Environmental Impact Assessment (EIA)
পরিবেশগত প্রতিক্রিয়া সমীক্ষা

Dhaka Environmentally Sustainable Water Supply Project
ঢাকা পরিবেশবান্ধব পানিসরবরাহ প্রকল্প

Package 1: P1 Raw Water Intake, Pipeline & Water Treatment Plant
Package 2: P2 Treated Water Pipeline Transmission Main Starting from Gandharbpur Treatment Plant to Near US Embassy
Package 3: P3 (Component 3.1) (23 km Major Distribution Pipe)
P3 (Component 3.2) (56 km Small Distribution pipe to DMA)

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AAQ	Ambient Air Quality
BFRI	Bangladesh Fisheries Research Institute
BIWTA	Bangladesh Inland Waterways Transport Authority
BWDB	Bangladesh Water Development Board
BNBC	Bangladesh National Building Code
BOD	Biochemical Oxygen Demand
DBC	Design Build Contractor
DESWSP	Dhaka Environmentally Sustainable Water Supply Project
DMC	Design Management Consultants
DoE	Department of Environment
DoF	Department of Fisheries
DTW	Deep Tube Well
DWASA	Dhaka Water and Sewerage Authority
ECA	Environment Conservation Act
ECR	Environment Conservation Rules
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EM&MP	Environmental Management & Monitoring Plan
GW	Ground Water
IEE	Initial Environmental Examination
IWM	Institute of Water Modeling
LAP	Land Acquisition Plan
MoEF	Ministry of Environment and Forest
NGO	Non-governmental Organization
PMU	Project Management Unit
RAP	Resettlement Action Plan
RoW	Right of Way
SC	Supervision Consultant
STW	Shallow Tube Well
SW	Surface Water
SWTP	Surface Water Treatment Plant
WSF	Water Safety Framework
WSP	Water Safety Plan
WTP	Water Treatment Plant

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GLOSSARY

Adverse impact: An impact that is considered undesirable.

Ambient air: Surrounding air.

Aquatic: Growing or living in or near water.

Baseline (or existing) conditions: The "baseline" essentially comprises the factual understanding and interpretation of existing environmental, social and health conditions of where the business activity is proposed. Understanding the baseline shall also include those trends present within it, and especially how changes could occur regardless of the presence of the project, i.e. the "No-development Option".

Beneficial impacts: Impacts, which are considered desirable and useful.

Biological diversity: The variety of life forms, the different plants, animals and microorganisms, genes they contain and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecological diversity.

Ecosystem: a dynamic complex of plant, animal, fungal, microorganism communities, and associated non-living environment interacting as an ecological unit.

Emission: The total amount of solid, liquid or gaseous pollutant emitted into the atmosphere from a given source within a given time, as indicated, for e.g., in milligrams per cubic meter of gas or by a relative measure, upon discharge from the source.

Endangered species: Species in danger of extinction and whose survival is unlikely if the existing conditions continue to operate. Included among those are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to suffer from immediate danger of extinction.

Environmental effects: The measurable changes, in the natural system of productivity and environmental quality, resulting from a development activity.

Environmental impact: An estimate or judgment of the significance and value of environmental effects for natural, socio-economic and human receptors.

Environment management plan (EMP): A Plan to undertake an array of follow-up activities, which provide for the sound environmental management of a project/ intervention so that adverse environmental impacts are minimized and mitigated; beneficial environmental effects are maximized; and sustainable development is ensured.

Environmental management: Managing the productive use of natural resources without reducing their productivity and quality.

Fauna: A collective term denoting the animals occurring in a particular region or period.

Field reconnaissance: A field activity that confirms the information gathered through secondary sources. This field study is essentially a rapid appraisal.

Flora: All of the plants found in a given area.

Habitat: The natural home or environment for a plant or animal.

Household: A household is identified as a dwelling unit where one or more persons live and eat together with common cooking arrangement. Persons living in the same dwelling unit having separate cooking arrangements constitute separate household.

Important environmental component (IEC): These are environmental components of biophysical or socio-economic importance to one or more interested parties. The use of important environmental components helps to focus the Environmental Impact Assessment.

Khal: Small Channel, Canal

River: A large natural stream of water flowing in a channel to the sea, a lake, or another such stream.

Land use: Types include agriculture, horticulture, settlement, pisciculture and industries.

Mouza: A Bangla word for the smallest government administrative area corresponding to village revenue unit.

Mitigation: An action, which may prevent or minimize adverse impacts and enhance beneficial impacts.

Public involvement / Focus Group Discussion/ Public Consultation: A range of techniques that can be used to inform, consult or interact with stakeholders" affected / to be affected by a proposal.

Stakeholders: Those who may be potentially affected by a proposal, e.g. Local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project or to take an interest in it.

Terrestrial: Living on land.

Union: Smallest unit of local self-government comprising several villages.

City corporation: A city corporation is the legal term for a local governing body, including cities, counties, towns, townships, charter townships, villages, and boroughs.

LIST OF UNITS

°C	degree Celsius
CFU	Colony-Forming Unit
dB	decibels
ha	hectare
km	kilometer
km/h	kilometer per hour
m	meter
mg/l	milligram per liter
MLD	million liters per day
mm	millimeter
µg/m^3	micro-gram per cubic meter
NTU	Nephelometric Turbidity Unit
ppm	parts per million

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EXECUTIVE SUMMARY

Background of Update of EIA Study

The project authority DESWSP of DWASA received the approval letter on 5th May 2015 of EIA report from DoE after submitting related document for Water Treatment Plant under Dhaka Environmentally Sustainable Water Supply Project (DESWSP) of Dhaka WASA. In the approval letter, it was mentioned in clause 16 that "The project authority shall apply for environmental clearance certificate along with NOCs from other relevant agencies for operational activity to the Narayangonj District office of DoE at Narayngonj with a copy to the head office of DoE Dhaka.

During the preparation of EIA and approval period, the project was not matured or framed of all the components of the whole project. A discussion meeting done on 12.01.2017 with Director Technical and Assist Director of DoE Dhaka regarding the Geotechnical Investigation study, changes of pipe dia and detail of component need update of EIA of approved EIA report. Director Technical suggested that prepare and submit after update the EIA report under same memo issued of EIA approval letter. However, over the time all the six project component framed under three package P1, P2 and P3 of DESWS project. Distribution of pipeline work at Uttara framed as P3.1 and P3.2 under package 3. During design stage, it changes the raw and treated water pipe diameter; perform geotechnical investigation borehole study for soil stability, suitability and safe design of pipeline. Hence, the update of the EIA is prepared as per requirement of all the component of the project for all the contractors. In order to fulfil the requirement of update of the approved EIA, the sub-consultant revised the report and updates the EIA considering all the environmental issues. Since the engagement of DBO contractor for P1 till not finalized, hence implementation of the project will get delay.

The project authority collected the No Objection Certificate (NOC) from relevant agencies for operational activity of the project. As per approval letter from DoE the project authority now applying for issuing environmental clearance certificate to DoE district office at Narayangonj with a copy to Head office with No Objection Certificate (NOC) and updated the EIA report.

Present Status of the Project

The project is now in initial stage. Preliminary and final design of P2 and P3 package is almost completed. Engagement of DBO contractor for Package-1 (P1) is under process. Acquisition of land is under process. Physical development and construction works has not yet started which was observed during recent site visit on January 2018.

Introduction

The Dhaka Water Supply and Sewerage Authority (DWASA), acting as the executing agency (EA) and assisted by the Asian Development Bank (ADB) and other development banks and bilateral agencies, have embarked on an ambitious expansion and refurbishment of Dhaka's water and sewerage systems. One of the components of DWASA's plan to augment the overall water supply and to reduce the amount of groundwater abstraction is the 500 million liters per day (MLD) Gandharbpur Water Treatment Plant Project. DWASA published a comprehensive feasibility study and IEE in 2011 and 2013 respectively.

The project intends to withdraw, in two phases, up to 1,050 MLD from Meghna River for transmission to Dhaka city and for distribution after treatment. The project consists of the following components: (i) construction of an intake at the village of Bishnondi from the Meghna River, with pumping and other facilities to deliver uninterrupted supply of water to

the transmission mains; (ii) construction of raw water transmission pipelines connecting the raw water intake with the Gandharbpur water treatment plant (WTP); (iii) construction of a 500-MLD surface WTP at Gandharbpur; and (iv) construction of treated water mains from the Gandharbpur treatment plant to the injection point, connecting with the distribution system inside Dhaka.

In accordance with ADB's Safeguard Policy Statement (SPS, 2009) the project is classified as category B, means no significant impacts are envisioned. However, as per the Government of Bangladesh's (GoB) Environmental Conservation Act (ECA, 1995) (Amendment 2000) and the Environmental Conservation Rules (ECR, 1997), the project is classified as a red category, requiring environmental impact assessment (EIA) for necessary environmental clearance requirements for any new industrial set up. In accordance with this, updated EIA has been carried out for the mentioned project. The updated EIA report has been prepared through identifying potential impacts the lacking gap in the approved EIA report, assessing them and recommending possible mitigating and enhancing measures for negative and positive impacts respectively.

Project Components

Co. Sl.	Package		Component name	Infrastructure	Contract Package
1	1		Water treatment plant at Gandharbpur	Capacity: 500 MLD at Gandharbpur	Design-build contract
2			Intake structures	Capacity: 1,050 MLD	Design-build contract
3				Total Capacity: 1,050 MLD Equipment Capacity: 500 MLD	Design-build contract
4			Raw water Transmission main from Intake to Gandharbpur WTP	17.2 km: Intake to Shezan Juice Factory 4.5 km: Shezan Juice Factory to Gandharbpur WTP	Design-build contract
5	2		Treated Water Pipeline Transmission Main Starting from Gandharbpur Treatment Plant to Near US Embassy	13 km: Gandharbpur WTP to US Embassy injection point	Construction contract
6	3	3.1	Distribution reinforcement	23 km: within the existing network	Construction contract
		3.2	Distribution reinforcement	56 km: Small distribution pipe to DMA (Additional area)	Construction contract

Project Location

The package 1 of the project is raw water intake at the Meghna River with structure with 2000 MLD capacity along with 22 km raw water pipeline and new WTP at Gandharbpur having capacity 500 MLD.

The project is located east-west through Araihazar and Rupganj Upazilla of Narayanganj district in Bangladesh. At the east end of the project, the intake is on the bank of Meghna river at Bishnanadi Union (adjacent GPS: N 23° 44' 45.821", E 90° 42' 45.186"), which is about 2km downstream (south) of Manikpur Ferry Ghat/crossing. The proposed pipelines and road are mostly through agricultural land and the pipeline will cross at Shezan Point at

Dhaka-Sylhet Highway. West end of the Package-1, the Water Treatment Plant is located at Gandharbpur village of Murapara Union of Rupganj Upazilla (GPS: N 23° 45' 32.422", E 90° 30' 50.119"). Package 2 started from WTP at Gandharbpur to Gulshan 2 near US embassy. Package 3 starting from US embassy to Uttara. Package 3 is constituted with P3.1 and P3.2.

Environmental Quality Monitoring

In order to identify the baseline condition of the project corridor 6 major important locations are selected and approved for monitoring of ambient air quality, noise level, ground water and surface water parameters. Monitoring performed 24 hours for ambient air and noise level, ground and surface water sample are collected for lab test analysis in pre-selected approved 6 locations in August 2017. Six monitoring locations are Chaitankanda (Bishnandi), Shejan Point, Gandharbpur, Murapara near LGED Bridge, Gulshan-2 near US Embassy, Uttara (House Building). All monitoring locations named in the map as ambient air, noise level, ground water, and surface water as AAQ1, NL1, GW1, SW1 &, AAQ2, NL2, GW2SW2, AAQ3, NL3, GW3, SW3, AAQ4, NL4, GW4SW4, AAQ5, NL5, GW5, SW5, and AAQ6, NL6, GW6, SW6 respectively,

Impact Identification

Pre-construction Impact

Pre-construction Impact of all the 6 components under 3 packages P1, P2 and P3 are identified and mitigated mainly in design stage. Intake structure, raw water transmission main and WTP at Gandharbpur under P1 package are yet to start after engagement of BDO contractor. Land acquisitions for P1 package are under process for acquisition. Preliminary design of P2 and P3 packages are completed.

Construction Impact

During construction of pipeline, the contractor will provide safe and convenient passage for vehicles and pedestrians through diversions to and from side roads, and property access connecting the project roads. Contractor should be asked for to avoid any damage of trees, utility service line damage, pedestrian and vehicle movement and have flexibility of freedom to shift the location of borehole point by few feet.

The contractor will ensure that (i) the construction works do not interfere with the convenience of the public or access to, use, and occupation of public or private roads, or any other access to properties, whether public or private. Temporary access to properties adjacent to the construction site will be provided through the construction of ramps with concrete slabs for use of pedestrians and light vehicles; (ii) in critical areas such as institutions, operating hours are factored into work schedules and workforce is increased for speedy completion; (iii) advance information on works to be undertaken including approval of appropriate authority, and (iv) the diversion is done in coordination with the traffic police division for necessary rerouting of traffic and traffic management.

Geotechnical Borehole Investigation Study

Geotechnical borehole investigation study done for P2 and P3 pipeline route starting from WTP to Uttara. 139 number of borehole drilling sites for P2 and 132 borehole drilling site for P3 were selected on a stratified basis to ensure diversified representation. Public

consultation was consulted on 17 April 2017 at DORF office at Gandharbpur and on 16 April 17 at North Dhaka City Corporation office and a number of informal, consultations conducted in the project corridor.

During geotechnical investigation activities of the river Balu and Shitalakhya, navigation facility is available and the pipeline alignment is crossing the Balu and Shitalakhya River. Geotechnical borehole investigation, which takes place only punctual and short-term, the location, will be demarked for awareness and information and hence navigation will not be affected. After the completion of the GI work, the small area disturbances will be gone and navigation can freely move in the Shitalakhya and Balu River.

Micro Tunnel for River Crossing

Package 2 comprises of treated water 13 km transmission line from Gandharbpur WTP to the injection point crosses two river entitled Shitalakhya and Balu River. Both the river ecology is very sensitive and treated as a protected area. MDS Consultant of this project fully concern both the rivers ecology and consider micro tunneling technology will be used for laying the pipeline 12 m below the river bed and maintain the BIWTA specified compliance rule, so that river ecology and navigation will not affect and hamper.

