


Figure 3.5(b): Location of visited municipalities on Bangladesh flood affected area map.

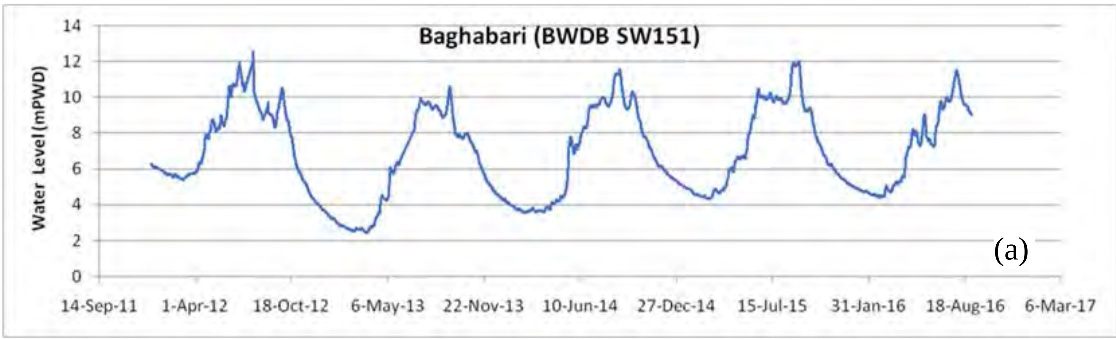
Figure 3.6(a): Temporal variation of water levels at selected surface water bodies nearest to the municipalities (source: BWDB)

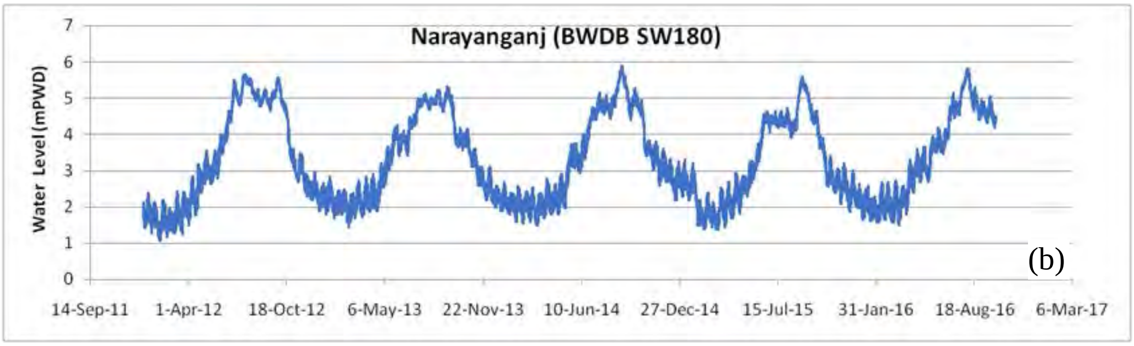
Table 3.2(c): Highest and lowest water levels of selected surface water monitoring stations near the municipalities visited (source BWDB)

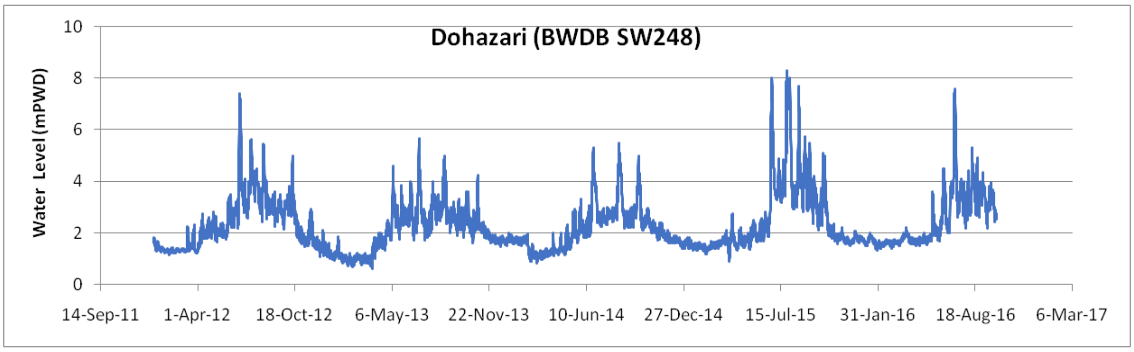
Municipality	Nearest BWDB Station	River	Highest water level, 2011-2017 (mPWD)	Lowest water level, 2011-2017 (mPWD)
Ullahpara Sirajganj	Baghabari	Karatoa-Atrai-GGH	12.55	2.43
Tarabo, Narayanganj	Narayanganj	Lakhya	5.9	1.07
Homna, Comilla	Meghna-Br	Meghna	4.5	0.5
Chandanaish, Chattogram	Dohazari	Sangu	8.3	0.6

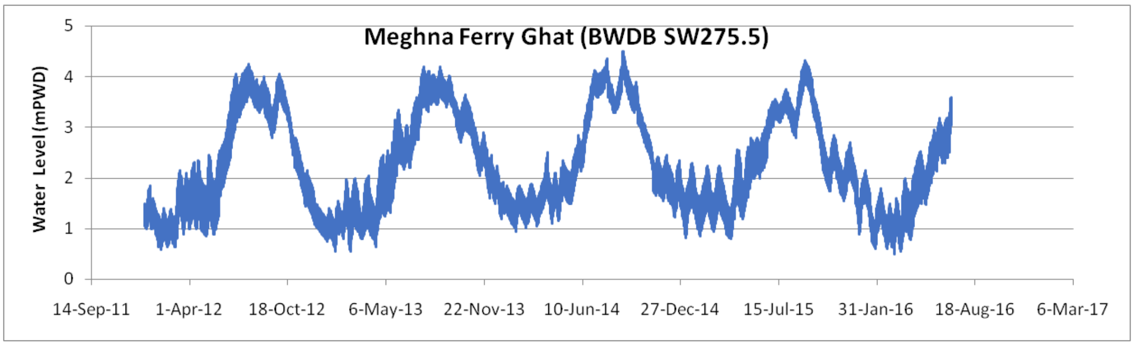
Groundwater Level

Water aquifers are present beneath the vast majority of Bangladesh, which are being recharged by the major river systems and by infiltration of rainwater. The groundwater level fluctuates seasonally, approaching the ground surface at some places of the country during the months July to September. Groundwater is replenished each year during the monsoon season when rain and flood water finds its way into the aquifer slowly percolating down through overlying soils and sediments. The rate of recharge varies depending on the property of soil and geology of the area. Figure 3.6(b) shows the location of the proposed project site on the groundwater zoning map of Bangladesh. It can be seen from the map that groundwater is available at most of the sites around 5.3-7.8 m below the ground surface. In Tarabo, Narayanganj the groundwater table is further below that (9.8 m or higher). However there is large seasonal variation in groundwater table in the municpalities as can be seen in Figure 3.6(c). The historical water level data of Ullahpara municipality shows that GW table can vary between 3.54m to 12.55 m depending on the season. In Homna municipality the GW table can vary between 0.62 to 6.75 m.









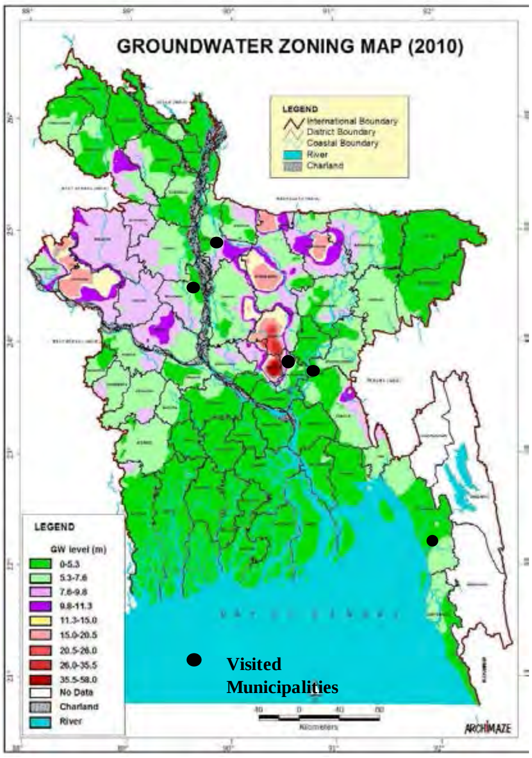


Figure 3.6(b): The location of the 5 municipalities over the groundwater level map of Bangladesh

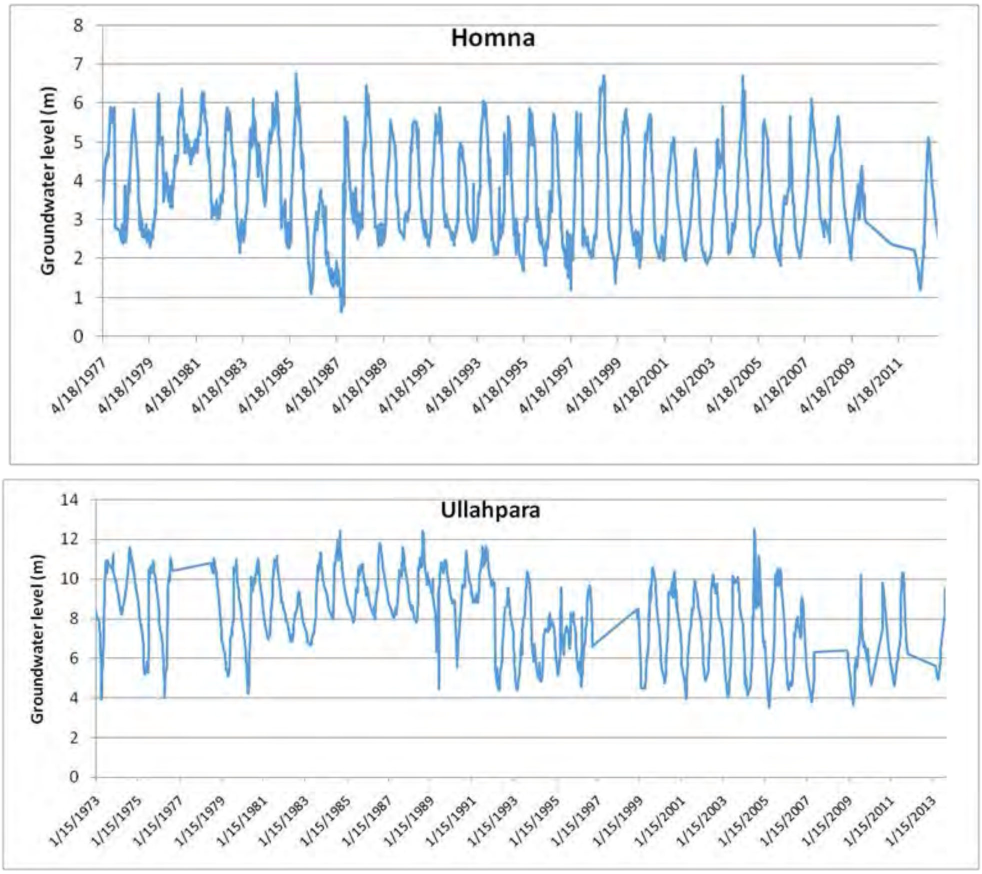


Figure 3.6(c): Seasonal variation of groundwater table in Ullahpara and Homna municipalities

Water Quality

As a part of the baseline survey, surface water and groundwater quality in and around the 5 Municipalities were assessed. To assess the drinking water parameters near the project areas, a groundwater sample from deep tubewell and a surface water sample from nearby river which is proposed to be the intake point for WTP, are taken from each Municipality. Except in Dhanbari Municipality, no surface water sample was taken since existing rivers are almost dead and hence cannot be used as an intake point. The samples were collected between on 28 February- 8 March, 2018 and were analyzed for selected drinking water quality parameters and other parameters in the Environmental Engineering Laboratory, BUET. Locations of these samples are shown in Table 3.3. Ground water sample test results along with WHO guideline values and Bangladesh Standard for Drinking Water (ECR, 97) are given in Table 3.4. In Table 3.5, surface water test results are given with inland water quality standard of ECR, 97.

Table 3.3: GPS Water Sampling locations and sample ID

Sample ID	Municipality	District	Sampling Location Description	Location Coordinates
DH- GW	Dhanbari	Tangail	Tubewell beside municipality office(Depth: 250-300ft)	24°40'43.19"N 89°57'06.70"E
UL- GW	Ullahpara	Sirajganj	Pumping Station near Municipality office (Depth: (160 ft)	24°18’35.98"N 89°34'09.53"E
UL- SW	Ullahpara	Sirajganj	Intake point at Karatoya River	24°17'57.60"N 89°35'35.74"E
TA- GW	Tarabo	Narayanganj	Pump Water (Depth: 320ft)	23°45'53.33"N 90°31'55.34"E
TA- SW	Tarabo	Narayanganj	Intake point at Shitalakshya River	23°45'44.53"N 90°30'35.66"E
HO-GW	Homna	Comilla	Inside Pourashava Building (Depth: 600-700ft)	23°40'29.33"N 90°42'42.13"E
HO-SW	Homna	Comilla	Intake point at Titas River	23°41'25.37"N 90°47'10.75"E
CH-GW	Chandanaish	Chattogram	Tubewell (Depth: 900ft)	22°11'18.41"N 91° 0'19.25"E
CH-SW	Chandanaish	Chattogram	Intake point at Sangu River	22°10'5.52"N 91°59'5.85"E

Table 3.4: Summary characteristics of water samples near the project area

Water Quality Parameters	Unit	Concentration Present					WHO Guide line values 2004	Bangladesh Standard for Drinking Water (ECR’97)
		DH-GW	UL-GW	TA-GW	HO-GW	CH-GW		
pH	-	6.86	7.03	7.29	6.55	7.2	6.5 - 8.5	6.5 - 8.5
Turbidity	NTU	3.71	227.0	1.92	120	19.6	5	10
Color	Pt. Co Unit	10	20	2	16	15	15	15

Water Quality Parameters	Unit	Concentration Present					WHO Guide line values 2004	Bangladesh Standard for Drinking Water (ECR'97)
		DH-GW	UL-GW	TA-GW	HO-GW	CH-GW		
Total Hardness as $CaCO_3$	mg/L	388	258	160	204	140	500	200 - 500
Iron, Fe	mg/L	0.18	12.4	0.06	14	2.2	0.3	0.3 - 1.0
Manganese, Mn	mg/L	6.98	1.1	0.038	0.697	0.699	0.4	0.1
TDS	mg/L	576	397	277	569	705		1000
Arsenic, As	µg/L	3.4	21.4	3.2	3	1.6	10	50
Chloride, Cl^-	mg/L	135	88	12	228	255	250	150 - 600
Total Coliform, TC	# / 100 ml	Nil	Nil	Nil	Nil	14	00 TC / 100 ml	00 TC / 100 ml
Fecal Coliform, FC	# / 100 ml	Nil	Nil	Nil	Nil	Nil	00 FC / 100 ml	00 FC / 100 ml
Electric Conductivity, EC	µS/cm	1053	737	440	798	1342	-	-

High Iron and Manganese have been found in groundwater in several locations. Excessive Iron has been found in Ullahpara, Homna and Chandanaish municipalities and installation of GW-based WTPs in these areas definitely has to address this issue. The Manganese concentration in these areas is high as well. Consequently the samples showed high color and turbidity which may not be acceptable for drinking. Bacteriological quality has been found to be generally acceptable. The arsenic concentration in these areas has been found to be acceptable. All the surface water samples have been found to have parameter values within acceptable levels except the one at the intake at Sitalakhya River at Tarabo. Compared to other surface water samples, this showed indication of organic pollution (relatively high BOD/COD values and Fecal coliform). Any water treatment system should address the abovementioned parameters in order to make the water suitable for drinking.

Table 3.5: Water Quality Test Results of surface water samples.

	Water Quality Parameter	Unit	Concentration present				Inland Water Quality Standard (ECR' 97)
			UL-SW	TA-SW	HO-SW	CH-SW	
1	pH	-	7.61	7.54	7.47	7.75	6.5-8.5
2	Turbidity	NTU	4.76	27.6	4.81	186	--
3	Electrical Conductivity (EC) at 25^oC	µS/cm	274	639	172	458	--
4	Nitrate (NO_3-N)	mg/L	0.04	1.02	0.01	0.07	--
5	Phosphate (PO_4)	mg/L	0.32	2.05	0.13	0.15	--
6	Chemical Oxygen Demand (COD)	mg/L	19	30	9	12	--
7	Biochemical	mg/L	2.4	6.4	0.4	0.8	≤ 2[a], ≤ 3[b],≤

	Water Quality Parameter	Unit	Concentration present				Inland Water Quality Standard (ECR' 97)
			UL-SW	TA-SW	HO-SW	CH-SW	
	Oxygen Demand (BOD_5)						$6^{c, d}$, $\leq 10^{e, f}$
8	Fecal Coliform, FC	# / 100 ml	40	3000	108	900	--

a: to be usable as a source of water supply only after disinfection; b: to be usable for recreational activity; c: to be usable as a source of water supply after conventional treatment; d: to be usable for fisheries; e: to be usable for various process and cooling industries; f: to be usable for irrigation

Ambient Noise Level

As a part of the baseline study, noise level measurements were carried out at nearby significant locations of the Municipality project sites. Sound level measurements were taken on February- March, 2018 during daytime and night time using a data logging sound level meter (Extech HD600). Summary of day time and night time noise measurements are shown in Tables 3.6-3.10. Bangladesh Standard for Noise level is presented in Table 3.11. As expected, all sampling locations in busy areas (bus stands, bazars, traffic intersections etc) showed high noise levels during daytime.

Table 3.6: Sound level measurements with respective locations on different points of Dhanbari, Tangail

Municipality, District	Location Description	Coordinates	Day Time				Night Time			
			Time	Equivelent Noise Level, Leq (dB)	Max	Min	Time	Equivelent Noise Level, Leq (dB)	Max	Min
Dhanbari, Tangail	Proposed WTP and Dumping Location	24°41'7.05"N 89°58'9.66"E	4:40 PM	52.74	66.3	42.3	7:05 PM	50.28	61	43.5
	Ambagan Mor	24°40'38.43"N 89°57'18.80"E	4:59 PM	77.64	92.5	60.4	7:21 PM	75.71	95.4	56.4
	Dhanbari Nawab Shahi Jame Mosque	24°40'29.66"N 89°57'21.12"E	5:05 PM	65.92	79.1	55.2	7:25 PM	58.87	74.5	54.3
	Koyapara Mor	24°40'3.32"N 89°57'31.40"E	5:11 PM	76.54	90.5	56.2	7:35 PM	72.54	85.6	51.6
	Dhanbari Bus Stand	24°40'37.10"N 89°57'8.18"E	5:17 PM	76.74	87	67.4	7:53 PM	77.85	92.5	64.2

Table 3.7: Sound level measurements with respective locations on different points of Ullahpara, Sirajganj.

Municipality, District	Location Description	Coordinates	Day Time				Night Time			
			Time	Equivelent Noise Level, Leq (dB)	Max	Min	Time	Equivelent Noise Level, Leq (dB)	Max	Min
Ullapara,	Vhatta Kawak	24°18'17.02"N	4:30 PM	64.13	74.9	51.9	8:03 PM	62.84	68.5	48.7

Municipality, District	Location Description	Coordinates	Day Time				Night Time			
			Time	Equivelent Noise Level, Leq (dB)	Max	Min	Time	Equivelent Noise Level, Leq (dB)	Max	Min
Shirajganj		89°33'58.33"E								
	Kawak Mohr	24°18'18.18"N 89°33'54.43"E	5:09 PM	73.52	86.5	59	7:30 PM	71.69	85.9	60.8
	Shyamoli Para Bus Stand	24°18'27.71"N 89°33'48.19"E	5:13 PM	82.59	97.2	70.5	9:02 PM	76.12	85	65.1
	Ullapara Pouro Bus Terminal	24°18'49.07"N 89°33'48.00"E	5:20 PM	57.9	64.8	47.3	8:45 PM	66.4	78.2	56
	Ullapara Bazar	24°18'39.28"N 89°34'6.72"E	5:31 PM	80.08	95.2	68.2	8:30 PM	73.5	83.5	64.5
	Near Intake Point at Karotoya River	24°17'54.06"N 89°35'35.85"E	5:46 PM	58.19	61.7	49.1	9:20 PM	58.37	64.8	54
	Ghatina Bridge	24°17'51.55"N 89°35'36.15"E	5:51 PM	74.42	91.3	55.5	9:23 PM	59.59	76.4	51.8

Table 3.8: Sound level measurements with respective locations on different points of Tarabo, Narayanganj

Municipality, District	Location Description	Coordinates	Day Time				Night Time			
			Time	Equivelent Noise Level, Leq (dB)	Max	Min	Time	Equivelent Noise Level, Leq (dB)	Max	Min
Tarabo, Narayanganj	Near Proposed Intake Point at Shitalakshya River	23°45'44.05"N 90°30'36.67"E	8:10 AM	67.37	88.2	46	7:48 PM	57.37	61.6	50.3
	Near Proposed WTP Plant, Bangshi Nagar, Doiboch	23°45'52.65"N 90°31'58.25"E	9:19 AM	50.58	53.4	49.1	7:11 PM	55.58	64.2	51.5

Municipality, District	Location Description	Coordinates	Day Time				Night Time			
			Time	Equivelent Noise Level, Leq (dB)	Max	Min	Time	Equivelent Noise Level, Leq (dB)	Max	Min
	S M Kader Kindergarten School	23°43'28.55"N 90°31'18.63"E	10:53 AM	72.95	84.7	62	7:01 PM	58.24	71.5	48.6
	Tarab Bysho Road	23°43'28.24"N 90°30'49.01"E	11:44 AM	84.87	95.5	78	8:12 PM	79.32	85.8	73.7
	Boropa Purba Bazar	23°44'47.55"N 90°32'40.53"E	12:12 PM	73.82	84.7	61	8:46 PM	66.87	81.9	54
	Shahid Miner	23°43'21.01"N 90°30'25.83"E	3:44 PM	73.18	83.2	66.5	8:46 PM	73.1	85.9	67.4

Table 3.9: Sound level measurements with respective locations on different points of Homna, Comilla

Municipality, District	Location Description	Coordinates	Day Time				Night Time			
			Time	Equivelent Noise Level, Leq (dB)	Max	Min	Time	Equivelent Noise Level, Leq (dB)	Max	Min
Homna, Comilla	Near Proposed Intake Point, Titash River	23°41'23.92"N 90°47'11.38"E	11:27 AM	54.97	67.8	48.9	6:46 PM	78.28	81.2	77.6
	Baghmara Mohr	23°41'25.62"N 90°47'15.93"E	11:46 AM	79.16	97.5	57.4	7:45 PM	68.84	79.3	56.1
	Homna Launch Ghat Road	23°41'5.11"N 90°46'55.41"E	12:19 PM	72.34	81.6	67.5	7.51 PM	64.57	71.4	55
	Thana Road Bazar	23°41'0.40"N 90°46'50.30"E	12:25 PM	77.62	92.1	69	7:54 PM	74.11	84.9	62
	Proposed WTP Area Near Homna Bridge	23°40'58.40"N 90°46'40.41"E	12:51 PM	77.22	96.2	57.8	8:03 PM	66.92	76	59.3

Table 3.10: Sound level measurements with respective locations on different points of Chandanaish, Chattogram

Municipality, District	Location Description	Coordinates	Day Time				Night Time			
			Time	Equivelent Noise Level, Leq (dB)	Max	Min	Time	Equivelent Noise Level, Leq (dB)	Max	Min
Chandanaish, Chattogram	Near Intake point at Shangu River, Jatermukh Bazar	22°10'5.82"N 91°59'7.40"E	8:45 AM	69.43	78	61.1	7:41 PM	69.15	85.9	55.6
	Chandanaish Bazar	22°12'35.27"N 92° 0'40.61"E	9:30 AM	74.23	79.6	64.1	8:31 PM	69.86	79.5	62.2
	Near Barama Masque	22°10'22.70"N 91°59'6.34"E	9:19 AM	73.05	89.7	54.5	8:46 PM	62.06	70.2	52.7

[Note: The equivalent level is the level (L_{eq}) of a hypothetical steady sound that would have the same energy (i.e., the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level represents the time average of the fluctuating sound pressure and is close to the maximum level observed during the measurement period. For the fluctuating noise scenario the equivalent noise level (L_{eq}) is generally used for more complete noise sample and is calculated as follows:

$$L_{eq} = 10\log_{10}\left[\sum_{i=1}^{n} P_i \, 10^{L_i/10}\right]$$

where P_i is the probability of the noise level lying in the i-th measurement interval and L_i is the mid-point of that interval.]

Table 3.11: Bangladesh standards for sound level (GoB, 2006)

Locations	Noise level (dBA) at day	Noise level (dBA) at night
Silent zone	50	40
Residential area	55	45
Mixed area	60	50
Commercial area	70	60
Industrial area	75	70

[Note: Noise Levels are defined as 1 minute Leq]

3.2.3 Aspects of the Municipality Sites Relevant to Project Activities

Dhanbari, Tangail

- Mostly hand Tube wells are used to satisfy drinking water demand in the municipality and only a small fraction has access to supply water. From interviews with relevant stakeholders it was found that there are constant complaints of high Fe and As contamination in almost all tubewells. When DPHE receives complaints from local tubewell users, testing of tubewell water is performed and related branch of Municipality are then informed. Samples are sent to Mymensingh Regional Lab for testing. Usually test results are available within 4-5 days.
- The land for the construction of WTP and pumping station is not purchased yet. The proposed land to be acquired is mainly an agricultural land and Suggested land for pumping station near Dhanbari Koyapara Mohr has a number of trees.
- Both paved and unpaved roads are available for laying down transmission and distribution pipeline network.
- Almost 38.47% (urban 65.13% and rural 25.46%) of the households use sanitary latrines, 49.36% (urban 30.75% and rural 8.45%) of dwelling households use non-sanitary latrines and 12.17% of households do not have latrine facilities. De-sludging work is performed in private initiative by local sweepers and dumped into locally available nearby places.

Present site conditions of Dhanbari Municipality are shown in Figure 3.7.

(a)

(b)

(c)

Figure 3.7: Present site status of Dhanbari Municipality: (a) Proposed lands for WTP and De-Sludging unit are agricultural, (b) Proposed land for Pumping station near Koyapara Mohr, (c) Existing roads are both paved and unpaved.

Ullahpara, Sirajganj

- Lands for WTP, Overhead tank, pumping stations are already acquired by the Municipality. So no land acquisition will be needed
- Sources of drinking water are: Tube-well 92.11%, tap 0.41%, pond 0.30% and others 7.18%. Water is supplied via pumping stations, overhead water reservoir and through a distribution network.
- Fe in water is a major concerning issue in the municipality. Arsenic Test kits are available but the reagents were out of date. Test samples are sent to Bogra regional lab for testing. It usually takes 1 week to get the results.
- 17.55% (rural 15% and urban 48.30%) of dwelling households of the upazila use sanitary latrines and 69.51% (rural 71.64% and urban 43.78%) of dwelling households use non-sanitary latrines; 12.94% of households do not have latrine facilities.(Source: BBS) Septic tank system is available in the area.
- Public Toilets are leased for 1 year through tender by the municipal authority and the lessee is responsible for the maintenance of the toilet. Mechanical De-

Sludgingwork is performed by private entities using local sweepers and dumped into nearby places.

- Most of the roads are paved, but the drainage system is inadequate in this area.

(a) (b) (c) (d)

Figure 3.8 Present site status of Ullahpara Municipality study area: (a) intake point at Karatoya river, (b) proposed land for WTP near Karatoya River intake point, (c) existing pumping station and (d) existing public toilet.

Tarabo, Narayanganj

- Water of Sitalakhya River, which is proposed for the surface water to be treated, is heavily polluted due to uncontrolled industrial discharge. High odour was felt by the side of the river.
- Tubewell and community based water supply system meets the local needs. As and Fe problem are not a problem in the municipality.
- Community-based water supply system is running in the locality.Ground water is extracted by 320 ft deep pump and stored in a 10000 liter overhead tank in a local house. Then water is supplied with pipes to the nearby houses. The beneficiary community is responsible for the maintenance of the whole operation. By this process about 70 houses, each consisted with an average of 6 members, is provided with a water connection.

- 90% of the households have no septic tank system. The local practice is to dumping sewage into drains or pits. Area for public toilet is available but no public toilet is in operation at the municipality.

(a)

(b)

(c)

(d)

Figure 3.9: Present site status of Tarabo Municipality, Narayanganj study area: (a) polluted Sitalakhya River (proposed intake point location), (b) proposed land for WTP, (c) community based water supply system, (d) probable area for public toilet by the side of Bissho Road.

Homna, Comilla

- The proposed intake point at Titas river is at about 2 km distance from proposed WTP area.
- Ground water is extracted from 600-700 ft with pump and supplied to the community via a distribution network.
- Septic tank system is available for sanitation purpose. But most of the sewage are discharged into the drains which are directly connected to Titas River.
- Public Toilets are leased for 1 year through tender by the municipal authority and the lessee is responsible for the maintenance of the toilet.
- Mechanical Desludging work is performed by private initiative via local sweepers and dumped into locally available nearby places.

(a) (b)

(c) (d)

Figure 3.10: Present site status of Tarabo Homna, Comilla study area: (a) Titas river intake point, (b) sewage is directly being dumped into Titas River, (c) proposed WTP plant area, (d) existing example of public toilet.

Chandanaish, Chattogram

- Intake point at Sangu river is at a 5-6 km distance from proposed WTP Land. No centralized water supply system (and distribution network) available in the area. Local water demand is met up by pond water or hand tubewells which are usually 850-900 ft deep.

- Water samples are sent to Comilla Regional office for testing. Usually it takes about 7 days to get the results.
- Recently a few public toilets are provided to the locality, but maintenance program is not yet availabl.
- Pit latrine available for 90% households.
- The spiral nature of roads may be a major problem in the laying of transmission / distribution pipe lines.


(a)


(b)

Figure 3.11: Present site status of Tarabo Chandanaish, Chattogram study area: (a) proposed intake point at Sangu River, (b) Spiral road network.

3.3 Ecological Environment

3.3.1 Introduction

A rapid eco-environmental baseline study was carried out for the proposed 'Bangladesh Municipal Water Supply and Sanitation (BMWSS) Project (BMWSSP), which will be implemented by the Department of Public Health Engineering (DPHE) of Bangladesh Government (GoB) with financial support from the World Bank (WB). As noted earlier, the proposed BMWSSP have two broad components viz. (a) water supply infrastructure that will include (i) construction of new water treatment plant (WTP), (ii) intake for raw water source, (iii) expansion and rehabilitation of distribution networks, and (b) sanitation and septage management that will include (i) construction of small scale fecal sludge treatment plant (FSTP) and (ii) decentralization of waste water treatment system.Thesebroad components will be implemented in 30 Pourashavas under 30 Districts of Bangladesh. However, theecological surveyassessment was conductedinthe fivePourashavas (randomly selected)fromthe tentatively proposed BMWSSP's sub project sites viz. (i) Dhanbari Pourashava of Tangail District, (ii) Ullahpara Pourashava of Sirajganj District, (iii) Tarabo Pourashava of Narayanganj District, (iv) Homna Pourashava of Comilla District and (v) Chandanaish Pourashavaof Chattogram Districtduring the perid between February and March 2018. The ecological information has been collected through rapid field research, consultation with local people and literature review, etc. As noted earlier, the specific objectives of the environmental baseline assessment were to gather information on the existing physical, biological, and socio-economic environment of the areas in and around the proposed sub-project sites of the BMWSSP; hence, this part describes the existing ecological environment of the above mentioned Pourashavas of the proposed BMWSSP's sub projectsites. The baseline ecological survey primarily focused on identifying floral and faunal diversity and their distribution and abundance as well as their biological status in Bangladesh. It is mentioned here that a detailedbaseline study will be required(sub-projectcomponent-wise) for inclusion of eco-information in the Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) reports for this BMWSSP. The possible impacts of the BMWSSP's sub-project activities will be evaluated against thosedetailedbaseline conditions and mitigation measures will also be suggested based on identified impacts, if any, in the IEE and EIA reports.