Fisheries Impact

Intake screens are to be designed according to the swimming characteristics of Hilsa (the key species in the Meghna), to ensure that the impacts on Hilsa as well as the smaller fish, including the jatka, are minimized. It is reported[1] that hilsa is a fast swimming fish up to 80 km/day average 71 km/day (82 cm/sec), therefore, its swimming velocity is not critical for screen design. However, as per the recommendation of National Marine Fisheries Service, National Oceanic and Atmospheric Administration (NOAA), US Department of Commerce for large river, the critical velocity for very small fish (less than 60 mm fork length) can be considered as 0.4 ft/sec (12 cm/sec) for active fish screen and 0.2 ft/sec (6 cm/sec) for passive screen. It is recommended in Water Works Engineering: planning, design & operation book[2] to use approach velocity for intake screen as 8 cm/sec for large river.

Intake Screen Design

The citable impact of the plant is the impact of intake structure at Meghna River on the fisheries and river ecology. If the intake velocity is higher than the fish swimming velocity of Key fish species like Hilsa, jatka or any other small fishes or any other river ecology then there might have some impact on river ecology. Therefore, intake screens are to be designed according to the swimming characteristics of Hilsa (the key species in the Meghna), to ensure that the impacts on Hilsa as well as the smaller fish, including the jatka, are minimized.

Therefore, it is recommended here to use 8 cm/sec approach velocity for screen mesh to avoid such impact. For screen mesh openings it is recommended that the opening shall not exceed 3/32 inch (2.38 mm) for woven wire or perforated plate screens, or 0.0689 inch (1.75 mm) for profile wire screens, with a minimum 27% open area. It is also recommended to provide screen in the direction of flow to escape small fish and spawn from the screen.

[1] UNDP. 1985. Bay of Bengal Programme on Marine Fisheries Resources Management: A review of the biology and fisheries of *Hilsa ilisha* in the upper Bay of Bengal.

[2] **Water Works Engineering**: planning, design & operation, by – Syed R. Qasim, Edward M. Motley, Guang Zhu, Eastern Economy Edition, PHI Learning Pte. Ltd. ISBN-978-81-203-2153-3

It is further recommended for consulting a fisheries expert as part of the detailed design to provide inputs on the design of the intake screen to minimize impacts on fish. Efforts to minimize such impacts will be integrated into the detailed designs by the fisheries expert.

Impact Identification and Mitigation Measure

There are no significant or irreversible environmental impacts envisaged due to the project interventions. The impacts are largely construction related, and can be addressed through adoption of good engineering practices during project implementation. While the project components are rather simple, the scale and magnitude of facilities proposed trigger the need for an effective integration of environmental measures at all stages of the project.

There are no protected areas, forests, wetlands, or environmentally sensitive areas within or approximately the project sites. The proposed locations for intake at the Meghna River and the WTP at Gandharbpur are agricultural lands. The raw water transmission lines from the intake to the Gandharbpur WTP and a portion (4.5 km) of the treated water mains from the WTP are proposed to be laid through agricultural and low-lying areas. The other transmission mains for raw and treated water are routed along existing roads within the road reserves. The proposed abstraction for the 1,050-MLD intake (two phases) accounts for 0.3% of the lean flow, and would have negligible impacts on ecological flow and downstream uses.

Potential negative impacts were identified in relation to design, construction, and operation of the improved infrastructure. Mitigation measures have been developed to reduce all negative impacts to acceptable levels.

Key construction stage impacts identified includes: loss of productive agricultural lands and destruction of topsoil; impacts on low-lying areas and water bodies; air, noise, and vibration impacts due to construction vehicles, equipment, and machinery in addition to dust generation during construction activities; impacts on the river courses and the water quality during the construction of the transmission mains across the rivers and streams; soil disposal due to the excavation for the transmission mains; accident hazards; impacts on community health and safety hazards posed to the public, specifically in inhabited areas. Field visits and consultations with the stake holders and affected population were taken into considerations in the evaluation and mitigation proposals in this assessment report.

The impacts from construction and operation will be manageable, and no insurmountable impacts are predicted, if the EMP is included in the contract and its provisions implemented and monitored to their full extent.

Based on the updated EIA, it is observed that there are no major adverse impacts due to the project located in the mentioned area. So the selected location for the construction of intake, WTP and transmission line for raw water and treated water and distribution pipeline is considered acceptable. In construction phase there would be some normal construction hazard, which will require precautions. Nevertheless, all the impacts at construction phase are of short term and reversible. It is understood that DWASA will take necessary steps to control, and minimize any adverse impact to an acceptable level through institutional measures and incorporating standard engineering practices.

Water abstraction from river Meghna is one of the major activities to be associated during operation phase of the proposed project. Nevertheless, the study reveals that a negligible amount, as already mentioned, would be abstracted during lean flow which would have negligible impacts on ecological flow and downstream uses. On the other hand, the project will have a positive impact in terms of production of pure drinking water supply from surface water conserving scarce ground water. The other positive impact of the project will be the employment during construction and operation phases. Field visits and consultations with the stake holders and affected population were taken into considerations in the evaluation and mitigation proposals in this assessment report.

Socio-Economic and Resettlement Plan and Budget

A Census in January - October 2016 and Resurvey in December 2016 result shows that, Environment associated socioeconomic impacts at the ***point of WTP*** is large. Almost 232 household have 1148 person will affect by this activity whereas, 106 farmers, 31-business man and 12 are Wage Laborers (unskilled) employed in Business Enterprises. However, 43 nos. Primary Structures, nine Secondary Structures and Trees (Including Banana and Bamboo) will affect 561 nos.

Report of the Resettlement Plan report shows that, for construction of ***Water Intake Area (WIA)*** *– Section 1* total land required 8.65 Ha. In this section cultivated land is 5.75 Ha. Total Vulnerable HHs of this point is 51, and the Total Affected Population is 535 persons.

From the information of the RP team presenting that, **Replacement Cost of the Structure,** trees and crops are 10,685,424 BDT.

Livelihood restoration and enhancement of vulnerable household is very sensitive issue. Specific program design to improve, or at least restore livelihood means is one of the main objective of RP. RP proposes livelihood program budget to enhance their skill as well as for livelihood assistance. This indicative budget prepared for training on expected occupation choices and grants for livelihood Restoration.

Estimated Budget for replacement value of land and others feature is 94,07,63,710 BDT. Whereas, Compensation for Land (in Acre) Private Land required most of the portions 927,521,474 BDT and Compensation for land (in Acre) GoB Land 132,42,236 BDT. Estimated Replacement Value for Primary Structures and Secondary structure is 152,230,635 BDT whereas Primary structure replacement cost is high, the figure is 161,564,071 BDT.

Operation Stage

Sludge Generation, Disposal and Management

Aluminum based sludge will generate after coagulation and flocculation process and will be store in a sludge thickening tank. Tis thicken sludge will be pumped to sludge-drying beds where the dried sludge will form cake. The dried cake will send to brickfield for making brick or construction material or dispose to a confine area as final disposal.

Oil & grease and hazardous waste material should be dispose to a DoE registered vendor for proper management. During pipeline construction in the river, pond and canal will generate spoil from dredging activity and contaminated oil and grease mix soil will affect nearby area. This type of spoil waste need safe disposal to landfill site.

Increase Wastewater Generation

After ensuring the pure water supply, it will generate wastewater after use. The increased wastewater volume from Zone 05 and 08, due to the additional water supply of 262 MLD, will be fully addressed by the ongoing government-funded Dasher Kandi sewage collection system and STP (500 MLD) development project (Phase 1 Priority Projects). For other area or zones generated wastewater need to STP for treatment.

Environmental Management Plan

An outline of package wise EMP has been given for each package in the present updated EIA report to mitigate/enhance the impacts, which are expected to be occurred during operation phase of the project. However, adequate and effective pollution prevention, abatement and control measures, proper and careful operation and maintenance, regular and effective environmental monitoring with adequate staff and budgetary provision, creation of an environmental cell headed by project director, ensuring preventive management practices, adoption of the Disaster Risk Management Plan and reporting to DOE should be ensured.

It is expected that DWASA will follow all environmental compatible steps during operation and maintenance by which it sets a positive example as an environmentally friendly water supply project. It is also expected that DOE will do surveillance monitoring of the project performance. DOE should also continue its encouragement for water supply project of DWASA for initiatives to save scarce underground water resource and to ensure a better environment.

The potential benefits, which are expected due to this project, considered substantial, and will offset the anticipated negative impacts. Hence, DOE should consider positively issuing the necessary clearance for implementation of such project in the above mentioned location.

Environmental Management Mitigation and Monitoring Budget

As part of good engineering practices in the Project, there have been several environmental mitigation measures as dust and noise control, clear the site, erosion prevention, rehabilitation of borrow areas, safety, signage, provision of temporary road for pedestrians, drains, etc., the costs for which will be included in the design costs of the Project. The update of EIA monitoring costs during construction and capacity building costs on environmental management of which are absorbed into contractors work packages. The costs for training proposed include the costs incurred toward site visits, travel to the training program by participants, printing of training materials, and other logistic arrangements. The costs involved towards preparation of training material and training are covered in the consultancy budget for the Design Supervision Consultant. The budget for the environmental management and mitigation costs for the Project included is contractors work packages.

The cost estimates mentioned in Table 8-4 are an indicative price. The bidder can provide his or her own reasonable quoted rate. Operation phase need only two locations monitoring. These two points are *Intake point at Bishnondi and Gandharpur (WTP).*

Conclusions and Recommendations

The beneficial impacts on the nation as well as human beings would only be meaningful and sustainable development would only be possible if the adverse effects were minimized through strict maintenance and control measures as adopted and further suggested for this project. No development can be expected without any adverse impact on environment. Further, to mitigate adverse impact on environment, there should be strict observance of EMP guidelines as specified in the report. All this would need vigilant care and subsequent monetary involvement, and the project authority should take these into considerations. It is expected that DWASA will follow all environmental compatible steps during operation and maintenance by which it sets a positive example as an environment friendly water supply project. It is also expected that DOE will do surveillance monitoring of the project performance, particularly that of sludge management and protection upstream of intake point from industrial pollution and other activities. DOE should also continue its

encouragement for water supply project of DWASA for initiatives to save precious underground water resource and to ensure a better environment.

The potential benefits, which are expected due to the project, considered substantial, and will offset the anticipated negative impacts.

Recommendations Proposed

- For the most appropriate mitigation and mechanism for watershed protection of Meghna River.
- Protect the Meghna River specially upstream of intake point.
- Protect the upstream of intake point for any type of fish culture.
- Protect the industrial effluent and domestic sewage and wastewater discharge to the Meghna river

1.0 INTRODUCTION

1.1 Background

The Dhaka Water Supply and Sewerage Authority (DWASA), acting as the executing agency (EA) and assisted by the Asian Development Bank (ADB) and other development banks and bilateral agencies, have embarked on an ambitious expansion and refurbishment of Dhaka's water and sewerage systems. The Dhaka Water Supply Sector Development Project (DWSSDP), funded by ADB, addresses the water sector[3]. It aims to increase surface raw water sources and thereby decrease reliance on groundwater abstraction, which is mining the aquifers at a current rate of 2-3 meters per year. The plan for water sources by DWASA is shown in Figure 1-1 and Table 1-1: Water supply master plan for DWASA. The project further aims to strengthen the distribution system, thereby adding to the service areas and significantly reducing non-revenue water (NRW).

One of the components of DWASA's plan to augment the overall water supply and to reduce the amount of groundwater abstraction is the 500 million liters per day[4] (MLD) Gandharbpur Water Treatment Plant Project. DWASA published a comprehensive feasibility study[5] (FS) in 2011; the review of this study and the endorsement or identification of gaps is the central objectives of this project preparatory technical assistance (PPTA).

The project intends to withdraw up to 1,050 MLD from Meghna River in two phases for transmission to Dhaka city and for distribution after treatment. The project consists of the following components Figure 1-1:

- construction of an intake at the village of Bishnondi from the Meghna River, with pumping and other facilities to deliver an uninterrupted supply of water into the transmission mains;
- construction of raw water transmission pipelines connecting the raw water intake with the Gandharbpur water treatment plant (WTP);
- Construction of a 500-MLD surface water treatment plant at Gandharbpur; and (iv) construction of treated water transmission mains from the Gandharbpur treatment plant to the injection point connecting with the distribution system inside Dhaka. ***Chapter 3*** of this report provides a more detailed description of the project components.

The socio-cultural roots of our present environmental crisis lie in the paradigms of scientific materialism and economic determinism, which fail to recognize the physical limits, imposed by ecological systems on economic activity. The economic activities must expand within ecosystems, which have limited regenerative capacities. Contrary to the neoclassical theory of continuous material growth, economic activities directly undermine the potential for development through over-exploitation of natural resources and indirectly compromise future production through the discharge of residuals. The entrenchment with quantitative growth as a major instrument of social policy is thus quite paradoxical.

The emergence of the concept of sustainable development in recent years has brought in the general realization that societal perceptions must shift towards ecological determinism

3 ADB. 2007. Report and Recommendation of the President to the Board of Directors: Proposed Loans and Technical Assistance Grant to the People's Republic of Bangladesh for the Dhaka Water Supply Sector Development Program. Manila. The scope of the program included preparation of a feasibility study of the project.

4 This is Phase 1, with an expansion of 500-MLD Phase 2 planned to go into production in 2020. The intake is to be designed for 1050 MLD (with 5% extra capacity).

5 DWASA, 2011. Feasibility Study for Augmentation of Water Supply to Dhaka, Design and Management Consultancy Services. Dhaka, August 2011.

so as to achieve qualitative growth within the limits of ecosystem carrying capacity. The carrying capacity based planning process, innovative technologies for enhanced material and energy efficiency of production and consumption, structural economic change towards less resource-intensive sectors, and preventive environmental management through increasingly interventionist policies are some of the strategies for reconciling developmental goals with ecological capabilities.

Proper location/siting, its process and waste abatement and control are very important for a water treatment plant to be environmentally sound. To ensure this, an Environmental

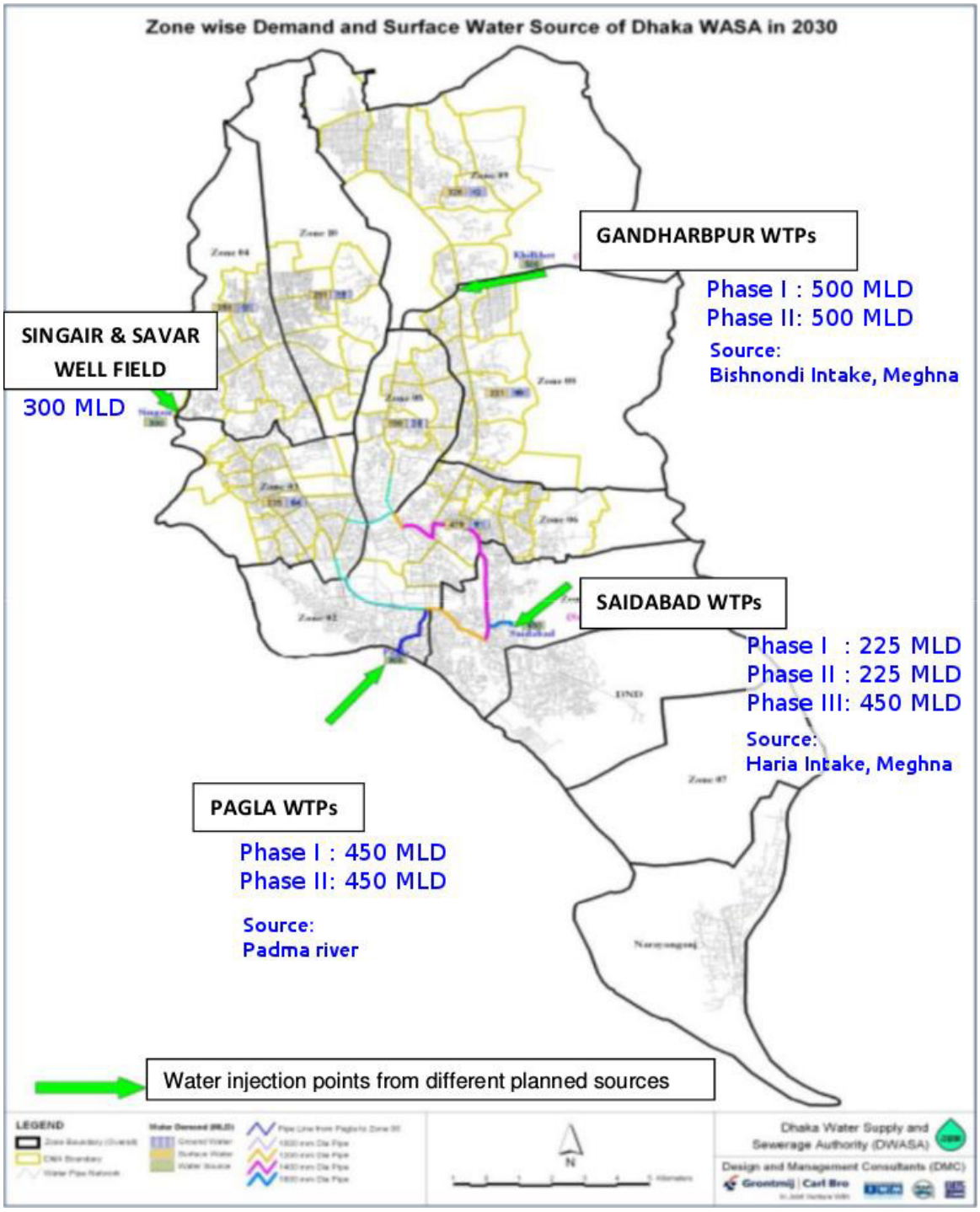


Figure 1-1: Plan for water sources by DWASA

Impact Assessment (EIA) is a very effective tool, which delineates what needs to be done to make a plant unit suitably located and operate in an environmentally friendly way.

The EIA was carried out as a follow-up study of the initial environmental examination (IEE)

prepared as part of the PPTA to address environmental impacts resulting from the project. It is based on review and updating of the IEE carried out by the FS. An environmental management plan (EMP) outlining the specific environmental measures to be adhered to during implementation of the project has been prepared. During the detailed design of P1, the EMP shall be further updated as a stand-alone EMP for each of the procurement packages and appended to the contract document. This will allow integration of environmental provisions and management measures in the document.

Table 1-1: Water supply master plan for DWASA

Year	2011	2015	2020	2025	2030	2035
Demand (Unit)	**m^3**	**m^3**	**m^3**	**m^3**	**m^3**	**m^3**
Required Production	2,179	2500	3,112	3,685	4,573	5,453
Supply:						
From GW sources	1,900	1950	1,360	1,260	1,260	1,260
From SW sources:						
Godnail, Sonakanda & Chandnighat (rehab ongoing)	10	96	96	96	96	96
Saidabad I (in operation)	225	225	225	225	225	225
Saidabad II (in operation)		225	225	225	225	225
Saidabad III (FS completed)			450	450	450	450
Gandharbpur I (FS completed)			500	500	500	500
Gandharbpur II (FS completed)					500	500
Padma I (FS completed)			450	450	450	450
Padma II (FS required)					450	450
Meghna I (Rupganj) (FS required)						500
Meghna II (N.ganj) (FS required)						200
From SW sources	235	546	1,946	1,946	2,896	3,596
Total Production (SW + GW)	**2,135**	**2,496**	**3,306**	**3,206**	**4,156**	**4,856**
Surplus or Deficit	-44	-4	194	-479	-417	-597

Source: DESWSP

1.2 Objective

The objective of the assignment is to carry out an Environmental Impact Assessment (EIA) in accordance with the Environment Conservation Act 1995 (ECA'95) and the Environment Conservation Rules 1997 (ECR'97) and in accordance with ADB's Safeguard Policy Statement (SPS, 2009). For the approval of feasibility, study (FS) by the Government of Bangladesh (GoB), the environmental and social studies, Environmental Impact Assessment (EIA) studies, and Environmental Management Plan (EMP) is required as per ECR'97. The specific objectives of the environmental study to be carried out for the proposed project are:

- to assess the existing environmental conditions (physical, biological and socio-economic) of the proposed project sites (intake structure and WTP sites) and routes of water transmission lines and their surrounding areas in order to establish a baseline framework, against which potential environmental impacts due to the

implementation of the project would be compared;
- to identify and evaluate environmental impacts resulting from the project activities during both construction and operational phases of the project, and to suggest appropriate mitigation measures;
- to carry out public consultations in order to get views and concerns of local people and peoples' representatives regarding different aspects of the proposed project, and to address those in the EIA.

1.3 Description:

i. Monitoring and reporting system, including water pollution mapping, strengthened in the relevant section of the Meghna River.
ii. Incentive or reward system for pollution control piloted
iii. Ecologically critical area identified and prepared for designation
iv. Training programs completed

1. Innovative Monitoring and Reporting for Sustainable Water Quality of Meghna River. PVW4S16022 (DELTARES#120919)

   Description of work: Train up the stakes holder and watch dock committee members, supervision of smart phone based water testing, supervision of database at DoE)

1.4 Scope of the Present Study

The major activities were carried out for the update of Environmental Impact Assessment (EIA) report of the proposed project is summarized below.

Review of Policy, legal, and administrative framework: The relevant local, regional, and national regulations and standards governing environmental quality (such as air and water discharge standards), health and safety aspects, protection of sensitive areas and endangered species, project site, and land use controls were reviewed.

Description of the Project: This covered the following information:

i. Nature and Scope of the project
ii. Need for the project (in the context of Dhaka metropolitan city's water supply scenario)
iii. Location and site description (using maps to show the project and site location, and any specific environmental attributes in and around the location)
iv. Description of the construction and operation activities

Description of Environmental Baseline: Environmental baseline surveys were performed covering areas in and around the proposed locations of the intake structure and treatment plant and along the proposed alignment of the raw and treated water transmission lines.

Physical Environment: This included information on topography, geology/seismology, soil type, climate and meteorology, natural gradient and drainage pattern, and ambient noise levels and air quality.

Assessment of Water Quality: Baseline data covered the assessment of water quality of the area including intake water quality.

Fisheries: Assessment of the baseline fisheries in the river stretch adjacent to the intake structure was undertaken.

Flora and Fauna: Baseline information on flora and fauna of importance, especially any endangered species, sensitive habitats, and species of commercial importance that may

be affected due to project activities were collected and presented.

Socio-economic: The socioeconomic baseline was established through secondary data and questionnaire survey at the site.

Description of potential environmental impacts and mitigation measures: All potential affects the project during construction and operational phases of the project were identified. This will include the following issues:

1) Loss of property/land/income
2) Dislocation and displacement,
3) Public health,
4) Air and noise pollution,
5) Raw and treated water quality
6) Sanitation and solid waste, disposal of treatment waste
7) Stability of riverbank and erosion
8) Aquatic and terrestrial flora and fauna
9) Traffic congestion and safety,
10) Employment and commercial activities,
11) Public health and safety

Using an impact matrix, the scale of impacts by the project related activities on the baseline environment were screened initially. The impact assessment was carried out and characterized in terms of nature (e.g., reversible, irreversible, positive or negative), scale (e.g., local, regional), and duration (e.g., short, medium, long-term).

After a detailed assessment of environmental impacts, mitigation measures were designed and suggested for reducing and eliminating adverse impacts and for enhancing the positive and beneficial impacts, both for construction and operational phases of the project.

Recommendations were proposed for the most appropriate mitigation and mechanism for watershed protection of Meghna River.

Analysis of Alternatives: Feasible alternatives to the intake location, route of water transmission pipeline and water treatment process were studied-including the zero alternative in terms of potential environmental impacts and the feasibility of mitigating the impacts.

Environmental Management Plan: Package wise an EMP was developed separately for all the three packages that consists of a set of mitigation, monitoring, and institutional measures to be taken during different stages of the project (construction, and operation) to mitigate the adverse environmental impacts, offset them, or reduce them to acceptable levels. The EMP identified and summarized all anticipated significant adverse impacts, and describe-with technical details-each mitigation measures. Furthermore, the EMP contained clear and agreed allocation of responsibility amongst project proponents and government agencies for implementation of the mitigation measures as well as their oversight and monitoring. The EMP proposed cost-effective mitigation measures, the cost of which should be a part of the project cost.

Public Consultations: In order to ensure that all relevant issues have been covered by the EA, potentially affected people and other relevant individuals/ organizations early in the EA process were consulted, so that their views and concerns about environmental issues can be addressed to the extent possible. Consultant organized Focus Group Discussions (FGDs) with the potentially affected persons (PAPs) and other stakeholders by taking help of the local people living in the zone of influence. FGD participants were mainly better informed people, educated and to some extent were aware of different development activities taking place in the locality.

1.5 Methodology

The present update of EIA report has been carried out based on approved EIA report. This updated EIA report is based on the primary data generated during the study period, environmental quality parameters monitoring and test analysis, secondary data from various sources and information from field visits and the project proponent. Several field visits were undertaken to the project location with a view to reconnaissance and detailed physical survey of the surrounding areas. These were followed by evaluation of the information to delineate the major environmental issues relating to the treatment plant. During this process, the following steps have been followed:

- Compilation of survey/monitoring data. Field survey using a prepared questionnaire covering a wide cross-section of people in the study area to acquire field-level data on the existing environment and socio-economics and apprehended impacts due to the project. Monitoring of water quality (both ground and surface water) of adjoining areas was done.
- Understanding the process involved in the plant.
- Identification of potential impacts and evaluation of their consequences, to the possible extent. Identification of impacts was done using **Checklist method**.
- Review of the adequacy and efficiency of proposed mitigation measures for the plant.
- Development of an **Environmental Management Plan (EMP)** for possible mitigation / enhancing measures for negative and beneficial impacts.
- the suggestion of mitigation measures for residual impacts.

This report is prepared following the EIA methodology as described in the Asian Development Bank (ADB, 1988) manual of EIA guidelines, and also EIA guidelines for Industries (DOE, 1997) to a certain extent, but not limited to those.

1.6 Limitation

An EIA is generally carried out as an integral part of the Feasibility Study (FS) or together with it and before going into the final design phase and into the construction phase of a particular development project. If so than the findings of the EIA could be incorporated in the project design, overall planning, and budget and that the project could be implemented accordingly. When an EIA is conducted separately as just an add-on, often it does not get due importance in the overall implementation of the project, which undermines the role of the EIAs and can contribute to environmental damages.

1.7 EIA Team

This update of EIA report has been prepared under the guidance and supervision of Dr. J C Saha, Team Leader of the project. The other members of the team and their responsibilities are Mr. Selim Reza, Environmental Engineer, Ms. Zisan Binte Walid, Ecologist, Md. Saidur Rahman, Environmentalist, and Md. Mozahidul Islam, Field officer, and GIS-based map preparation.

1.8 Report Structure

This update of EIA report contains nine chapters. The report has been structured in compliance with the requirement of the TOR. *Chapter and its outline are given below-*

Chapter 1: Introduction: The introduction chapter presents a brief overview of the Water supply pipeline Project along with its background, objectives, scope of work, methodology etc.

Chapter 2: Policy, Legal and Administrative Framework: This chapter outlines the Policy and Legislation on environmental issues. Specific this assignment.

Chapter 3: Project Description: This Chapter describes the detail of the proposed Project interventions including project category, location, and component of the project, project size and magnitude of operation.

Chapter 4: Description of Environmental Baseline: Chapter 4 presents a description of the environmental baseline condition (physical, biological, environmental) of the project area.

Chapter 5 Identification and Evaluation of Potential Environmental Impacts: This chapter deals with the environmental impacts, prediction of impact and evaluation of impact of the proposed project.

Chapter 6: Analysis of Alternatives: Chapter 6 presents the analysis of alternatives

Chapter 7: Environmental Mitigation and Management Plan: The chapter mainly deals with the environmental management plan, which includes an implementation plan of mitigation measures, institutional requirements and environmental monitoring program of the project. The EMP also includes specific compensation, monitoring and enhancement plan.

Chapter 8: Public Consultation: This chapter mainly describes the public opinion of the water supply pipeline project at the project site as well as the major problems, impacts and probable solutions recommended by the project.

Chapter 9: Conclusion and Recommendations: This chapter presents the findings, conclusion, and recommendations of the proposed road project.

2.0 LEGISLATIVE, REGULATORY AND POLICY CONSIDERATION

2.1 Literature Review

During the preparation of this report, pertinent references were consulted and reviewed. Many environmental legislative were reviewed that have implication to the project.