3.3.2 Ecological Environment

The baseline ecologicalassessment of the five sub-project sites under the five districts of the proposed BMWSSP have been describe below separately:

Dhanbari Pourashava of Tangail District: Bio-ecologically the Dhanbari Pourashava remains under the Brahmaputra - Jamuna Floodplain (IUCN Bangladesh, 2002) and Agro-ecologically it remains under the Old Brahmaputra Floodplain (BARC/UNDP/FAO, 1995). The non-calcareous / calcareous dark gray / gray floodplain soil provides suitable environment for growing numerous type of floral species, and also provide supportive habitat for various type of fauna.However, themajor components of this sub-project site have been described here, in brief, from the ecological perspective: (i) the proposed raw water intake source for water treatment have preliminary been selected from Bongshai river near Horipur Bazar of Dhanbari Pourashava; During monsoon, the river has plenty of water with various types of native fish, but in winter, it has little water with some common aquatic flora and fish; some flora and fauna depend on the river for their suitable habitat throughout the year;(ii) the proposed water treatment plant site has preliminary been selected in a seasonal agro-low-wetland near Chatutia village of Dhanbari Pourashava which gets inundated during monsoon and is dry in winter. A number of rural fauna depend on the proposed and adjacent land for food throughout the year; (iii)the water distribution pipe network will run under the existing road networks (paved, semi-paved and non-paved) that have some peripheral florasand some fauna which directly depend on those floras; (iv) the proposed overhead tank site has preliminary been selected in an open space / land within the current pourashava premises; (v) the DTW site has preliminary been selected at the peripheral section of the Singata pond and Koywapara crossing, respectively. As all of the componentsof this sub-project site are geographically scattered and have preliminarily been selected, hence, the general description of the existing eco-aspects is described briefly in the following sections that have covered all the proposed sub project component sites of BMWSSP of DPHE.

(a)

(b)

(c)

(d)

(e)

(f)

Figure 3.12: Selected sites (preliminary) for construction of various components of BMWSSP's sub-project at *Dhanbari Pourashava*: (a) Raw water Intake site,Bongshai River near Horipur Bazar (b) Probable location of Booster pump (c) Proposed water treatment plantsite in agro-wetland near Chatutia village (d) Proposed Water distribution pipelines along the road (e) Site of overhead tank at the Pourashava premises and (f) DTW with pump house near Bonik Samity of Pourashva.

(a) Terrestrial Ecology: The terrestrial macro-ecological aspects of the proposed sub-project site of Dhanbari Pourashavaincludes various types of terrestrial fauna (mammal. bird, reptile and amphibia) and flora (tree, herb and shrub), most of which are distributed in and around the urban homestead, agricultural land, fallow land, along the road, market, shop and building site, in open area, besides water body (pond, canal, river) of Dhanbari Pourashava.Common terrestrial flora grows naturally in abundanceduringthe rainy season. Most of the flora, particularly the trees, are planted for economic purposes and are fairly common, and are scattered geographically. This area has similarity withmost of the other districts of Bangladesh. The existingterrestrial floral diversity makes a complex ecosystem in which some fauna has direct relationship through their ecological niche. Brief description of the terrestrial ecology is given below:

(i) Terrestrial Fauna: Most of the terrestrial faunal species found at Dhanbari Pourashava are fairly common compared to other districts of Bangladesh. Faunal species that are adapted in altered urban habitat are commonly distributed in the urban site, and others types of fauna are distriburted in the rural site of the Pourashava. The following table (Table 3.12)provides the existing faunal information of the proposed sub-project site under Dhanbari Pourashava and following figure (Figure 3.13) shows some of faunal diversity observed during the rapid field survey.

Table 3.12: Terrestrial Faunal Diversity Checklist of Dhanbari Pourashava of Tangail District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Common toad	*Bufo melanostictus*	Y	N	Y	N		Hoopoe	***Upupa epops***	Y	N	N	N
Cricket frog	*Limnonectes limnocharis*	Y	N	Y	N		Indian Cuckoo	*Cuculus micropterus*	Y	N	N	N
Maculated Tree frog	*Polypedus maculates*	N	Y	N	N		Lineated Barbet	*Megalaima lineate*	Y	N	N	N
Common Garden Lizard	*Calotes versicolor*	N	Y	N	N		Oriental Magpie Robin	*Copsychus saularis*	Y	N	Y	N
Common House Lizard	*Hemidactylus flaviviridis*	N	Y	Y	N		Paddy field Pipit	*Anthus rufulus*	N	Y	N	N
Common House Lizard	*Hemidactylus frenatus*	N	Y	Y	N		Purple Sunbird	*Nectarinia asiatica*	N	Y	N	N
Common Vine Snake	*Ahaetulla nasutus*	N	Y	N	N		Pariah Kite	*Milvus migrans*	Y	N	N	N
Yellow Speckled Wolf Snake	*Lycodon zara*	Y	N	N	N		Pied Wagtail	*Motacilla alba*	N	Y	N	N
Garden Monitor Lizard	*Varanus bengalensis*	N	Y	N	Y		Red-vented Bulbul	*Pycnonotus cafer*	Y	N	Y	N
Rat Snake	*Coluber mucosus*	N	Y	N	N		Red-wattled Lapwings	*Vanellus indicus*	Y	N	N	N
Asian Pied Starling	*Sturnus contra*	Y	N	Y	N		Rock Pigeon	*Columba livia*	Y	N	N	N
Black-Hooded Oriole	*Oriolus xanthornus*	N	Y	N	N		Rufous Tree Pie	*Dendrocitta vagabunda*	N	Y	N	N
Black Headed Shrike	*Lanius schach*	N	Y	Y	N		Spotted Dove	*Spilopelia chinensis*	Y	N	Y	N
Black Drongo	*Dicrurus macrocercus*	Y	N	Y	N		Bandicoot Rat	*Bandicota indica*	N	Y	N	N
Black-rumped Flameback	*Dinopium benghalense*	Y	N	N	N		Common House Rat	*Rattus rattus*	N	Y	Y	N
Common Myna	*Acridotheres tristis*	Y	N	Y	N		Fulvous Fruit bat	*Rousettus leschenaultia*	N	Y	N	N
Common Iora	*Aegithina tiphia*	N	Y	N	N		Flying Fox	*Pteropus gigantius*	N	Y	N	N
Common Babbler	*Turdoides caudatus*	N	Y	Y	N		Grey Musk Shrew	*Suncus murinus*	N	Y	N	N
Common Kingfisher	*Alcedo atthis*	Y	N	Y	N		House Mouse	*Mus musculus*	N	Y	Y	N
Common Tailorbird	*Orthotomus sutorius*	Y	N	Y	N		Indian Pipistrelle	*Pipistrellus coromandra*	N	Y	Y	N
Common Tailed Starling	*Sturnus malabaricus*	Y	N	Y	N		Indian Field Mouse	*Mus booduga*	N	Y	N	N
Green Bee Eater	*Merops orientalis*	N	Y	Y	N		Indian Mole Rat	*Bandicota bengalensis*	N	Y	N	N
House Crow	*Corvus splendens*	Y	N	Y	N		Jackal	*Vulpes bengalensis*	Y	N	N	Y
House Sparrow	*Passer domisticus*	Y	N	Y	N		Small Indian Mongoose	*Herpestes auropunctatus*	N	Y	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.

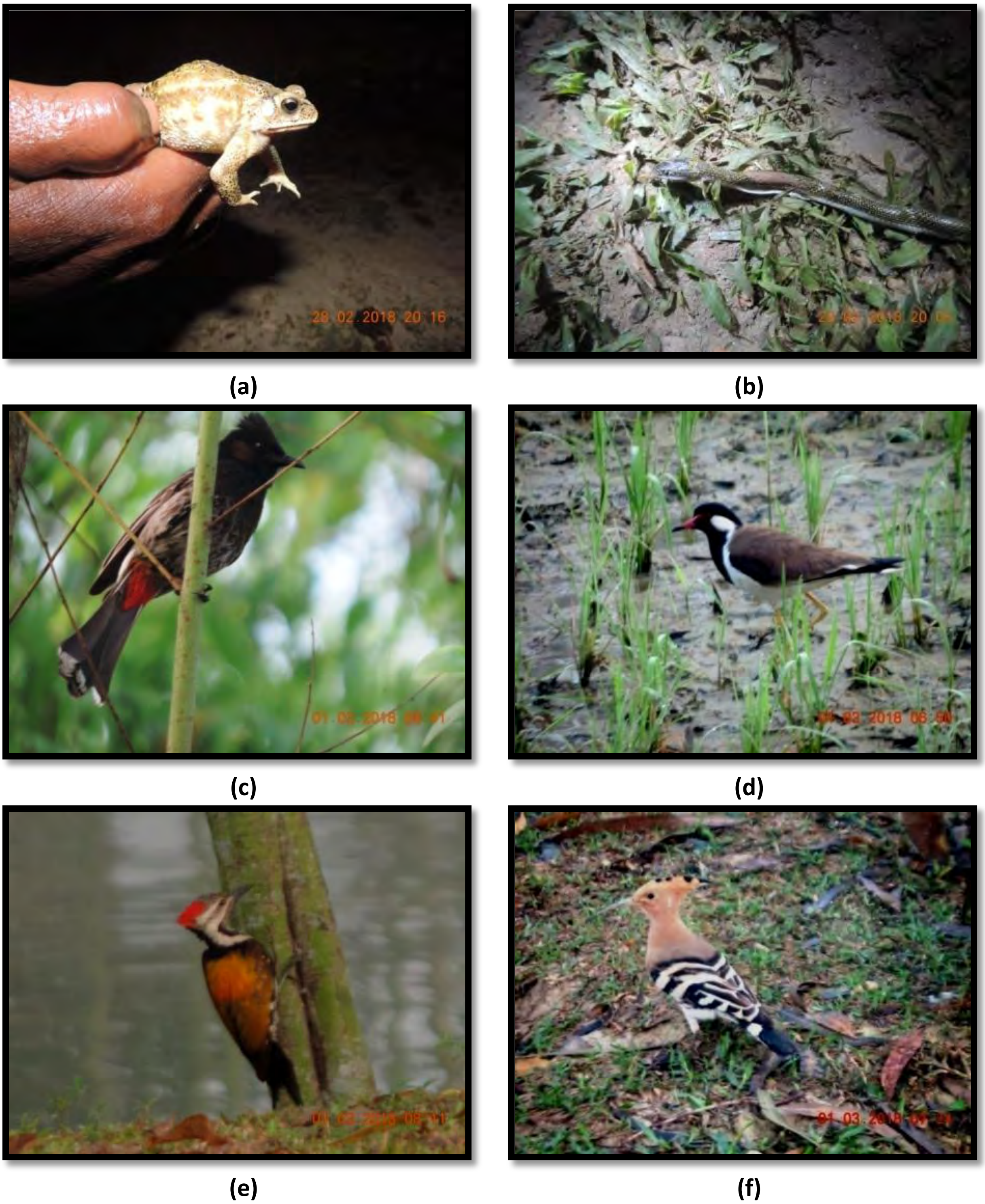


Figure 3.13: Terrestrial fauna observed within and outside of Dhanbari Pourashava of Tangail district: (a) Common Toad (*Bufo melanostictus*), (b) Yellow Speckled Wolf Snake (*Lycodon zara*), (c) Red-vented Bulbul (*Pycnonotus cafer*) (d) Red-wattled Lapwings (*Vanellus indicus*), (e) Black-rumped Flameback (*Dinopium benghalense*) and (f) Hoopoe **(***Upupa epops***)**

(ii) Terrestrial Flora: Most of the terrestrial floral species found at Dhanbari Pourashava are fairly common. Most of the terrestrial floras are distributed in scattered way in some specific sites such as urban homestead, fallow land, along the roads, market and building sites, in open areas, beside rural houses and water bodies.Most of the floras, particularly the trees,are planted for economic and aesthetic purposes, and are fairly common.The following table (Table 3.13) provides the existing floral information of the proposed sub-project sites of BMWSSP Dhanbari Pourashava and also the following figure (Figure 3.14) shows some of floral diversity observed during the rapid field eco-assessment.

(a) **(b)**

(c) **(d)**

(e) **(f)**

Figure 3.14: Terrestrial flora observed within and outside of the proposed sub-project site of DPHE: BMWSSP under Dhanbari Pourashava of Tangail district: (a) Acacia (*Acacia mangium*), (b) Eucalyptus (*Eucalyptus citriodora*), (c) Bamboo (*Bambusa sp.*), (d) Khejur (*Phoenix sylvestris*), (e) Sarkachu (*Monochoria vaginalis*), and (f) Fern (*Drynaria quercifolia*).

Table 3.13: Terrestrial Floral Diversity Checklist of Dhanbari Pourashava of Tangail District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Am	*Mangifera indica*	Y	N	Y	N		Kakdumur	*Ficus hispida*	Y	N	N	N
Acacia	*Acacia mangium*	Y	N	Y	N		Koroi	*Albizia procera*	Y	N	N	N
Assamlata	*Mikania cordata*	N	Y	N	N		Krishnachura	*Delomix regia*	N	Y	N	N
Bansh	*Bambusa spp*	Y	N	Y	N		Kadam	*Anthocephalus chinensis*	Y	N	N	N
Bot	*Ficus benghalensis*	Y	N	Y	N		Khejur	*Phoenix sylvestris*	Y	N	N	N
Boroi, Kul	*Zizyphus mauritiana*	Y	N	N	N		Lazzaboti	*Mimosa pudica*	N	Y	N	N
Bel	*Aegle marmelos*	Y	N	N	N		Lebu	*Citrus limmon*	Y	N	N	N
Bishkatali	*Polygonum hydropiper*	Y	N	N	N		Mehagini	*Swietenia mahagoni*	Y	N	Y	N
Chatim	*Alstonia scholaris*	Y	N	N	N		Mandar	*Erythrina variegate*	N	Y	N	N
Debdaru	*Polyalthia longifolia*	Y	N	N	N		Neem	*Azadirachta indica*	N	Y	N	N
Dholkalmi	*Ipomoea fistulosa*	Y	N	N	N		Narikel	*Coccos nucifera*	Y	N	Y	N
Durbaghas	*Cynodon dactylon*	Y	N	Y	N		Pepe	*Carica papaya*	N	Y	Y	N
Dhan	*Oryza sativa*	Y	N	Y	N		Payara	*Psidium guayava*	Y	N	N	N
Dhekishak	*Pteris vittatai*	Y	N	N	N		Reri, venna	*Ricinus communis*	N	Y	N	N
Dhutra	*Datura metol*	N	Y	N	N		Rendi	*Samanea saman*	N	Y	N	N
Eucalyptus	*Eucalyptus citriodora*	Y	N	Y	N		Sheora	*Sireblus asper*	Y	N	N	N
Hatisur	*Heliotropium indicum*	Y	N	N	N		Sheyalmutra	*Blumea lacera*	Y	N	N	N
Jagadumur	*Ficus glomoreta*	Y	N	N	N		Shon grass	*Phragmites sp.*	Y	N	N	N
Katchu	*Colocasia esculenta*	Y	N	Y	N		Supari	*Areca catechu*	Y	N	Y	N
Kola	*Musa paradisiacal*	Y	N	Y	N		Sarkachu	*Monochoria vaginalis*	Y	N	N	N
Kathal	*Artocarpus heterophyllus*	Y	N	Y	N		Tal	*Borassus fiabellifer*	Y	N	N	N
Kamranga	*Averrhoa carambala*	Y	N	N	N		Tamarind	*Tamarindusindica*	N	Y	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No

(b) Aquatic Ecology: The aquatic macro ecological aspect includes various types of aquatic fauna (mammal. bird, reptile, amphibian and fish) and flora (tree, herb and shrub); and most of the eco-aspects are distributed in and around the water bodies (pond, canal, river, ditch etc) of Dhanbari Pourashava. Common natural aquatic flora grows in plenty in the rainy season. Aquatic flora plays an important role for biodiversity conservation. Aquatic flora grow in river, pond, canal, ditch and low lying cultivated field as submerge, free-floating and rooted floating state.Brief description of the aquatic ecology is given below:

(i) Aquatic Fauna: Most of the aquatic faunal species found at Dhanbari Pourashava are fairly common compared to other districts of Bangladesh. Aquatic faunal species that are adapted in altered urban habitat are commonly distributedin the urban aquatic site and others types of aquatic fauna are distributed in the rural aquatic site of the Pourashava.The following table (Table 3.14) provides the existing aquatic faunal information of the proposed sub-project site under Dhanbari Pourashava and Figure 3.15 shows some of aquatic faunal diversity observed during the rapid field eco-assessment.

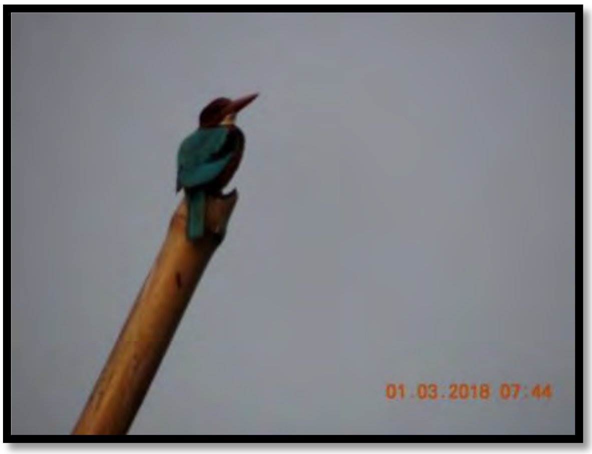
Table 3.14:Aquatic Faunal Diversity Checklist of Dhanbari Pourashava of Tangail District.

Name		**O**	**L**	**C**	**T**	**Name**		**O**	**L**	**C**	**T**
English / Native	**Scientific**					**English / Native**	**Scientific**				
Bull Frog	*Hoplobatrachus tigerinus*	N	Y	N	N	Flying Barb	*Esomus danricus*	N	Y	N	N
Skipper frog	*Euphlyctis cyanophlyctis*	Y	N	Y	N	Grass Carp	Ctenopharyngodon *idella*	N	Y	N	N
Common Skink	*Mabuya carinata*	N	Y	N	N	Gangetic Mudeel	*Monopterus cuchia*	N	Y	N	N
Checkered Keelback	*Xenochrophis piscator*	N	Y	N	N	Gangetic Mystus	*Mystus cavasius*	Y	N	N	N
Common Smooth Water Snake	*Enhydris enhydris*	N	Y	N	N	Gery Fetherback	*Notopterus notopterus*	N	Y	N	N
Dark Belled Marsh Snake	*Xenoch. Cerasogaster*	N	Y	N	N	Giant Snakehead	*Channa marulius*	N	Y	N	N
Olive Keelback	*Atretium schistosum*	N	Y	N	N	Humped Fetherback	*Notopterus chitala*	N	Y	N	N
Bronze Winged Jacana	*Metopidius indicus*	N	Y	N	N	Long whiskered Catfish	*Aorichthys aor*	N	Y	N	N
Cattle Egret	*Bubulcus ibis*	N	Y	N	N	Magur	*Clarius batrachus*	N	Y	N	N
Common Kingfisher	*Alcado athis*	Y	N	N	N	Mrigal	*Cirrhinus mrigala*	Y	N	N	N
Common Sandpiper	*Actitis hypoleucos*	N	Y	N	N	Mottled Nandus	*Nandus nandus*	N	Y	N	N
Fantail Snipe	*Gallinago gallinago*	N	Y	N	N	One-stripe Spinyeel	*Macrognathus aculeatus*	N	Y	N	N
Intermediate Egret	*Egretta intermedia*	N	Y	N	N	Pangus	*Pangasius pangasius*	Y	N	N	N
Large Egret	*Ardea alba*	Y	N	N	N	Rosy Barb	*Puntius conchonius*	N	Y	N	N
Little Egret	*Egretta garzetta*	N	Y	N	N	Rohu	*Labeo rohita*	Y	N	N	N
Little Cormorant	*Phalacrocorax niger*	Y	N	N	N	Rice–paddy Eel	*Pisodonophis boro*	N	Y	N	N
Pond Heron	*Ardeola grayii*	Y	N	N	N	Stinging Catfish	*Heteropneustes fossilis*	Y	N	N	N
Snipe	*Gallinago henura*	N	Y	N	N	Swamp Barb	*Puntius chola*	N	Y	N	N
White Throated Kingfisher	*Halcyon smyrnensis*	Y	N	N	N	Spotted Snakehead	*Channa punctatus*	N	Y	N	N
White Brested Waterhen	*Amaurornis phoenicurus*	N	Y	N	N	Striped Snakehead	*Channa striatus*	N	Y	N	N
Asiatic Snakehead	*Channa orientalis*	Y	N	N	N	Sunset Gourami	*Colisa sota*	N	Y	N	N
Bumblebee Goby	*Brachygobius nunas*	N	Y	N	N	Silver carp	Hypophthalmichthys *molitrix*	Y	N	N	N
Climbing Perch	*Anabas testudineus*	Y	N	N	N	Tank Goby	*Glossogobius giuris*	Y	N	N	N
Catla	*Catla catla*	Y	N	N	N	Ticto/Firefin Barb	*Puntius ticto*	N	Y	N	N
Freshwayer Shark	*Wallago attu*	N	Y	N	N	Tengra Mystus	*Mystus tengara*	Y	N	N	N

Legend: O = Observed, L= Local information, C = Common, T= Threatened, Y=Yes, N=No

(a)

(b)



(c)

(d)

(e)

(f)

Figure 3.15: Aquatic fauna observed within and outside of the sub project sites in Dhanbari Pourashava,Tangail: (a) Pond Heron (*Ardeola grayii*), (b) Little Cormorant (*Phalacrocorax niger*), (c) White-breasted Kingfisher (*Halcyon smyrnensis*), (d) Common King fisher (*Alcado athis*), (e) Fish net in the Bongshairiver to catch fish, and (f) Fish sale in local market.

(ii) AquaticFlora: Most of the aquatic floras are distributed in scattered way in some specific aquatic sites such as water-bodies of agro-wetland, pond, canal, ditch, river etc. All of the aquatic floras are naturally grown, especially in the monsoon season, and are fairly common. Table 3.15 provides the existing aquatic floral information of the proposedsub-project sites of BMWSSP under Dhanbari Pourashava and also Figure 1.16 shows some of floral diversity observed during the rapid field ecological survey.

Table 3.15:Aquatic Floral Diversity Checklist of Dhanbari Pourashava of Tangail District.

Name		**O**	**L**	**C**	**T**
English / Native	**Scientific**				
Floating Grass	*Echinoclo acolonum*	Y	N	N	N
Ghenchu	*Aponogeton natans*	Y	N	N	N
Haicha	*Alternanthera sesilis*	Y	N	Y	N
Helencha	*A. Philoxeroides*	N	Y	N	N
Indurkanipana	*Salvinia cuculata*	N	Y	N	N
Jhangi	*Utricularia aurea*	N	Y	N	N
Janglidhan	*Hygroryza aristata*	N	Y	N	N
KACHURIPANA	*Eichhornia crassipes*	Y	N	Y	N
Khudipana	*Lemna perpusilla*	N	Y	N	N
Katchu	*Colocasia esculenta*	Y	N	Y	N
Kalmi	*Ipomoea aquatic*	N	Y	N	N
Kurcli	*Hydrilla verticillata*	N	Y	N	N
Patajhangi	*Vallisneria spiralis*	N	Y	N	N
Sada Shapla	*Nymphaea nouchali*	N	Y	N	N
Spiral Algae	*Spirogyra sp.*	N	Y	N	N
Topapana	*Pistia strateotes*	Y	N	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.

(a)

(b)

Figure 3.16: Aquatic flora observed within and outside of the proposed sub-project siteunder Dhanbari Pourashava of Tangail district: (a) Kachurypana (*Eichhornia crassipes*), and (b) Topapana (*Pistia strateotes*).

(c) Threatened flora and fauna: No threatened floraswere identified from this proposedsub project sites, but a couple of terrestrial fauna were identified as threatened inDhanbari Pourashava. These threatened faunas are (a) Garden Monitor Lizard (*Varanusbengalensis*) and Jackal (*Vulpes bengalensis*); both of the faunasare also threatened for entire country.

(d) Protected areas, wildlife sanctuaries, game reserves and ecologically critical areas:
(i) Protected Area (PA): Protected Area (PA) refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means i.e., PA is predominantly a natural area established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources (IUCN, 1990). No PA exists at or near the proposed sub-project studysites of BMWSSPunder Dhanbari Pourashava of Tangail district.

(ii) National Park (NP): It is a reserve land, usually declared and owned by a national government, protected from most human development and pollution (IUCN, 1990). No NP exists at or near the proposed sub-project studysites of BMWSSPunder Dhanbari Pourashava of Tangail district.

(iii) Game Reserve (GR): It is an area of land set aside for maintenance of wildlife for tourism or hunting purposes (IUCN, 1990). No GR exists at or near the proposedsub-project study sites of BMWSSP under Dhanbari Pourashava of Tangail district.

(iv) Wildlife Sanctuary (WS): It is an area that assures the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment, where these require specific human manipulation for their perpetuation (IUCN, 1990). No WS exists at or near the proposed sub-project study sites of BMWSSP under Dhanbari Pourashava of Tangail district.

(v) Ecologically Critical Area (ECA): It is an environmental protection zone, defined by the Government of Bangladesh under the Bangladesh Environment Conservation Act, 1995, where ecosystem is considered to be threatened to reach a critical state. No ECA exists at or near the proposedsub-project study sites of BMWSSP under Dhanbari Pourashava of Tangail district.

Ullahpara Pourashava under Sirajganj District
Bio-ecologically the Ullahpara Pourashava remains under the Ganges Floodplain (IUCN-BD, 2002) and agro-ecologically it remains under Karatoya-Bengali Floodplain (BARC/UNDP/FAO, 1995). The calcareous grey floodplain soil / calcareous brown floodplain soil is the prime soil characteristic, which provides habitat for certain type of flora in which local fauna make relationship through their ecological niche. However, the major components of this sub-project site have been described here in brief from the ecological perspective: (i) the proposed raw water intake source for water treatment has preliminary been selected from Karatoya River in between Charghatina Rail and Road Bridges near Charghatina Village of UllahparaPourashava. Throughout the year, the Karatoya river has plenty of water with various types of native fish; some flora and fauna depend on the river for their livelihood throughout the year; (ii) the proposed water treatment plant site has preliminary been selected beside a land adjacent to the Charghatina Bridge near Charghatina village of Ullahpara Pourashava; the proposed land have some peripheral floras that are used by some local fauna as permanent and / or temporary habitat; (iii) the water distribution pipe network will run under the existing road networks (paved, semi-paved and non-paved) that have some peripheral floras, and some fauna directly depend on those floras; (iv) the proposed overhead tank sites have preliminary been selected beside the Ullahpara Poura Bus Terminal (new) and Nayanganj of Ullahpara Pourashava. This area seems to be an agro-

low wetland with some aquatic flora and fauna; (v) the DTW and pump house site has preliminary been preliminarily selected at Kawak Village (Ward no 6) of Ullahpara Pourashava; and (vi)the proposed de-sludge unit or waste dumping site has preliminary been selected in an agro-wetland near Shrelekha village under Ullahpara pourashava(Figure 3.17). As all the sub-project siteshave preliminarily been selected, hence, the general description of the existing eco-aspects is described below in brief that covers all the proposed sub-project component sites of BMWSSP of DPHE.


(a) **(b)**


(c) **(d)**


(e) **(f)**

Figure 3.17: Selected sites (preliminary) for construction of various components of BMWSSP's sub-project atUllahpara of Sirajganj District: (a) Raw water Intake site, Karotoya River (b) Booster pump station (c) Proposed locationfor water treatment plant (d) Proposed Water distribution pipelines along the road (e) Ooverhead tank site in the low-land and (f) Agro-wetland for de-sludge unit / waste dumping unit.

(a) Terrestrial Ecology: The terrestrial macro-ecological aspects of the proposed sub-project site of BMWSSP under Ullahpara Pourashava consists of various types of terrestrial fauna (mammal. bird, reptile and amphibia) and flora (tree, herb and shrub), most of which are distributed in and around the urban homestead, agricultural land, fallow land, along the road, market, shop and building site, in open area, beside water bodies (pond, canal, river) of the Ullahpara Pourashava. Common terrestrial flora grows naturally in plenty in the rainy season. Most of the terrestrial flora particularly the trees are planted for economic purposes and are fairly common, and distributed in scattered way, and have similarity with most of the districts of Bangladesh. The existing terrestrial floral diversity makes a complex ecosystem in which some fauna has direct relationship through their ecological niche. Brief description of the terrestrial ecology is given below:

(i) Terrestrial Fauna: Most of the terrestrial faunal species found at Ullahpara Pourashava are fairly commonand also available in other areas of the district. Faunal species that are adapted in altered urban habitat are commonly distributed in the urban site, and other types of faunas are distributed in the rural site of the Ullahpara Pourashava. The following table (Table 3.16) provides the existing faunal information of the proposed sub-project sites of BMWSSP under Ullahpara Pourashava and following figure (Figure 3.18) shows some of faunal diversity observed during the rapid field eco-assessment.

(a)

(b)

(c)

(d)

(e) **(f)**

Figure 3.18: Terrestrial fauna observed within and outside of the proposed sub-project sites of Ullahpara Pourashava of Sirajganj district: (a) Common House Lizard (*Hemidactylus frenatus*), (b) Common Toad (*Bufo melanostictus*), (c) Pied Wagtail (*Motacilla alba*), (d) Black-headed Shrike (*Lanius schach*), (e) Common Myna (*Acridotheres tristis*), and (f) Large Indian Mongoose **(***Herpestes* edwardsi**).**

(ii) Terrestrial Flora: Most of the terrestrial floral species found at Ullahpara Pourashava are fairly common to other districts of Bangladesh. Most of the terrestrial floras are planted and are distributed in scattered way in some specific sites such as urban homestead, fallow land, along the road, market and building site, in open area, beside rural house and water body. Most of the floras, particularly the trees, are planted for economic and aesthetic purposes, and are fairly common. The following table (Table 3.17) provides the existing floral information of the proposed sub-project site of BMWSSP under Ullahpara Pourashava and Figure 3.19 shows some of floral diversity observed during the survey.

Table 3.16: Terrestrial Faunal Diversity Checklist of Ullahpara Pourashava of Sirajganj District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Common toad	*Bufo melanostictus*	Y	N	Y	N		Indian Cuckoo	*Cuculus micropterus*	Y	N	N	N
Cricket frog	*Limnonectes limnocharis*	Y	N	Y	N		Lineated Barbet	*Megalaima lineate*	Y	N	N	N
Maculated Tree frog	*Polypedus maculates*	N	Y	N	N		Oriental Magpie Robin	*Copsychus saularis*	Y	N	Y	N
Common Garden Lizard	*Calotes versicolor*	N	Y	N	N		Paddy field Pipit	*Anthus rufulus*	N	Y	N	N
Common House Lizard	*Hemidactylus frenatus*	Y	N	Y	N		Purple Sunbird	*Nectarinia asiatica*	N	Y	N	N
Common Vine Snake	*Ahaetulla nasutus*	N	Y	N	N		Pariah Kite	*Milvus migrans*	Y	N	N	N
Garden Monitor Lizard	*Varanus bengalensis*	N	Y	N	Y		Pied Wagtail	*Motacilla alba*	N	Y	N	N
Yellow Monitor Lizard	*Varanus* flavescens	N	Y	N	Y		Red-vented Bulbul	*Pycnonotus cafer*	Y	N	Y	N
Rat Snake	*Coluber mucosus*	N	Y	N	N		Rock Pigeon	*Columba livia*	Y	N	N	N
Asian Pied Starling	*Sturnus contra*	Y	N	Y	N		Rufous Tree Pie	*Dendrocitta vagabunda*	N	Y	N	N
Black-Hooded Oriole	*Oriolus xanthornus*	N	Y	N	N		Spotted Dove	*Spilopelia chinensis*	Y	N	Y	N
Black Headed Shrike	*Lanius schach*	N	Y	Y	N		Bandicoot Rat	*Bandicota indica*	N	Y	N	N
Black Drongo	*Dicrurus macrocercus*	Y	N	Y	N		Common House Rat	*Rattus rattus*	N	Y	Y	N
Common Myna	*Acridotheres tristis*	Y	N	Y	N		Fulvous Fruit bat	*Rousettus leschenaultia*	N	Y	N	N
Common Iora	*Aegithina tiphia*	N	Y	N	N		Flying Fox	*Pteropus gigantius*	N	Y	N	N
Common Babbler	*Turdoides caudatus*	N	Y	Y	N		Grey Musk Shrew	*Suncus murinus*	N	Y	N	N
Common Kingfisher	*Alcedo atthis*	Y	N	Y	N		House Mouse	*Mus musculus*	N	Y	Y	N
Common Tailorbird	*Orthotomus sutorius*	Y	N	Y	N		Indian Pipistrelle	*Pipistrellus coromandra*	N	Y	Y	N
Common Tailed Starling	*Sturnus malabaricus*	Y	N	Y	N		Indian Field Mouse	*Mus booduga*	N	Y	N	N
House Crow	*Corvus splendens*	Y	N	Y	N		Jackal	*Vulpes bengalensis*	Y	N	N	Y
House Sparrow	*Passer domisticus*	Y	N	Y	N		Large Indian Mongoose	*Herpestes*edwardsi	Y	N	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.

Table 3.17: Terrestrial Floral Diversity Checklist of Ullahpara Pourashava of Sirajganj District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Am	*Mangifera indica*	Y	N	Y	N		Kathal	*Artocarpus heterophyllus*	Y	N	Y	N
Acacia	*Acacia mangium*	Y	N	Y	N		Kakdumur	*Ficus hispida*	Y	N	N	N
Bansh	*Bambusa spp*	Y	N	Y	N		Koroi	*Albizia procera*	Y	N	N	N
Bot	*Ficus benghalensis*	Y	N	Y	N		Krishnachura	*Delomix regia*	N	Y	N	N
Boroi, Kul	*Zizyphus mauritiana*	Y	N	N	N		Kadam	*Anthocephalus chinensis*	Y	N	N	N
Bel	*Aegle marmelos*	Y	N	N	N		Khejur	*Phoenix sylvestris*	Y	N	N	N
Bishkatali	*Polygonum hydropiper*	Y	N	N	N		Mehagini	*Swietenia mahagoni*	Y	N	Y	N
Chatim	*Alstonia scholaris*	Y	N	N	N		Neem	*Azadirachta indica*	N	Y	N	N
Debdaru	*Polyalthia longifolia*	Y	N	N	N		Narikel	*Coccos nucifera*	Y	N	Y	N
Dholkalmi	*Ipomoea fistulosa*	Y	N	N	N		Pepe	*Carica papaya*	N	Y	Y	N
Durbaghas	*Cynodon dactylon*	Y	N	Y	N		Payara	*Psidium guayava*	Y	N	N	N
Dhan	*Oryza sativa*	Y	N	Y	N		Reri, venna	*Ricinus communis*	N	Y	N	N
Dhekishak	*Pteris vittatai*	Y	N	N	N		Rendi	*Samanea saman*	N	Y	N	N
Dhutra	*Datura metol*	N	Y	N	N		Sheora	*Sireblus asper*	Y	N	N	N
Eucalyptus	*Eucalyptus citriodora*	Y	N	Y	N		Sheyalmutra	*Blumea lacera*	Y	N	N	N
Hatisur	*Heliotropium indicum*	Y	N	N	N		Simul	*Bombax ceiba*	Y	N	N	N
Jagadumur	*Ficus glomoreta*	Y	N	N	N		Supari	*Areca catechu*	Y	N	Y	N
Katchu	*Colocasia esculenta*	Y	N	Y	N		Sarkachu	*Monochoria vaginalis*	Y	N	N	N
Kola	*Musa paradisiacal*	Y	N	Y	N		Tal	*Borassus fiabellifer*	Y	N	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No

(a) (b) (c) (d) (e) (f)

Figure 3.19: Terrestrial flora observed within and outside of the proposed sub-project sitesin Ullahpara Pourashava of Sirajganj district: (a) terrestrial floras beside paved road and rail line, (b) Simul tree (*Bombax ceiba*), (c) Banana tree plantation, (d) Bot tree (*Ficus benghalensis*), (e) Acacia (*Acacia mangium*), and (f) Road side plantation and Farm land

(b) Aquatic Ecology: The aquatic macro ecological aspect consists of various types of aquatic fauna (mammal, bird, reptile, amphibian and fish) and flora (tree, herb and shrub); and most of them are distributed in and around the water bodies (pond, canal, river, ditch etc) of Ullahpara Pourashava. Common natural aquatic flora grows in plenty in the rainy season.

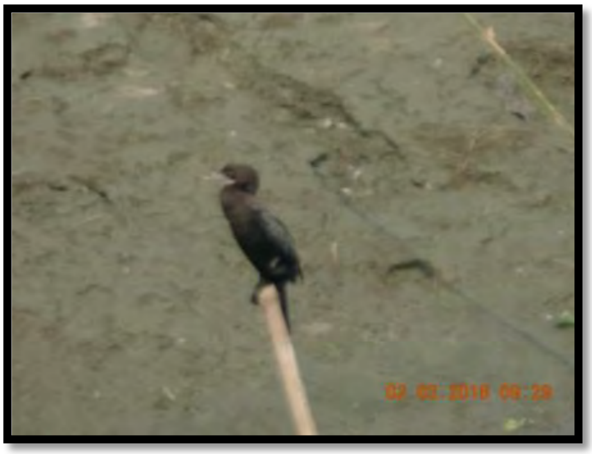
Aquatic flora plays an important role for biodiversity conservation. The aquatic habitat is characterized by anaerobic conditions, which inhabit plant growth. Aquatic flora grow in river, pond, canal, ditch and low lying cultivated field as submerge, free-floating and rooted floating state.Brief description of the aquatic ecology is given below:

(i) Aquatic Fauna: Most of the aquatic faunal species found at Ullahpara Pourashava are fairly common compared to other districts of Bangladesh. Aquatic faunal species that are adapted in altered urban habitat are commonly distributed in the urban aquatic site and others types of aquatic faunas are distributed in the rural aquatic site of the Ullahpara Pourashava. The following table (Table 3.18) provides the existing aquatic faunal information of the proposedsub-project site of BMWSSP under Ullahpara Pourashava and following figure (Figure 3.20) shows some of aquatic faunal diversity observed during the rapid field eco-assessment.

Table 3.19: Aquatic Faunal Diversity Checklist of Ullahpara Pourashava of Sirajganj District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Bull Frog	*Hoplobatrachus tigerinus*	N	Y	N	N		Gangetic Mudeel	*Monopterus cuchia*	N	Y	N	N
Skipper frog	*Euphlyctis cyanophlyctis*	Y	N	Y	N		Gangetic Mystus	*Mystus cavasius*	Y	N	N	N
Checkered Keelback	*Xenochrophis piscator*	N	Y	N	N		Gery Fetherback	*Notopterus notopterus*	N	Y	N	N
Common Smooth Water Snake	*Enhydris enhydris*	N	Y	N	N		Giant Snakehead	*Channa marulius*	N	Y	N	N
Dark Belled Marsh Snake	*Xenoch. Cerasogaster*	N	Y	N	N		Humped Fetherback	*Notopterus chitala*	N	Y	N	N
Bronze Winged Jacana	*Metopidius indicus*	N	Y	N	N		Long whiskered Catfish	*Aorichthys aor*	N	Y	N	N
Cattle Egret	*Bubulcus ibis*	N	Y	N	N		Magur	*Clarius batrachus*	N	Y	N	N
Common Kingfisher	*Alcado athis*	Y	N	N	N		Mrigal	*Cirrhinus mrigala*	Y	N	N	N
Common Sandpiper	*Actitis hypoleucos*	N	Y	N	N		Mottled Nandus	*Nandus nandus*	N	Y	N	N
Fantail Snipe	*Gallinago gallinago*	N	Y	N	N		One-stripe Spinyeel	*Macrognathus aculeatus*	N	Y	N	N
Large Egret	*Ardea alba*	Y	N	N	N		Pangus	*Pangasius pangasius*	Y	N	N	N
Little Egret	*Egretta garzetta*	N	Y	N	N		Rosy Barb	*Puntius conchonius*	N	Y	N	N
Little Cormorant	*Phalacrocorax niger*	Y	N	N	N		Rohu	*Labeo rohita*	Y	N	N	N
Pond Heron	*Ardeola grayii*	Y	N	N	N		Rice–paddy Eel	*Pisodonophis boro*	N	Y	N	N
Snipe	*Gallinago henura*	N	Y	N	N		Stinging Catfish	*Heteropneustes fossilis*	Y	N	N	N
White Throated Kingfisher	*Halcyon smyrnensis*	Y	N	N	N		Swamp Barb	*Puntius chola*	N	Y	N	N
White Brested Waterhen	*Amaurornis phoenicurus*	N	Y	N	N		Spotted Snakehead	*Channa punctatus*	N	Y	N	N
Asiatic Snakehead	*Channa orientalis*	Y	N	N	N		Striped Snakehead	*Channa striatus*	N	Y	N	N
Bumblebee Goby	*Brachygobius nunas*	N	Y	N	N		Sunset Gourami	*Colisa sota*	N	Y	N	N
Climbing Perch	*Anabas testudineus*	Y	N	N	N		Silver carp	*H. molitrix*	Y	N	N	N
Catla	*Catla catla*	Y	N	N	N		Tank Goby	*Glossogobius giuris*	Y	N	N	N
Freshwayer Shark	*Wallago attu*	N	Y	N	N		Ticto/Firefin Barb	*Puntius ticto*	N	Y	N	N
Flying Barb	*Esomus danricus*	N	Y	N	N		Tengra Mystus	*Mystus tengara*	Y	N	N	N
Grass Carp	Ctenopharyngodon *idella*	N	Y	N	N							

Legend: O = Observed, L= Local information, C = Common, T= Threatened, Y=Yes, N=No



(a) (b)

(c) (d)

(e) (f)

Figure 3.20: Aquatic fauna observed within and outside of the proposed sub-project site of DPHE: BMWSSP under Ullahpara Pourashava of Sirajganj district: (a) Skipper Frog (*Euphlyctis cyanophlyctis*), (b) Little Cormorant (*Phalacrocorax niger*), (c) + (d) + (e) native fish catch from Karatoya river and (f) commercial fish culture practice in the Karatoya river.

(ii) Aquatic Flora: The aquatic floral species found at Ullahpara Pourashava have similarity to other districts' aquatic floral diversity. Most of the aquatic floras are distributed in scattered way in some specific aquatic sites such as water-bodies of agro-wetland, pond, canal, ditch, river etc. Aquatic floras are naturally grown, plenty in monsoon season, and are fairly common.The following table (Table 3.20) provides the existing aquatic floral information of the proposed BMWSSP's sub-project site under Ullahpara Pourashava. Figure 3.21 shows some of floral diversity observed during the rapid field eco-assessment.

Table 3.20: Aquatic Floral Diversity Checklist of Ullahpara Pourashava of Sirajganj District.

Name		O	L	C	T
English / Native	**Scientific**				
Haicha	*Alternanthera sesilis*	Y	N	Y	N
Helencha	*A. Philoxeroides*	N	Y	N	N
Indurkanipana	*Salvinia cuculata*	N	Y	N	N
Jhangi	*Utricularia aurea*	N	Y	N	N
Janglidhan	*Hygroryza aristata*	N	Y	N	N
Kachuripana	*Eichhornia crassipes*	Y	N	Y	N
Khudipana	*Lemna perpusilla*	Y	N	N	N
Katchu	*Colocasia esculenta*	Y	N	Y	N
Kalmi	*Ipomoea aquatic*	Y	N	N	N
Kurcli	*Hydrilla verticillata*	N	Y	N	N
Patajhangi	*Vallisneria spiralis*	N	Y	N	N
Sada Shapla	*Nymphaea nouchali*	N	Y	N	N
Spiral Algae	*Spirogyra sp.*	N	Y	N	N
Topapana	*Pistia strateotes*	N	Y	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.

(a)

(b)

(c)

(d)

Figure 3.21: Aquatic flora observed within and outside of the proposed sub-project sites of Ullahpara Pourashava of Sirajganj district: (a) mixed aquatic flora, in an urban site of the pourashava, (b) accumulation of aquatic flora e.g. Kachurypana (*Eichhornia crassipes*), for fish trap / catching in the river, (c) Khudipana (*Lemna perpusilla),* in an agro-wetland, and (d) Kachurypana (*Eichhornia crassipes*), in an wetland.

(c) Threatened flora and fauna: No threatened flora was identified from these sub project sites of DPHE: BMWSSP, but three terrestrial fauna were identified as threatened from Ullahpara Pourashava of Sirajganj district. These threatened fauna are (a) Garden Monitor Lizard (*Varanus bengalensis*), (b) Yellow Monitor Lizard (*Varanus* flavescens) and (c) Jackal (*Vulpes bengalensis*); all of these faunasare also threatened for entire country.

(d) Protected areas, wildlife sanctuaries, game reserves and ecologically critical areas:

(i) Protected Area (PA): Protect Area (PA) refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means i.e. PA is predominantly a natural area established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources (IUCN, 1990). No PA exists at or near the proposedsub-project study areas of BMWSSP under Ullahpara Pourashava of Sirajganj district.

(ii) National Park (NP): A reserve land is usually declared and owned by Government, protected from most human development and pollution (IUCN, 1990). No NP exists at or near the proposed sub-project study areas of BMWSSP under Ullahpara Pourashava of Sirajganj district.

(iii) Game Reserve (GR): It is an area of land set aside for maintenance of wildlife for tourism or hunting purposes (IUCN, 1990). No GR exists at or near the proposed sub-project study areas of BMWSSP under Ullahpara Pourashava of Sirajganj district.

(iv) Wildlife Sanctuary (WS): It is an area that assures the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment, where these require specific human manipulation for their perpetuation (IUCN, 1990). No WS exists at or near the proposed sub-project study areas of BMWSSP under Ullahpara Pourashava of Sirajganj district.

(v) Ecologically Critical Area (ECA): It is an environmental protection zone, defined by the Government of Bangladesh under the Bangladesh Environment Conservation Act, 1995, where ecosystem is considered to be threatened to reach a critical state. No ECA exists at or near the proposedsub-project study areas of BMWSSP under Ullahpara Pourashava of Sirajganj district.

Tarabo Pourashava under Narayanganj District: Bio-ecologically, the Tarabo Pourashava of Narayanganj district remains under the Brahmaputra - Jamuna Floodplain (IUCN Bangladesh, 2002) and Agro-ecologically it remains under the Old Meghna Estuarine Floodplain (BARC/UNDP/FAO, 1995). The non-calcareous / calcareous dark gray / gray floodplain soil provides suitable environment for growing numerous type of floral species, and also provide supportive habitat for various type of fauna. However, the major components of this sub-project site of BMWSSP have been described here briefly from the ecological perspective: (i) the proposed raw water intake source for water treatment have preliminary been selected from Sitalakkha River near Gandhappur Gudaraghat / Nurul Market of Tarabo Pourashava. Throughout the year,the Sitalakkha river has plenty of water with current and few native fish exist there due to polluted water that mainly comes from the nearby industrial sources; few flora and fauna depend on the river for their livelihood throughout the year due to high pollution; (ii) the proposed water treatment plant site has preliminary been selected in a land at Bongshinagar area of Tarabo Pourashava; the proposed land seem to be an agro-low-wetland that remain under water for several months of a year and have few common aquatic floras in winter; some local fauna use the area as their permanent and / or temporary habitat; (iii) the water distribution pipe network will run along the existing road networks (paved, semi-paved and non-paved) that have few peripheral floras, and some fauna directly depend on those floras; (iv) the proposed overhead tank site has preliminary been selected in a land of Mograkul Dighi area of Tarabo Pourashava. The area seems to be a low land with some flora and fauna; and (v).the proposed public toilet site has preliminary been selected at the peripheral side of Tarabo Bus Stand (Main Road) under Tarabo pourashava. Photographs of some components of this sub-project site of BMWSSP have been shown in the following figure (Figure 3.22). As all of the components of this sub-project site remains in scattered way, and have preliminarily been selected, hence, the general description of the existing eco-aspects are described below in brief that have covered in the proposed sub project component sites of BMWSSP of DPHE.

(a)

(b)

(c)

(d)

(e) **(f)**

Figure 3.22: Preliminary Selected sites for construction of various components of the sub-project of BMWSSP atTarabo pourashava, Narayanganj district: (a) Intake point at Sitalakkha River, (b) Booster pump station site, (c) Water treatment plant site, (d) Water distribution pipelines route (sample road) (e) Overhead tank site and (f) Site for Public toilet.

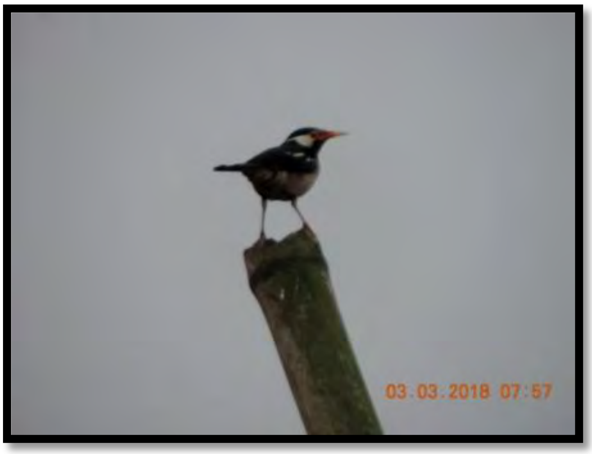
(a) Terrestrial Ecology: The terrestrial macro ecological aspects of the proposedsub-project site of BMWSSP under Tarabo pourashava includes various types of terrestrial fauna (mammal. bird, reptile and amphibia) and flora (tree, herb and shrub), most of which are distributed in and around the urban homestead, agricultural land, fallow land, along the road, market, shop and building site, in open area, besides water bodies (pond, canal, river) of the Tarabo pourashava. Common terrestrial flora grows naturally in plenty in the rainy season. Most of the flora particularly the trees are planted for economic purposes and are fairly common. Trees are distributed in scattered way and have similarity compared to nearby areas of the district. The existing terrestrial floral diversity makes a complex ecosystem in which some fauna has direct relationship through their ecological niche. Brief description of the terrestrial ecology is given below:

(i) Terrestrial Fauna: Most of the terrestrial faunal species found at Tarabo Pourashava are fairly common and is found in other areas of the district. Faunal species that are adapted in altered urban habitat are commonly distributed in the urban site, and other types of faunas are distributed in the rural site of the Pourashava. Table 3.21 provides the existing faunal information of the proposed sub-project site of BMWSSP under Tarabo Pourashava and Figure 3.23 shows some of faunal diversity observed during the physical survey.

Table 3.21: Terrestrial Faunal Diversity Checklist of Tarabo Pourashava of Narayanganj District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Common toad	*Bufo melanostictus*	N	Y	Y	N		Indian Cuckoo	*Cuculus micropterus*	Y	N	N	N
Cricket frog	*Limnonectes limnocharis*	N	Y	Y	N		Oriental Magpie Robin	*Copsychus saularis*	Y	N	N	N
Maculated. Tree frog	*Polypedus maculates*	N	Y	N	N		Paddy field Pipit	*Anthus rufulus*	N	Y	N	N
Common Garden Lizard	*Calotes versicolor*	N	Y	N	N		Purple Sunbird	*Nectarinia asiatica*	N	Y	N	N
Common House Lizard	*Hemidactylus frenatus*	Y	N	N	N		Pariah Kite	*Milvus migrans*	Y	N	N	N
Common Vine Snake	*Ahaetulla nasutus*	N	Y	N	N		Pied Wagtail	*Motacilla alba*	N	Y	N	N
Garden Monitor Lizard	*Varanus bengalensis*	N	Y	N	Y		Red-vented Bulbul	*Pycnonotus cafer*	Y	N	N	N
Asian Pied Starling	*Sturnus contra*	Y	N	N	N		Rock Pigeon	*Columba livia*	Y	N	N	N
Black-Hooded Oriole	*Oriolus xanthornus*	N	Y	N	N		Rufous Tree Pie	*Dendrocitta vagabunda*	N	Y	N	N
Black Headed Shrike	*Lanius schach*	Y	N	N	N		Spotted Dove	*Spilopelia chinensis*	Y	N	N	N
Black Drongo	*Dicrurus macrocercus*	Y	N	N	N		Common House Rat	*Rattus rattus*	N	Y	N	N
Common Myna	*Acridotheres tristis*	Y	N	N	N		Fulvous Fruit bat	*Rousettus leschenaultia*	N	Y	N	N
Common Iora	*Aegithina tiphia*	N	Y	N	N		Grey Musk Shrew	*Suncus murinus*	N	Y	N	N
Common Babbler	*Turdoides caudatus*	Y	N	N	N		House Mouse	*Mus musculus*	N	Y	N	N
Common Kingfisher	*Alcedo atthis*	N	Y	N	N		Indian Pipistrelle	*Pipistrellus coromandra*	N	Y	N	N
Common Tailorbird	*Orthotomus sutorius*	Y	N	N	N		Indian Field Mouse	*Mus booduga*	N	Y	N	N
Common Tailed Starling	*Sturnus malabaricus*	Y	N	N	N		Jackal	*Vulpes bengalensis*	N	Y	N	N
House Crow	*Corvus splendens*	Y	N	N	N		Small Indian Mongoose	*Herpestes auropunctatus*	N	Y	N	N
House Sparrow	*Passer domisticus*	Y	N	N	N							

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.



(a) **(b)**

(c) **(d)**

(e) **(f)**

Figure 3.23: Terrestrial fauna observed within and outside of the proposed sub-project sites of in Tarabo Pourashava, Narayanganj district: (a) Asian Pied Starling (*Sturnus contra*), (b)Black Drongo (*Dicrurus macrocercus*), (c) Spotted Dove (*Spilopelia chinensis*), (d) Common Myna (*Acridotheres tristis*), (e)Common Babbler - Juvenile stage (*Turdoides caudatus*) and (f) Black Headed Shrike (*Lanius schach*).

(ii) Terrestrial Flora: Most of the terrestrial floral species found at Tarabo Pourashava are fairly common. These terrestrial floras are distributed in scattered way in some specific sites such as urban and village homestead, fallow land, along the road, market, building and industrial site, in open area, beside rural etc. Most of the floras, particularly the trees, are planted for economic and aesthetic purposes, and are commonly found.Table 3.22 provides the existing floral information of the proposed sub-project sites of BMWSSP under Tarabo Pourashava and also the Figure 3.24 shows some of floral diversity observed during the survey.

(a)

(b)

(c)

(d)

Figure 3.24: Terrestrial flora observed within and outside of the proposed sub-project site of BMWSSP under Tarabo Pourashava of Narayanganj district: (a) Mixed terrestrial flora, in a village,adjacent to the proposed WTP site, (b) Varieties of terrestrial flora, at the end of asemi-pave road, (c) Terrestrial floras at proposed overhead tank site, and (d) Banana flower in a homestead garden

Table 3.22: Terrestrial Floral Diversity Checklist of Tarabo Pourashava of Narayanganj District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Am	*Mangifera indica*	Y	N	Y	N		Koroi	*Albizia procera*	Y	N	N	N
Acacia	*Acacia mangium*	Y	N	Y	N		Krishnachura	*Delomix regia*	Y	N	N	N
Bansh	*Bambusa spp*	Y	N	Y	N		Kadam	*Anthocephalus chinensis*	Y	N	N	N
Bot	*Ficus benghalensis*	Y	N	Y	N		Mehagini	*Swietenia mahagoni*	Y	N	Y	N
Boroi, Kul	*Zizyphus mauritiana*	Y	N	N	N		Mandar	*Erythrina variegate*	Y	N	N	N
Bel	*Aegle marmelos*	Y	N	N	N		Neem	*Azadirachta indica*	Y	N	N	N
Bishkatali	*Polygonum hydropiper*	Y	N	N	N		Narikel	*Coccos nucifera*	Y	N	Y	N
Debdaru	*Polyalthia longifolia*	Y	N	N	N		Pepe	*Carica papaya*	Y	N	Y	N
Dholkalmi	*Ipomoea fistulosa*	Y	N	N	N		Reri, venna	*Ricinus communis*	Y	N	N	N
Durbaghas	*Cynodon dactylon*	Y	N	Y	N		Rendi	*Samanea saman*	Y	N	N	N
Dhan	*Oryza sativa*	Y	N	Y	N		Sheora	*Sireblus asper*	Y	N	N	N
Dhekishak	*Pteris vittatai*	Y	N	N	N		Sheyalmutra	*Blumea lacera*	Y	N	N	N
Dhutra	*Datura metol*	Y	N	N	N		Supari	*Areca catechu*	Y	N	Y	N
Eucalyptus	*Eucalyptus citriodora*	Y	N	Y	N		Sarkachu	*Monochoria vaginalis*	Y	N	N	N
Katchu	*Colocasia esculenta*	Y	N	Y	N		Tal	*Borassus fiabellifer*	Y	N	N	N
Kola	*Musa paradisiacal*	Y	N	Y	N		Tamarind	*Tamarindusindica*	Y	N	N	N
Kathal	*Artocarpus heterophyllus*	Y	N	Y	N							

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No

(b) Aquatic Ecology: The aquatic macro ecological aspect includes various types of aquatic fauna (mammal, bird, reptile, amphibian and fish) and flora (tree, herb and shrub); and most of the aquatic eco-aspects are distributed in and around the water bodies (pond, canal, river, ditch etc) of Tarabo Pourashava. Common natural aquatic flora grows in plenty in the rainy season. Aquatic flora plays an important role for biodiversity conservation. Aquatic flora grows in river, pond, canal, ditch and low lying cultivated field as submerged, free-floating and rooted floating state. Brief description of the aquatic ecology is given below:

(i) Aquatic Fauna: Most of the aquatic faunal species found at Tarabo Pourashava have similarity of those found in other districts of Bangladesh. Aquatic faunal species that are adapted in altered urban habitat are commonly distributed in the urban aquatic sites and others types of aquatic fauna found in the rural aquatic site of the Pourashava. Table 3.23 and Figure 3.25 provide the existing aquatic faunal information and faunal diversity observed during the physical survey in the proposed sub-project site of BMWSSP under Tarabo Pourashava respectively.

Table 3.23: Aquatic Faunal Diversity Checklist of Tarabo Pourashava of Narayanganj District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Bull Frog	*Hoplobatrachus tigerinus*	Y	N	Y	N		Grass Carp	Ctenopharyngodon *idella*	Y	N	N	N
Skipper Frog	*Euphlyctis cyanophlyctis*	Y	N	Y	N		Gangetic Mudeel	*Monopterus cuchia*	Y	N	N	N
Common Skink	*Mabuya carinata*	N	Y	N	N		Gangetic Mystus	*Mystus cavasius*	Y	N	N	N
Checkered Keelback	*Xenochrophis piscator*	Y	N	N	N		Gery Fetherback	*Notopterus notopterus*	Y	N	N	N
Common Smooth Water Snake	*Enhydris enhydris*	Y	N	N	N		Long Whiskered Catfish	*Aorichthys aor*	Y	N	N	N
Dark Belled Marsh Snake	*Xenoch. cerasogaster*	N	Y	N	N		Magur	*Clarius batrachus*	Y	N	N	N
Bronze Winged Jacana	*Metopidius indicus*	Y	N	N	N		Mrigal	*Cirrhinus mrigala*	Y	N	N	N
Cattle Egret	*Bubulcus ibis*	N	Y	N	N		Mottled Nandus	*Nandus nandus*	Y	N	N	N
Common Kingfisher	*Alcado athis*	Y	N	N	N		One-stripe Spinyeel	*Macrognathus aculeatus*	Y	N	N	N
Common Sandpiper	*Actitis hypoleucos*	N	Y	N	N		Pangus	*Pangasius pangasius*	Y	N	N	N
Little Egret	*Egretta garzetta*	N	Y	N	N		Rosy Barb	*Puntius conchonius*	Y	N	N	N
Little Cormorant	*Phalacrocorax niger*	Y	N	N	N		Rohu	*Labeo rohita*	Y	N	N	N
Pond Heron	*Ardeola grayii*	Y	N	N	N		Stinging Catfish	*Heteropneustes fossilis*	Y	N	N	N
Snipe	*Gallinago henura*	N	Y	N	N		Swamp Barb	*Puntius chola*	Y	N	N	N
White Throated Kingfisher	*Halcyon smyrnensis*	N	Y	N	N		Spotted Snakehead	*Channa punctatus*	Y	N	N	N
Asiatic Snakehead	*Channa orientalis*	Y	N	N	N		Striped Snakehead	*Channa striatus*	Y	N	N	N
Bumblebee Goby	*Brachygobius nunas*	Y	N	N	N		Sunset Gourami	*Colisa sota*	N	Y	N	N
Climbing Perch	*Anabas testudineus*	Y	N	N	N		Silver Carp	Hypophthalmichthys *molitrix*	Y	N	N	N
Catla	*Catla catla*	Y	N	N	N		Tank Goby	*Glossogobius giuris*	Y	N	N	N
Freshwayer Shark	*Wallago attu*	N	Y	N	N		Ticto/Firefin Barb	*Puntius ticto*	Y	N	N	N
Flying Barb	*Esomus danricus*	N	Y	N	N		Tengra Mystus	*Mystus tengara*	Y	N	N	N

Legend: O = Observed, L= Local information, C = Common, T= Threatened, Y=Yes, N=No

(a) (b)

(c) (d)

(e) (f)

Figure 3.25(a): Aquatic fauna observed within and outside of the proposed sub-project sites of BMWSSP under Tarabo Pourashava of Narayanganj district: (a) Checkered Keelback (*Xenochrophis piscator*), (b) Bronze Winged Jacana (*Metopidius indicus*), (c) Little Cormorant (*Phalacrocorax niger*), (d) Bull Frog (*Hoplobatrachus tigerinus*), (e) Skipper Frog (*Euphlyctis cyanophlyctis*), and (f) Agro-wetland, prime aquatic faunal habitat.