Bangladesh has consented to be bound by the terms of some 21 of the 44 principal international conventions, treaties and protocols relating to the environment. Those with partial and indirect relevance to projects are the Paris convention of 1972 concerning the protection of the world cultural and natural heritage, convention concerning safety in the use of chemicals at work, Geneva 1990, Biodiversity convention, Rio-De-Janeiro 1992, convention concerning occupational health services, Geneva 1985 etc.

A wide range of laws and regulations related to social and environmental issues are effective in Bangladesh. Many of these are cross-sectoral and only partially related to environmental and social issues. The laws and regulations such as National Water Policy, 1999; Forest Act 1927 (modified up to 30th April 2000); National Forest Policy, 1994; National Conservation Strategy; National Environmental Management Action Plan (NEMAP); Environment Conservation Act 1995 (ECA 1995); Environmental Conservation Rules 1997; Environment Conservation (Amendment) Act (2002) and Draft Environment Conservation (Amendment) Act 2009; Coastal Zone Policy, 2005; Coastal Development Strategy, 2006; National Agricultural Policy, 1999; National Fisheries Policy, 1996; National Livestock Development Policy, 2007; Standing Orders on Disaster, 1999; Climate Change Strategy and Action Plan, 2009; National Plan for Disaster Management, 2008-2015; and Other Legislation are considered here.

Some of the most important legislation that have implication with the project activities:

- Bangladesh Environmental Conservation Act (ECA), 1995
- Environment Conservation Rules (ECR), 1997
- National Water policy, 1999
- National Safe Drinking Water Supply and Sanitation Policy 1998
- National Fisheries Policy, 1996
- National Agricultural Policy, 1999
- National Livestock Development Policy, 2007
- Others

The most important of these are the Environment Conservation Act, 1995 (ECA, 1995), and the Environment Conservation Rules (ECR, 1997). The ECA 1995 is primarily an instrument for establishing the Department of Environment (DoE), and for controlling industrial pollution. The Act also defines in general terms that if any particular activity is causing damage to the ecosystem, the person responsible will have to apply corrective measures. Until the appearance of ECR, 1997, enforcement of the Act was not possible, as many of the clauses refer to specifications spelled out in the Rules.

A list of this review has been presented in Chapter- 2.

2.2 Relevant Other Study of this project

This section provides the related other project of this assignment in Bangladesh. These are water quality monitoring at various point, Strengthening Monitoring and Enforcement and Innovative Monitoring and Reporting for Sustainable Water Quality of Meghna River. All the three projects details information are presenting below-

2. Surface Water Quality Monitoring Near Bishnondi Point, Meghna River under Dhaka Environmentally Sustainable Water Supply Project (DESWSP), DWASA

   Description: To obtain for 14 months water quality monitoring of the Bishnondi intake

point [Chaitankanda, Bishnandi, (Coordinates: 23^0 45/ 14.69" N 90^0 43/ 18.07" E) in preparation of the design and implementation of Gandharbpur surface water treatment plant. Four selected location water quality measured at Bishnondi Point at Manik nagar Ferrighat, Chaitankanda point, Nunertech point, and Near Anandabazar and Near Meghna bridge point

3. Strengthening Monitoring and Enforcement in the Meghna River for Dhaka's Sustainable Water Supply (42173-014) Project TA-8803 BAN:

2.3 ADB Safeguard Policy (ADB Safeguards Policy Statement, 2009)

The ADB SPS stipulates addressing environmental concerns, if any, of a proposed activity in the initial stages of project preparation. For this, the SPS categorizes the proposed components into categories (A, B or C) to determine the level of environmental assessment required to address the potential impacts. All three-safeguard policies involve a structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. The safeguard policies require that

- impacts are identified and assessed early in the project cycle;
- plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and
- Affected people are informed and consulted during project preparation and implementation.

The policies apply to all ADB-financed projects, including private sector operations, and to all project components. The internal procedural requirements are detailed in the *Operations Manual* sections and involve similar implementation processes as follows:

- screening and scoping of the main issues start as soon as potential projects for ADB financing are identified and continue throughout the project cycle;
- impacts are assessed, safeguard plans summarizing mitigation measures, monitoring program, and institutional arrangements are prepared, and arrangements are made to integrate safeguards into project design and implementation;
- affected people are consulted during project preparation and implementation and information is disclosed in a form, manner, and language accessible to them; and
- Safeguard plans are disclosed to the public and the information is updated at various stages in the project cycle. ADB's safeguard policies require that both ADB's and DMCs' safeguard requirements are complied with.

A screening process for all ADB projects classified them into four environmental assessment categories as described in Table 2-1: ADB projects environmental classification.

Table 2-1: ADB projects environmental classification

Category	Category A	Category B	Category C	Category FI
Description	The 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	The project has potential adverse environmental impacts on human populations or environmentally important areas—including wetlands, forests, grasslands, and 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, mitigatory measures	The project is likely to have minimal or no adverse environmental impacts	The project involves investment of IFC funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

Category	Category A	Category B	Category C	Category FI
	to physical works	can be designed more readily than for Category A projects.		
EA Requirements	For a Category A project, the project sponsor is responsible for preparing a report, normally an EIA	EA is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.	Beyond screening, no further EA action is required for a Category C project	For FI category subproject sponsors requires to carry out appropriate EA for each subproject

2.4 Government Policies, Laws, Regulations

The severe floods of 1987 and 1988, and the resurgence of concern about environmental issues have heightened in improving environmental conditions of the country through promulgation of numbers of policies and legislation in the country. All of the policies or legislation aimed at the conservation and protection of the environment. The existing policies and legislation, which are relevant to the environment, are described in the following sections.

2.4.1 Industrial Policy 1991

The Industrial policy of 1991 contains the following clauses in respect of environmental protection:

- To conserve ecological balance and prevent pollution during industrialization.
- To take effective steps for pollution control and conservation of environment during industrialization.

To ensure embodying of necessary pollution control and preventive measures by industrial investment project endangering environment

2.4.2 National Environmental Policy 1992

Bangladesh National Environmental Policy (GoB, 1992) was approved in May 1992, and sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. Key elements of the policy are:

- Maintenance of the ecological balance and overall progress and development of the country through protection and improvement of the environment.
- Protection of the country against natural disasters.
- Identification and regulation of all types of activities which pollute and degrade the environment.
- Ensuring sustainable utilization of all natural resources.
- Active association with all environmentally related international initiatives.

The environmental policy contains the following specific objectives with respect to the industrial sector:

- To adopt corrective measures in phases in industries that cause pollution.
- To conduct Environmental Impact Assessments (EIAs) for all new public and private industries.
- To ban the establishment of an industry that produces goods that cause environmental pollution, closure of such existing industries in phases and discouragement of the use of such goods through the development and/or introduction of environmentally sound substitutes.

- To ensure sustainable use of raw materials in industries and to prevent their wastage.

2.4.3 National Safe Drinking Water Supply and Sanitation Policy 1998

National Safe Drinking Water Supply and Sanitation Policy (NSDWSSP, 1998) was drafted in 1998, and sets out the basic framework for the improvement of public health quality and to ensure improved environment, together with a set of broad sectoral action guidelines. The draft policy offered various objectives to achieve the goal and these are:

- To manage water supply and sanitation-related basic needs for all.
- To bring the positive change in peoples attitude, regarding water and sanitation.
- To reduce the outbreak of water-borne diseases.
- To increase the efficiency of the Local Government and associated community for handling more effectively the problems related to water supply and sanitation.
- To improve sustainable water supply and sanitation system.
- To ascertain proper conservation, management and use of surface water, and to control water pollution due to the scarcity of underground water.
- To take necessary steps to use and conserve rainwater.
- To ascertain the rainwater disposal in the urban areas.

2.4.4 National Conservation Strategy 1992

National Conservation Strategy (GoB/IUCN, 1992) was drafted in late 1991 and submitted to the Government in early 1992. This approved in principle; however, the final approval of the document is yet to be made by the cabinet. Meanwhile, it underwent a number of modifications over the last five years and waiting for approval. For sustainable development in the industrial sector, the report offered various recommendations; some of those are as follows:

- Industries based on nonrenewable resources should be made to adopt technology which conserves raw materials, and existing industries should be given incentives to install technical fixes to reduce wastage rate.
- All industries, especially those based on imported raw materials, should be subjected to EIA and adoption of pollution prevention/control technologies should be enforced.
- No hazardous or toxic materials/wastes should be imported for use as raw material.
- Import of appropriate and environmentally sound technology should be ensured.
- Complete dependence on imported technology and machinery for industrial development should gradually be reduced, so that industrial development is sustainable with local skills and resources.

2.4.5 National Environmental Management Plan

National Environmental Management Action Plan, also referred to as NEMAP (GoB, 1995) is a wide-ranging and multi-faceted plan, which builds on and extends the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements during the period 1995 to 2005 and sets out the framework within which the recommendations of the National Conservation Strategy are to be implemented.

NEMAP has the broad objectives of:

- identification of key environmental issues affecting Bangladesh.
- identification of actions necessary to halt or reduce the rate of environmental degradation.
- improvement of the natural and built environment.
- conservation of habitats and biodiversity.
- promotion of sustainable development.
- improvement in the quality of life of the people.

One of the key elements of NEMAP is that sectoral environmental concerns are identified. In outline, the environmental issues of the industrial sector include the following:

- Pollution arising from various industrial processes and plants throughout the country

causing varying degrees of degradation of the receiving environment (Air, Water, and Land).

- There is a general absence of pollution abatement in terms of waste minimization and treatment.
- Low level of environmental awareness amongst industrialists and entrepreneurs.
- Lack of technology, appropriate to the efficient use of resources and waste minimization leading to unnecessary pollution loading in the environment.
- Economic constraints on pollution abatement and waste minimization such as the cost of new technology, the competitiveness of labor, and intensive production methods as compared to more modern methods.
- The concentration of industry and hence pollution in specific areas which exacerbate localized environmental degradation and exceed the carrying capacity of the receiving bodies.
- Unplanned industrial development has resulted in several industries located within or close to residential areas which adversely affects human health and quality of human environment.
- Establishment of industries at the cost of good agricultural lands and in the residential areas.
- Lack of incentives to industrialists to incorporate emission/discharge treatment plant in their industries.

2.4.6 National Water Management Plan

The Government commenced preparation of this National Water Management Plan, with the intention of operationalizing the directives given by Policy. In reflecting the objective of rationalizing and decentralizing management of the sector, the Plan is a framework plan within which line agencies and other organizations are expected to plan and implement their own activities in a coordinated manner. The Plan is presented in three phases: in the short-term (2000-05), it is considered a firm plan of ongoing and new activities; in the medium-term (2006-10) it is an indicative plan, and in the long-term (2011-25) a perspective plan. Implementation of the plan is to be monitored regularly and it will be updated every five years.

The National Water Management Plan has been prepared to respond to these challenges and paradigms, with three central objectives consistent with Policy aims and national goals. These objectives are:

- Rational management and wise-use of Bangladesh's water resources
- People's quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
- Clean water in sufficient and timely quantities for multi-purpose use and preservation of the aquatic and water dependent eco-systems

2.5 Conventions, Treaties and Protocols

Bangladesh has consented to be bound by the terms of some 21 of the 44 principal international conventions, treaties and protocols relating to the environment (Islam, 1996). Those with partial and indirect relevance to industrial projects are the Paris convention of 1972 concerning the protection of the World cultural and natural Heritage, Convention concerning safety in the use of chemicals at work, Geneva 1990, Biodiversity convention, Rio-de-Janeiro, 1992, Convention concerning occupational health services, Geneva 1985 etc.

2.5.1 Environment Conservation Act 1995 Amended in 2000 & 2002

Provides for the conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. In line with these provisions of the act, the Environment Conservation Rules, 1997 have been framed. This act provides for (i) remedial measures for injury to the ecosystem; (ii) any person affected by environmental

pollution to apply to DoE for remediation of the damage; (iii) discharge of excessive environmental pollutants; (iv) inspection of any activity or testing any equipment or plant for compliance to the environment act, including power to take samples for compliance; (v) power to make rules and standards with reference to the environment; and (vi) penalty for non-conformance to the Environment Act under the various sections.

The provisions of the act apply to the entire project interventions in the construction and operation stages.

The main objectives of ECA '95 are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

The main strategies of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried/initiated in the ecologically critical areas;
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental Clearance;
- Regulation of the industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines.

Before any new project can go ahead, as stipulated under the rules, the project promoter must obtain Environmental Clearance from the Director General. An appeal procedure does exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment to a maximum of 3 years imprisonment or a maximum fine of Tk. 300,000 or both. The Department of Environment (DOE) executes the Act under the leadership of the Director General (DG).

Bangladesh Environmental Conservation Act (Amendment 2000)

This amendment of the Act focuses on: (1) ascertaining responsibility for Compensation in cases of damage to ecosystems, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

Bangladesh Environmental Conservation Act (Amendment 2002)

This amendment of the Act elaborates on: (1) restriction on polluting automobiles, (2) restriction on the sale and production of environmentally harmful items like polythene bags, (3) assistance from law enforcement agencies for environmental actions, (4) break up of punitive measures and (5) authority to try environmental cases

The Environmental Conservation Act (Amendment 2010)

The amendment of ECA ’95 has been published on 5 October 2010 as Bangladesh Environmental Conservation Act, 2010. Some changes and inclusions has been made in different clauses particularly in defining the Ecological Critical Area, farming certain rules and

conditions in cutting and/or razing hills, handling disposal of hazardous wastes, managing ship braking industries & wetlands, fixing responsibilities of environmental and safety management, obligations of obtaining and issuance of environmental clearance certificates and imposing penalties for violations including but not limited to filing cases for compensations, fixing fees and framing different rules under this Act.

Environment Conservation Rules (ECR, 1997) (Subsequent amendments in 2002 & 2003)

Empowers the GoB to declare ecologically critical areas, classification of industries and projects into various categories, procedures for issuing the environmental clearance certificate, and determination of environmental standards. According to the Rule 7 (1) of the Environmental Conservation Rules 1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every industrial units or projects, in consideration of their site and impact on the environment, will be classified into the four categories and they are: Category I (green), Category II (Orange-A), Category III (Orange B) and Category IV (Red). Development or restoration or upgradation of Khal are not included in any of these categories.

The Protection and Conservation of Fish Rules (1985)

These are a set of rules in line with the overall objectives of the Fish Act. Section 5 of the Rules requires that "No person shall destroy or make any attempt to destroy any fish by explosives, gun, bow and arrow in inland waters or within coastal waters". Section 6 of the Rules states -"No person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters".