(a) (b)

(c) (d)

(e) (f)

Figure 3.25(b): Aquatic fauna observed within and outside of the proposed sub-project sites of BMWSSP under Tarabo Pourashava of Narayanganj district: (a) Fishermen catching fish from an wetland / big pond, (b) Fresh fish ready for marketing, (c) Big pond ready for carp fish culture, (d) Fish died in a pond, (e) Shallow agro-wetland, use by aquatic fauna to to catch small native fish, and (f) Polluted Sitalakkha river, almost no aquatic fauna.

(ii) Aquatic Flora: The aquatic floral species found at Tarabo Pourashava have similarity to the aquatic floral diversity of other areas of the district. Most of the aquatic floras are distributed in scattered way in some specific aquatic sites such as water-bodies of agro-wetland, pond, canal, ditch, river etc. All of the aquatic floras are naturally grown, and are fairly common.Table 3.24 provides the existing aquatic floral information of the proposed sub-project sites of BMWSSP under Tarabo Pourashava and also Figure 3.25 shows some of floral diversity observed during the rapid field eco-assessment.

Table 3.24: Aquatic Floral Diversity Checklist of Tarabo Pourashava of Narayanganj

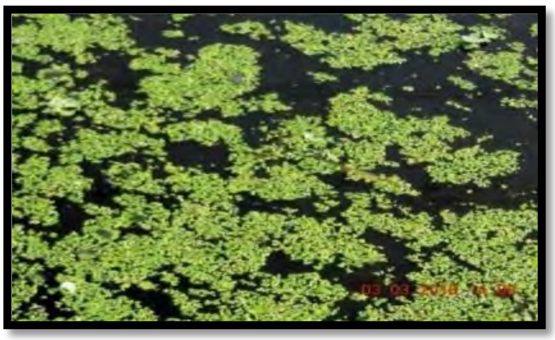
Name		O	L	C	T
English / Native	**Scientific**				
Ghenchu	*Aponogeton natans*	Y	N	N	N
Haicha	*Alternanthera sesilis*	Y	N	Y	N
Helencha	*A. Philoxeroides*	Y	N	N	N
Indurkanipana	*Salvinia cuculata*	N	Y	N	N
Jhangi	*Utricularia aurea*	N	Y	N	N
Janglidhan	*Hygroryza aristata*	Y	N	N	N
KACHURIPANA	*Eichhornia crassipes*	Y	N	Y	N
Khudipana	*Lemna perpusilla*	Y	N	N	N
Katchu	*Colocasia esculenta*	Y	N	Y	N
Kalmi	*Ipomoea aquatic*	Y	N	N	N
Kurcli	*Hydrilla verticillata*	N	Y	N	N
Patajhangi	*Vallisneria spiralis*	N	Y	N	N
Sada Shapla	*Nymphaea nouchali*	N	Y	N	N
Topapana	*Pistia strateotes*	Y	N	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.

(a)

(b)

(c)



(d)

Figure 3.25: Aquatic flora observed within and outside of the proposed sub-project sites of BMWSSP under Tarabo Pourashava of Narayanganj district: (a) Topapana (*Pistia strateotes*), (b) Kalmi (*Ipomoea aquatic*) (c) Kachurypana (*Eichhornia crassipes*) and (d) Khudipana (*Lemna perpusilla*).

(c) Threatened flora and fauna: No threatened flora was identified from this sub project sites of BMWSSP, but a couple of terrestrial fauna regarded as threatened were identified from Tarabo Pourashava, viz. (a) Garden Monitor Lizard (*Varanus bengalensis*), and (b) Jackal (*Vulpes bengalensis*); both faunas are threatened for entire country, too.

(d) Protected areas, wildlife sanctuaries, game reserves and ecologically critical areas:

(i) Protected Area (PA): Protect Area (PA) refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means i.e. PA is predominantly a natural area established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources (IUCN, 1990). No PA exists at or near the proposed sub-project study areas of BMWSSP under Tarabo Pourashava of Narayanganj district.

(ii) National Park (NP): It is a reserve land, usually declared and owned by government, protected from most human development and pollution (IUCN, 1990). No NP exists at or near the proposed sub-project study areas of BMWSSP under Tarabo Pourashava of Narayanganj district.

(iii) Game Reserve (GR): It is an area of land set aside for maintenance of wildlife for tourism or hunting purposes (IUCN, 1990). No GR exists at or near the proposed sub-project study areas of BMWSSP under Tarabo Pourashava of Narayanganj district.

(iv) Wildlife Sanctuary (WS): It is an area that assures the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment, where these require specific human manipulation for their perpetuation (IUCN, 1990). No WS exists at or near the proposed sub-project study areas of BMWSSP under Tarabo Pourashava of Narayanganj district.

(v) Ecologically Critical Area (ECA): It is an environmental protection zone, defined by the Government of Bangladesh under the Bangladesh Environment Conservation Act, 1995, where ecosystem is considered to be threatened to reach a critical state. No ECA exists at or near the proposed sub-project study areas of BMWSSP under Tarabo Pourashava of Narayanganj district.

Homna Pourashava under Comilla District: Bio-ecologically the Homna Pourashava remains under the Brahmaputra - Jamuna Floodplain (IUCN Bangladesh, 2002) and Agro-ecologically it remains under the Old Brahmaputra Floodplain (BARC/UNDP/FAO, 1995). The non-calcareous / calcareous dark grey / grey floodplain soil provides suitable environment for growing numerous type of floral species, and also provide supportive habitat for various type of fauna. However, the major components of the sub-project site of BMWSSP have been described here in brief from the ecological perspective: (i) the proposed raw water intake source for water treatment has preliminary been selected from Titas River near Baghmara village (western part) of Homna Pourashava.Throughout the year, Titas River has plenty of waterand active current, and have various types of flora and fauna including native fishes; (ii) the proposed water treatment plant site has preliminary been selected in a land, near Homna-Bancharampur Bridge, not far away from Baghmara village of Homna Pourashava; the landhas some planted flora, and some fauna directly depend on it for food collection; and (iii) the water distribution pipe network will follow the existing road networks (paved, semi-paved and non-paved) that have some peripheral floras, and some fauna directly depend on those floras. Photographs of some components of this sub-project site of BMWSSP have been shown in the following figure (Figure 3.26). As all of the components of this sub-project site remains in scattered way, and have preliminarily been selected, hence, the general description of the existing eco-aspects are described briefly in the following sections that have covered all the proposed sub project component sites of BMWSSP of DPHE.

(a)

(b)

(c)

(d)

Figure 3.26: Selected sites (preliminary) for construction of various components of the sub-project under Homnapourashava of Comilla district: (a) Intake point at Titas River (b) Booster pump station site (c) Proposed Water treatment plant site and (d) Water distribution pipelines route along the road

(a) Terrestrial Ecology: The terrestrial macro ecological aspects of the proposed sub-project sites of BMWSSP under Homna pourashava includes various types of terrestrial fauna (mammal, bird, reptile and amphibia) and flora (tree, herb and shrub), most of which are distributed in and around the urban homestead, agricultural land, fallow land, along the road, market, shop and building site, in open area, besides water bodies (pond, canal, river) of the Homna pourashava. Common terrestrial flora grows naturally in plenty during the rainy season. Most of the flora particularly the trees are planted for economic purposes and are fairly common, and distributed in scattered way, and have similarity to most of the other districts'terrestrial species. The existing terrestrial floral diversity makes a complex ecosystem in which some fauna has direct relationship through their ecological niche. Brief description of the terrestrasil ecology of Homna pourashava is given below:

(i) Terrestrial Fauna: Most of the terrestrial faunal species found at Homna Pourashava are fairly common. Faunal species that are adapted in altered urban habitat are commonly distributed in the urban site, and others types of faunas are distributed in the rural site of the Pourashava. The following table (Table 3.24) provides the existing faunal information of the proposed sub-project site of BMWSSP under Homna Pourashava and following figure (Figure 3.27) shows some of faunal diversity observed during the rapid field eco-assessment.

Table 3.24: Terrestrial Faunal Diversity Checklist of Homna Pourashava of Comilla District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Common toad	*Bufo melanostictus*	Y	N	Y	N		Indian Cuckoo	*Cuculus micropterus*	Y	N	N	N
Cricket frog	*Limnonectes limnocharis*	Y	N	Y	N		Jungle crow	*Corvus macrorhynchos*	Y	N	N	N
Maculated. Tree frog	*Polypedus maculates*	N	Y	N	N		Lineated Barbet	*Megalaima lineate*	N	Y	N	N
Common Garden Lizard	*Calotes versicolor*	N	Y	N	N		Oriental Magpie Robin	*Copsychus saularis*	Y	N	Y	N
Common House Lizard	*Hemidactylus flaviviridis*	N	Y	Y	N		Pariah Kite	*Milvus migrans*	Y	Y	N	N
Common House Lizard	*Hemidactylus frenatus*	N	Y	Y	N		Pied Wagtail	*Motacilla alba*	N	Y	N	N
Common Vine Snake	*Ahaetulla nasutus*	N	Y	N	N		Red-vented Bulbul	*Pycnonotus cafer*	Y	N	Y	N
Asian Pied Starling	*Sturnus contra*	Y	N	Y	N		Rock Pigeon	*Columba livia*	Y	N	N	N
Black-Hooded Oriole	*Oriolus xanthornus*	N	Y	N	N		Rufous Tree Pie	*Dendrocitta vagabunda*	N	Y	N	N
Black Drongo	*Dicrurus macrocercus*	Y	N	Y	N		Spotted Dove	*Spilopelia chinensis*	Y	N	Y	N
Common Myna	*Acridotheres tristis*	Y	N	Y	N		Common House Rat	*Rattus rattus*	N	Y	Y	N
Common Iora	*Aegithina tiphia*	N	Y	N	N		Fulvous Fruit bat	*Rousettus leschenaultia*	N	Y	N	N
Common Babbler	*Turdoides caudatus*	N	Y	Y	N		Grey Musk Shrew	*Suncus murinus*	N	Y	N	N
Common Kingfisher	*Alcedo atthis*	Y	N	Y	N		House Mouse	*Mus musculus*	N	Y	Y	N
Common Tailorbird	*Orthotomus sutorius*	Y	N	Y	N		Indian Pipistrelle	*Pipistrellus coromandra*	N	Y	Y	N
Chestnut-backed Laughing Thrush	*Garrulax nuchalis*	Y	N	N	N		Indian Field Mouse	*Mus booduga*	N	Y	N	N
Green Bee Eater	*Merops orientalis*	Y	N	N	N		Jackal	*Vulpes bengalensis*	Y	N	N	Y
House Crow	*Corvus splendens*	Y	N	Y	N		Small Indian Mongoose	*Herpestes auropunctatus*	N	Y	N	N
House Sparrow	*Passer domisticus*	Y	N	Y	N							

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.

(a) (b) (c) (d) (e) (f)

Figure 3.27: Terrestrial fauna observed within and outside of the proposed sub-project sites of in Homna Pourashava, Comilla district: (a) Common Toad (*Bufo melanostictus*), (b) Chestnut-backed Laughing Thrush (*Garrulax nuchalis*) (c) Jungle Crow (*Corvus macrorhynchos*), (d) Black Drongo (*Dicrurus macrocercus*) (e) Common Myna (*Acridotheres tristis*) and (f) Jackal **(***Vulpes bengalensis***)**cave

(ii) Terrestrial Flora: Common terrestrial floral species were found at Homna Pourashava Most of the terrestrial floras are distributed in scattered way in some specific sites such as urban homestead, fallow land, along the road, market and building site, in open areas, beside rural house and water body. Most of the floras, particularly the trees, are planted for economic and aesthetic purposes, and are fairly common.The following table (Table 3.25) provides the existing floral information of the proposed sub-project sites of BMWSSP under Homna Pourashava and also the following figure (Figure 3.28) shows some of floral diversity observed during the rapid field eco-assessment.

(a) **(b)**

(c) **(d)**

Figure 3.28: Terrestrial flora observed within and outside of the proposed sub-project sites of BMWSSP under Homna Pourashava of Comilla district: (a) Mixed terrestrial flora, (b) Acacia (*Acacia mangium*) plantation, (c) Mixed terrestrial flora, and (d) Boroi (*Zizyphus mauritiana*).

Table 3.25: Terrestrial Floral Diversity Checklist of Homna Pourashava of Comilla District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Am	*Mangifera indica*	Y	N	Y	N		Kamranga	*Averrhoa carambala*	Y	N	N	N
Acacia	*Acacia mangium*	Y	N	Y	N		Koroi	*Albizia procera*	Y	N	N	N
Assamlata	*Mikania cordata*	Y	N	N	N		Kadam	*Anthocephalus chinensis*	Y	N	N	N
Bansh	*Bambusa spp*	Y	N	Y	N		Khejur	*Phoenix sylvestris*	Y	N	N	N
Bot	*Ficus benghalensis*	Y	N	Y	N		Lebu	*Citrus limmon*	Y	N	N	N
Boroi, Kul	*Zizyphus mauritiana*	Y	N	N	N		Mehagini	*Swietenia mahagoni*	Y	N	Y	N
Bel	*Aegle marmelos*	Y	N	N	N		Mandar	*Erythrina variegate*	Y	N	N	N
Chatim	*Alstonia scholaris*	Y	N	N	N		Neem	*Azadirachta indica*	Y	N	N	N
Debdaru	*Polyalthia longifolia*	Y	N	N	N		Narikel	*Coccos nucifera*	Y	N	Y	N
Dholkalmi	*Ipomoea fistulosa*	Y	N	N	N		Pepe	*Carica papaya*	Y	N	Y	N
Durbaghas	*Cynodon dactylon*	Y	N	Y	N		Payara	*Psidium guayava*	Y	N	N	N
Dhan	*Oryza sativa*	Y	N	Y	N		Reri, venna	*Ricinus communis*	Y	N	N	N
Dhekishak	*Pteris vittatai*	Y	N	N	N		Rendi	*Samanea saman*	Y	N	N	N
Dhutra	*Datura metol*	Y	N	N	N		Sheora	*Sireblus asper*	Y	N	N	N
Eucalyptus	*Eucalyptus citriodora*	Y	N	Y	N		Sheyalmutra	*Blumea lacera*	Y	N	N	N
Hatisur	*Heliotropium indicum*	Y	N	N	N		Shon grass	*Phragmites sp.*	Y	N	N	N
Jagadumur	*Ficus glomoreta*	Y	N	N	N		Supari	*Areca catechu*	Y	N	Y	N
Katchu	*Colocasia esculenta*	Y	N	Y	N		Sarkachu	*Monochoria vaginalis*	Y	N	N	N
Kola	*Musa paradisiacal*	Y	N	Y	N		Tal	*Borassus fiabellifer*	Y	N	N	N
Kanthal	*Artocarpus heterophyllus*	Y	N	Y	N							

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No

(b) Aquatic Ecology: The aquatic macro ecological aspect includes various types of aquatic fauna (mammal, bird, reptile, amphibian and fish) and flora (tree, herb and shrub); and most of the eco-aspects are distributed in and around the water bodies (pond, canal, river, ditch etc) of Homna Pourashava. Common aquatic flora grows naturally in plenty in the rainy season. Aquatic flora plays an important role for biodiversity conservation. Aquatic flora grows in river, pond, canal, ditch and wetland, free-floating and rooted floating state. Brief description of the aquatic ecology of Homna pourashava is given below:

(i) Aquatic Fauna: Most of the aquatic faunal species found at Homna Pourashava are fairly common. Aquatic faunal species that are adapted in altered urban habitat are commonly distributed in the urban aquatic site and other types of aquatic faunas are distributed in the rural aquatic site of the Pourashava. The following table (Table 3.26) provides the existing aquatic faunal information of the proposedsub-project sites of BMWSSP under Homna Pourashava and following figure (Figure 3.29) shows some of aquatic faunal diversity observed during the rapid field eco-assessment.

Table 3.26: Aquatic Faunal Diversity Checklist of Homna Pourashava of Comilla District.

Name		**O**	**L**	**C**	**T**	**Name**		**O**	**L**	**C**	**T**
English / Native	**Scientific**					**English / Native**	**Scientific**				
Bull Frog	*Hoplobatrachus tigerinus*	N	Y	N	N	Gangetic Mudeel	*Monopterus cuchia*	N	Y	N	N
Skipper frog	*Euphlyctis cyanophlyctis*	Y	N	Y	N	Gangetic Mystus	*Mystus cavasius*	Y	N	N	N
Checkered Keelback	*Xenochrophis piscator*	N	Y	N	N	Gery Fetherback	*Notopterus notopterus*	Y	N	N	N
Common Smooth Water Snake	*Enhydris enhydris*	N	Y	N	N	Humped Fetherback	*Notopterus chitala*	N	Y	N	N
Dark Belled Marsh Snake	*Xenoch. Cerasogaster*	N	Y	N	N	Long Whiskered Catfish	*Aorichthys aor*	N	Y	N	N
Bronze Winged Jacana	*Metopidius indicus*	N	Y	N	N	Magur	*Clarius batrachus*	Y	N	N	N
Cattle Egret	*Bubulcus ibis*	N	Y	N	N	Mrigal	*Cirrhinus mrigala*	Y	N	N	N
Common Kingfisher	*Alcado athis*	Y	N	N	N	Mottled Nandus	*Nandus nandus*	Y	N	N	N
Common Sandpiper	*Actitis hypoleucos*	N	Y	N	N	One-stripe Spinyeel	*Macrognathus aculeatus*	Y	N	N	N
Fantail Snipe	*Gallinago gallinago*	N	Y	N	N	Pangus	*Pangasius pangasius*	Y	N	N	N
Little Egret	*Egretta garzetta*	N	Y	N	N	Rosy Barb	*Puntius conchonius*	Y	N	N	N
Little Cormorant	*Phalacrocorax niger*	Y	N	N	N	Rohu	*Labeo rohita*	Y	N	N	N
Pond Heron	*Ardeola grayii*	Y	N	N	N	Silver Carp	Hypophthalmichthys *molitrix*	Y	N	N	N
White Throated Kingfisher	*Halcyon smyrnensis*	Y	N	N	N	Stinging Catfish	*Heteropneustes fossilis*	Y	N	N	N
Asiatic Snakehead	*Channa orientalis*	Y	N	N	N	Swamp Barb	*Puntius chola*	Y	N	N	N
Bumblebee Goby	*Brachygobius nunas*	Y	N	N	N	Spotted Snakehead	*Channa punctatus*	Y	N	N	N
Climbing Perch	*Anabas testudineus*	Y	N	N	N	Striped Snakehead	*Channa striatus*	N	Y	N	N
Catla	*Catla catla*	Y	N	N	N	Sunset Gourami	*Colisa sota*	N	Y	N	N
Freshwater Shark	*Wallago attu*	N	Y	N	N	Tank Goby	*Glossogobius giuris*	Y	N	N	N
Flying Barb	*Esomus danricus*	N	Y	N	N	Ticto/Firefin Barb	*Puntius ticto*	Y	N	N	N
Grass Carp	Ctenopharyngodon *idella*	N	Y	N	N	Tengra Mystus	*Mystus tengara*	Y	N	N	N

Legend: O = Observed, L= Local information, C = Common, T= Threatened, Y=Yes, N=No

(a) **(b)**

(c) **(d)**

(e) **(f)**

Figure 3.29: Aquatic fauna observed within and outside of the proposed sub-project sites of in Homna Pourashava, Comilla district: (a) Little Cormorant (*Phalacrocorax niger*), (b) Skipper Frog (*Euphlyctis cyanophlyctis*) in calling state, (c) Fisherman catching fish by hook inside the Titas River, (d) Various type of native fish catches from pond, (e) Stinging Catfish (*Heteropneustes fossilis*), and (f) Women sales carp fish in a local market.

(ii) Aquatic Flora: The aquatic floral species found at Homna Pourashava have similarity to those of the other areas of the districts. Most of the aquatic floras are distributed in scattered way in some specific aquatic sites such as water bodies of agro-wetland, pond, canal, ditch, river etc. All of the aquatic floras are naturally grown, plenty in monsoon, and are fairly common.Table 3.27 provides the existing aquatic floral information of the proposedsub-project sites of BMWSSP under Homna Pourashava and Figure 3.30 shows some of floral diversity observed during the rapid field eco-assessment.

Table 3.27: Aquatic Floral Diversity Checklist of Homna Pourashava of Comilla

Name		O	L	C	T
English / Native	**Scientific**				
Haicha	*Alternanthera sesilis*	Y	N	Y	N
Janglidhan	*Hygroryza aristata*	N	Y	N	N
KACHURIPANA	*Eichhornia crassipes*	Y	N	Y	N
Khudipana	*Lemna perpusilla*	N	Y	N	N
Katchu	*Colocasia esculenta*	Y	N	Y	N
Kalmi	*Ipomoea aquatic*	N	Y	N	N
Sada Shapla	*Nymphaea nouchali*	N	Y	N	N
Topapana	*Pistia strateotes*	Y	N	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.

(a) **(b)**

Figure 3.30: Aquatic flora observed within and outside of the proposed DPHE: BMWSSP's sub-project site under Homna Pourashava of Comilla district: (a) and (b) Kachurypana (*Eichhornia crassipes*) accumulated in Titas river for fish trap.

(c) Threatened flora and fauna: No threatened floras were identified from this sub project site of BMWSSP, but one terrestrial fauna, Jackal (*Vulpes bengalensis)*was identifiedas threatened in Homna Pourashava.This species is also regarded as threatened for entire country.

(d) Protected areas, wildlife sanctuaries, game reserves and ecologically critical areas:

(i) Protected Area (PA): Protected Area (PA) refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means i.e. PA is predominantly a natural area established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources (IUCN, 1990). No PA exists at or near the proposed sub-project study areas of BMWSSP under Homna Pourashava of Comilla district.

(ii) National Park (NP): A reserve land, usually declared and owned by the government, protected from most human development and pollution (IUCN, 1990). No NP exists at or near the proposed sub-project study areas of BMWSSP under Homna Pourashava of Comilla district.

(iii) Game Reserve (GR): It is an area of land set aside for maintenance of wildlife for tourism or hunting purposes (IUCN, 1990). No GR exists at or near the proposed sub-project study areas of BMWSSP under Homna Pourashava of Comilla district.

(iv) Wildlife Sanctuary (WS): It is an area that assures the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment, where these require specific human manipulation for their perpetuation (IUCN, 1990). No WS exists at or near the proposed sub-project study areas of BMWSSP under Homna Pourashava of Comilla district.

(v) Ecologically Critical Area (ECA): It is an environmental protection zone, defined by the Government of Bangladesh under the Bangladesh Environment Conservation Act, 1995, where ecosystem is considered to be threatened to reach a critical state. No ECA exists at or near the proposed sub-project study areas of BMWSSP under Homna Pourashava of Comilla district.

Chandanaish Pourashava under Chattogram District: Bio-ecologically the Chandanaish Pourashava remains under Coastal Plain (IUCN-BD, 2002). Agro-ecologically, it falls under Chattogram Coastal Plain (BARC/UNDP/FAO, 1995). The non-calcareous dark grey / grey floodplain soil is the prime soil characteristic of the proposed sub-project site of BMWSSP, which provides habitat for certain types of flora naturally, that subsequently helps to increase the associated insect population, which primarily consumed by the local fauna. Some fauna use the proposed and adjacent lands as their permanent, seasonal and temporary habitat. However, the major components of this sub-project site of BMWSSP have been described here in brief from the ecological perspective: (i) the proposed raw water intake source for water treatment has preliminary been selected from Sangu River near Zathormukh Bazar of Chandanaish Pourashava; The river has plenty of water in both season and various types of aquatic flora, fauna and fish exist there; some flora and fauna depend on the river for their livelihood throughout the year; (ii) the proposed water treatment plant site has preliminary been selected in an agro-land near Harla village (Ward no 5) of Chandanaish Pourashava; some rural fauna depend on the proposed and adjacent land for food collection throughout the year; (iii) the water distribution pipe network will run under the existing road networks (paved, semi-paved and non-paved) that have some peripheral floras, and some fauna directly depend on those floras. Photographs of some component of this sub-project site of BMWSSP have been shown in Figure 3.31. As all components of the sub-project sitesof BMWSSP remains in scattered ways and have preliminarally been selected, hence, the general description of the existing eco-aspects is described briefly as follows.

(a) **(b)**

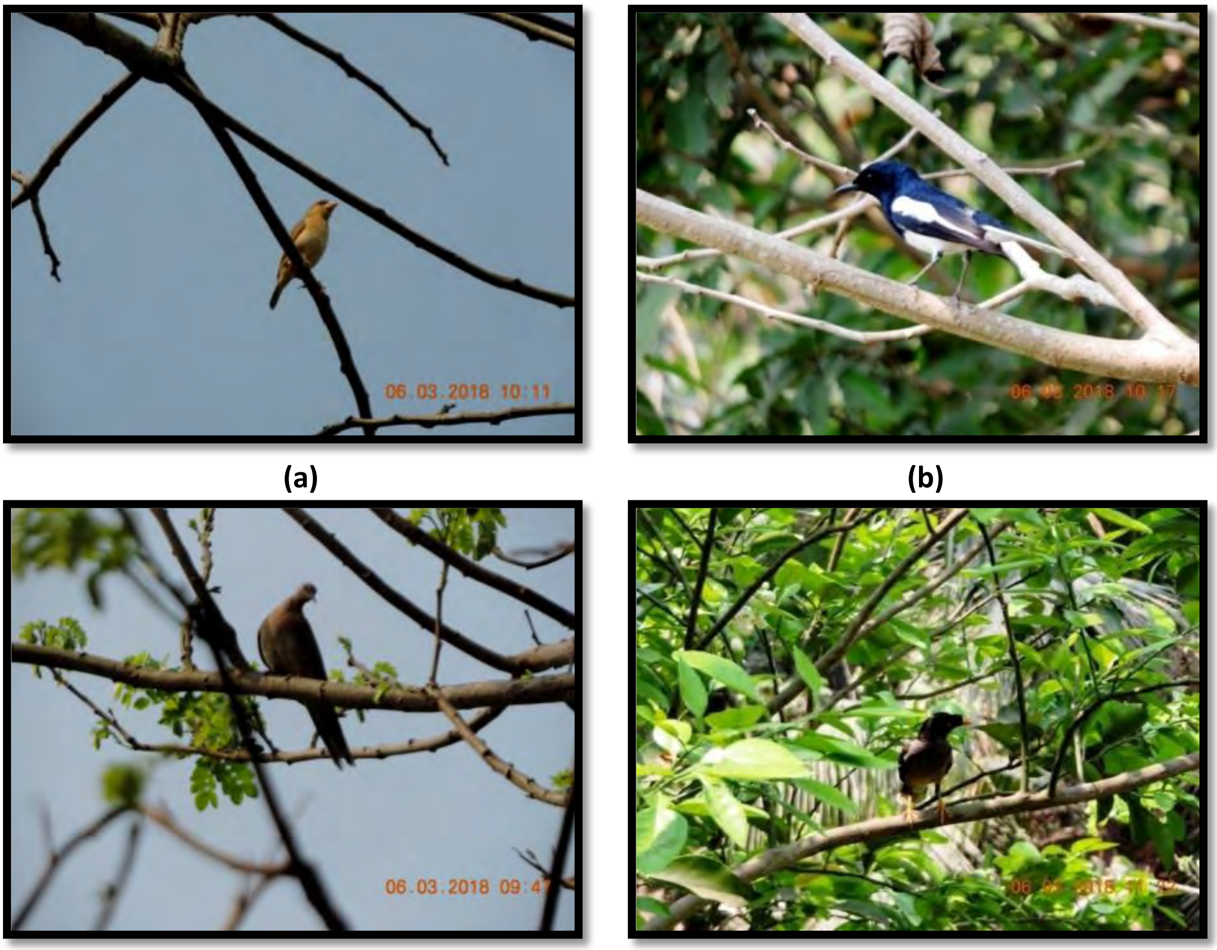
(c) **(d)**

Figure 3.31: Selected sites (preliminary) that will be use for construction of various components of the sub-project of BMWSSP under Chandanaish pourashava of Chattogram district: (a) Intake point at Sangu river, (b) Booster pump station site, (c) water treatment plant site, and (d) Water distribution pipeline along the road.

(a) Terrestrial Ecology: The terrestrial macro ecological aspects of the proposedsub-project sites of BMWSSP includes various types of terrestrial fauna (mammal, bird, reptile and amphibia) and flora (tree, herb and shrub), most of which are distributed in and around the urban homestead, agricultural land, fallow land, along the road, market, shop and building site, in open areas, besides water bodies (pond, canal, river) of the Chandanaish pourashava. Common terrestrial flora grows naturally in plenty in the rainy season. Most of the flora particularly the trees are planted for economic purposes and are fairly common, and distributed in scattered ways, and have similarity to species found in nearby districts.The existing terrestrial floral diversity makes a complex ecosystem in which some fauna has direct relationship through their ecological niche. Brief description of the terrestrial ecology of Chandanaish pourashava is given below:

(i) Terrestrial Fauna: Most of the terrestrial faunal species found at Chandanaish Pourashava are fairly common in compare to nearby areas of the district. Faunal species that are adapted in altered urban habitat are commonly distributed in the urban site, and others types of faunas are distributed in the rural site of the Pourashava. Table 3.28 provides the existing faunal information of the proposedsub-project sites of BMWSSP under

Chandanaish Pourashava and Figure 3.32 shows some of faunal diversity observed during the rapid field survey.



(a) (b)

(a) (b)

Figure 3.32: Terrestrial fauna observed within and outside of the proposed sub-project sites of BMWSSP under Chandanaish Pourashava of Chattogram district: (a) Baya Weaver (*Ploceus philippinus*), (b) Oriental Magpie Robin(*Copsychus saularis*),(c) Spotted Dove (*Spilopelia chinensis*), and (d) Jungle Myna**(***Acridotheres fiscus*).

Table 3.28: Terrestrial Faunal Diversity Checklistof Chandanaish Pourashava of Chattogram District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Common toad	*Bufo melanostictus*	Y	N	Y	N		Indian Cuckoo	*Cuculus micropterus*	Y	N	N	N
Cricket frog	*Limnonectes limnocharis*	Y	N	Y	N		Jungle Myna	*Acridotheres fiscus*				
Maculated. Tree frog	*Polypedus maculates*	N	Y	N	N		Lineated Barbet	*Megalaima lineate*	Y	N	N	N
Common Garden Lizard	*Calotes versicolor*	N	Y	N	N		Oriental Magpie Robin	*Copsychus saularis*	Y	N	Y	N
Common House Lizard	*Hemidactylus flaviviridis*	N	Y	Y	N		Pariah Kite	*Milvus migrans*	Y	N	N	N
Common Vine Snake	*Ahaetulla nasutus*	N	Y	N	N		Pied Wagtail	*Motacilla alba*	N	Y	N	N
Garden Monitor Lizard	*Varanus bengalensis*	N	Y	N	Y		Red-Vented Bulbul	*Pycnonotus cafer*	Y	N	Y	N
Rat Snake	*Coluber mucosus*	N	Y	N	N		Red-Wattled Lapwings	*Vanellus indicus*	Y	N	N	N
Asian Pied Starling	*Sturnus contra*	Y	N	Y	N		Rock Pigeon	*Columba livia*	Y	N	N	N
Black-Hooded Oriole	*Oriolus xanthornus*	N	Y	N	N		Rufous Tree Pie	*Dendrocitta vagabunda*	N	Y	N	N
Black Headed Shrike	*Lanius schach*	N	Y	Y	N		Spotted Dove	*Spilopelia chinensis*	Y	N	Y	N
Black Drongo	*Dicrurus macrocercus*	Y	N	Y	N		Common House Rat	*Rattus rattus*	N	Y	Y	N
Baya Weaver	*Ploceus philippinus*	Y	N	N	N		Fulvous Fruit bat	*Rousettus leschenaultia*	N	Y	N	N
Common Myna	*Acridotheres tristis*	Y	N	Y	N		Flying Fox	*Pteropus gigantius*	N	Y	N	N
Common Iora	*Aegithina tiphia*	N	Y	N	N		Grey Musk Shrew	*Suncus murinus*	N	Y	N	N
Common Babbler	*Turdoides caudatus*	N	Y	Y	N		House Mouse	*Mus musculus*	N	Y	Y	N
Common Kingfisher	*Alcedo atthis*	Y	N	Y	N		Indian Pipistrelle	*Pipistrellus coromandra*	N	Y	Y	N
Common Tailorbird	*Orthotomus sutorius*	Y	N	Y	N		Indian mole Rat	*Bandicota bengalensis*	N	Y	N	N
House Crow	*Corvus splendens*	Y	N	Y	N		Jackal	*Vulpes bengalensis*	Y	N	N	Y
House Sparrow	*Passer domisticus*	Y	N	Y	N		Small Indian Mongoose	*Herpestes auropunctatus*	N	Y	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.