2.5.2 Acquisition and Requisition of Immovable Property Ordinance (1982)

This Ordinance has replaced the Land Acquisition Act of 1894 and the East Bengal (Emergency) Requisition of Property Act of 1948. The Ordinance governs acquisition and requisition by the government of immovable property for any public purpose or in the public interest. It may be noted that contrary to the previous Acts (i.e. Act XIII of 1948), this Ordinance deals only with immovable property.

The Ordinance has well-defined procedures regarding payment of compensation for an acquired piece of land. If, for example, the land is used for rice growing, then an amount equivalent to approximately 1.5 times the market value of a given variety of rice (e.g., paddy) that is currently being (or could be) produced annually is fixed as a yearly lease value. In case of outright purchase (carried out on a 99-year lease), the compensation-value of acquired land varies widely according to the locality, soil fertility, and access to transportation and related infrastructure factors. The current compensation and resettlement provisions are however inadequate both in terms of timing of payments and quantum. The procedures involved are cumbersome, time consuming, and often causes hindrance to the smooth execution of the project. Legal provisions covering adequate compensation to the project affected persons, particularly disadvantaged groups such as women & squatters and such other vulnerable groups are yet to be framed.

2.6 Compliance with DoE EIA guideline

DWASA should adopt a policy of compliance with all the requirements for environmental permission and clearance, regardless of whether the company might otherwise be able to obtain exemptions from some or all of the rules.

In this case, it will be necessary for DWASA to obtain only environmental clearance for this project. DWASA received exemption for IEE earlier for this project and approval of ToR for EIA study. With respect to the list of documents required to accompany the application for environmental clearance for the project, Based on require document EIA report was submitted on August 2014 and approved the EIA on 21st May 2015 **(Appendix-1**). However, over the time there are some additional distribution pipeline work included in this project. Hence the approve EIA report need update which should be submitted along with relevant document and the key map of DESWS Project.

The DoE has issued EIA Guidelines for Industries (this document was released in December 1997) and addresses the IEE and EIA for several industrial sectors and development projects. Each Project Proponent shall conduct an EIA and is expected to consult and follow the DoE guidelines.

In this case, it will be necessary for DWASA to obtain only environmental clearance for this project.

After received the approval of ToR for EIA study to DoE for go ahead signal submit the EIA report consultant shall conduct EIA study following the approved ToR **(Appendix-2)** by DoE classified in the 'Red' category should be accompanied by the following documents:

a) Feasibility Study Report of the project;
b) EIA report including environmental management plan (EMP) and emergency response plan for the mitigation of adverse environmental impacts;
c) An NOC (No Objection Certificate) from the local authorities concerned;
d) Outline of relocation plans (where applicable) and;
e) Other information as deemed necessary

As per ECR 1997, DESWS project clearly falls under the red category of project. The Environmental Impact Assessment should include the prediction, evaluation and mitigation of environmental impacts caused, based on the characteristics of project, and an Environmental Management Plan (EMP) shall be prepared. The approval of the EIA and EMP is required before submitting an application for an Environmental Clearance Certificate (ECC).

2.6.1 Environment Conservation Rules 1997

The rules outline the processes and requirements of environmental clearances for specific types of projects indicated therein, and stipulates that "no industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate (ECC) from the Director General" of the Department of the Environment. Schedule 1 of the rules classify industrial units and projects into four categories according to their site and impact on the environment, namely (i) green, (ii) orange-A, (iii) orange-B, and (iv) red. The rules specify the procedures for issuing ECC for the various categories of projects.

The Project is categorized as red and requires two stages of clearance, location clearance, and environmental clearance. All requisite clearances (LCC and ECC) from the DoE shall prior to being obtained commencement of civil works.

2.6.2 Environment Court Act 2000 Amendment in 2010

Enacted to establish environment courts and make rules for protection against environmental pollution. Environment courts are situated at the district level, but the government may, by notification in the official Gazette, establish such courts outside the districts. Environment courts were given power to directly take into cognizance any offense relating to environmental pollution. Proceedings of this court will be similar to that of criminal courts. One important feature of this act is that it has been given retrospective effect on any crime committed against environmental laws; thus, any crime previously committed but not taken before any court can be taken before the environment court or any special magistrate.

Table 2-1 summarizes the applicable national and local laws, regulations, and standards for environmental assessment and management.

Table 2-2: Government policies, laws, regulations, and environmental standards

Laws, Regulations, and Standards	Details	Relevance
Environment Conservation Act, 1995	Provides for the conservation of the environment, improvement of environmental standards and control and mitigation of environmental pollution. In line with these provisions of the Act, the Environment Conservation Rules, 1997 have been framed. This Act provides for (i) remedial measures for injury to ecosystem; (ii) provides for any affected person due to environmental pollution to apply to DOE for remediation of the damage; (iii) discharge of excessive environmental pollutants; (iv) inspection of any activity for testing any equipment or plant for compliance to the environment act, including power to take samples for compliance; (v) power to make rules and standards with reference to environment; and (vi) penalty for non-conformance to environment act under the various sections.	The provisions of the act apply to the entire Project interventions in the construction and operation stages.
Environment Conservation Rules (ECR), 1997	The Rules outline the processes and requirements of environmental clearances for specific type of projects indicated therein, and stipulates that “no industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate (ECC) from the Director General” of the Department of the Environment. Schedule 1 of the Rules classifies industrial units and projects into four categories according to their site and impact on the environment, namely (i) green, (ii) orange-A, (iii) orange–B, and (iv) red. The Rules specify the procedures for issuing ECC for the various categories of projects. For Red Category: (i) completed application for ECC, and the appropriate fee; (ii) report on the feasibility of the project; (iii) report on the IEE for the project, and Terms of Reference for the EIA; or EIA report prepared on the basis of TOR previously approved by DOE (**Appendix 2),** plus (in the case of an industrial project): layout plan showing location of ETP, process flow diagram, design and time schedule of the ETP; (iv) report on the EMP; (v) no objection certificate from the local authority; (vi) emergency plan relating to adverse environmental impact and plan for mitigation of the effect of pollution; and (vii) outline of the relocation and rehabilitation plan (where applicable).	The project activities are categorized under this rule and as per categorization required environmental assessments were done

Laws, Regulations, and Standards	Details	Relevance
Environment Court Act, 2000	Enacted to establish Environment Courts and make rules for the protection of environmental pollution. Environment Courts are situated at the District-level but Government may by notification in the official Gazette, establish such courts outside the districts. Environment Courts were given power to directly take into cognizance any offense relating to environmental pollution. Proceeding of Environmental Courts will be similar to Criminal Courts. One important feature of this Act is that it has been given the retrospective effect of any crime committed under environmental laws and thus any crime previously committed but is not taken before any court can be taken before the Environment Court or any special Magistrate.	The Court has jurisdiction over, in accordance with the Act provisions, the trial of an offense or for compensation under an environmental law, imposing penalties for violation etc.
National Policy for Arsenic Mitigation, 2004	Provides a framework for the provision of water supply for areas/aquifers with high arsenic levels. Roles for agencies are specified for development of water supply systems, certification of arsenic removal technology, and disposal of treatment sludge. Arsenic-prone area also identified.	Considered in design and project preparation. Water supply is considered under this policy.
Pourashava Ordinance (Second Amendments) 1988; Municipal Administration Ordinance 1960	These ordinances have clearly assigned responsibilities to the LGIs to ensure urban health for their residents. It has given them the mandate to ensure and provide a wide range of primary and public health services including primary health care, sanitation, water supply, drainage, food and drink, birth and death registration, vector and infectious disease control, etc. As independent autonomous bodies, the LGIs, as necessary, may take all required actions to ensure good health for tourist and concerned population within its jurisdiction. They have the authority to address all related issues with their legal and administrative mandate.	The Project integrated community and workers health and hygiene at the construction stage, and this will be taken forward during the operation and maintenance of the infrastructure facilities for tourists, local community and other concerned peoples.
National Forestry Policy, 1994	Rules related to forest protection, often a domain of environmental management, are found in the Policy. Due to the death of forests, afforestation is actively pursued with targets to “implement programs of tree plantation and afforestation on fallow and hinterland, the bank of the pond and homestead land, which are under private ownership.”	It is desirable to incorporate tree planting in the Project (Where it is practical).
Bangladesh Labor Act, 2006	The Act provides the guidance on employer’s extent of responsibility and workers’ extent of rights to compensation in case of injury by accident while working.	Provides for the safety of workforce during the construction period.
National Water Policy, 1999	The Policy explicitly states 6 main objectives: (i) address the use and development of groundwater and surface water in an efficient and equitable way; (ii) ensure the availability of water to all parts of the society; (iii) accelerate the development of public and private water systems through legal and financial measures and incentives, including appropriate water rights and water pricing rules; (iv) formulate institutional changes, encouraging decentralization and enhancing the role of women in water management; and (v) provide a legal and regulatory framework that encourages decentralization,	Water supply should be under this consideration

Laws, Regulations, and Standards	Details	Relevance
	consideration of environmental impacts, and private sector investment.	
Bangladesh Standard Specification for Drinking Water, 1990	Formulation and revision of national standards. Now it is incorporated into the schedule of ECR 1997	Water supply should be under this consideration
National Agriculture Policy, 1999	The act deals with the programs related to make the nation self-sufficient in food through increasing production of all crops, including cereals, and ensure a dependable food security system for all	Ministry of Agriculture
The National Water Policy, 1999	Protection, restoration and enhancement of water resources;	Ministry of Resources
National Biodiversity Strategy and Action Plan (2004)	Conserve, and restore the biodiversity of the country for well-being of the present and future generations; Maintain and to improve environmental stability for ecosystems; Ensure preservation of the unique biological heritage of the nation for the benefit of the present and future generations; Guarantee the safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country; and Stop introduction of invasive alien species, genetically modified organisms and living modified organisms.	Ministry of Environment and Forest Bangladesh Wild Life Advisory Board
The Protection and conservation of Fish Act 1950 subsequent amendments in 1982	Deals with the protection/conservation of fishes in Government owned water bodies	Department of Fisheries
The embankment and Drainage Act 1952	Describe the protection of embankment and drainage facilities	Ministry of Water Resources
Inspection and Enforcement Manual 2008	This manual has been written to provide national standard and uniformity environmental sampling for the inspections, investigations in the Department of Environment (DOE) in Bangladesh.	Will be considered at the time of environmental monitoring during the implementation of EMP
Acquisition and Requisition of Immovable Properties Ordinance 1982	The government made rules in the exercise of the powers conferred upon by section 46 of the acquisition and requisition of the immovable property ordinance, 1982 (Ordinance No. II of 1982). ARIPO sets the Government rules and regulations governing all cases of land acquisition.	If any acquisition is required, this will be considered

EIA = Environmental Impact Assessment, EMP =Environmental Management Plan, ETP = effluent treatment plant, IEE = Initial Environmental Examination, km = kilometer, LGI = Local Government Institution, TOR = terms of reference

2.7 International Conservations, Treaties and Protocols

The following are the International Environmental Conservations, Treaties, and Protocols:

- Rio Declaration, Convention on Biological Diversity, Rio De Janeiro, 1992 (Ratified 1994)
- RAMSAR, 1971(Ratified 1992)

- International Plant Protection Conservation, Rome, 1951 (Ratified 1978)
- Basel Convention, Basel, 1989 (Ratified 1993)
- United Nations Framework Conservation on Climate Change, New York, 1992 (Ratified 1994)
- Montreal Protocol, 1987 (Ratified 1994)
- World Heritage Convention, 1972 (Ratified 1983)

Among them, Table 2-3 summarizes the relevant to this project activity.

Table 2-3: International environmental conventions relevant to the project activities

International	Details	Relevance
Rio Declaration 1992	United Nations Conference on Environment and Development (UNCED) adopted the global action program for sustainable development called 'Rio Declaration' and 'Agenda 21 'Principle 4 of the Rio Declaration', 1992, to which Bangladesh is a signatory along with a total of 178 countries.	No sensitive species are located in the project area. There is no threat to the conservation of flora or fauna.
Convention on Wetland of International Importance Especially as Waterfowl Habitats, Ramsar (1972)	The Ramsar Convention was adopted on 2 February 1971 and entered into force on 21 December 1975. Bangladesh ratified the Convention on 20 April 2002. Bangladesh has two Ramsar Sites (i) parts of Sundarban Reserved Forest (Southwest of Bangladesh), and (ii) Tanguar Haor Northeast of Bangladesh).	No impact

2.8 Relevant Occupational Health and Safety Laws and Rules

During construction, the Project will conform to the occupational and health-related rules as outlined in Table 2-4 below.

Table 2-4: Relevant occupational health and safety laws and rules

Title of Laws and Rules	Descriptions
Social Security under the Act, 1923 and an amendment in 1980	According to the Act social impact assessment includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions.
The Employer's Liability Act, 1938	The Act declares that the doctrine of common employment and of assumed risk shall not be raised as a defense in suits for damages in respect of employment injuries. Under the Maternity Benefit Act, 1939, the Maternity Benefit Act, 1950, the Mines Maternity Benefit Act, 1941, and finally the rules framed thereunder, female employees are entitled to various benefits for maternity, but in practice, they enjoy leave of 6 weeks before and 6 weeks after delivery.
Public Health (Emergency Provisions) Ordinance, 1994	The ordinance calls for special provisions with regard to public health. Whereas an emergency has arisen, it is necessary to make special provision for preventing the spread of human disease, safeguarding public health and providing them adequate medical service and other services essential to the health of respective community and workers in particular during

Title of Laws and Rules	Descriptions
	the construction related work.
The Employees State Insurance Act, 1948	It has to be noted that health, injury and sickness benefit should be paid to people, particularly respective workers at workplace under the Act.
Bangladesh Factory Act, 1979	The Act requires every workplace including small or large scale construction where women are employed to have an arrangement of childcare services. Based on this Act and Labor Laws - medical facilities, first aid and accident and emergency arrangements are to be provided by the authority to the workers at workplaces.
Water Supply and Sewerage Authority Act, 1996	The Act specifies WASA's responsibility to develop and manage water supply and sewerage systems for the public health and environmental conservation.

2.9 Compliance with DoE EIA Guidelines

The most important of these is the Environmental Conservation Act, 1995 (ECA, 1995) and the Environment Conservation Rules (of this Act), 1997 (ECR, 1997). The ECA 1995 is primarily an instrument for establishing the Department of Environment (DOE) for implementing Environmental pollution legislation. As per Environmental Conservation Act (ECA, 1995) and ECR 1997, the industrial units and projects shall, in consideration of their site and impact on the environment, be classified into the following four categories:

1) Green; 2) Orange – A; 3) Orange – B; and 4) Red

Industries and projects included in the various categories as specified in sub-rule (1) have been described in Schedule – 1 of ECR 1997.

- Environmental Clearance Certificate shall be issued to all existing industrial units and projects and to all proposed industrial units and projects falling in the Green Category.
- For industrial units and projects falling in the Orange – A, Orange – B and Red categories, firstly a Location Clearance Certificate and thereafter an Environmental Clearance Certificate shall be issued:

  Provided that the Director General may, without issuing a Location Clearance Certificate at the first instance, directly issue Environmental Clearance Certificate if he, on the application of an industrial unit or project, considers it appropriate to issue such certificate to the industrial unit or project.
- The entrepreneur of the concerned industrial unit or project shall apply to the concerned Divisional Officer of the Department in Form-3 along with appropriate fees as specified in Schedule – 13 of ECR 1997.
- the following documents shall be attached with an application made under sub-rule above
  - Green category industries are to be granted environmental clearance within 15 days. The Green Category Schedule does not list specific projects.
  - For industries and projects in Category Orange A & B, an application for environmental clearance is accomplished by a Feasibility Report, Initial Environmental Examination (IEE), and for industries also a Process Flow Diagram and Layout Plan.
  - For Red Category Industries and projects requires an Environmental Impact Assessment (EIA) for final approval and clearance. The ECR, 1997 list the Contents required for both IEE and EIA.

2.10 Obtaining Environmental Clearance

Steps Followed for Environmental Clearance Procedure of Red Category Project is pictorially presented in Figure 2-1.

2.11 Environmental Standard

Drinking water standard from DoE and WHO water quality standard and surface water quality standard for different environmental parameters have been described in the Environmental Conservation Rules 1997 as described in the **Appendix-3**.

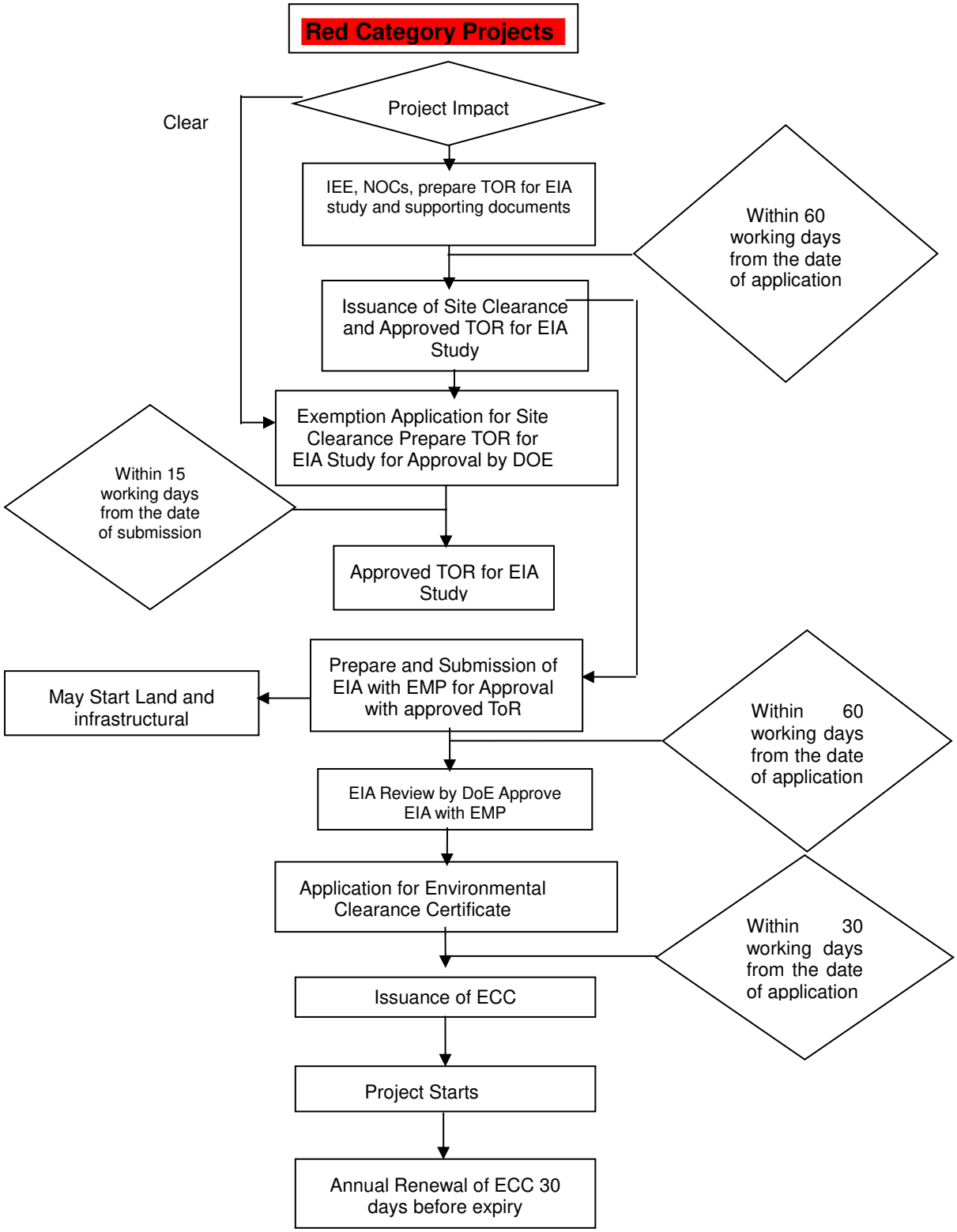


Figure 2-1: Steps followed for environmental clearance of red category project

3.0 THE PROJECT

This project under EIA is describing under package-1 of "Dhaka Environmentally Sustainable Water Supply Project". There are three packaged planned under this project, which are:

Package-1: Raw water intake at the Meghna river with structure with 1050 MLD capacity + 22 km Raw water pipeline + WTP at Gandharbpur (WASA Land) having capacity 500 MLD.

Package-2: Treated water transmission pipeline from the Gandharbpur WTP to the injection point of the existing distribution network at Baridhara near US embassy Total 13km.

Package-3: P3 (Component 3.1 Distribution reinforcement line) (23 km Major Distribution Pipe)
P3 (Component 3.2) (56 km Small Distribution pipe to DMA**)**

Package-1 consists of a river intake & pumping station to draw raw water from Meghna River, pipelines to carry that water to a water treatment plant, the treatment plant

Package-2 treated water delivery mains to the injection point near US Embassy

Package-3 Distribution reinforcement line inside Dhaka city.

3.1 Project Location, area and topographic features

Location: The project spread east-west through Araihazar and Rupganj Upazilla of Narayanganj district in Bangladesh. At the east end of the project, the intake is on the bank of Meghna river at Bishnanadi Union (adjacent GPS: N 23° 44' 45.821", E 90° 42' 45.186"), which is about 2km downstream (south) of Manikpur Ferry Ghat/crossing (Figure 3-1). The proposed pipelines and road are mostly through agricultural land and the pipeline will cross at Shezan Point at Dhaka-Sylhet Highway. West end of the Package-1, the Water Treatment Plant is located at Gandharbpur village of Murapara Union of Rupganj Upazilla (GPS: N 23° 45' 32.422", E 90° 30' 50.119").

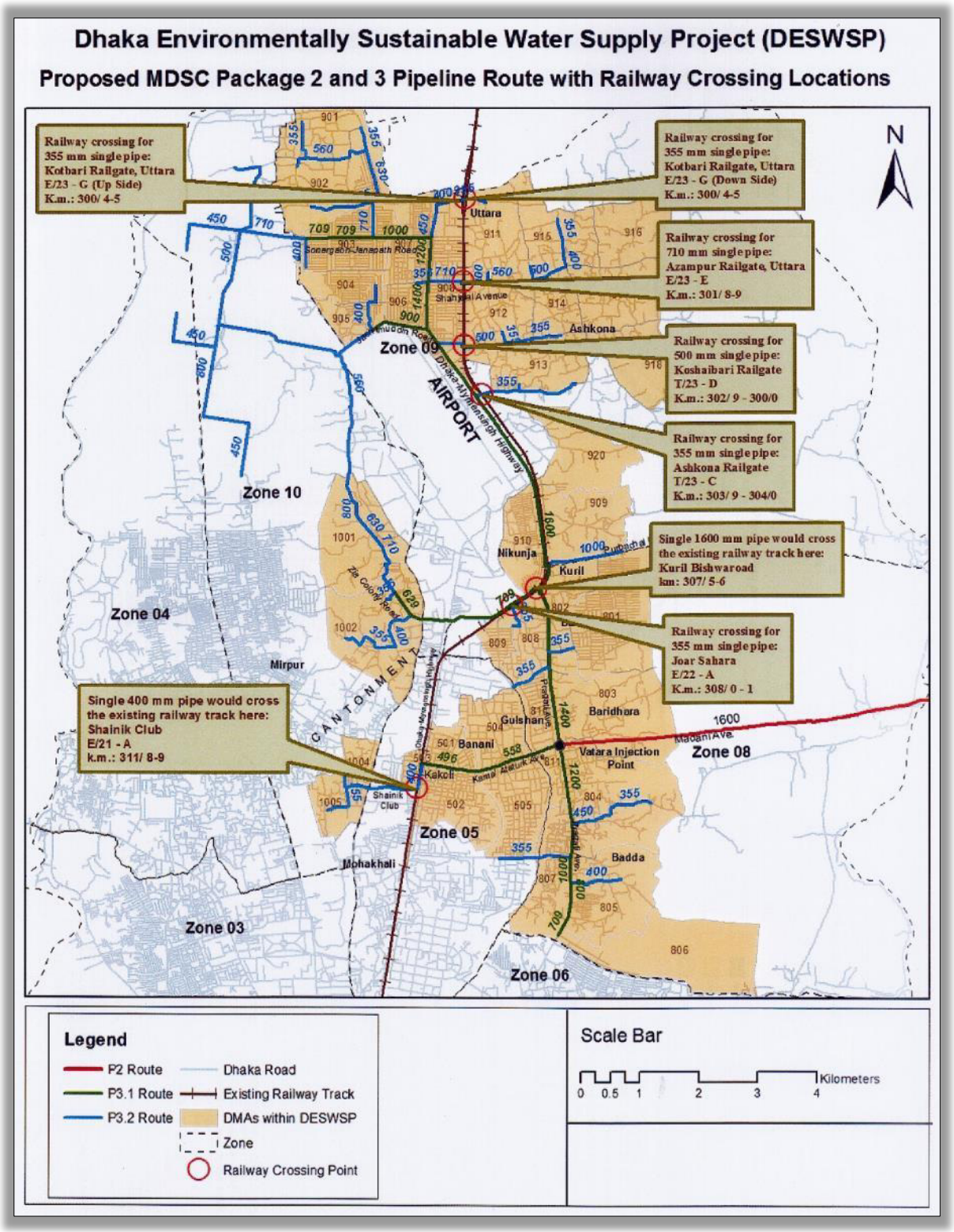


Figure 3-1: Topographic feature of the study area

Area: A total of 197-acre land acquired for this part of the project. More information that is detailed is provided in Table 3-1. The land area required for the WTP site was acquired by DWASA long ago, and hence, no new land acquisition for WTP is required.

Table 3-1: Land acquisition requirements

Sl.	Location	Length (km)	Width (m)	Land Area (Acres)
1	Shomvupura & Chetia mouja of Bishnandi Union at Araihazar Upazilla on the bank of Meghna river	-	-	21
2	From Meghna Bishnandi to Dhaka-Sylhet roads Shezan Juice point (Vulta union, Golakanda Mouja)	17.50	31.0	148
3	Shejan Juice points to Gandharbpur WTP	4.50	25.0	28
			Total :	**197**

3.2 Project Concept

The water supply of Dhaka city is heavily depending on groundwater (GW), but the aquifer is not sufficient to support the growing demands and is now depleting due to over-harvesting of water. Reducing recharge due to the expansion of urbanization is also contributing to this problem. Therefore, shifting the dependency of Dhaka water supply from depleting groundwater sources to more sustainable surface water is the central theme of this project. Besides, expanding the coverage of DWASA is another major concern behind this project.

3.3 Project Components

The overall proposed project has six project components. Among those, components 1 to 3 falls under package-1, component 5 under Package 2 and component 6 under Package 3 Table 3-2 which all are covered by this EIA study (Figure 3-2). The components are as follows:

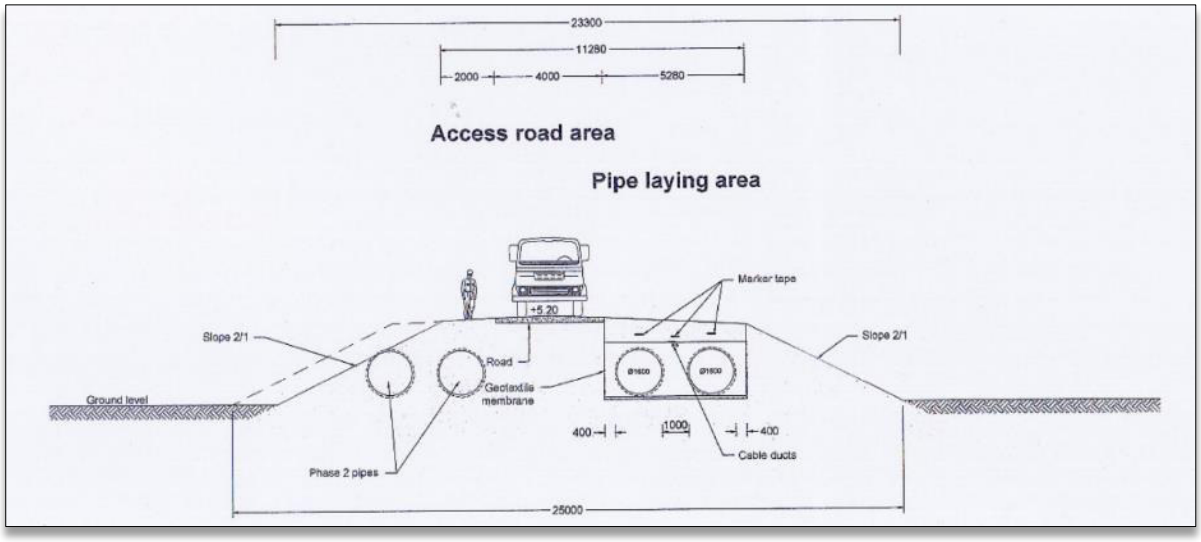


Figure 3-2: Transmission line – intake to Dhaka-Sylhet highway junction

Table 3-2: Project components

Co. Sl.	Package	Component name	Infrastructure	Contract Package
1	1	Water treatment plant at Gandharbpur	Capacity: 500 MLD at Gandharbpur	Design-build contract
2		Intake structures	Capacity: 1,050 MLD	Design-build contract
3			Total Capacity: 1,050 MLD	Design-build

Co. Sl.	Package		Component name	Infrastructure	Contract Package
				Equipment Capacity: 500 MLD	contract
4			Raw water Transmission main from Intake to Gandharbpur WTP	17.2 km: Intake to Shezan Juice Factory 4.5 km: Shezan Juice Factory to Gandharbpur WTP	Design-build contract
5	2		Treated Water Pipeline Transmission Main Starting from Gandharbpur Treatment Plant to Near US Embassy	13 km: Gandharbpur WTP to US Embassy injection point	Construction contract
6	3	3.1	Distribution reinforcement	23 km: within the existing network	Construction contract
		3.2	Distribution reinforcement	56 km: Small distribution pipe to DMA (Additional area)	Construction contract

3.4 List of project equipment

This section describes the total instruments use this project. Some of them are harmonies to nature and human behavior, which are presenting in Table 3-3.