(ii) Terrestrial Flora: Common terrestrial floral species were found at Chandanaish Pourashava.They are distributed in scattered ways in some specific sites such as urban homestead, fallow land, along the road, market and building site, in open area, beside rural house and water body. Most of the floras, particularly the trees, are planted for economic and aesthetic purposes, and are fairly common.The following table (Table 2.29) provides the existing floral information of the proposedsub-project sites of BMWSSP under Chandanaish Pourashava and also the following figure (Figure 3.33) shows some of floral diversity observed during the survey.

Table 3.29: Terrestrial Floral Diversity Checklist of Chandanaish Pourashava of Chattogram District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Am	*Mangifera indica*	Y	N	Y	N		Kadam	*Anthocephalus chinensis*	Y	N	N	N
Acacia	*Acacia mangium*	Y	N	Y	N		Khejur	*Phoenix sylvestris*	Y	N	N	N
Bansh	*Bambusa spp*	Y	N	Y	N		Lebu	*Citrus limmon*	Y	N	N	N
Bot	*Ficus benghalensis*	Y	N	Y	N		Mehagini	*Swietenia mahagoni*	Y	N	Y	N
Boroi, Kul	*Zizyphus mauritiana*	Y	N	N	N		Neem	*Azadirachta indica*	Y	N	N	N
Chatim	*Alstonia scholaris*	Y	N	N	N		Narikel	*Coccos nucifera*	Y	N	Y	N
Debdaru	*Polyalthia longifolia*	Y	N	N	N		Pepe	*Carica papaya*	Y	N	Y	N
Dholkalmi	*Ipomoea fistulosa*	Y	N	N	N		Payara	*Psidium guayava*	Y	N	N	N
Durbaghas	*Cynodon dactylon*	Y	N	Y	N		Reri / Venna	*Ricinus communis*	Y	N	N	N
Dhan	*Oryza sativa*	Y	N	Y	N		Rendi	*Samanea saman*	Y	N	N	N
Dhekishak	*Pteris vittatai*	Y	N	N	N		Sheora	*Sireblus asper*	Y	N	N	N
Eucalyptus	*Eucalyptus citriodora*	Y	N	Y	N		Sheyalmutra	*Blumea lacera*	Y	N	N	N
Hatisur	*Heliotropium indicum*	Y	N	N	N		Shon grass	*Phragmites sp.*	Y	N	N	N
Katchu	*Colocasia esculenta*	Y	N	Y	N		Supari	*Areca catechu*	Y	N	Y	N
Kola	*Musa paradisiacal*	Y	N	Y	N		Sarkachu	*Monochoria vaginalis*	Y	N	N	N
Kathal	*Artocarpus heterophyllus*	Y	N	Y	N		Tal	*Borassus fiabellifer*	Y	N	N	N
Koroi	*Albizia procera*	Y	N	N	N		Tamarind	*Tamarindusindica*	Y	N	N	N
Krishnachura	*Delomix regia*	Y	N	N	N							

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No

(a) (b)

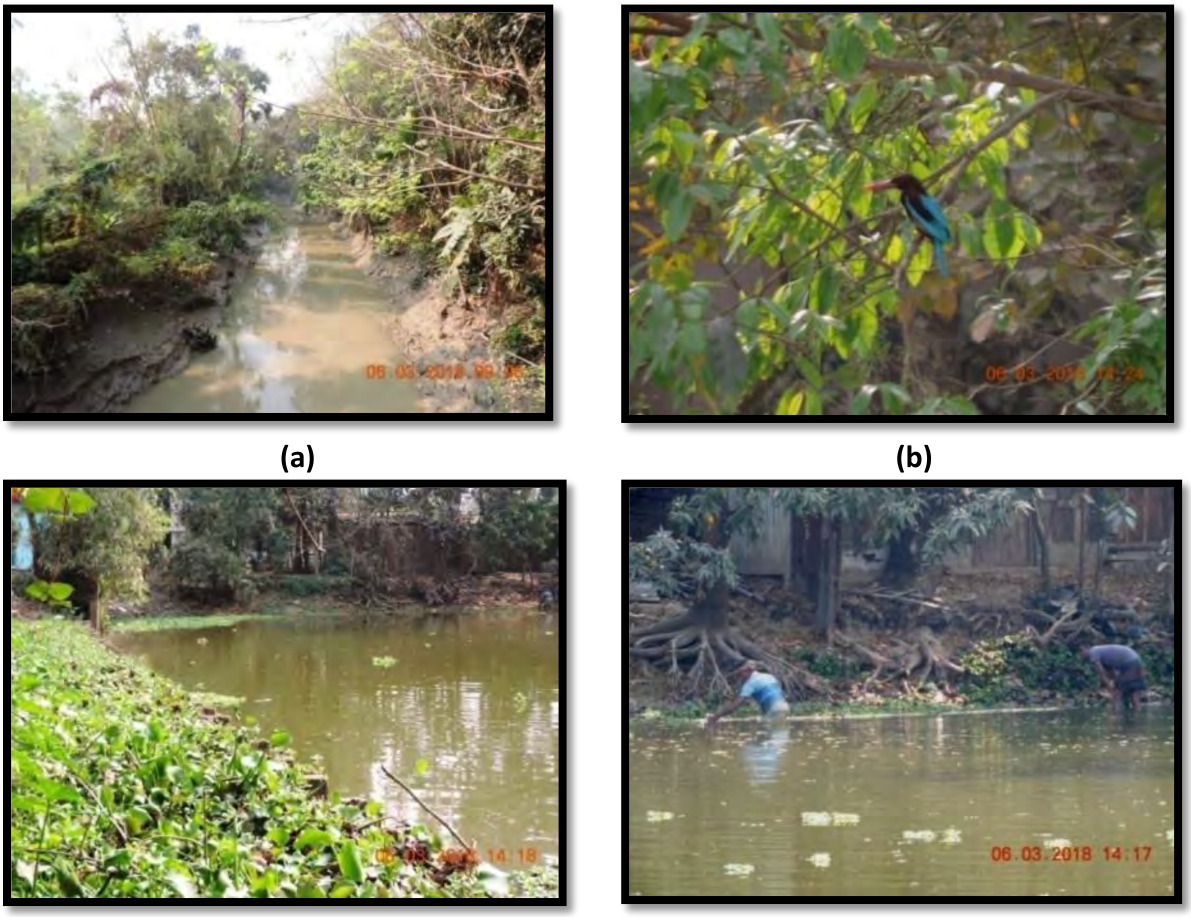
(c) (d)

(e) (f)

Figure 3.33: Terrestrial flora observed within and outside of the proposed DPHE: BMWSS project site under Chandanaish Pourashava of Chattogram district: (a) and (b) Mixed Road side plantation, (c) Plantation in the peripheral side of a village, (d) Road side mixed plantation, (e) Piper (*Capsicum frutescens*), and (f) Coconut (*Coccos nucifera*)

(b) Aquatic Ecology: The aquatic macro ecological aspect includes various types of aquatic fauna (mammal. bird, reptile, amphibian and fish) and flora (tree, herb and shrub); and most of the eco-aspects are distributed in and around the water bodies (pond, canal, river, ditch etc) of Chandanaish Pourashava. Common natural aquatic flora grows in plenty in the rainy season. Aquatic flora plays an important role for biodiversity conservation. Aquatic floras grow in river, pond, canal, ditch and low lying cultivated field as submerge, free-floating and rooted floating state. Brief description of aaquatic ecology of this site is given below:

(i) Aquatic Fauna: Most of the aquatic faunal species found at Chandanaish Pourashava are fairly common in comparison to other areas of the district. Aquatic faunal species that are adapted in altered urban habitat are commonly distributed in the urban aquatic site and others types of aquatic faunas are distributed in the rural aquatic site of the Pourashava. Table 3.30 and Figure 3.34 provide the existing aquatic faunal information and some of the aquatic faunal diversity observed in the proposed sub-project sites of BMWSSP under Chandanaish Pourashava.



(a) (b)

(c) (d)

Figure 3.34: Aquatic fauna observed within and outside of the proposed sub-project sites of BMWSSP under Chandanaish Pourashava of Chattogram district: (a) Canal is one of prime habitat for aquatic fauna, (b) White-Throated Kingfisher (*Halcyon smyrnensis*), (c) Pond use for fish culture, and (d) local people catch fish by hand from the peripheral side of a pond.

Table 3.30: Aquatic Faunal Diversity Checklist of Chandanaish Pourashava of Chattogram District.

Name		O	L	C	T		Name		O	L	C	T
English / Native	**Scientific**						**English / Native**	**Scientific**				
Bull Frog	*Hoplobatrachus tigerinus*	N	Y	N	N		Gangetic Mystus	*Mystus cavasius*	Y	N	N	N
Skipper frog	*Euphlyctis cyanophlyctis*	N	Y	N	N		Gery Fetherback	*Notopterus notopterus*	N	Y	N	N
Checkered Keelback	*Xenochrophis piscator*	N	Y	N	N		Long Whiskered Catfish	*Aorichthys aor*	N	Y	N	N
Common Smooth Water Snake	*Enhydris enhydris*	N	Y	N	N		Magur	*Clarius batrachus*	N	Y	N	N
Cattle Egret	*Bubulcus ibis*	N	Y	N	N		Mrigal	*Cirrhinus mrigala*	N	Y	N	N
Common Kingfisher	*Alcado athis*	Y	N	N	N		Mottled Nandus	*Nandus nandus*	N	Y	N	N
Common Sandpiper	*Actitis hypoleucos*	N	Y	N	N		One-stripe Spinyeel	*Macrognathus aculeatus*	N	Y	N	N
Little Egret	*Egretta garzetta*	N	Y	N	N		Pangus	*Pangasius pangasius*	Y	N	N	N
Little Cormorant	*Phalacrocorax niger*	Y	N	N	N		Rohu	*Labeo rohita*	Y	N	N	N
Pond Heron	*Ardeola grayii*	N	Y	N	N		Stinging Catfish	*Heteropneustes fossilis*	Y	N	N	N
White Throated Kingfisher	*Halcyon smyrnensis*	Y	N	N	N		Swamp Barb	*Puntius chola*	N	Y	N	N
Asiatic Snakehead	*Channa orientalis*	N	Y	N	N		Spotted Snakehead	*Channa punctatus*	N	Y	N	N
Bumblebee Goby	*Brachygobius nunas*	N	Y	N	N		Striped Snakehead	*Channa striatus*	N	Y	N	N
Climbing Perch	*Anabas testudineus*	N	Y	N	N		Sunset Gourami	*Colisa sota*	N	Y	N	N
Catla	*Catla catla*	N	Y	N	N		Silver carp	Hypophthalmichthys *molitrix*	Y	N	N	N
Flying Barb	*Esomus danricus*	N	Y	N	N		Tank Goby	*Glossogobius giuris*	Y	N	N	N
Grass Carp	Ctenopharyngodon *idella*	N	Y	N	N		Tengra Mystus	*Mystus tengara*	Y	N	N	N
Gangetic Mudeel	*Monopterus cuchia*	N	Y	N	N							

Legend: O = Observed, L= Local information, C = Common, T= Threatened, Y=Yes, N=No

(ii) Aquatic Flora: The aquatic floral species found at Chandanaish Pourashava have similarity to those of the nearby districts of Bangladesh. Most of the aquatic floras are distributed in scattered ways in some specific aquatic sites such as water-bodies of agro-wetland, pond, canal, ditch, river etc. All of the aquatic floras are naturally grown, plenty in monsoon, and are fairly common.The following table (Table 3.31) provides the existing aquatic floral information of the proposed sub-project sites of BMWSSP under Chandanaish Pourashava and also the following figure (Figure 3.35) shows some of floral diversity observed during the rapid field eco-assessment.

Table 3.31: Aquatic Floral Diversity Checklist of Chandanaish Pourashava of Chattogram

Name		O	L	C	T
English / Native	**Scientific**				
Haicha	*Alternanthera sesilis*	N	Y	N	N
Janglidhan	*Hygroryza aristata*	N	Y	N	N
Kachuripana	*Eichhornia crassipes*	Y	N	Y	N
Khudipana	*Lemna perpusilla*	N	Y	N	N
Katchu	*Colocasia esculenta*	Y	N	Y	N
Kalmi	*Ipomoea aquatic*	N	Y	N	N
Sada Shapla	*Nymphaea nouchali*	N	Y	N	N
Topapana	*Pistia strateotes*	Y	Y	N	N

Legend: O = Observed, L= Local Information, C = Common, T= Threatened, Y=Yes, N=No.

(a) **(b)**

Figure 3.35: Aquatic flora observed outside of the proposed sub-project sites of BMWSSP under Chandanaish Pourashava of Chattogram district: (a) Kachurypana (*Eichhornia crassipes*), and (b) Kachu (*Colocasia esculenta*).

(c) Threatened flora and fauna:

No threatened flora was identified from this sub-project site of BMWSSP, but a couple of threatened terrestrial fauna were identified from Chandanaish Pourashava. The threatened faunas are (a) Garden Monitor Lizard (*Varanus bengalensis*), and (b) Jackal (*Vulpes bengalensis*); both of the faunas are also threatened for entire country.

(d) Protected areas, wildlife sanctuaries, game reserves and ecologically critical areas:

(i) Protected Area (PA): Protected Area (PA) refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means i.e. PA is predominantly a natural area established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources (IUCN, 1990). No PA exists at or near the proposedsub-project study areas of BMWSSP underChandanaish Pourashava of Chattogram district.

(ii) National Park (NP): It is a reserve land, usually declared and owned by the government, protected from most human development and pollution (IUCN, 1990). No NP exists at or near the proposed sub-project study areas of BMWSSP underChandanaish Pourashava of Chattogram district.

(iii) Game Reserve (GR): It is an area of land set aside for maintenance of wildlife for tourism or hunting purposes (IUCN, 1990). No GR exists at or near the proposed sub-project study areas of BMWSSP underChandanaish Pourashava of Chattogram district.

(iv) Wildlife Sanctuary (WS): It is an area that assures the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment, where these require specific human manipulation for their perpetuation (IUCN, 1990). No WS exists at or near the proposed sub-project study areas of BMWSSP under Chandanaish Pourashava of Chattogram district..

(v) Ecologically Critical Area (ECA): It is an environmental protection zone, defined by the Government of Bangladesh under the Bangladesh Environment Conservation Act, 1995, where ecosystem is considered to be threatened to reach a critical state. No ECA exists at or near the proposedsub-project study areas of BMWSSP under Chandanaish Pourashava of Chattogram district.

Summary

The ecological baseline survey conducted among the five randomly selected sub-project sites of BMSSWP revealed that the terrestrial and aquatic flora and fauna found in those areas are very common and similar to the species usually found in other districsts of Bangladesh. None of the floral species (both terrestrial and aquatic)were observed asthreatned. Among the terrestrial faunal species, only Jackal was reported as threatedned in all five sub-project sites. Garden Monitor Lizard was identified as threatened in three sub -project sites (Dhanbari, Tarabo and Chandanaish) and threatened Yellow Monitor Lizard was identified in one sub-project site (Ullapara). The status of these three species is considered as threatened in entire Bangladesh also.

3.4 Socio-economic Environment

3.4.1 Introduction

A rapid socio-economic baseline assessment has been carried out for the proposed 'Bangladesh Municipal Water Supply and Sanitation Project' (BMWSSP), which will be implemented by the Department of Public Health Engineering (DPHE) of Bangladesh Government (GoB) with financial support from the World Bank (WB). As noted earlier, the proposed BMWSSP have two broad components viz. (a) water supply infrastructure that will include construction of (i) new water treatment plant (WTP), (ii) intake for raw water source, (iii) expansion and rehabilitation of distribution networks, and (b) sanitation and septage management that will include (i) construction of small scale fecal sludge treatment plant (FSTP) and (ii) decentralization of waste water treatment system. These broad components will be implemented in 30 Pourashavas under 30 Districts of Bangladesh. The socio-economic baseline survey has been conducted in February - March 2018, at the five Pourashavas (randomly selected) of the proposed BMWSSP's sub project sites such as (i) Dhanbari Pourashava of Tangail District, (ii) Ullahpara Pourashava of Sirajganj District, (iii) Tarabo Pourashava of Narayanganj District, (iv) Homna Pourashava of Comilla District and (v) Chandanaish Pourashava of Chattogram District. Efforts have been made to identify the socio-economic aspects that may be impacted by the proposed sub-project activities of the BMWSSP of DPHE. The main purposes of the baseline socio-economic assessment were to understand the: (i) people's socio-economic condition, (ii) extent of people's access to basic services; and (iii) people's perception regarding the proposed sub-project of BMWSSP at their locality. Based on field observation and secondary information, the socio-economic aspects that exist within and outside of the proposed sub-project sites have been described in this annex. It is mentioned here that detail baseline study will be required (sub project component wise) later for inclusion of social information in the Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) reports for this BMWSSP. The possible impacts of the BMWSSP's sub project activities will be evaluated against those detail baseline conditions, and mitigation measures will also be suggested based on identified impacts, if any, in the IEE and EIA reports.

3.4.2 Social Baseline

The baseline social assessment of the five sub-project sites under the five districts of the proposed BMWSSP have been described below separately:

3.4.2.1 Dhanbari Pourashava of Tangail District: Socio-economic perspectives of the proposed sub-project of BMWSSP at Dhanbari Pourashava of Tangail district are presented below:

(i) Social Information: Basic information on the socio-economic aspects of Dhanbari Pourashava of Tangail district is available in the respective pourashava office / upazila / district office, and summary of some important social information is shown in Table 3.32.

Table 3.32: Social Aspects of Dhanbari Pourashava of Tangail District.

Dhanbari Pourashava of Tangail District					
No	**Social Aspect**		**No**	**Social Aspect**	
1	Office Establishment Period: 12/08/1996		10	Educational Institution (all type)	37
2	Total area (sq. km)	24.89	11	Mosque	71
3	Ward	9	12	Temple	06
4	Mouza	11	13	Post Office	02
5	Village	35	14	Hospital	02
6	Total Household	9134	15	Bank	04
7	Average Household Size	4.23	16	Kitchen Market	02
8	Total Population	38968	17	Auto Rice Mill	14
Male		18995	18	Brick Field	05
Female		19973	19	Paved Road (km)	68
9	Population Density / km^2	1553	20	Non-Paved Road (km)	54

(ii) Proposed Dhanabari Sub-Project Site (component-wise): As noted earlier, the proposed sub-project of BMWSSP has two major sections with some components, most of which are distributed in scattered way inside the Dhanbari Pourashava. However, the proposed raw water intake source has preliminary been selected from the Bongshai River near Horipur Bazar. This site and adjacent area of the river is used by the local people / fishermen for fish collection seasonally. During winter, people make fish trap inside the shallow part of the river and catch fish from that section. Most of the common native fishes are available in the river, and consumption of those fish adds nutrition value to the health of local people. On the other hand, an agro wetland has preliminary been selected for the proposed water treatment plant site. This site is used for paddy cultivation and there are some ponds in the nearby area which are used for commercial fish culture. During monsoon, all the area including the proposed project site goes under water and people catch fish from the inundated area. Water transmission and distribution pipelines will be laid under the existing paved and non-paved road networks in the pourashava. Roads are used by the local people for movement and material transportation from one place to another. However, some social aspects of the proposed sub-project site of Dhanbari Pourashava are shown in Figure 3.35.

(a)

(b)

(c) **(d)**

Figure 3.35: Socio-economic aspects observed within the proposed sub-project site of BMWSSP of DPHE at Dhanbari Pourashava of Tangail District: (a) local people catch fish by creating trap in the shallow part of the Bongshai River at or near the proposed intake raw water source point, (b) paddy cultivation and fish culture practice at or near the proposed water treatment plant site, (c) exotic tree plantation in both side of a new non-pave road under which the proposed water transmission and distribution pipe lines will be laid, and (d) pave road, beside boundary wall of residential house, under which the proposed water distribution pipeline will be laid.

(iii) Adjacent Areas of the Proposed Dhanbari Sub-Project Site: Adjacent areas of the proposed sub-project site of BMWSSP of DPHE at Dhanbari Pourashava have urban and rural (mostly) environment with little development. Thousands of people having diverse occupation (day laborer to Government service holder) live in the area, with and without families. Most of the people are in low to middle income class group. Some villages exist adjacent to the proposed project site. All villages seem to be bounded by floras that have economic value. Some agricultural lands are changing to residential lands which indicate local people's economic strength. Most of the villages have fertile soil for growing short rotation crops and vegetables. Productive agricultural lands exist; and some of these lands are inundated in the rainy season for several months and provide habitat for native fish species. People rear cattle, produce paddy in the agricultural land, and do small business at the roadside. Local community catches fish from the seasonal wetlands, ponds and adjacent river. Some local market exist here that supply goods for local community. The area dominates by Muslim and their religious establishments are remarkable. During social assessment, no ancient religious establishment has been identified, but a historical establishment, more than 100 years old, known as Rajbari, has been identified within the pourashava jurisdiction area. Medical facilities (hospital) are available in the project adjacent areas. The existing pave roads are used mainly for communication. Therefore, small market or shop, rickshaw, three wheeler CNG taxi etc also available that plays an import economic role among the people of present society. All sorts of educational facilities are available, and number of educated peoples is increasing. There are school, college, religious institution, bank in the Pourashava and play a vital socio-economic role to the local community. CNG taxi, local bus, rickshaw, van, microbus etc available are available as transport modes. Fuel pump station is also available. Most of the residences have access to electricity but are dissatisfied with the service for dinterrupted supply. No pipe natural gas line is available for the local people. People use underground water via tube well for drinking purposes though most of the tube-wells are contaminated by iron (Fe). Pit latrines are common in the village. There are few children play ground. The local economy depends primarily on the surrounding small establishment and small businesses. The economic condition of the area is relatively poor compared to other areas of Bangladesh. Poor drainage condition, noise pollution and air pollution are some of the important socio-environmental issues that influence the socio-economic environment of the project surrounding areas, especially the pourashava environment. Some of the above mentioned socio-economic aspects are shown in Figure 3.36 to Figure 3.38.

(a)

(b)

(c)

(d)

Figure 3.36: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Dhanbari Pourashava of Tangail District: (a) tin-shed house with small shop and concrete building, the symbol of gradual economic progress, (b) concrete basement for construction of a multistoried building inside an agricultural land, simple of individual economic growth, (c) religious establishment, Rajbari Mosque, more than 100 years old, use for regular prayer by the local Muslim people, and (d) Muslim grave-yard, more than 100 years old.

(e)

(f)

(g)

(h)

Figure 3.37: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Dhanbari Pourashava of Tangail District: (e) child worker making furniture in a shop, (f) tube well, the prime source of drinking water, in a local school, (g) Govt. primary school for the children education, and (h) gate of Rajbari, over hundred years old establishment.

(i)

(j)

(k) **(l)**

Figure 3.38: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Dhanbari Pourashava of Tangail District: (i) brick produce & supply from a local brick-field for development work, (j) both male and female workers are working in the brick filed, (k) social event: annual sport of a school, and (l) villager rear cattle inside their vicinity, adjacent to the pourashava.

3.4.2.2 Ullahpara Pourashava of Sirajganj District: Socio-economic perspectives of the proposed sub-project of BMWSSP at Ullahpara Pourashava of Sirajganj district are given below:

(i) Social Information: Basic information on the socio-economic aspects of Ullahpara Pourashava of Sirajganj district is available in the respective pourashava office / upazila / district office, and summary of some important social information is shown in Table 3.33.

Table 3.33: Social Aspects of Ullahpara Pourashava of Sirajganj District.

Ullahpara Pourashava of Sirajganj District					
No	**Social Aspect**		**No**	**Social Aspect**	
1	Office Establishment Period: 01/07/1994		10	Educational Institution (all type)	44
2	Total area (sq. km)	12.70	11	Mosque	62
3	Ward	09	12	Temple	33
4	Mouza	-	13	Super Market	30
5	Village	-	14	Hospital	20
6	Total Household	14000	15	Bank	15
7	Average Household Size	-	16	Kitchen Market	03
8	Total Population	75827	17	Fire Station	01
Male (%)		52	18	Bus Terminal	01
Female (%)		48	19	Pave Road (km)	65
9	Population Density / km^2	-	20	Non-Pave Road (km)	60

(ii) Proposed Ullahpara Sub-Project Site (component-wise): As noted earlier, the proposed sub-project of BMWSSP has two major sections with some components, most of which are distributed in scattered way inside the Ullahpara Pourashava of Sirajganj district. The proposed raw water intake location has preliminary been selected from the Karatoya River in between Charghatina Rail and Road Bridge near Charghatina Village of Ullahpara

Pourashava. This site and adjacent areas of the river is used by the local fishermen for fish collection throughout the year. People create large fish trap inside the river and catch fish from those fish-traps throughout the year. Most of the common native fishes are available in the river. On the other hand, a riverside high land has preliminary been selected for the proposed water treatment plant site. This site is used for duck house (seasonal and temporary) and also some part of it or nearby area has a couple of tin shed structures and used as material storage house. The water transmission and distribution pipelines will be laid under the existing pave and non-pave roads within the pourashava, and most roads are used by the local people for movement and also for material transportation. However, some social aspects of the proposed sub-project site of Ullahpara Pourashava are shown in Figure 3.39.

(a)

(b)

(c)

(d)

Figure 3.39: Socio-economic aspects observed within the proposed sub-project site of BMWSSP of DPHE at Ullahpara Pourashava of Sirajganj District: (a) few planted exotic flora, may need to remove for the proposed boosted pump house construction, near the proposed raw water intake source point, (b) seasonal duck house & two tin-shed structures, at or near the water treatment plant (WTP) site, may need to remove for the proposed WTP construction, (c) non-motorize vehicle inside the pourashava road under which the water distribution pipeline will be laid, and (d) narrow pave road, under which the proposed water distribution pipeline will be laid.

(iii) Adjacent Areas of the Proposed Ullahpara Sub-Project Site: Adjacent areas of the proposed sub-project site of BMWSSP of DPHE at Ullahpara Pourashava have urban (mostly) and rural environment with moderate development. Thousands of people having diverse occupation live in this Pourashava, with and without families. Most people seem to be middle class income group. Some governmental and semi-governmental offices exist in the adjacent areas of the proposed sub-project site. Rural area also exists adjacent to the proposed sub-project site. All urban and rural areas seem to be bounded by various types of floras that have economic value to the present society. Some lands inside the Pourashava are changing to residential and commercial lands which indicate local people's economic status. The rural areas have fertile soil for growing short rotation crops and vegetables. Productive agricultural lands exist; and some of these lands are inundated in the rainy season for few months and provide habitat for native fish species. People rear cattle and poultry in the village vicinity, produce paddy in the agricultural land, and do small business at the roadside spaces. Local community catches fish from the seasonal agro-wetlands, ponds and river. The area dominates by Muslim, and their religious establishments are quite remarkable. No ancient religious and historical establishment is identified during the assessment. Medical facilities (hospital) are available in the project adjacent pourashava area. Small markets and shops are available in the project area that supplies goods to the local community. All sorts of educational facilities are available, and educated peoples are increasing. University, college, school, religious institution, bank etc also are in the Pourashava and play a vital socio-economic role to the local community. All types of motorize and non-motorize vehicles such as rickshaw, van, three wheeler CNG taxi, bus, truck etc. are available in the pourashava area that are used as main transport. Newly constructed modern bus terminal exists in the peripheral side of the pourashava. Fuel pump station is also available. All residents are under electricity coverage but dissatisfied with the supply. A very limited piped natural gas is available for the local people. People use underground water via tube well for drinking purposes though all of those are contaminated by Iron (Fe), Arsenic (As) and Manganese (Mn) - according to local people information. Modern sanitary latrines are in use in the pourashava, whereas poor rural people use pit latrines. A few number of play-ground is available for children. The local economy depends primarily on the surrounding agro-industrial business, small establishment and small businesses. The economic condition of the area is improving compared to other areas of Bangladesh. Poor drainage condition, noise pollution and air pollution are some of the important environmental issues that also influence the social environment of the project surrounding area, especially the pourashava environment. However, some of the above mentioned socio-economic aspects of Ullahpara Pourashava are shown in Figure 40 to Figure 42.

(a) (b)

(c) (d)

Figure 3.40: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Ullahpara Pourashava of Sirajganj District: (a) multistoried residential building inside the pourashava, (b) multistoried market under construction, (c) multistoried mosque under construction, and (d) poor drainage line / condition inside the pourashava.

(e) (f)

(g) **(h)**

Figure 3.41: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Ullahpara Pourashava of Sirajganj District: (e) tube well in public place, frequently use by the local pourashava people, (f) cloth store, able to fulfill local demand to some extent, (g) sheep freely move from one place to other for searching food, and (h) exotic fish culture with case-net inside the Karatoya River.

(i) **(j)**

(k) **(l)**

Figure 3.42: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Ullahpara Pourashava of Sirajganj District: (i) pipeline of natural gas in a residential building, (j) non-motorize and motorize vehicle runs in pave road, (k) high school for higher education, and (l) newly constructed bus terminal.

3.4.2.3 Tarabo Pourashava of Narayanganj District: Socio-economic perspectives of the proposed sub-project of BMWSSP at Tarabo Pourashava of Narayanganj district are given below:

(i) Social Information: Basic information on the socio-economic aspects of Tarabo Pourashava of Narayanganj district is available in the respective pourashava office / upazila / district office, and summery of some important social information is given in Table 3.34.

Table 3.34: Social Aspects of Tarabo Pourashava of Narayanganj District.