Table 3-3: List of the project all components and associated noise level

Sl No.	Name of the Equipment	Noise Level (dB)
1	Drilling rig	
2	SPT equipment	
3	Cone penetration testing (CPT); incl. a seismic cone	
4	Standpipe and standpipe piezometers	
5	Hammer	
6	Water tubing for sampling	
7	PPE	
9	Heavy trucks (avg.)	82 – 96
10	Grader (avg.)	79 – 93
11	Excavator (avg.)	81 – 97
12	Crane (avg.)	74 – 89
13	Pile driver (peak)	81 – 115
14	Concrete mixer (avg.)	75 – 88
15	Compressor (avg.)	73 – 88
18	Backhoe (avg.)	72 – 90
19	Paver (+grind) (avg.)	85 – 89
20	Front loader (avg.)	72 – 90
21	Generator (avg.)	71 – 82
22	Jackhammer/rock drills (avg.)	75 – 99
23	Roller (vg.)	72 – 75
24	Pumps (avg.)	68 – 80
	Sources: Western Highway Institute (1971)	

3.5 Details of the P1 component

3.5.1 Water Treatment Plant at Gandharbpur

The 30.35-hectare (ha) site at Gandharbpur will accommodate the phase 1, 500 MLD facility as well as Gandharbpur 2, doubling the total capacity to 1,000 MLD for Gandharbpur 1 and Gandharbpur 2. The plant will be designed for a continuous output of 500 MLD. The treatment plant will include pre-chlorination, coagulation, flocculation, sedimentation, filtration, PPTA, and the 20-m width was found inadequate for construction purposes. Post-chlorination facilities. Recirculation of backwash water and dewatering of sludge are included. The following main components are proposed:

(i) pre-chlorine, aluminum sulfate, lime, and polyelectrolyte dosing facilities for treatment;
(ii) three lines of two rapid mixing chambers in series, each equipped with a mechanical rapid mixer;
(iii) three lines of 2 x 2 flocculation chambers in series, each tank equipped with one mechanical flocculation;
(iv) three lines of two plate settlers in parallel, each settler equipped with a scraper and desludging valves;
(v) three lines of eight rapid sand filtration units in parallel of the deep sand bed type, including air and water backwash facilities and a backwash water storage tank;
(vi) post-chlorination and lime solution dosing facilities;
(vii) Three contact time reservoirs in parallel;
(viii) two common storage reservoirs in parallel; and
(ix) one treated water pumping station.

There will also be a storage tank and pumping facilities for backwash water before recycling. Backwash water will be pumped through the process after temporary storage for flow equalization. Sludge from the sedimentation, after preliminary thickening in the sedimentation tanks themselves, will be pumped to sludge-drying beds for final disposal.

3.5.2 Intake Structure

The intake structure will design for the full design capacity of 1,050 MLD in the year 2030. The intake structure will receive raw water from the Meghna River, and the water will flow by gravity to the pump sump in the pumping station, located near the riverbank. The intake structure and the pump station shall be designed for the 100-year flood level and 50-year low levels in Meghna River. The intake structure serves as a pre-sedimentation chamber to settle larger particles. A pre-chlorination facility is also included in order to avoid organic growth in the transmission line. Coarse/Rough and fine screens will be included in the intake structure and at the inlet to the pump sump for removing coarse and fine suspended materials.

3.5.3 Intake building (Pumping Station)

The pumping station structure will design for full capacity in the year 2030. The pumps will draw water from the pump sump (pre-sedimentation chamber), supplied by gravity through the intake channel from Meghna River. The pumping station includes a power supply and necessary controls.

3.5.4 Transmission Mains

The proposed system will consist of one raw water transmission pipe (1,600 mmx2) to convey 500 MLD to Gandharbpur WTP. The raw water pipe include will include two pipes of 1,600 mm each for a 17.2-km stretch from intake to Shezan juice factory on the Dhaka-Sylhet Highway (Figure 3-7). A 31 -m wide corridor is being acquired under the project, to accommodate a future total of four pipes and an access road (6.5 m-wide carriageway with 2 m-wide shoulders on either side) during construction and maintenance (Figure 3-3) & (Figure 3-8: Schematic of project components intake, treatment plant and pipeline). Then it goes on for a length of 4.5 km from Shezan juice factory to the Gandharbpur WTP, to be accommodated within a 25 m-wide corridor through agricultural lands and open areas.

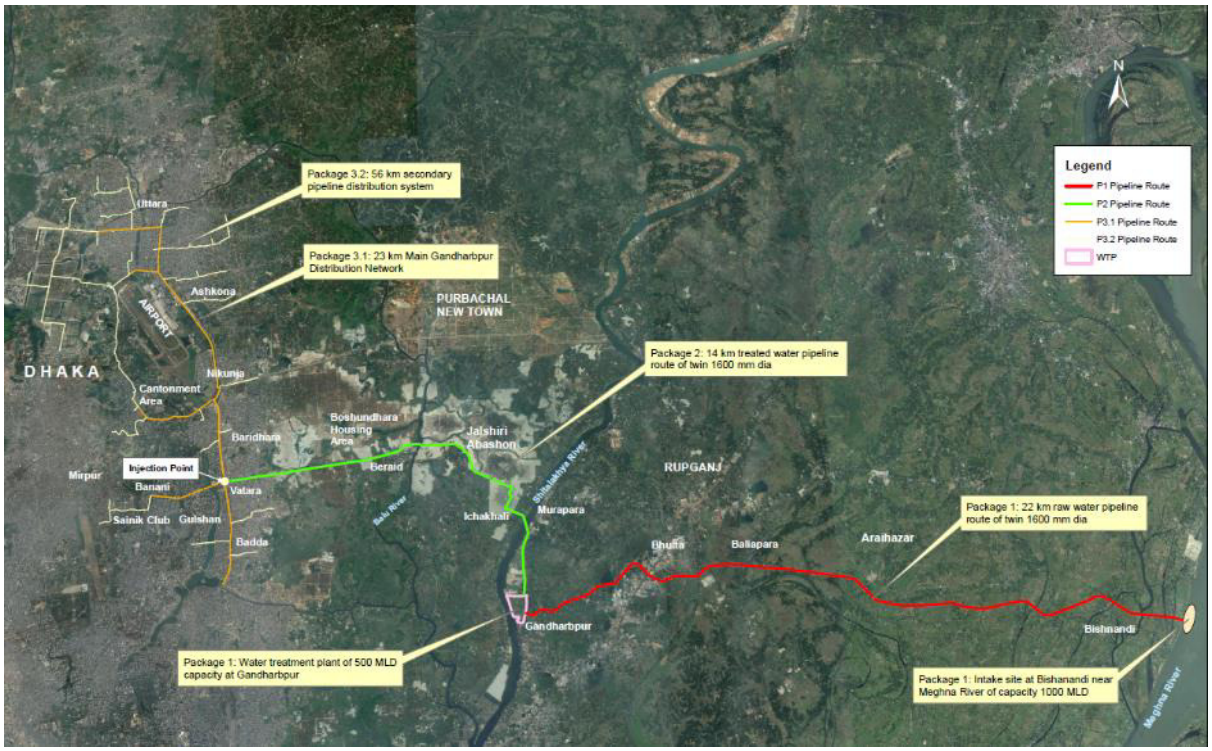


Figure 3-3: Project layout plan

a) Intake to Shezan juice factory on Dhaka-Sylhet Highway

This section of the transmission lines is a green field alignment for a length of 17.2 km through agricultural fields and open areas. One pipe with a diameter of 1,600 mm is proposed to be accommodated within the 31-m width of land[6] to be acquired for the length of this corridor, to accommodate pipes and access road. While one pipe of 1,600 mm is proposed to be laid as part of the present project, the remaining pipe(s) will be laid at a subsequent phase. The transmission mains would require a width of 16 m, while construction of an access road (to transport pipes during construction, as well as excavated soil and bedding materials) would require 15 m. To minimize land take, sheet piling on the edges of the corridor is proposed. The road will provide continued access to the transmission mains during the project and allow access to the site during the laying of the pipes at a later phase.

b) Shezan Juice factory to Gandharbpur WTP

The transmission line along this 4.5-km stretch from Shezan to Gandharbpur WTP is proposed through agricultural fields and open areas. One pipe with a diameter of 1,600 mm is proposed to be accommodated within the 25-m width of land to be acquired. While one pipe of 1,600 mm is to be laid under the project, road reserve to accommodate an additional pipe is being secured for utilization at a later phase Table 3-4.

6 The FS proposal of a 20 m-wide pipeline corridor to accommodate the four 1,600-mm pipelines was reviewed by the PPTA, and the 20-m width was found inadequate for construction purposes.

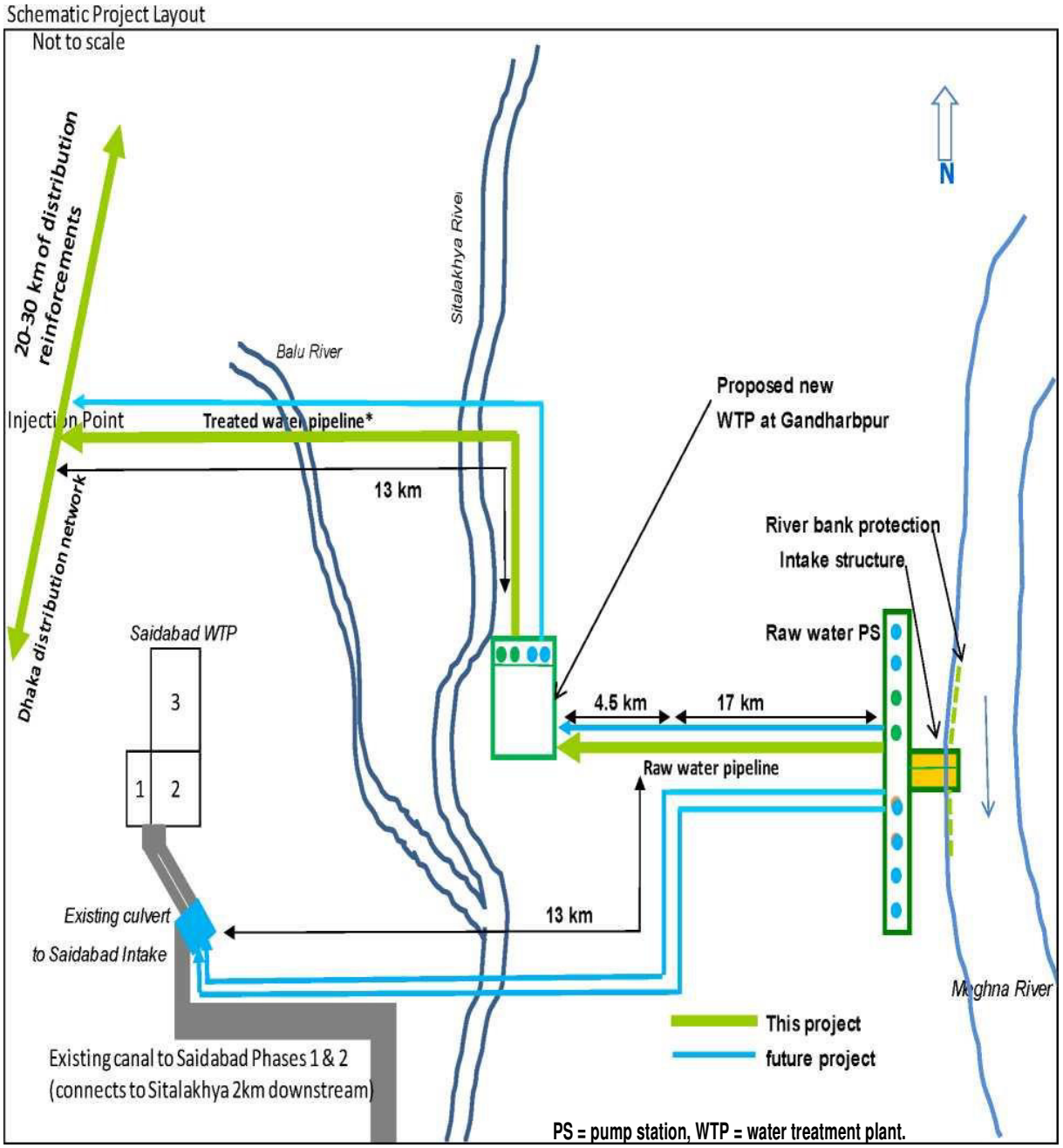


Figure 3-4: Schematic project layout plan

Table 3-4: Water supply from Gandharbpur WTP

Zone	Name	Population	%	Amount, MLD
04	Mirpur	537,300	36%	178
05	Gulshan	253,050	17%	84
08	Badda	536,621	36%	178
09	Uttara	179,907	12%	60
Total		1,506,878	100%	500

Treated water from Gandharbpur 1 WTP will be conveyed to the US Embassy injection point through one 2,000-mm pipe. This section will include (i) Gandharbpur WTP to Murapara Bridge (3 km), along the DWDB road, (ii) Sitalakhya River crossing by micro-tunneling method

(0.5 km); (iii) the west bank of Sitalakhya River to Balu River through open paddy fields for a length of 4.5 km, wherein the pipes shall be accommodated within a 25 m-wide corridor through open paddy fields; (iv) Balu River crossing at Baraid by micro-tunneling for a length of 0.25 km; and (v) Balu River crossing to Vatara near US Embassy for a length of 6.5 km within the RoW of Raidhani Unnayan Kartripakhaya (RAJUK), a 100-ft road.