Tarabo Pourashava of Narayanganj District					
No	**Social Aspect**		**No**	**Social Aspect**	
1	Office Establishment Period: 07-10-2002		10	Educational Institution (all type)	44
2	Total area (sq. km)	24.60	11	Mosque	52
3	Ward	09	12	Temple	03
4	Mouza	20	13	Post Office	03
5	Village	-	14	Hospital / Clinic	03
6	Total Household	12600	15	Bank	04
7	Average Household Size	-	16	Kitchen Market	04
8	Total Population	150709	17	Industrial Establishment	262
Male		81088	18	Jamdani Polli	01
Female		69621	19	Paved Road (km)	56.65
9	Population Density / km^2	6126.38	20	Unpaved Road (km)	25.80

(ii) Proposed Tarabo Sub-Project Site (component-wise): As noted earlier, the proposed sub-project of BMWSSP has two major sections with some components, most of which are distributed in scattered way inside the Tarabo Pourashava. However, the proposed raw water intake source has preliminary been selected from the Sitalakkha River near Gandhappur Gudaraghat / Nurul Market of Tarabo Pourashava. This site and adjacent area of the river is used by the local people for irrigating the agro-land of the river bank and the quality of water is bad due to industrial pollution. Almost no fish is found in the river now-a-days. Few people cross the river through engine boat from this or adjacent areas of the river. On the other hand, a wetland has preliminary been selected for the proposed water treatment plant site. This site is mainly dry in winter season, but in rainy season, the land and adjacent area is inundated with water and used for commercial fish culture. Water transmission and distribution pipelines will be laid under the existing pave and non-pave road networks within the pourashava, and most of the roads are used by the local people for movement and material transportation through vehicles. Some of the social aspects of the proposed sub-project site of Tarabo Pourashava are shown in Figure 3.43.

(a) **(b)**

(c) **(d)**

Figure 3.43: Socio-economic aspects observed within the proposed sub-project site of BMWSSP of DPHE at Tarabo Pourashava of Narayanganj District: (a) Sitalakkha River, proposed raw water intake source point, have polluted water that use for watering of riverbank agro-land, (b) proposed water treatment plant site, use for seasonal commercial fish culture, (c) underground of a non-pave road will be use for the, proposed water distribution pipeline route, and (d) tin-shed structure with floral resources exist within a piece of land that proposed for construction of overhead tank.

(iii) Adjacent Areas of the Proposed Tarabo Sub-Project Site: Adjacent areas of the proposed sub-project site of BMWSSP of DPHE at Tarabo Pourashava have both urban and rural environment with low to moderate development. Thousands of people having various occupation (day laborer to Government service holder) live in the area, with and without families. Most people seem to be low to middle income group. A small number of governmental and semi-governmental offices exists in the adjacent areas of the proposed sub-project site. Some villages are also within the proposed sub-project site and seem to be bounded by various types of floras that have economic value. Some agricultural lands are changing to residential and commercial lands which indicate that local people's economic condition is improving. Soils are fertile for growing short rotation crops and vegetables. Productive agricultural lands exist, and some of these lands are inundated in the rainy season for several months and provide habitat for native fish species. People rear cattle and run poultry farming in the village vicinity, produce paddy in the agricultural land, and do small business at the roadside spaces. Local people catch fish from the seasonal wetlands and ponds. Some local market exist here that supply goods for local community. Majority of the people in this area is Muslim followed by Hindus, and their religious establishments are quite considerable. No ancient religious and historical establishment is identified during the survey. Medical facilities (hospital) are available in the project adjacent urban area. Some big industries exist in the pourashava and thousands of laborer work there. Small markets and shops are available inside the pourashava. All sorts of educational facilities are available, and educated peoples are increasing. College, school, religious institution, bank etc are available and play a vital socio-economic role to the local community. All types of motorize and non-motorize transport e.g. rickshaw, van, three wheeler CNG taxi, bus, truck, car, etc. are available in the pourashava area. Fuel pump station is available in the area. All residents have electricity in their houses but are not satisfied for interruptible supply. Considerable number of residences has pipeline natural gas.

(a)

(b)

(c)

(d)

Figure 3.44: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Tarabo Pourashava of Narayanganj District: (i) Cargo vessel frequently move through the Sitalakkha River, adjacent to the raw intake water source point, (b) local people cross the Sitalakkha River through engine boat, (c) an industrial establishment inside the pourashava provide employment opportunity for thousand of worker, and (d) unauthorized kitchen market beside a pourashava road under which the proposed water pipeline will be laid.

Most people use underground water via tube well for drinking purposes. Local people use both modern and pit latrines. Few play-grounds are available for children. The local economy depends primarily on the surrounding industrial businesses, transport, aquaculture, agro-business, small establishment and small businesses Poor drainage condition, noise pollution and air pollution are some of the important environmental issues that are increasing and also influence the socio-economic environment of the project surrounding area, especially the local environment. However, some of the above mentioned socio-economic aspects are shown in Figure 3.44 to Figure 3.46.

(e) **(f)**

(g) **(h)**

Figure 3.45: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Tarabo Pourashava of Narayanganj District: (e) piper cultivation in a riverbank agro-land, near the proposed raw water intake source point, (f) cattle are grazing in an open land, near the proposed water treatment plant site, (g) small scale turkey firming for income generation, observed near water treatment project site, and (h) rural women are working in a agro-land for vegetable gardening.

(i)

(j)

(k)

(l)

Figure 3.46: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Tarabo Pourashava of Narayanganj District: (i) A newly build concrete building, adjacent to the proposed water treatment plant site, (j) worship place for Hindu community, adjacent to the water treatment plant site, (k) a private high school for local student, adjacent to the proposed overhead water tank construction site, and (l) a small play-ground for local student, adjacent to the proposed overhead water tank site.

3.4.2.4 Homna Pourashava of Comilla District: Socio-economic perspectives of the proposed sub-project of BMWSSP at Homna Pourashava of Comilla district are given below:

(i) Social Information: Basic information on the socio-economic aspects of Homna Pourashava of Comilla district is available in the respective pourashava office / upazila / district office, and summery of some important social information is given in Table 3.35.

Table 3.35: Social Aspects of Homna Pourashava of Comilla District.

Homna Pourashava of Comilla District					
No	**Social Aspect**		**No**	**Social Aspect**	
1	Office Establishment Period: 19/12/2002		10	Educational Institution (all type)	20
2	Total area (sq. km)	14.10	11	Mosque	62
3	Ward	09	12	Temple	05
4	Mouza	07	13	Auditorium	01

Homna Pourashava of Comilla District					
No	**Social Aspect**		**No**	**Social Aspect**	
5	Village	-	14	Hospital	01
6	Total Household	6300	15	Bank	09
7	Average Household Size	-	16	Kitchen Market	01
8	Total Population	34447	17	Bus Stand	04
Male		16778	18	Water Pump	01
Female		17669	19	Pave Road (km)	29
9	Population Density / km^2	2444	20	Non-Pave Road (km)	15

(ii) Proposed Homna Sub-Project Site (component-wise): As noted earlier, the proposed sub-project of BMWSSP has two major sections with some components, most of which are distributed in scattered way inside the Homan Pourashava. However, the proposed raw water intake source has preliminary been selected from the Titas River near Baghmara village (western part) of Homna Pourashava. This site and adjacent area of the river is used by the local people for bathing and other domestic purposes due to the very clean water in the river. Various types of native fishes exist in the river and local fishermen catch fish from the river, adjacent to the proposed raw water intake source point. Various types of water vessels also move from one place to another through the the river. The river bank high land is occasionally used as brick stockpile as the supply of bricks come through the water way. On the other hand, a high land has preliminary been selected for the proposed water treatment plant site. This site seems to be quite a highland with various types of mature and non-matured floras. A couple of old concrete houses, including toilet facilities, exist in the proposed land, and a guard with his family live inside the land. Water transmission and distribution pipelines will be laid under the existing paved and unpaved road networks inside the pourashava, and most roads are used by the local people for communication and material transportation through vehicles. However, some social aspects of the proposed sub-project site of Homna Pourashava are shown in Figure 3.47.

(a)

(b)

(c) **(d)**

Figure 3.47: Socio-economic aspects observed within the proposed sub-project site of BMWSSP of DPHE at Homna Pourashava of Comilla District: (a) sand transmission through pipeline from a water vessel, at or near the proposed raw water intake source point at Titas River, (b) brick stockpile in the riverbank high land, where proposed booster pump house will be constructed, (c) various type of floras and concreted structures exist inside the proposed water treatment plant construction site, and (d) underground of pave road will be use to laid the proposed water distribution pipeline.

(iii) Adjacent Areas of the Proposed Homna Sub-Project Site: Adjacent areas of the proposed sub-project site of BMWSSP of DPHE at Homna Pourashava have both urban and rural (mostly) environment with low development. Thousands of people havingvarious occupation live in the area. Most of the people are in low income group. Some villages exist adjacent to the proposed sub-project site. All villages seem to be bounded by floras that have economic value. Few village lands are changing as residential lands which indicate local people's economic strength. Most villages have fertile soil for growing short rotation crops and vegetables. Productive agricultural lands exist; and few lands are inundated in the rainy season for several months and provide habitat for native fish species. People rear cattle and poultry in the village vicinity, produce paddy in the agricultural land, and do small business beside specific road. Local community catches fish from the seasonal agro-wetlands, ponds and river. The area dominates by Muslim, and their religious establishments are quite remarkable. No ancient religious and historical establishment identified during the assessment. Some governmental or semi-governmental offices exist in the adjacent areas of the proposed sub-project site. Limited medical facilities are available in the project adjacent area. Small markets and shops are available in the pourashava that supplies goods for the local community. All sorts of educational facilities are available, and educated peoples are increasing. College, school, religious institution, bank etc also available, and play a vital socio-economic role to the local community. All types of motorize and non-motorize transport e.g. rickshaw, van, three wheeler CNG taxi, bus, truck etc. are available here that are used as main transport. Few bus stations are available inside the pourahsva. Fuel pump station is available. Most of the residences are under electricity coverage but dissatisfied with the interruptible supply. Most people use ground water via tube well for drinking purposes, while others use river water who live adjacent to the river. Village people use pit latrines. Few play grounds are available for children. The local economy depends primarily on the surrounding agro-business, small establishment and small businesses. The economic condition of the area is poor in comparison with other areas of Bangladesh. Poor drainage condition, noise pollution and air pollution are some of the important environmental issues that are increasing and also influence the socio-economic environment of the project surrounding area, especially the pourashava environment. However, some of the above mentioned socio-economic aspects of Homna Pourashava are shown in Figure 3.48 to Figure 3.50.

(a)

(b)

(c)

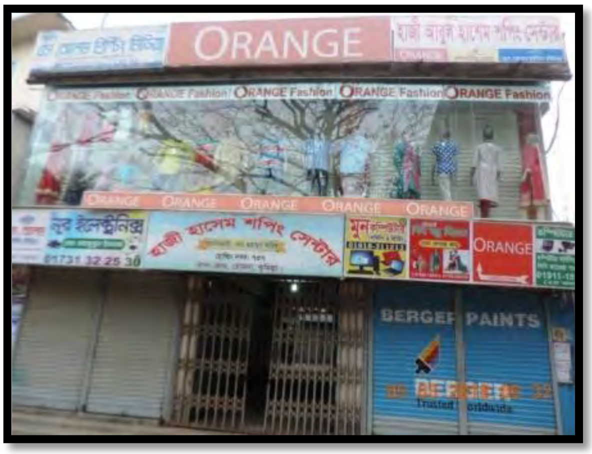
(d)

Figure 3.48: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Homna Pourashava of Comilla District: (a) riverside resident collecting pure river water for drinking, adjacent to the proposed raw water intake source point, (b) children bathing in the pure river water before sunset, adjacent to the proposed raw water intake source point, (c) a concrete building under construction, adjacent to the proposed booster pump house, and (d) kitchen market, beside a pave road under which the proposed water distribution pipeline will be laid.

(e)

(f)

(g)



(h)

Figure 3.49: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Homna Pourashava of Comilla District: (e) concrete bridge linked the Homna pourashava with Bancharampur upazila of Brahmanbaria district, adjacent to the proposed water treatment plant site, (f) a govt. primary school, adjacent to the proposed water pipeline distribution route, (g) people in front of a multistoried local market with and without transport in the road, under which the proposed water distribution pipeline will be laid, and (h) a modern showroom in a shopping complex, adjacent to the proposed water distribution pipeline route.

(i)

(j)

(k) **(l)**

Figure 3.50: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Homna Pourashava of Comilla District: (i) a women operate small business in her shop beside a road, adjacent to the proposed water distribution pipeline route, (j) worker making bread in a local restaurant, adjacent to the proposed water distribution pipeline route, (k) cattle rearing inside the village vicinity, adjacent to the proposed water distribution pipeline route, and (l) Homna press club and other office, adjacent to the water distribution pipeline route.

3.4.2.5 Chandanaish Pourashava of ChattogramDistrict: Socio-economic perspectives of the proposed sub-project of BMWSSP at Chandanaish Pourashava of Chattogram district are given below:

(i) Social Information: Basic information on the socio-economic aspects of Chandanaish Pourashava of Chattogram district is available in the respective pourashava office / upazila / district office, and summery of some important social information is given in Table 3.36.

Table 3.36: Social Aspects of Chandanaish Pourashava of Chattogram District.

Chandanaish Pourashava of Chattogram District					
No	**Social Aspect**		**No**	**Social Aspect**	
1	Office Establishment Period: 25/08/2002		10	Educational Institution (all type)	62
2	Total area (sq. km)	17.08	11	Mosque	62
3	Ward	09	12	Hindu Temple	13
4	Mouza	-	13	Buddish Temple	07
5	Village	-	14	Hospital / Community Clinic	14
6	Total Household	15030	15	Bank	-
7	Average Household Size	-	16	Kitchen Market	05
8	Total Population	68570	17	Small Industry	03
Male		-	18	Commercial Establishment	191
Female		-	19	Paved Road (km)	52
9	Population Density / km^2	4014	20	Unpaved Road (Km)	87

(ii) Proposed Chandanaish Sub-Project Site (component-wise): As noted earlier, the proposed sub-project of BMWSSP has two major sections with some components, most of which are distributed in scattered way inside the Chandanaish Pourashava. However, the proposed raw water intake source point has preliminary been selected from the Sangu River near Zathormukh Bazar of Chandanaish Pourashava; This site and adjacent area of the river is used by the local people for boat landing station and various types of crops and vegetables comes with the boat for sale in the Zathormukh Bazar whole sale market. Few people catch fish from the Sangu River including the proposed raw water intake source point. Few engine boats also move from one place to another place through the the river. A high land has preliminary been selected for the proposed water treatment plant site. This site is an agro-highland with pepper (Chili) field and in the peripheral side have some mature and non-matured flora. Water transmission and distribution pipelines will be laid under the existing paved and unpaved road networks within the pourashava, and most roads are used by the local people for movement and material transportation through vehicles. However, some social aspects of the proposed sub-project site of Chandanaish Pourashava are shown in Figure 3.51.

(a) **(b)** **(c)** **(d)**

Figure 3.51: Socio-economic aspects observed within the proposed sub-project site of BMWSSP of DPHE at Chandanaish Pourashava of Chattogram District: (a) boat with crop / vegetable at Zathormukh Bazar, at or near the proposed raw water intake source point at Sangu River, (b) piper cultivation inside the proposed water treatment plant site, (c) papaya garden in a high land that will be used for booster pump house construction, and (d) underground of pave road (with bridge) will be use to lay the water distribution pipeline.

(iii) Adjacent Areas of the Proposed Chandanaish Sub-Project Site: Adjacent areas of the proposed sub-project site of BMWSSP of DPHE at Chandanaish Pourashava have both urban and rural (mostly) environment with very low development. Thousands of people havingdiverse occupation live in the area, with and without families. Women seem to stay inside the house due to the religious customs. Most people seem to be low to middle income group. Some governmental or semi-governmental offices exist in the proposed sub-project assessment areas. Some village exists in the proposed sub-project site. All villages seem to be bounded by floras that have economic value to the society. Few village lands are changing as residential lands which indicate local people's economic strength. Most villages have fertile soil for growing short rotation crops and vegetables. People rear cattle and poultry in the village vicinity, grow paddy in the agricultural land, and do small business at the roadside spaces. Local community people catch fish from the ponds, canals and river. The majority of the people in this area is Muslim, and their religious establishments are quite remarkable. No ancient religious and historical establishments exit in the assessment area. Both pave and non-pave road exists in the proposed sub-project adjacent areas. Small markets and shops are available in the rural and urban side of the project assessment area that supplies goods for the local community. All sorts of educational facilities (e.g. colleges, primary and high schools, religious institutions, etc) are available, and number of educated people are increasing. Bank and other type of financial institution are available here that play a vital socio-economic role to the local community. All types of motorize and non-motorize transport e.g. rickshaw, van, three wheeler CNG taxi, bus, truck etc. are available in the pourashava area that are used as main transport. Fuel pump station is available. Most of the residence have access to electricity but are not satisfied with the interruptible electric supply. People have no piped natural gas line for cooking; they use LP Gas, fuel wood, etc. for cooking food. Most people use underground water via tube well for drinking purposes though most of the tube-wells are contaminated by iron (Fe) and arsenic (As), according to local people. Pit latrines are used by the village people. Few playgrounds are available for children. The local economy depends primarily on the surrounding agro-business, small establishment and other types of businesses in addition to foreign earning as a considerable number of people work in the foreign countries. The economic condition of the area is relatively improving compared to other areas of Bangladesh. Poor drainage condition, noise pollution and air pollution are some of the important environmental issues that increasing and also influence the socio-economic environment of the sub-project surrounding area, especially the urban environment. However, some of the above mentioned socio-economic aspects of Chandanaish Pourashava are shown in Figure 3.52 to Figure 3.54.

(a)

(b)

(c)

(d)

Figure 3.52: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Chandanaish Pourashava of Chattogram District: (a) local people catch fish from the Sangu River, adjacent to the proposed raw water intake source point, (b) fish cleaning for cooking by a local women, adjacent to the proposed water distribution pipeline route, (c) potato collection by a farmer from an agro-land, adjacent to the proposed water treatment plant construction site, and (d) various type of crops are ready for whole sale at Zathormukh Bazar, adjacent to the proposed booster pimp house construction site.

(e)

(f)

(g)

(h)

Figure 3.53: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Chandanaish Pourashava of Chattogram District: (e) concrete mosque, frequently use by the local Muslim, adjacent to the proposed water distribution pipeline route, (f) concrete temple, frequently use by the local Hindu, adjacent to the proposed water distribution pipeline route, (g) primary school for local student, adjacent to the proposed water distribution pipeline route, and (h) pave road use by the student and local people, under which the proposed water distribution pipeline will be laid.

(i) **(j)**

(k) **(l)**

Figure 3.54: Socio-economic aspects observed adjacent to the proposed sub-project site of BMWSSP of DPHE at Chandanaish Pourashava of Chattogram District: (i) partially damage mud house of a poor people, adjacent to the proposed water distribution pipeline route, (j) modern concrete building of a rich people, adjacent to the proposed water distribution pipeline route, (k) water collection from a pond for household purposes, adjacent to the proposed water distribution pipeline route, and (l) dry leaf and fuel-wood collection from a land for cooking, adjacent to the proposed water treatment plant site.

Chapter 4
OVERALL ENVIRONMENTAL IMPACTS

4.1 Introduction

After establishing the baseline environment and identification of the sub-project activities during construction phase, the next step in the IEE/ EIA involves assessment/ prediction of the impacts of these activities on the baseline environment. The potential environmental impacts during construction phase of sub-projects could be categorized into: (a) ecological impacts; (b) physic-chemical impacts; and (c) socio-economic impacts. This Chapter identifies and describes the generic potential significant environmental impacts during construction and operational phases of different sub-projects under BMWSSP. The impacts during construction and operational phases have been discussed separately.

4.2 Potential Significant Impacts during Construction Phase

Ecological impacts:
Based on primary assessment of the nature and scale of the proposed sub-projects and assessment of sub-project locations (based on field visits), it appears that ecological impacts are not likely to be significant for most of the proposed sub-projects. However, for a few sub-projects the significance of ecological impacts needs to be assessed. These sub-projects include: (i) Fecal sludge management, (ii) Water treatment plant with raw water transmission line, (iii) Clear water transmission line construction/rehabilitation/expansion, and (iv) Water distribution network. For some sub-projects, felling of trees may be required; felling of significant number of trees, if required, would generate adverse ecological impacts.

In general, the ecological impact should focus on:

(a) Impact on flora (aquatic and terrestrial);
(b) Impact on fauna (aquatic and terrestrial) including fish;

Based on preliminary assessment, it appears that the ecological impacts resulting from the sub-project (listed above) activities would of relatively low. The environmental management framework (EMF) of the BMWSSP presents a detail methodology for assessment of ecological impacts.

Physicochemical impacts:
Possible physicochemical impacts from the sub-project activities to be carried out in different Paurashavas may include the following:

- Drainage congestion,
- Noise pollution,
- Air pollution,
- Surface water pollution,
- Groundwater pollution,
- Soil erosion/ contamination, and
- Environmental pollution from solid/ construction waste

Drainage congestion:
During execution of sub-projects, temporary drainage congestion often results from obstruction to natural flow of drainage water due to storage of materials, piled up excavated material/soil, and temporary embankments constructed to keep work area dry. Such drainage congestions could create significant discomfort to people living in sub-project areas.

Noise pollution:
Noise pollution could results from a wide range of construction activities, including movement of vehicles (carrying equipment/ material to and from site), operation of construction equipment and generators. Significant noise is generated from operation of pile drivers, bulldozers, dump trucks, compactors, mixing machines, and generators, etc. Demolition activities, if required, also generate noise. Such noise may cause discomfort to the people living in the surrounding areas at close proximity of the sub-project site, especially if such activities are continued during the night. Noise pollution is particularly important for sensitive establishment e.g., hospitals, educational/religious institutions. The construction work will take place inside the Paurashava boundary and likely to be in close proximity to the residential and highly populated areas. Therefore, a large number of people may be exposed to high levels of noise during construction.

Air pollution:
During construction phase, air pollution may result from exhaust emissions (containing carbon monoxide (CO), sulfur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM)) from machines and equipment (e.g., drilling rig, mixing machines, generators, asphalt plants) used for different sub-project activities. Furthermore, construction activities such as excavation, leveling, filling and vehicular movement on unpaved tracks may also cause fugitive dust emissions. Sub-projects that could generate appreciable air pollution include clear water transmission construction/rehabilitation/expansion, water distribution network, drain, water treatment plant with raw water transmission, and fecal sludge management). For the sub-projects to be implemented under the MWSSP, adverse impacts of air pollution are likely to be limited to the areas surrounding the sub-project sites.

Surface Water pollution:
1. Water pollution may result from discharge of wastewater (e.g., liquid waste from labor sheds), spills and leaks of oils/ chemical into nearby water bodies (e.g., drain, pond, khal, drain, river). For water treatment plant and FSTP sub-projects, construction activities would be related to water bodies (source and treated effluent disposal); hence these sub-projects are more likely to generate water pollution. For other sub-projects, the presence and existing use of water bodies surrounding the sub-project site would determine the level of impact. For example, if a pond/lake located close to a sub-project site is used for washing/ bathing or for fish farming; pollution of the pond/lake from sub-project activities would generate significant adverse impacts.

Environmental pollution from solid/ construction waste:
In many sub-projects, construction debris (e.g., demolition of existing structures) is likely to be generated from different sub-project activities. Solid wastes will also be generated from labor sheds, particularly for labor-intensive sub-projects. Improper management of

construction debris and solid waste could cause blockage of drainage line/ path and environmental pollution.

Socio-economic impacts:

Possible socio-economic impacts from the sub-project activities to be carried out in different Paurashavas may include the following:

- loss of land,
- loss of income and displacement,
- traffic congestion,
- impact on top soil,
- health and safety,
- impact on archaeological and historical sites, and
- employment and commercial activities.

Loss of land:

Acquisition of private land is often necessary for implementation of projects, and loss of land is one of the most significant socio-economic impacts. However, based on feasibility study of the proposed BMWSSP and field visits carried out so far, it appears that significant land acquisition will not be required for any of the sub-projects to be implemented in different Paurashavas. Many of the sub-projects involve rehabilitation/ improvement/ expansion of existing infrastructure/ facilities, and sub-projects involving new construction would be carried out in government/ Paurashava owned land. Therefore, loss of land is not likely to be an issue of concern for the proposed MWSSP. However, if significant land acquisition becomes necessary for implementation of any sub-project, the issue should be addressed in light of the Government regulations and relevant WB operational guideline OP 4.12: Involuntary Resettlement (World Bank, 2001).

Loss of income and displacement:

Loss of income may result from inability to use a particular piece of land/ establishment (e.g., footpaths) during the construction phase for income generation activity. Some of the proposed sub-projects may cause temporary displacement of people. For example, during construction/ rehabilitation of clear water transmission line or water distribution network, road-side vendors or small temporary shops on footpaths may not be able to operate for a period of time. However, considering the extent and scale of the sub-projects, it appears that such impacts would not be significant; for example, in most cases, the affected road-side vendors or footpath shops would be able to operate by just moving a short distance away from the sub-project site.

Traffic congestion:

During construction phase of sub-projects, traffic congestion may result from stock piling of material by the sides of roads, increased movement of people and vehicles carrying material and equipment. Field visits carried out reveal that traffic congestion is a major problem in most Paurashavas. Some of the sub-projects, such as clear water transmission line, water distribution network and drain, may aggravate the existing traffic problem during construction phase. This should be addressed with proper traffic management and avoiding stockpiling of materials in a way that could hamper traffic movement.

Impact on top soil:
For sub-projects involving significant excavation (e.g., installation of transmission line), conservation of top soil is an important issue. Utmost care should be taken to protect the topsoil (and thus maintain soil fertility) during excavation and backfilling. First 12 to 18 inches of topsoil should be excavated and stored on one side and the rest of the excavated soil on the other side. During back filling of trench, the top soil should be placed on the top again.

Health and safety:
Safety is an important issue during construction phase. General construction activities pose safety risks, which should be addressed as part of occupational health and safety plan. Section 4.8 provides guideline on occupational health and safety issues.

Impact on archeological and historical sites:
Archeological and historical sites are protected resources. Damage of such sites by digging, crushing by heavy equipment, uprooting trees, exposing sites to erosion, or by making the sites more accessible to vandals are of particular concern. While there are archaeological and historical sites at many of the 5 Paurashavas visited, none of these would be directly affected by the sub-project activities.

Employment and Commercial Activities:
During construction phase, some beneficial impact at local level would come in the form of employment in sub-project related works, which would depend on the nature and extent of the sub-project. For example, labor-intensive sub-project works (e.g., manual excavation) could generate employment for considerable number semi-skilled workforce. This in turn would induce some positive impacts on some other parameters including commercial activities in the sub-project areas.

Safeguarding physical cultural resources (PCR):
Since the exact locations of the sub-projects to be implemented under BMWSSP are not known at this moment, a guideline for identification of physical cultural resources (PCR) and determination of the suitability of the sub-projects from the perspective of PCR needs to be prepared.

4.3 Potential Significant Impacts during Operational Phase

Ecological impacts:

During operational phase, the possible impact of the sub-project activities on the biological environment would be insignificant, except for a few of sub-projects. These include: (a) water treatment plant; (b) fecal sludge management; (c) SWM (e.g., land filling), (d) DEWATS; and (d) storm drain.

Discharge of effluents generated from FSTP, DEWATS or leachate from solid waste disposal sites could cause pollution of the receiving river/ khal, thereby affecting the aquatic ecology. Monitoring of water quality (for river/ khal) is therefore necessary to detect possible adverse ecological at an early stage. As explained earlier, poor quality of drainage water (e.g., due to direct discharge of toilet wastewater into storm drain) could cause pollution of the receiving water body (e.g., river, khal) and thus adversely affect aquatic flora, fauna and associated terrestrial fauna.

Physicochemical impacts:

Depending on the type of sub-projects a number of Physicochemical parameters could experience both positive and negative impacts during operation phase of the sub-projects. Important issues and parameters include:

- Drainage,
- Water quality,
- Air quality and noise level, and
- Environmental pollution from solid waste

Drainage:
The proposed sub-projects involving construction and rehabilitation of storm drains are likely to bring about improvement in the drainage condition in the sub-project areas, which is a major problem in many Paurashavas. However, blockage of the drains (e.g., by solid wastes due to improper maintenance) could aggravate drainage problem. Better management of solid waste could significantly facilitate the maintenance of storm drains.

Water quality:
Implementation of fecal sludge treatment plant (FSTP), SWM disposal system and decentralized wastewater treatment (DEWATS) systems are likely to significantly improve surface water quality in the project areas because fecal sludge and untreated domestic wastewater are currently being discharged in open water bodies and low-lying areas. Operation of public toilets would also contribute to improvement of water quality through discouraging open defecation. However, discharge of poor quality effluent from FSTP and DEWATS could adversely affect the receiving water bodies. Poor quality drainage water could also adversely affect the receiving water bodies.

Air quality and noise level:
During operational phase, vehicular movement would be the principal sources of air pollutants and noise. Increased movement of service vehicles surrounding service facilities like water treatment plant, fecal sludge management plant and water office building could generate higher noise and air pollution.

Environmental pollution:
Implementation of the sub-project involving fecal sludge management (collection of fecal sludge using vacuum trucks, transport to plant, etc.), SWM and DEWATS would significantly improve overall environmental condition and reduce the risk of widespread environmental pollution from indiscriminate disposal of fecal sludge and wastewater. However, lack of solid waste disposal facility at the Paurashavas is a concern.

Socio-economic impacts:

The proposed BMWSSP is aimed at bringing about improvement in the socio-economic conditions of the Paurashavas through improvement of basic infrastructure. Thus, implementation of the proposed sub-projects is likely to bring about significant improvement in the overall environmental and socio-economic conditions at the

Paurashavas. Important socio-economic parameters that are likely to experience beneficial impacts due to implementation of the sub-projects include:

- water supply and sanitation,
- public health and safety,
- employment

Water Supply:

Implementation of a number of sub-projects is likely to bring about significant improvement in the water supply and sanitation situation at the Paurashavas. These include deep tube well with pump house, water treatment plant with raw water transmission line, clear water transmission line, water distribution network, pit, and overhead tank. However, efforts should be made to properly manage these facilities which will improve the overall water supply condition of the community.

Sanitation and Public Health:

Subprojects like fecal sludge treatment system including construction of FSTP, decentralized wastewater treatment system (DEWASTS), SWM system, and public toilets would significantly improve the sanitation situation in the project areas, and would support attainment of SDT Target 6.2 (safely managed sanitation). Improvement of sanitation services together with improvement of water supply situation is likely to contribute significantly to the improvement of public health in the Paurashavas where these subprojects would be implemented.

Employment and commercial activities:

A number of basic infrastructures to be developed under the MWSSP are likely to generate opportunity for employment water treatment plant and fecal sludge management plant.

Chapter 5
STAKEHOLDER ANALYSIS AND PUBLIC CONSULTATION

5.1 Introduction

Five Focus Group Discussion (FGD) sessions have been organized for the proposed Bangladesh Municipal Water Supply and Sanitation Project (BMWSSP) of the Department of Public Health Engineering (DPHE) of Bangladesh Government (GoB) at five sub-project sites (randomly selected) in five districts of Bangladesh. The FGD sessions included major stakeholders of the Paurashavas who reside in and adjacent to the proposed sub-project sites. The public consultations have been carried out for documenting the local people's views, opinions and concerns regarding the proposed components of the sub-project of BMWSSP at their localities. This chapter presents the major findings obtained from the FGD sessions in five sub-project sites of BMWSSP of DPHE.

5.2 Methodology

One FGD session has been organized and conducted in the Conference Room / Public Place of the Mayor Office / Councilor Office, adjacent to the proposed sub-project site in each of the selected Paurashava, during February and March 2018. The locations were selected to inform about the project and collect the viewpoints of the general people who reside near the proposed BMWSSP's sub-project sites. A wide range of stakeholders including businessmen, land owners, house owners, farmers, drivers, laborers, engineers, govt. officials, govt. retired officers, teachers, doctors, Imam, students were invited to attend in the discussion session. Members of the EMF team of BMWSSP, respective Mayor and Ward Councilor and the representative engineers and officials from the local DPHE offices have been participated in the FGD sessions. Apart from the EMF team, more than 140 people participated in the five FGD sessions; details of which are presented in Table 5.1 and the participant list with signature is shown in Appendix-H2.

Table 5.1: Details of Focus Group Discussion (FGD) sessions for the proposed sub-project of BMWSSP of DPHE in five districts of Bangladesh.

FGD No.	Location	Date	Time	Number of Participants
1	Conference Room, Mayor Office, Dhanbari Paurashava, Tangail District.	28 / 02 / 2018	04.00 p.m. to 05.00 p.m.	27
2	Conference Room, Mayor Office, Ullahpara Paurashava, Sirajganj, District.	01 / 03 / 2018	04.00 p.m. to 05.00 p.m.	34
3	Open Field/Councilor Office, Ward No # 01, Tarabo Paurashava, Narayanganj District.	03 / 03 / 2018	04.00 p.m. to 05.00 p.m.	39
4	Conference Room, Mayor Office, Homna Paurashava, Comilla District.	04 / 03 / 2018	04.00 p.m. to 05.00 p.m.	22
5	Conference Room, Mayor Office, Chandanaish Paurashava, Chattogram District.	05 / 03 / 2018	11.00 a.m. to 12.00 p.m.	21
			Total	**143**

5.3 Findings of Focus Group Discussion (FGD) Sessions

Efforts have been made in the FGD sessions to get feedback from the participants on the understanding of environmental impacts due to the project and their suggestions about the ways to mitigate the adverse impacts and enhance beneficial impacts for the proposed components of the sub-project of BMWSSP of DPHE under five Paurashavas of five districts in Bangladesh. People who participated in the public consultation was found enthusiastic in sharing their views. The participants expressed their opinions regarding different issues including their knowledge about the proposed BMWSSP's sub-projects and its components, socio-economic condition of people in their localities, possible impacts of the proposed sub-project component on the existing environment (physical, ecological and social) and in their localities and livelihood, and also mitigation measures to address the potential adverse impacts. The major findings of FGD sessions are summarized below in Paurashava wise.

(A) Dhanbari Paurashava of Tangail District: The first public consultation on the components of DPHE, BMWSSP's sub-project activities and the local environment through FGD has been conducted on 28 February, 2018 at Conference room of Mayor's Office, Dhanbari Paurashava, Tangail (Figure 5.1). Participants from various occupations, including panel Mayor, participated in the discussion session and provided their valuable opinions on various component of the sub-project of BMWSSP that will be implemented at their locality. The outcomes of the session are given below:

Figure 5.1: First Focus Group Discussion (FGD), Dhanbari Paurashava, Tangail, Bangladesh.

(a) General opinions on the proposed DPHE: BMWSSP's sub-project at Dhanbari Paurashava of Tangail:

- Before interaction with the EMF team through FGD, most participants (over 90%) were well aware of the proposed DPHE: BMWSSP's sub-project at their locality, which indicates that information has been disseminated to the local community properly.
- All participants (100%) were supportive for the proposed sub-projects at their locality, as it would improve the condition of local peoples live and livelihood by getting opportunity to use safe water as well as modern sanitation system.
- Some participants opined that they have less experience on environmental impact issues. They requested to provide expert opinion to them time to time so that they can be alerted by themselves or other peoples of their Paurashava.

- The proposed raw water intake source has preliminarily been selected from the Bongshai River near Horipur Bazar and according to them, the rives has insufficient water in winter. Before finalization of surface water intake point, detail assessment of water availability seems to be urgently required; otherwise, the proposed component of this sub-project benefits might be jeopardized during winter.
- Local people's lifestyle may change to some extent for implementation of the proposed sub-project at their locality, as it would improve the local environment.
- According to the participants, the proposed sub-project related documents should not be kept in paper and also require action base work with active monitoring system.

(b) Opinions on environmental impacts due to the proposed DPHE: BMWSSP's sub-project at Dhanbari :

- Most participants commented that it is a good project for their community. It will not create any adverse impacts on the existing environment; while, others opined that all project have positive and negative impact on the existing environment, and this sub-project is not free from such type of impacts. All participants agreed to accept any short term negative impacts on the environment as the proposed sub-project will bring long term benefits to them and environment.
- At present, people use tube well water in Dhanbari. Water of the most of the tube wells are contaminated by iron (Fe). Proposed water supply component of this sub-project will solve that problem and local community will get benefit instead of using the polluted water either from tube well or pond or river.
- Minor impacts may occur on air quality during the implementation of this sub-project. Dust from proposed water treatment plant construction, road excavation for laying pipelines as well as related activities may cause air pollution to the nearby villages and will create health problems especially to the children and old people.
- Water treatment plant construction activities may involve with pilling related work that may create noise pollution to the local community. They suggested to use modern machineries with less sound impact.
- There are schools within the proposed sub-project area. They requested to introduce traffic management system during school hours.
- They expressed concern that withdrawing raw water from the river will not create any adverse impact to the aquatic biodiversity (e.g. flora, fauna and fish) of the river.
- Few trees may need to cut for implementation of some component of this sub-project. Immediate flora re-plantation program on the same species could solve the issue.
- Use of pure water for drinking and other domestic use will help to improve the people's, especially the women's health condition; but request for inclusion of drainage system as a new component of this sub-project; otherwise, discharge of waste water without drainage system will create environmental problem to the local community.
- Land acquisition is a complex issue. Participants were relieved to know that the proposed sub-project will not acquire any private land; otherwise, legal procedure for land acquisition may delay the project completion on time. Use of Govt. land for implementation of this sub-project will be welcomed by the local community.
- No major impacts will occur on the proposed lands as all of the lands are owned by

the Paurashava or GoB. However, the productive assets or structures that exist on the proposed lands should be removed with compensation, if needed. Otherwise, legal procedure may delay the project completion on time.

- Moderate impact may occur on the shallow ponds that exist adjacent to the proposed water treatment plant project site. Nearby surface water or ponds will not be impacted by this project activity if proper waste management plans are prepared and ensured its active enforcement on time.

(c) People's recommendations and expectations from the Sub-project:

- Ensure quick implementation of this sub-project.
- Ensure inclusion of drainage system as a new component of this sub-project.
- Ensure safe water supply for all throughout the year.
- Ensure widening of sewer pipeline; otherwise, it will be un-usable after some days.
- Ensure modern management system of all wastes that arise from the Paurashava household, business shop, market and also other source. If possible, introduce small scale recycling system in waste management.
- Ensure modern sludge management system, and / or all sludge should be taken out of the Paurashava.
- Ensure local people participation in all components of this sub-project.
- Ensure recruitment of 40% local people for both skilled and non-skilled worker during construction and also operational phases.
- Engage skilled and experience contractor for timely completion of this sub-project with quality.

(B) Ullahpara Paurashava of Sirajganj District: The second consultation on the components of DPHE-BMWSSP's sub-project was conducted at Mayor's Office of Ullahpara Paurashava on 1 March, 2018 (Figure 5.2). Participants from various professions, including Mayor, were present in the discussion meeting and provided valuable suggestions on several issues regarding the sub-project and the outcomes of the discussion are given below:

Figure 2: FGD at Mayor Office, Ullahpara Paurashava, Sirajganj, Bangladesh.

(a) General opinions on the proposed DPHE: BMWSSP's sub-project, Ullahpara

- Around 30% participants were aware of the sub-project previously, which indicates that proper information has not been disseminated to the local community.

- All participants (100%) were supportive for the proposed project components at their locality, because it will improve the condition of local peoples live and livelihood by getting opportunity to use the pure water as well as modern sanitation system. Currently, the public health of this Paurashava is under great threat due to lack of safe water. Request to DPHE for priority base implementation of this project at their locality.
- The proposed raw water intake source has preliminarily been selected from the Karatoya River that has plenty of water and no water shortage will occur for this component of the sub-project, throughout the year. The quality of the river water is very good and people sometime can drink it without purification.
- Use of pure water and sanitation system of this BMWSSP's sub-project may change the behavior of the local people and also the future generation.

(b) Opinion on the proposed DPHE: BMWSSP's sub-project and environmental Impact at Ullahpara Paurashava of Sirajganj District:

- Controversial opinion comes from the participants on environmental impact issues. Some believed that no negative environmental impact will occur, while others believed the quite opposite. However, all participants agreed to accept any short term negative impact as the proposed sub-project will bring long term benefits to the community.
- Minor impacts may occur on air quality of some project area for implementation of this sub-project components. Dust from proposed water treatment plant construction site, road excavation for water pipeline lay as well as related activities may cause air pollution to the nearby villages and will create health problem to the old people. Request to use jack-boring system / technique (generally use in Dhaka for laying pipes) instead of open cut of the road for laying the water pipelines.
- Water treatment plant construction activities may involve pilling related works that may create noise pollution to the local community. Request to use modern machineries that produce less sound.
- Schools are not far away from the proposed components of this sub-project areas. Request to introduce traffic management system during school hours.
- Raw water that will be withdrawn from the Karatoya River will not create any adverse impact to the aquatic biodiversity (e.g. flora, fauna and fish) of the river.
- No major impact will occur on the existing biodiversity of the proposed water treatment plant site, because similar type of ecological habitat exist there, and affected biodiversity could easily be move there (except floras), though there will be a competition on eco-space, food and freedom.
- Few trees may need to cut for implementation of some component of this sub-project e.g. water pipeline laying, water treatment plant construction, booster pump station construction, etc. Immediate floral re-plantation program on the same species could resolve the floral loss.
- Most tube well water is contaminated by iron (Fe) which makes the water colored and most of the clothing, household utensils etc. become dirty or discolored after one day use due to the highly colored water; proposed water supply component of this sub-project may resolve the problem permanently, and local community will get benefit from the health hazards that is caused by the use of polluted water either

from tube well or pond or river.

- Water borne diseases (e.g. diarrhea, dysentery, skin, etc) will reduce significantly in future due to use of pure water from this sub-project.
- Participants felt happy to know that the proposed sub-project will not acquire any private land. Generally, legal procedures for land acquisition delay the finishing of project completion on time.
- No major impact will occur on the proposed lands as all of the lands are owned by the Paurashava or GoB. However, the productive assets or structures that exist on the proposed lands could easily be removed with compensation, if needed. Otherwise, legal procedure may delay the project completion on time.
- Use of pure water for drinking and other domestic use will help people's, especially the women's health condition to improve; but request for inclusion of drainage system as a new component of this sub-project; otherwise, release of use water without drainage system will create environmental problem to the local community.

(c) Opinion on the proposed DPHE: BMWSSP's Sub-project and Peoples Expectation:

- Ensure immediate implementation of proposed components of this sub-project on priority basis as local people's life are now under threat due to non-availability of safe water; most water sources are contaminated with Iron (Fe), Arsenic (As) and Manganese (Mn).
- Ensure inclusion of drainage system as a new component of this sub-project.
- Ensure all time pure water supply for all people of the Paurashava.
- Ensure modern management of all wastes that arise from the Paurashava household, business shop, market and also other sources.
- Ensure modern sludge management system, and / or all sludge should be taken out of the Paurashava.
- Ensure local people participation in all components of this sub-project.
- Ensure local recruitment of 30% local employment for both skilled and non-skilled worker during construction and also operational phases.
- Ensure skilled and experience contractor for on-time completion of all components of this sub-project.
- Ensure high quality pipe for water transmission and distribution lines.

(C) Tarabo Paurashava of Narayanganj District: The third consultation on the components of DPHE-BMWSSP's sub-project and the local environment, and also on the potential impacts for the sub-project activities at Tarabo Paurashava have been rigorously discussed (Figure 5.3), and the outcomes of the discussion are given below:

Figure 3: Third Focus Group Discussion (FGD) session at an open field near Councilor Office, Ward No # 1 of Tarabo Paurashava, Narayanganj, Bangladesh. Participants from various occupations, including ward councilors were present and provided valuable suggestions.

(a) Opinion on the proposed DPHE: BMWSSP's sub-project at Tarabo Paurashava of Narayanganj District:

- Before interaction with the EMF team, few participants (15%) were learned about the proposed DPHE: BMWSSP's sub-project at their locality, which indicates that proper information has yet not been disseminated to the local community.
- All participants (100%) were supportive for the proposed components of the DPHE: BMWSSP's sub-project at their locality, because it will improve the condition of local peoples live and livelihood by getting opportunity to use the pure water as well as modern sanitation system.
- The proposed raw water intake source has preliminarily been selected from the Sitalakhya River that has plenty of water and no water shortage will occur for this component of the sub-project, throughout the year.
- Some Participant opined that the proposed river water could not fully be treated as drinking level, because of high pollution, and they do not want to get sub-pure water from this mega project of DPHE. Request to ensure surface water from Meghna River or more underground water for Tarabo Paurashava.

(b) Opinion on the proposed DPHE: BMWSSP's sub-project and environmental Impact at Tarabo Paurashava of Narayanganj District:

- Some participant opined that all components of the sub-project of DPHE: BMWSSP have negligible impacts on the existing environment, while others opined that it will create both positive and negative impacts to the community. However, all participants agreed to accept any short term negative impact as the proposed sub-project will bring long term benefit to the community.
- Minor impacts may occur on air quality for implementation of this sub-project. Dust from the proposed water treatment plant construction, road excavation for water pipeline lay as well as related activities may cause air pollution to the nearby community though major air pollution already comes from other industrial sources that have created health problem to the people.
- People are habituated with the pilling work as many industries and buildings have already been constructed in and around the Paurashava. Pilling work for water

treatment plant and / or other components will not add more problems to the local community. Request to use modern machineries for less sound production.
- Several schools exist not far away from the proposed components of this sub-project. Request to introduce traffic management system during school hours.
- Raw water that will be taken from the Sitalakhya River will not create any adverse impact to the aquatic biodiversity (e.g. flora, fauna and fish) of the river, as river water is already polluted by the industrial activities and almost no biodiversity exist there.
- No major impacts will occur on the existing biodiversity of the proposed water treatment plant site, because similar types of ecological habitat exist there, and affected biodiversity could easily be shifted there (except floras), though there will be a competition on eco-space, food and freedom.
- Few trees may be felled off for implementation of some components of this sub-project e.g. laying of water pipeline beside the peripheral road. Immediate floral re-plantation program on the same species could resolve the floral loss.
- Water borne diseases (e.g. diarrhea, dysentery, skin, etc) will reduce significantly in future due to use of pure water from this sub-project.
- Participants felt happy to know that the proposed sub-project will not acquire any private land. If private land required by the authority in future, participant are ready to handover those, but request to pay appropriate compensation (e.g. provide current market rate of land) to the project affected person (PAP).
- No major impacts will occur on the proposed lands as all of the lands are owned by the Paurashava or GoB. However, the productive assets (e.g. fish, vegetable, structure) that exist on the proposed lands could easily be removed with compensation, if needed.
- Use of pure water for drink or in the bathroom, kitchen and toilet will help people's especially the women's health condition to improve; but request for inclusion of drainage system as a new component of this sub-project; otherwise, release of use water without drainage system will create environmental problem to the local community.

(c) Opinion on the proposed DPHE: BMWSSP's Sub-project and Peoples Expectation:
- Ensure immediate implementation of proposed components of this sub-project.
- Ensure inclusion of drainage system as a new component of this sub-project.
- Ensure all time pure water supply for all people of the Paurashava.
- Ensure modern management of all wastes that may arise from the Paurashava household, business shop, market and also other sources.
- Ensure local people participation in all components of this sub-project.
- Ensure local recruitment of 40% local employment for both skilled and non-skilled worker during construction and also operational phases. Also ensure 50% of women job in the sub-project of BMWSSP of DPHE.

(D) Homna Paurashava of Comilla District: The fourth consultation meeting on the components of DPHE:BMWSSP's sub-project and the local environment, and also on the potential impacts for the sub-project activities at Homna Paurashava have been carried out at Conference room of Mayor Office, Homan (Figure 5.4) and the outcomes of the discussion are given below:

Figure 5.4: Forth Focus Group Discussion (FGD) session at Conference Room, Mayor Office, Homna Paurashava, Comilla, Bangladesh.

(a) Opinion on the proposed DPHE: BMWSSP's sub-project at Homna Paurashava of Comilla District:

- Before interaction with the EMF team, few participants (20%) were informed about the proposed DPHE: BMWSSP's sub-project at their locality, which indicates that proper information has not been disseminated to the local community.
- All participants (100%) were supportive for the proposed components of the DPHE: BMWSSP's sub-project at their locality, because it will improve the condition of local peoples live and livelihood by getting opportunity to use the pure water as well as modern sanitation system. Currently, the public life is under threat due to lack of pure water. Request to the respective authority for priority base implementation of this project at their locality.
- The proposed raw water intake source is preliminarily been selected from the Titas River that has plenty of water and no water shortage will occur for this component of the sub-project, throughout the year.
- People will be grateful to get opportunity to use pure water and sanitation system from this BMWSSP's sub-project of DPHE.

(b) Opinion on the proposed DPHE: BMWSSP's sub-project and environmental Impact at Homna Paurashava of Comilla District:

- Some participants commented that insignificant environmental impacts may arise for implementation of this sub-project of BMWSSP, but others opined that it will bring positive impacts to the environment. However, all participants agreed to accept any short term negative impact as the proposed sub-project will bring long term benefit to them.
- Short term air pollution may arise due to various activities of the proposed sub-project, but it will not create great problem to the whole Paurashava.
- Insignificant noise pollution may arise for a certain period from various activities of the proposed sub-project, but it will not create a great problem to them. Request to use modern machineries that produce less sound.
- Some schools are not far away from the proposed components of this sub-project. Request to introduce traffic management system during school hours.

- Raw water that will be taken from the Titas River will not create any adverse impact to the aquatic biodiversity (e.g. flora, fauna and fish) of the river.
- No major impact will occur on the existing biodiversity of the proposed water treatment plant site, because similar type of ecological habitat exist there, and affected biodiversity could easily be move there (except floras), though there will be a competition on eco-space, food and freedom.
- Some flora may need to cut for implementation of this sub-project e.g. water treatment plant construction, water pipeline laying, booster pump station construction, etc. Immediate flora re-plantation program on the same species could resolve the floral loss.
- Almost all tube well water is contaminated by Arsenic (As) and Iron (Fe) and most of the new clothing, household utensils become dirty or discolor after one day use due to contaminated water; the food item that cooked for human consumption is also discolor and people suffer a lot; proposed water supply component of this sub-project may resolve the problem permanently, and local community will get benefit from the health hazards that cause by the use of polluted water either from tube well or pond.
- Water borne diseases (e.g. diarrhea, dysentery, skin, hair drop, etc) will reduce significantly in future due to use of pure water from this sub-project.
- Participants were happy to know that the proposed sub-project will not acquire any private land; if private land required, urge to pay current market rate to the PAP. Generally, legal procedures for land acquisition delay the finishing of project completion on time.
- No major impacts will occur on the proposed lands as all proposed lands are owned by the Paurashava or GoB. However, the productive assets or structures that exist on the proposed lands could easily be removed with compensation, if needed. Otherwise, legal procedure may delay the project completion on time.
- Use of pure water for drinking and domestic purposes will help people's health, especially the women's health condition to improve; but request for inclusion of drainage system as a new component of this sub-project; otherwise, release of use water without drainage system will create environmental problem to the local community.

(c) Opinion on the proposed DPHE: BMWSSP's Sub-project and Peoples Expectation:

- Ensure immediate implementation of proposed components of this sub-project on priority basis as local peoples life are now under threat due to non-availability of pure water; most water sources are contaminated with Arsenic (As) and Iron (Fe).
- Ensure inclusion of drainage system as a new component of this sub-project.
- Ensure all time pure water supply for all people of the Paurashava.
- Ensure modern sludge management system.
- Ensure high quality pipe for water transmission and distribution lines.
- Ensure local people participation in all components of this sub-project.
- Ensure local recruitment of 40% local employment for both skilled and non-skilled worker during construction and also operational phases.
- Ensure skilled and experience contractor for on-time completion of all components of this sub-project.

(E) Chandanaish Paurashava of Chattogram District: The fifth consultation on the components of DPHE-BMWSSP's sub-project and the local environment, and also on the potential impacts for the sub-project activities have been discussed in detail (Figure 5.5), and the outcomes of the discussion are given below:

Figure 5: Fifth Focus Group Discussion (FGD) session at Conference Room, Mayor Office, Chandanaish Paurashava, Chattogram, Bangladesh. Participants from various sectors including Mayor, participated and provided valuable opinions on various components of the sub-project that will be implemented at their locality.

(a) Opinion on the proposed DPHE: BMWSSP's sub-project at Chandanaish Paurashava of Chattogram District:

- Before interaction with the EMF team, all participants (100%) were well informed about the proposed DPHE: BMWSSP's sub-project at their locality, which indicates that proper information has been disseminated to the local community.
- All participants (100%) were supportive for the proposed components of the DPHE: BMWSSP's sub-project at their locality, because it will ensure all time pure water supply and also introduce the modern sanitation system to the community that subsequently improve the condition of local peoples live and livelihood.
- The proposed raw water intake source is preliminarily been selected from the Sangu River that has plenty of hilly water and no water shortage will occur for this component of the sub-project, throughout the year.
- Availability of pure water and sanitation system of this BMWSSP's sub-project will change the behavior of the local people; for example, cooking behavior has changed through accepting the LPG for cooking instead of fuel wood.

(b) Opinion on the proposed DPHE: BMWSSP's sub-project and environmental Impact at Chandanaish Paurashava of Chattogram District:

- Most participants opined that all components of the sub-project of BMWSSP have little negative impact (less that 5%) but have more positive impact on environment. However, all participants agreed to accept any short term negative impact as the proposed sub-project will bring long term positive impact to them.
- Some participants opined that minor impact may arise on air quality for the

implementation of this sub-project components. Proposed activities may create dust that may pollute air, and people may suffer from it; use of modern machineries may resolve the issue.

- Water treatment plant construction activities may involve with pilling related work that may create sound pollution to the local community though the villages are quite far away from the proposed site Request to use modern machineries that produce less sound.
- Raw water collection from the Sangu River will not create any adverse impact to the aquatic biodiversity (e.g. flora, fauna and fish) of the river.
- No major impact will occur on the existing biodiversity of the proposed water treatment plant site, because similar type of ecological habitat exist there, and affected biodiversity could easily be move there (except floras), though there will be a competition on eco-space, food and freedom.
- Some flora may need to cut for implementation of some component of this sub-project e.g. water pipeline laying, water treatment plant construction, booster pump station construction, toilet construction, etc. Immediate floral re-plantation program on the same species could resolve the floral loss.
- Most tube well water is contaminated by iron (Fe) and also by microbes due to its existence near toilet; and the new cloths, household utensils etc. become dirty or discolor due to use of contaminated water; proposed water supply component of this sub-project may resolve the problem permanently, and local community will get benefit from the health hazards that cause by the use of polluted water either from tube well or pond or river.
- Water borne diseases (e.g. diarrhea, dysentery, skin, hair loss, etc) will reduce significantly in future due to use of pure water and sanitation system from this sub-project.
- Participants were happy to know that the proposed sub-project will use Paurashava or GoB land and will not acquire any private land, though they are ready to provide private land, if require, with current market rate compensation.
- No major impacts will occur on the proposed lands as those belong to the Paurashava or GoB. However, the productive assets or structures that exist on the proposed lands could easily be removed with compensation, if needed. Otherwise, legal procedure may delay the project completion on time.
- Use of safe water for drinking and other purposes will help people's especially the women's health condition to improve; but request for inclusion of drainage system as a new component of this sub-project; otherwise, release of use water without drainage system will create environmental problem to the local community.
- Some participants commented that problem may arise during implementation of any project at anywhere; to resolve the issues, a co-ordination team under Mayor may be form to resolve the issues, if needed.

(c) Opinion on the proposed DPHE: BMWSSP's Sub-project and Peoples Expectation:

- Ensure immediate implementation of proposed components of this sub-project on priority basis as local people are now suffering from contaminated water in the tube wells.
- Ensure inclusion of drainage system without leakage as a new component of this sub-project.

- Ensure all time sufficient amount of pure water supply for all household of the Paurashava;
- Ensure inclusion of pure water supply program as per Master plan of the Paurashava.
- Ensure local people participation in participatory way in all components of this sub-project.
- Ensure skilled and experience contractor for on-time completion of all components of this sub-project; and
- Ensure to form a monitoring team to look after all the construction & environmental aspects of this sub-project.
- Ensure to install the modern instrument for all components of the sub-project.
- Ensure proper maintenance of water transmission and distribution lines
- Ensure transparency and accountably of this sub-project.

Appendix H-1:
Terms of Reference
for the
Preparation of an EMF for the proposed Bangladesh Municipal Water Supply and Sanitation Project (MWSSP)

A. Background

1. The World Bank has been engaged in providing credit for urban governance and service delivery improvements in municipalities and city corporations for a number of years. In 2012-13 the Bank undertook an in-depth analytical study which analyzed options for appropriate models of water supply and sanitation (WSS)service delivery i.e., a program of reforms and made recommendations for operationalizing these model. Discussions were initiated on possible World Bank lending assistance to GoB for strengthening the WSS service delivery system along with infrastructure development at secondary town level; which resulted in the current project proposal.

2. The proposed Project Development Objective is to strengthen the institutional capacities of participating municipalities for delivering improved WSS services. The project development objective will be achieved by: (i) increasing access to sustainable piped water services and improved sanitation facilities in selected municipalities by strengthening municipality water and sanitation entities, (ii) improving institutional setup towards urban water supply and sanitation service delivery, (iii) establishing performance criteria to incentivize municipalities for availing project resources, (iv) strengthening their institutional capacities for efficient service delivery, that includes fiduciary, environment and social aspects and improvements in local governance and accountability, and(v) improving central government's policy, regulation, and M&E (including sector oversight) capacities for ensuring local government WSS service delivery in Bangladesh.

3. The two land based components of the project which will impact the environment are the following:

- ***Investment for Water Supply Infrastructure:*** This component will support government investments in water supply infrastructure development in selected municipalities. The selection of municipalities will be based on the defined selection criteria designed at the preparation stage. However, the project will prioritize municipalities where there is no formal piped water supply coverage and the respective municipalities display established institutional setup, manpower and financial standing. Investments will *include construction of new water treatment plants, intake for raw water source, expansion and rehabilitation of distribution networks.* Expansion of piped water supply to those municipalities that have limited piped water supply coverage will be also considered.
- ***Improving Sanitation and Septage Management***: This component will strengthen the stakeholders involved in sanitation service delivery in municipal towns and contribute to funding sanitation solutions and infrastructure in selected areas. *Urban Septage Infrastructure* will support the provision of facilities and services for the safe management and disposal of fecal sludge by financing infrastructure capital expenditure for the municipalities. This will include the *construction of small scale*

FSTPs, decentralized waste water treatment systems in line with the municipalities' Master Plan and feasibility studies.

4. The IDA approval of the loan is contingent upon to the GOB's (i.e., PMU's-Project Management Unit's) compliance to the WB environmental safeguards requirements. Hence, the PMU has undertaken to prepare an EMF (Environmental Management Framework) for the project to ensure the requirements and also for compliance of GOB (DOE) requirements for IEE and EIA. As the specific sub-projects are yet to be identified, a framework approach has been adopted. The EMF document will provide the broad framework for the environmental management in the sub-projects; while the preparation of sub-project specific EMP (Environmental Management Plan) and their implementation will be done during project implementationusing the EMF guidelines.

B. Objectives of the Assignment

5. The objective of this consultancy is to assist the MWSSP PMU in the preparation of the project's EMF with effective environmental tools based on lessons learnt from previous similar projects in Bangladesh and elsewhere.The EMF will at a minimum (i) identify all relevant potential environmental risks and social concerns that may arise as a result of the proposed program and the projects that it will support; (ii) specify appropriate roles and responsibilities of involved agencies and parties; (iii) develop a screening and assessment methodology for potential projects, that will allow an environmental risk classification and the identification of appropriate safeguards instruments; (iv) develop environmental criteria for screening and prioritization within a portfolio of potential projects and activities; (v) outline the required procedures for managing and monitoring environmental risks related to the sub-projects including issues to be included in the contract documents; (vi) determine the training, capacity building and technical assistance needed to successfully and effectively develop and implement the required safeguards instruments for investments planned during the TA Program; (vii) establish the funding required to implement the EMF requirements; and (viii) provide practical information on resources for implementing the EMF.

C. Scopes of Assignment

6. The Consultant's scope of services shall include, but not be limited to the issues given in the following. As and when necessary the consultant will discuss with the MWSSP PMU and the WBteam on issues/problems encountered in the pursuit of the activities related to the work.

Specific tasks for the Consultant:

Task 1: Review of Existing Documents

- Review the EMF documents of similar project both in-country and international to identify effective environmental tools and document requirement for the project's compliance with WB policies and guidelines and as well as GOB's own laws and rules.
- Review the Government legal and regulatory framework, including pertinent laws, regulations and standards governing environmental quality applicable to mentioned project interventions, occupational health and safety, protection of sensitive areas and endangered species, siting, land use control etc.

- Review the present institutional structure and capacity relevant to these aforementioned issues.
- Review the WB’s Environmental Health and Safety (EHS) guidelines for environmental enhancement measures.

Task 2: Field Visit and Stakeholder Consultation

- Conduct at field visits to some sub-projects areas already identified. Field visit report with pictures should be added in the Annex of the report.
- Consult with the local community, Civil society organization, private organization and key stakeholders on the sub-project and their potential environmental impacts.

Task 3: Drafting the Environmental Management Framework

- Collect the baseline information focusing on the existing conditions of the sub-project areas in pollution management, environmental work environment and EHS;
- Identify all relevant potential environmental risks concerns that may arise as a result of the proposed program and the typical sub-projects that it will support in the municipalities;
- Develop a screening and assessment methodology for potential sub-projects that will allow an environmental risk classification and the identification of appropriate safeguards instruments;
- Identify significant positive and negative, direct and indirect, immediate and long-term impacts associated with the project activity. Identify impacts that are unavoidable or irreversible (if any). Wherever possible, describe impacts quantitatively, in terms of environmental costs and benefits;
- Identify key mitigation and enhancement approaches that may be considered;
- Outline the required procedures for managing and monitoring environmental risks concerns related to the projects;
- Provide environmental code of practice;
- Provide sub-project type specific EHS guidelines to be followed for the workers;
- Determine the training, capacity building and technical assistance needed to successfully and effectively develop and implement the required safeguards instruments for investments planned during the TA Program; and
- Establish the funding required to implement the Environmental Management Plan (EMP)/EMF requirements.

Task 4: Finalizing the Environmental Management Framework and preparing the Bengali Version

- Present the key features of EMF to the implementing partners and the World Bank.
- Finalize the draft EMF incorporating the comments from the consultation.
- Based on the findings prepare the project EMF acceptable to the World Bank and DOE of the GOB. A translation of the Executive Summary in Bangla has to be submitted.
- Advise the implementing agency about the process of necessary clearance from regulatory agencies, if required.
- Translate and finalize the key part of the EMF in Bengali.

D. Suggested Methodology of the Assignment

7. The methodology of the assignment includes review of the available EMF reports (BAMWSP, BRWSSP),Environmental Impact assessment and Social Impact Assessment (EIA/SIA) for Porashvas by DPHE,existing guidelines (including EHS) and polices, field visit of selected sub-project sites, consultation with different stakeholders etc. This section outlines the broader methodology to carry out the different Tasks.

i) In consultation with the stakeholders identify all relevant potential environmental risks concerns that may arise as a result of the proposed program and the sub-projects that it will support.
ii) Undertake site visits to some existing WSS facilities randomly selected fromPourashavas and documentthe lessons learnt in respect of environmental risk management.
iii) Discuss relevant developments during EMF preparation with PMU (DPHE), Department of Environment, and the World Bank project team.
iv) Organize a consultation at national level on the draft EMF document before finalization.

F. Time Frame and Deliverables

(i) The total estimated time for the assignment is 25 days (fiveweeks) days inputfrom *Month, 2017 to Month, 2017*. The assignment should be completed within 60 days of the contract signing. Travel to the field is required.

The payment will be made in BDT at the end of each task.

(ii) Draft EMF Report by ………., 2017
(iii) Final EMF Report by……….., 2017
(iv) Draft Bengali EMF Report by…………, 2017
(v) Final Bengali EMF Report by …………, 2017

If any recommendation or suggestion received on the final disclosed version, then the consultant will have to update the document by ……….., 2017.

G. Payment Schedule

1. Upon submission and acceptance of the inception report which will include updated outline of the report, delivery plan - 30%
2. Upon submission and acceptance of the draft EMF report – 50%
3. Upon submission and acceptance of the final EMF report – 20%

H. Key Qualifications:

8. The consultant should have the following key qualifications.
- Should have advanced degree in Engineering/Physical/Environmental sciences with more than 10 years of experience in the areas relevant to the TOR for the current consultancy;
- Experience in World Bank funded projects and have in-depth knowledge of Bank instruments, policies and procedures, including Safeguards;

- Have demonstrated capacity to work independently and produce quality report on environmental assessment and audit; and
- Familiarity with country environmental policies, strategies, institutions, and regulations will be preferred.

I. Reporting Obligation and Oversight:

9. The consultant will work independently and will report to the PMU at DPHE, Dhaka. In addition, s/he will maintain a close coordination with the Project Task Team at the WB.

J. Contents of the EMF report:

The EMF report is expected to have the following suggested sections at minimum:

Abbreviations

Executive Summary (Should mirror the report and be about 10% in length)

I. **Introduction:** Background, EMF purpose, objectives, principles and methodology

II. **Policy, Legal and Administrative Framework:** National environmental policies, laws and regulations, International agreements and treaties; Institutional arrangements at national and sub-national levels; World bank environmental safeguard policies; Implications of national policies and regulations on the proposed project; Implications of world bank safeguard policies/guidelines on the proposed project.

III. **Project Description:** Project Description, Location, Project Activities

IV. **Overall Project Baseline Environment:** Physical and chemical environment (physical infrastructure, climate, geology, soils and seismicity, flood---prone areas, air quality assessment , noise level, water quality; ecological environment (description of project areas. Floral and faunal diversity in project areas, threatened flora and fauna, protected area, national park, game reserve, wildlife sanctuary and ecologically critical areas)

V. **Environmental Assessment:** Methodology for screening, categorization and typology of identified investment projects: safeguards policies trigged, safeguards category, instruments required to be prepared for policy compliance; for due-diligence-related management and decision making; List of environmental screening and selection criteriato be used for project identification, characterization and prioritization, including negative ones; Analysis of alternatives, Range of appropriate safeguards instruments for identified investment projects (IEE, EIA, EMP etc); description, required expertise, timeframe, review and clearances, disclosure and consultation procedures, with references to Annexes with detailed guidance, TOC, templates and samples; Required studies and assessments beyond single sub-project scale, e.g. regional, sectoral or cumulative studies; Roles and responsibilities for project screening and selection, determination of safeguards category, instruments and process, for disclosure and consultations, financing, supervision of studies and subsequently implementation of works, quality assurance, and decision making.

VI. **Evaluation of Environmental Impacts:** Impacts during construction and operation phases, impact on flora and fauna; noise pollution; air pollution; geology and soils; impact on water resources; aesthetic and visual resources; impact on infrastructure; human health and safety; cumulative summary of impacts; no project scenario; summary of impact evaluation.

VII. **Environmental Management Plan:** Introduction, mitigation measures during construction phase, operation phase, environmental management plan; environmental monitoring plans in construction and operation phases; resources and implementation; capacity analysis and proposals for improving and consolidating capacity and skills required for program implementation, and beyond the program for general due diligence management; training requirements.

VIII. **Public Consultation:** Focus Group Discussions (FGD), *Organization of FGDs, Major Findings from FGDs;* Key Informant Interviews (KII) and findings; National Level Consultation report.

IX. **Disclosure:** Projects proposed for IDA funding, one of the prerequisites is the disclosure EIA/EMF before the Bank appraisal of these projects. The EMF document draft should be disclosed on the project's website with its executive summary in Bangla. The final document should be transmitted to the Bank and for clearance by the Bank; it will be disclosed on the Bank's Infoshop.

X. **Grievance Redress:** A mechanism for grievance complying with WB requirement has to be proposed.

XI. **Conclusions and Recommendations:**Conclusions, Recommendations from the study should be provided.

XII. **References**

XIII. **Annexes**

Annexes should be provided to complement the main EMF Report with detailed, additional information and resources.

Appendix-H2

Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD # Venue # CONFERENCE ROOM, DHANBARI POURASHOVA Date # 28/02/2018 Time # 4:00 pm to 5:00 pm

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
1	মোঃ আঃ মতিন মিন্টু	১নং ওয়ার্ড মেম্বার	43	Mel	ব্যবসা	0174463232[illegible]	[illegible] 28/2/18
2	মোঃ রফিকুল ইসলাম	২নং ওয়ার্ড মেম্বার	47	mel	ব্যবসা	01716033637	[illegible] 28/2/18
3	মোঃ রুকনউদ্দিন তালুকদার	ধনবাড়ী-পৌর ১নং	50	mel	কৃষক ব্যবসায়ী	01712687-938	[illegible] 28/2/18
4	কাজী আনোয়ার-আনসারী	কাউন্সিলর ধনবাড়ী পৌরসভা	35	male	ব্যবসা	01710013683	[illegible] 28-02-18
5	মর্জিনা পারভীন	~~প্রভাষক~~ ধনবাড়ী আ. মাদ্রাসা	86	Femel	প্রভাষক	0171827 8466	[illegible]
6	মোছাঃ শিখা খাতুন	কাউন্সিলর ধনবাড়ী পৌরসভা	42	Female	গৃহিনী	01762898790	[illegible]
7	মোঃ [illegible]	[illegible]	48	Male	কৃষক	01916644457	[illegible]
8	মোঃ আনোয়ার উদ্দিন	কাউন্সিলর, ধনবাড়ী পৌরসভা	46	Male	ব্যবসা	01712395098	[illegible]
9	মোছাঃ রাবেয়া জিলানী	কাউন্সিলর - ধনবাড়ী	50	Female	গৃহিনী	01763864909	রাবেয়া
10	মো: মিজানুর রহমান	প্রধান শিক্ষক ধনবাড়ী [illegible]	88	MEL	চাকুরী	01918-460838	[illegible]

Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD # Venue # CONFERENCE ROOM, DHANBARI POURASHOVA Date # 28/02/2018 Time # 4:00PM to 5:00PM

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
11	মোঃ মনিরুজ্জামান	[illegible] মেকানিক্স, [illegible] প্রাইভেট [illegible] ধনবাড়ী, [illegible]	৬০	mal	চাকুরী	01762243377	[illegible]
12	বিশ্বনাথ গুপ্ত	[illegible], ধনবাড়ী পৌরসভা	৫০	পুঃ	চাকুরী	01712-707522	[illegible]
13	[illegible]	নবাববাড়ী মসজিদ	৪৬	পুঃ	ইমাম	[illegible]	[illegible]
14	মো: হুমায়ুন কবীর	[illegible] সহকারী ধনবাড়ী পৌরসভা	৩৮	পুঃ	চাকুরী	[illegible]	[illegible]
15	[illegible]	~~ব্যবসায়ী~~ ধনবাড়ী পৌরসভা	৫৮	পুঃ	ব্যবসায়ী	[illegible]	[illegible]
16	শ্রী [illegible]	~~ব্যবসায়ী~~ ধনবাড়ী [illegible]	৭২	পুঃ	ব্যবসায়ী	[illegible]	[illegible]
17	মো: [illegible]	[illegible]	৫৫	পুঃ	কৃষক	[illegible]	[illegible]
18	মোঃ [illegible] ইসলাম	[illegible]	33	Male	চাকুরী	01715-602978	[illegible] 28.02.18
19	এস.এম. [illegible]	সহকারী প্রকৌ:	৪২	পুং	চাকুরী	[illegible]	[illegible]
20	এম.এম. [illegible]	SAE/DPHE Dhanbari	[illegible]	পুরুষ	DPHE	[illegible]	[illegible]

Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD #   Venue # CONFERENCE ROOM, DHANBARI POURASHOVA   Date # 28/02/2018   Time # 4:00 pm to 5:00 pm

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
21	মোঃ আকতারুজ্জামান	উপ-সহকারী প্রকৌশলী ধনবাড়ী পৌরসভা	৬৩	male	চাকুরী	01915621250	[illegible]
22	মীর মোঃ মনিরুজ্জামান	অফিস সহায়ক ধনবাড়ী পৌরসভা	২৯	men	চাকুরী	01772810218	মনিরুজ্জামান
23	ছবিরন বেগম	অফিস সহায়ক ধনবাড়ী পৌরসভা	২৮	fem	চাকুরী	01942318626	ছবিরন
24	মো: রফিকুল ইসলাম	বিজ্ঞাপন মুদ্রণ কর্মকর্তা ধনবাড়ী পৌরসভা	৩৮	md	চাকুরী	01716721304	[illegible]
25	মোঃ বজলুর রশিদ	কর্মচারী ধনবাড়ী পৌরসভা	৩৮	male	[illegible]	01712-828606	[illegible]
26	আবুল কালাম আজাদ	কর আদায়কারী ধনবাড়ী পৌঃ	৪১	পুং	চাকুরী	01710650729	[illegible]
27	মোঃ মজনু মিয়া	ধনবাড়ী পৌঃ	৪২	পুং	চাকুরী	০১৯১০০১১২২৬	[illegible]
28							
29							
30							

Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD # Venue # CONFERENCE ROOM ULLAPARA, POURASHAVA, SIRAJGONJ Date # 01-03-2018 Time # 4:00 PM to 5:00 PM

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
1	মো: এম. নুরুল ইসলাম	মেয়র, উল্লাপাড়া পৌরসভা	43	পুরুষ	মেয়র	0121600020	
2	মো: ইউনুস হোসেন	উপ-সহকারী প্রকৌশলী ভারপ্রাপ্ত প্রকৌশলী, উল্লাপাড়া	50	পুরুষ	চাকুরী	01740-908503	
3	তোহিদুল ইসলাম	সচিব, উল্লাপাড়া পৌরসভা	36	পুরুষ	চাকুরী	01717-036908	
4	মো: [illegible] ইসলাম	উল্লাপাড়া পৌরসভা [illegible]	[illegible]	পুরুষ	চাকুরী	[illegible]	
5	আনোয়ারা	উল্লাপাড়া	৬৮	মহিলা	গৃহিনী	01773178836	আনোয়ারা
6	মো: [illegible]	৮ নং ওয়ার্ড কাউন্সিলর	৪৬	পুরুষ	ব্যবসা	01723254896	
7	মো: সহিদুল ইসলাম	০২ নং ওয়ার্ড কাউন্সিলর	৫২	"	ব্যবসা	[illegible]	
8	মো: সাইদুল করিম	সহকারী প্রকৌশলী উল্লাপাড়া পৌরসভা	৪৮	"	চাকুরী	[illegible]	০১/০৩/২০১৮
9	Md. Zahurul Islam	Sub-Assistant Engr. Ullapara Pourashava	34	Male	Service	01753456298	
10	জুয়েল আহমেদ	বস্তি উন্নয়ন কর্মকর্তা	48	পুরুষ	চাকরী	01711-184221	০১/০৩/১৮

Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD # Venue # CONFERENCE ROOM, ULLAPARA, POURASHAVA SIRAJGONJ Date # 01-03-2018 Time # 4:00pm/05:00pm

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
11	মো: আব্দুস ছোবহান	উল্লাপাড়া পৌরসভা	৬০	পুরুষ	ব্যবসা	0173172344 76	Sabh
12	মোঃ মিজানুর রহমান	উল্লাপাড়া পৌরসভা	৬৫	পুরুষ	মুক্তিযোদ্ধা	01746-8080 18	[illegible]
13	মো: এনামুল হক	চিফ ক্লার্ক (ভারপ্রাপ্ত) শাখা, উল্লাপাড়া পৌরসভা	66	পুরুষ	চাকুরী	01743-918 814	[illegible]
14	মো: রুহুল আমিন	উল্লাপাড়া পৌরসভা	২৭	পুরুষ	চাকরিজীবী	01746-691 991	[illegible]
15	মো: শাহীন রেজা	উল্লাপাড়া	২৭	পুরুষ	চাকরী	01764779669	শাহীন
16	মো: কামরুজ্জামান ভূঁইয়া	হিসাব রক্ষণ কর্মকর্তা উল্লাপাড়া পৌরসভা	৪০	পুরুষ	চাকুরী	01717137393	[illegible]
17	মো: আসাদুজ্জামান	কাউন্সিলর, ০৭নং ওয়ার্ড	৪০	পুরুষ	ব্যবসা	০১৭১৬৭২৪০৯০	[illegible]
18	মো: আবুল হোসেন	প্রশাসনিক কর্মকর্তা উল্লাপাড়া পৌরসভা	৪৫	পুরুষ	চাকুরী	০১৭২২৮২৫৬৫৫	[illegible]
19	মোসা: [illegible]	কাউন্সিলর সংরক্ষিত ০৭নং ওয়ার্ড	৫৬	"	কাউন্সিলর	০১৭৭৫৫[illegible]	[illegible]
20	মো: সাইফুল্লাহ	কাউন্সিলর উল্লাপাড়া পৌরসভা ০৪ ওয়ার্ড	৫২	পুরুষ	কাউন্সিলর	০১৭৭২৯৭১ ৮৭২০	[illegible]

Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD # Venue # CONFERENCE ROOM, ULLAPARA POURASHAVA, SIRAJGONJ Date # 01-03-2018 Time # 4:00 Pm to 5:00 Pm

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
21	এম. এ. [illegible]	নবাগত [illegible] উল্লাপাড়া পৌঃ সভা	66	পুরুষ	ব্যবসা	01713-460009	[illegible] 01-03-18
22	[illegible]	উল্লাপাড়া পৌরসভা কাউন্সিলর [illegible]	৪৮	মহিলা	গৃহিনী	0177281352	[illegible]
23	মোছা: নাজমা খাতুন	চর [illegible] কাউন্সিলর	৫৭	মহিলা	গৃহিনী	01755-360184	নাজমা
24	[illegible] বর্মন	ঝিকিড়া কালিবাড়ি	[illegible]	মহিলা	গৃহিনী	01796785876	[illegible]
25	মোছা: [illegible]	ঝিকিড়া	৬৬	মহিলা	গৃহিনী	01713728830	[illegible]
26	[illegible] সিদ্দিকা	1, 2, 3 নং ওয়ার্ড মহিলা কাউন্সিলর উল্লাপাড়া পৌরসভা	৬৫	মহিলা	গৃহিনী	01719801423	Sumy
27	ডলি রানী কুন্ডু	উল্লাপাড়া ঘোষ [illegible]	৩০	মহিলা	গৃহিনী	01734 887[illegible]	ডলি রানী কুন্ডু
28	মো: মোজাহারুল ইসলাম	[illegible], ওয়ার্ড নং 02	47	পুরুষ	চাকুরী	0173728974[illegible]	[illegible]
29	মো: আমিনুল ইসলাম	উল্লাপাড়া, ওয়ার্ড নং-08	২৮	পুরুষ	চাকুরী	01718341898	[illegible]
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Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD # Venue # CONFERENCE ROOM, ULLAPARA. POURASHAVA SIRAJGONJ Date # 01-03-2018 Time # 9:00 pm to 5:00 pm

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
31	Prof. Md. Abu Sayeed A Raza	Shamdipara	67	Male	Retd. Principal	01712-193141	[illegible] 1/3/18
32	[illegible]	[illegible]	৪৯	〃	[illegible]	০১৭১১ ৬০২১৮২	[illegible]
33	[illegible]	[illegible]	৪৫	〃	[illegible]	[illegible]	[illegible]
34	[illegible]	[illegible]	৪৪	〃	[illegible]	01992712[illegible] 75	[illegible]
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Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD # Venue # WORD NO-01 GONDHARBAPUR, TARABA, NARAYANGANJ Date # 02-02-2018 Time # 4:00 pm to 5:00 pm

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
1	RAFIQUL ISLAM MONIR	Gondharbapur W-01	32	Male	Business	01712246051	[illegible]
2	[illegible]	নামাপাড়া, গন্ধর্বপুর তারাব	80	মহিলা	গৃহিনী	017788643331	[illegible]
3	MD Rafiqul Islam	A/E DPHE Narunj	56	Male	Service	01822690837	[illegible]
4	Rafiqul Islam	Gondharbapur	40	male	Business	01755874715	[illegible]
5	Md. Zahidul Kabir	Gondharbapur	71	male	Business	01746085842	[illegible]
6	[illegible]	গন্ধর্বপুর, তারাব	৬০	পুরুষ	চাকুরি	01982108391	[illegible]
7	মো: [illegible]	গন্ধর্বপুর, তারাব	৫৬	"	"	নাই।	[illegible]
8	মো: [illegible]	গন্ধর্বপুর তারাব	65	"	[illegible]	01795085674	[illegible]
9	মো: [illegible]	গন্ধর্বপুর	60	"	ব্যবসায়ী	01827941268	[illegible]
10	মো: [illegible]	গন্ধর্বপুর	66	"	ব্যবসা	01740925247	[illegible]

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FGD # Venue # WORD NO-01 GONDHARBAPUR, TARABO, NARAYANGONJ. Date # 03-03-2016 Time # 4:00PM to 5:00PM

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
11	মাফুজা	গন্ধর্বপুর, ০১ নং	৪০	মহিলা	হস্তশিল্প	01987919783	মাফুজা
12	জেসমিন	গন্ধর্বপুর, ০১ নং	৩০	মহিলা	গৃহিনী	01968263759	জেসমিন
13	তাহমিনা বেগম	গন্ধর্বপুর, ০১ নং	৪২	"	সেলাই কাজ	01991744438	তাহমিনা
14	মোঃ আলতাফ হোসেন	গন্ধর্বপুর, ০১ নং	৩৮	পুরুষ	ব্যবসায়	019274447207	[illegible]
15	মোঃ মানিক হোসাইন	গন্ধর্বপুর ০১ নং ওয়ার্ড	৬৮	পুরুষ	ব্যবসা	01921214241	[illegible]
16	রবীন্দ্র দাস	গন্ধর্বপুর ০১ নং ওয়ার্ড	৩৪	পুরুষ	কৃষক	016894376788	[illegible]
17	রিফাত ভূঁইয়া	গন্ধর্বপুর ০১ নং ওয়ার্ড	24	পুরুষ	ছাত্র	01927-069523	[illegible]
18	মোঃ মনিরুজ্জামান	গন্ধর্বপুর ০১ নং ওয়ার্ড	৫৫	পুরুষ	প্রতিবেশী	019409699977	[illegible]
19	হাসি	গন্ধর্বপুর ০১ নং ওয়ার্ড	৫০	মহিলা	গৃহিনী	01748398545	[illegible]
20	[illegible]	গন্ধর্বপুর ০১ নং ওয়ার্ড	৫০	মহিলা	গৃহিনী	01748398545	[illegible]

Environmental Management Framework
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FGD # Venue # WORD NO-01 GANDHARBAPUR, TARABO, NARAYANGONJ Date # 03-03-2018 Time # 4:00PM to 5:00PM

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
21	লায়লা আক্তার	গন্ধবাপুর	৪৫	মহিলা	গৃহিনী	0172072656	লায়লা
22	মোসা: সাবিনা	গন্ধর্বপুর	৪০	মহিলা	গৃহিনী	01755113905	সাবিনা
23	রহিমা বেগম	গন্ধর্বপুর তারাব	৪৭	মহিলা	গৃহিনী	01755113905	রহিমা
24	সেলিনা	গন্ধর্বপুর তারাব	৩৫	মহিলা	গৃহিনী	—	সেলিনা
25	নাজমা	গন্ধর্বপুর তারাব	৩০	"	গৃহিনী	—	নাজমা
26	স্বর্ণা দত্ত	গন্ধর্বপুর তারাব	২৫	"	টিচার Teacher	0177922700	~~Hades~~
27	মোসা: ইয়াসমিন	গন্ধর্বপুর তারাব	২৫	"	দোকানদার	—	ইয়াসমিন
28	মো: আলিম	গন্ধর্বপুর তারাব	৩৬	পুরুষ	ব্যবসা	01962421281	আলিম
29	মো: আসলাম মিয়া	গন্ধর্বপুর তারাব	৬৪	"	ব্যবসা	01956369692	[illegible]
30	মোসা: বিউটি আক্তার	ঐ	২৬	মহিলা	গৃহিনী	01 ~~বিউটি~~	বিউটি

Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD #   Venue # WORD NO-01 GANDHARBAPUR, TARABO, NARAYAN (GONJ)   Date # 03-03-2018   Time # 4.00pm to 5.00pm

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
31	পারভীন	গন্ধর্বপুর, তারাব	৩৫	মহিলা	গৃহিনী	—	পারভীন
32	ইতি	গন্ধর্বপুর, তারাব	২৬	মহিলা	গৃহিনী	—	ইতি
33	মাহফুজা আক্তার	নবীপাড়া-গন্ধর্বপুর	৩২	"	গৃহিনী	01902939985	মাহফুজা
34	মো: নুরুল আলম	গন্ধর্বপুর, তারাব	৪৫	পুরুষ	কাঠমিস্ত্রি	01937749561	নু: আলম
35	মো: মনসুর আলী	গন্ধর্বপুর, তারাব	৩৮	"	ব্যবসা	01621094883	মনসুর
36	মোসা: হাজেরা আক্তার	গন্ধর্বপুর,	৪৭	মহিলা	সমাজসেবী	01787772345	[illegible]
37	বিলকিস আক্তার	গন্ধর্বপুর, তারাব	৪০	মহিলা	কৃষিজীবী	01679424168	বিলকিস
38	মেরিনা বেগম	গন্ধর্বপুর, তারাব	৩৫	মহিলা	গৃহিনী	01954715025	মেরিনা
39	মিনারা	ঐ	৪৫	মহিলা	গৃহিনী	—	মিনারা
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FGD # Venue # CONFERENCE ROOM, HOMNA, POURASHAVA COMILLA Date # 04.03.2018 Time # 4:00 PM to 5:00 PM

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
1	Md. Naznul Islam	Homna Pourashava Homna Comilla.	52	Male	Mayor	01711938561	[signature] 4.3.18
2	Md. Tafazzal Hossain	Homna Pourashava.	51	Male	Assistant Engineer.	01715216771	[signature]
3	Md. Jahir Uddin	Homna Pourashava	41	Male	Sub-Asstt. Engineer	01914708115	[signature]
4	Ahsan Ullah	DPHE, Homna	35	male	Karmi	01829531711	[signature]
5	Sabuj	DPHE. Homna	32	male	"	01711449432	Sabuj
6	Md: Hossian	[illegible] হোমনা	39	পুরুষ	ইমাম	01812920782	[signature]
7	মো: ইব্রাহিম	হোমনা	৫৪	পুরুষ	চাকুরী	[illegible]	[signature]
8	মো: [illegible] মিয়া	[illegible]	৬৬	পুরুষ	[illegible]	[illegible]	[signature]
9	মো: সাহিদ মিয়া	"	৭০	"	"	[illegible]	সাহিদ
10	মো: আবুল হোসেন	[illegible]	৭০	পুরুষ	কৃষিজীবী	0182938477	[signature]

Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD # Venue # CONFERENCE ROOM, HOMNA, POURASHAVA COMILLA Date # 04-03-2018 Time # 4:00 PM to 5:00 PM

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
11	আক্তারুন্নাহার	হোমনা কুমিল্লা	৪৬	মহিলা	গৃহিনী	01825611438	[illegible]
12	সুফিয়া বেগম	হোমনা পৌরসভা	৪০	"	গৃহিনী	01731384731	সুফিয়া
13	জান্নাতুল আক্তার সুমা	হোমনা পৌরসভা	৩৫	"	কাউন্সিলর	01818086652	[illegible]
14	মাসুদা বেগম	হোমনা পৌরসভা	৪০	"	কাউন্সিলর	01931873082	[illegible]
15	মেহেরাজ মিয়া	হোমনা পৌরসভা	৫৫	পুরুষ	কাউন্সিলর	018144[illegible]	Rahim[illegible]
16	মো: মাহমুদুল হাসান	সচিব, হোমনা পৌরসভা	৪৬	"	চাকুরী	01712274735	[illegible] 4.3.18
17	মো: আবুল মিয়া	হোমনা পৌরসভা	৫৫	"	ব্যবসা	01819839899	[illegible]
18	জাহাঙ্গীর আহম্মেদ (সুমন)	হোমনা পৌরসভা	৪৭	"	কাউন্সিলর ওয়ার্ড নং ৫	01812920888	[illegible]
19	মোঃ শফিকুল ইসলাম ভূঁইয়া	সাংবাদিক হোমনা, কুমিল্লা	৪৬	"	সাংবাদিক	01812526906	[illegible]
20	মো: [illegible] ইসলাম	ASI of Police	31	"	BD Police	01721557003	[illegible]

Environmental Management Framework
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FGD # Venue # CONFERENCE ROOM, HOMNA, POURASHAVA COMILLA Date # 04-03-2018 Time # 4:00 PM to 5:00 PM

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
21	[illegible]	[illegible]	48	M	Business	01813395618	[illegible]
22	M.A. Sadeque	Buet.	47	M	Service	01818082922	[illegible]
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Environmental Management Framework
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FGD # Venue # CONFERENCE ROOM, CHANDANAISH CHITTAGONG POURASHAVA Date # 06-03-2018 Time # 11:00 AM to 12:00 PM

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
1	Md. Mahabubul Alam	Mayor	60	Male	Mayor	01842725960	[illegible]
2	Mizanur Rahman Faisal.	SAE. DPHE. Chandanish	27	Male	SAE. DPHE.	01830-795277	Mizan
3	Md. Mozammel Hoque Chowdhury	Councilor seven no word	58	Male	Councilor	01813-236150	[illegible]
4	Nurul Islam	Chandanaish-02 Chandanaish Pou.	42	Male	Councilor	01819 356072	Nurul
5	M.D. Nasiruddin	Harola-04 Chandanaish Pou.	42	"	Councilor	01811585829	[illegible]
6	MD. SHAH ALAM	Harola-05 Chandanaish Pou.	40	"	COUNCILOR	0182527998	Shah
7	Hunu Begum	Councilor-7,8,9 Chandanaish Pou.	33	Female	SERVICE	01820983988	Hunu
8	Korsheda Begum	Chandanash Paurshava	45	Female	Kansular	01822291590	Kor
9	Jahanara Begum	Chandanash Paurshave	48	Female	House wife	01714289249	Jahnara
10	AJOY DUTTA	COUNCELLOR	32	MALE	BUSINESS	01823456399	[illegible]

Environmental Management Framework
Bangladesh Municipal Water Supply and Sanitation Project

FGD # Venue # CONFERENCE ROOM, CHANDANAISH. POURASHAVA, CHITTAGONG Date # 06-03-2018 Time # 11:00 AM to 12:00 PM

Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
11	মোহাম্মদ হোসেন উদ্দীন	গ্রাম- গাইজবাড়িয়া- ০৬ নং ওয়ার্ড, চন্দনাইশ পৌরসভা	৩৩	পুরুষ	[illegible]	01728224830	[illegible]
12	মো: আহমদ উদ্দিন	গ্রাম- [illegible] ওয়ার্ড- ২ চন্দনাইশ পৌরসভা	৩২	পুরুষ	ব্যবসা	01832670518	[illegible]
13	জুলফা আক্তার	গ্রাম: পূর্ব চন্দনাইশ ওয়ার্ড নং ০২	৩৭	মহিলা	গৃহিনী	01816-555562	[illegible]
14	আসমানা বেলাল আনি	গ্রাম: দ: হারালা ওয়ার্ড নং ০৫	২৬	মহিলা	ছাত্রী		[illegible]
15	ইয়াছমিন আকতার	গ্রাম: পূর্ব চন্দনাইশ ওয়ার্ড নং- ০৭	২৯	মহিলা	গৃহিনী	01879152915	[illegible]
16	রেশমী আকতার	গ্রাম: পূর্ব চন্দনাইশ ওয়ার্ড নং- ০২	২৮	মহিলা	গৃহিনী	01875372985	[illegible]
17	শাহীন আকতার	গ্রাম: দক্ষিণ- হারলা ওয়ার্ড-নং- ০৫	29	মহিলা	গৃহিনী	01814-814089	[illegible]
18	অর্চনা রানী সুশীল	প্র: শি: হারলা সমবায় সপ্রাবি।	৪৮	মহিলা	শিক্ষিকা	01818977837	[illegible]
19	মোহাম্মদ হোসাইন	দ: [illegible]	৪২	পুরুষ	[illegible]	01815920930	[illegible]
20	বাদশা মিস্ত্রী	পূর্ব জোয়ারা ওয়ার্ড-৬ [illegible]	৭২	"	কৃষক	01826346288	বাদশা [illegible]

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21	ডাঃ [illegible]	চন্দনাইশ পৌঃ ২নং ওয়ার্ড	92	পুরুষ	ডাক্তার	01817255979	[illegible]
22	আবুল কাসেম	৭, জোয়ারা, চন্দনাইশ পৌরসভা	৬৫	"	কৃষি	০১৮৬৭০৫ ৫০৬৫	কাসেম
23	মো: [illegible]	৪নং ওয়ার্ড [illegible]	80	"	[illegible]	01819548581	[illegible]
24	মো: আবুল কালাম আজাদ	৩নং ওয়ার্ড.	৬৫.	"	ব্যবসা,	01843213371	[illegible]
25	[illegible]	৫, ৬, ৫ ওয়ার্ড, কাটগড়, চন্দনাইশ পৌরসভা	80	মহিলা	কাউন্সিলর	01831093098	[illegible]
26	Nurul Alam (মাস্টার)	Harala, 4th Ward.	67	Male	Social worker	01862030516	[illegible]
27	Md. Mosleuddin [illegible]	South Gachbaria Ward. 08 Paurashava.	33	Male	Social [illegible]	01812-678446	[illegible]
28	Md. Nurul H[illegible]	[illegible] Bedels	50	Male	Serves	01819838306	[illegible]
29	[illegible]	[illegible]	80	পুরুষ	[illegible]	01574861553	[illegible]
30	[illegible]	চন্দনাইশ পৌরসভা - ০৭ নং ওয়ার্ড -	80	Male	[illegible]	01861941597	[illegible]

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Sl	Name	Address	Age	Sex	Profession	Mobile No	Signature
31	M.D. SIRAJ	S. JOARA	37		B.S	0186839813	
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