Further, from the injection point, 1,000 mm-1,600 mm diameter feeder mains will be laid along major arterial roads, connecting at strategic points based on the Dhaka water distribution model designed and operated for DWASA by Institute of Water Modeling (IWM) under the Design Management Consultants (DMC).

3.6 Details of P2 component

Package 2 comprises of treated water transmission line from Gandharbpur WTP to the injection point. This 13km pipeline crosses two river entitled Sitalakhya and Balu River. It is a matter of concern that, both river ecology is very sensitive and treated as a protected area. Interestingly, MDSC of this project fully concern about those rivers ecology and they planned not hamper the river ecology. The micro tunneling technology will be used for laying the pipeline 12 m below the river bed and maintain the BIWTA specified compliance rule, undisturbed navigation and river ecology. That's why, micro-tunneling system planned to be incorporate here. Details of the micro tunneling system of this river Sitalyka and Balu presented Figure 3-5.

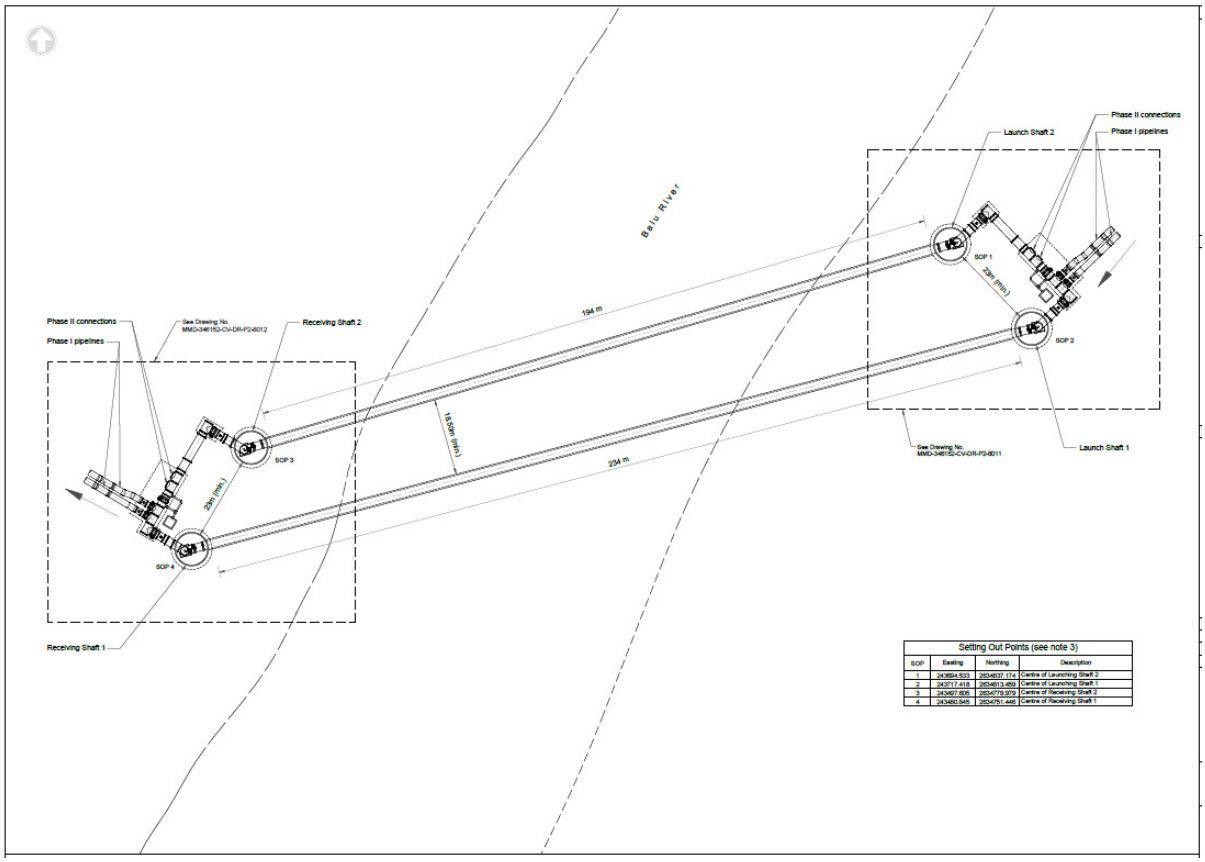


Figure 3-5: Micro tunneling system of P2 component

3.7 Details of the P3 component

Through analyses, the best location for the pipeline route in relation to the foundation conditions needs to investigate. The P2 component of the project is a transmission pipeline with 2x1.6m dia. starting from the Gandharbpur water treatment plant to the US Embassy. P3.1 is the primary distribution water pipeline with 1.4-0.8 m dia starting from US Embassy to Utarra DMA. P3.2 is the secondary distribution of pipeline with 0.4-0.8 m dia will be connected

to DMAs. This implies that the priority of 132 boreholes for P3. Location of the P3.1 & P3.2 is presenting in Figure 3-6**.**

Figure 3-6: Location of the P2, P3.1 & P3.2 components

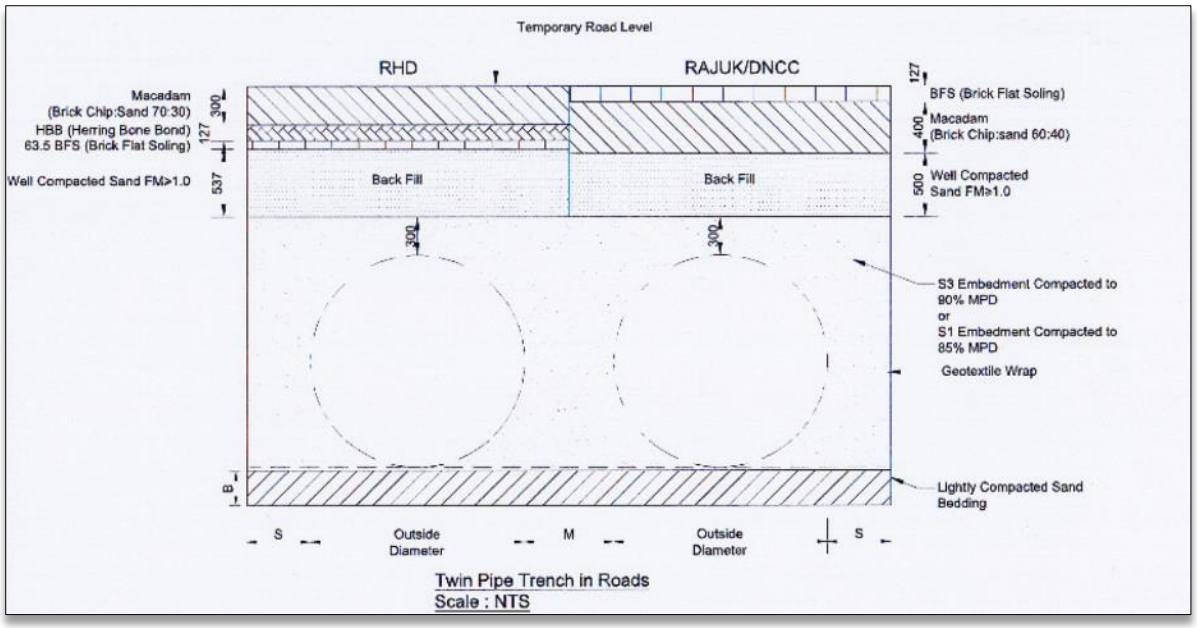


Figure 3-7: Twin pipe trench in roads scale in component 3

3.8 Project Activities and Schedule

A detailed project schedule listing all the project activities or steps and schedule in the form of Gantt chart has presented in **Appendix-4.** In order to run the geotechnical investigation,

several investigation objectives have souled.

3.8.1 Investigation Objective

- Pipeline design
- Bedding and backfill design
- Liquefaction assessment
- Suction/collapse assessment
- River crossing design
- Pipeline corrosively design
- In-ground concrete aggressively assessment
- (Unexpected) contamination

3.9 List of Equipment

For the execution of the drilling works, the Contractor shall at least use two drilling rigs continuously on site.

The drilling equipment usually consists of the following elements:

1. Drilling rig
2. SPT equipment
3. Cone penetration testing (CPT); incl. a seismic cone
4. Standpipe and standpipe piezometers
5. Hammer
6. Water tubing for sampling
7. PPE

The Contractor shall attach to his offer a complete list of his specific equipment and tools that he proposes to use during his works. This list shall include all borehole drilling equipment, performance data, manufacturer, and type of equipment. Assignment of the work to Contractor includes an approval of the list of equipment. However, Engineer may require additions or changes to this list, in case he necessary or useful for the proper performance of the work deems such changes or additions.

Several locations of the geotechnical investigation have test air (Figure 3-8: Schematic of project components intake, treatment plant and pipeline**)** presenting the final borehole location of the P2 & P3.1 and P3.2.

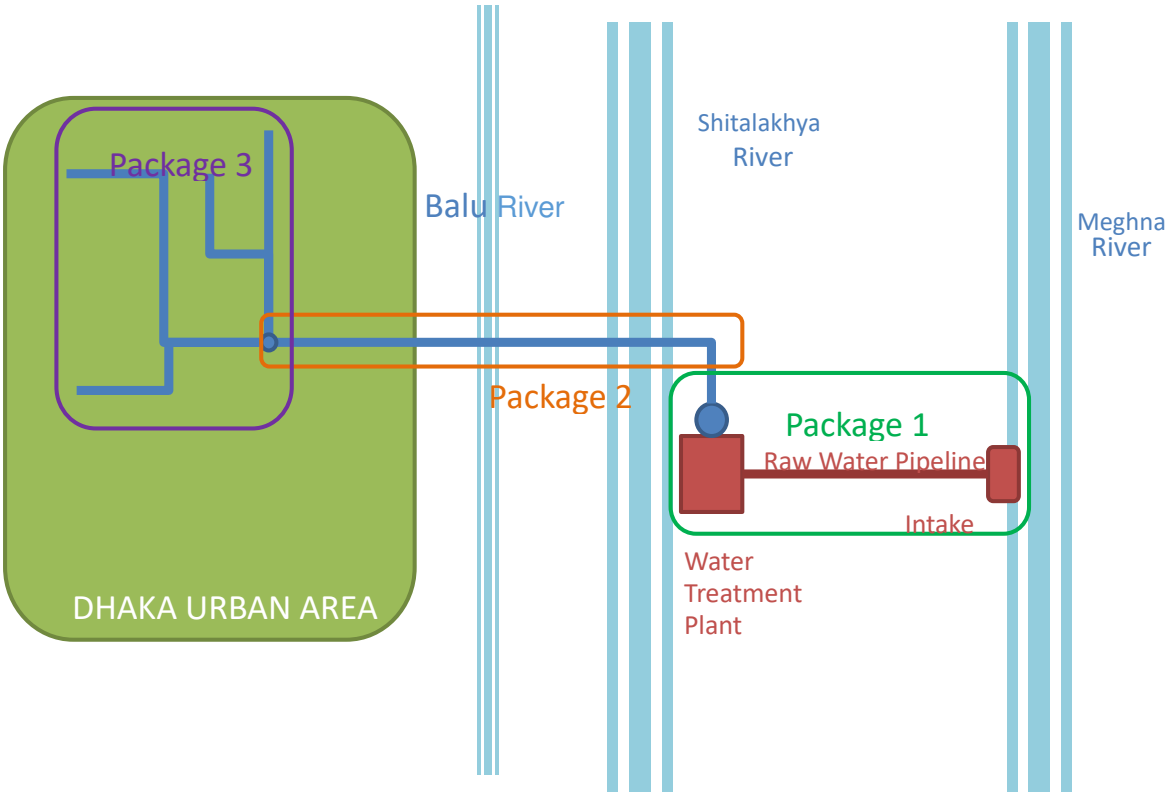


Figure 3-8: Schematic of project components intake, treatment plant and pipeline

The project activities related to package one that may produce environmental impacts or related to environmental issues can be listed below:

- **Planning stage**
  - Recruitment of DB Contractor
  - Survey Investigation for WTP at Gandharpur and pipe network
  - Preparation of EIA and obtaining Environmental Clearance
  - Preparation Resettlement Action Plan (RAP)
- **Design Stage**
  - Design Development for WTP at Gandharpur and pipe network
  - Incorporation of EIA recommendation to Design
  - Survey investigation including soil investigation
  - Implementation of land acquisition and RAP
- **Construction Stage**
  - Excavation and disposal of soil and debris
  - Relocation of utilities and allocation of utilities for construction
  - Transportation and storage of construction material at site
  - Land acquisition
  - River training at intake location for construction of intake (if any)
  - Construction of intake
  - Construction of water treatment plant
  - Construction of pump and layout of pipes
  - Construction of road along the pipe
  - Construction of bridge, culvert and other water regulating structures
  - Construction of other infrastructures

  - Supplies of utilities
  - Implementation of EIA recommended mitigation measures
  - Environmental monitoring
- Testing and commissioning of the treatment plant, pump station and pipe
- Operational stage
  - Uptake of water form Meghna River
- Environmental monitoring

3.10 Resources and Utility Demand

Existing power sources can use in intake and WTP sites for power requirements for electro-mechanical work. The contractor may arrange for portable power generator for works requiring a power supply in the pipeline construction.

Pumping station shall be able to operate 24 hours without disruptions. All pumping stations shall have a primary power supply and a backup power supply. In the feasibility study, it is assumed that primary power supply comes from the public grid with a backup system of diesel generators ensuring a swift changeover with interruptions of minor durations (5-10 minutes).

Existing road network and the navigation facilities will use to transport construction materials and equipment to Intake, WTP and pipe construction sites.

The contractor will arrange for water used in construction sites and labor-sheds from existing stream network and by installing STW for GW.

Construction of the road will require a lot of earth filling. The contractor will arrange for the bulk material (earthwork) by sand mining from existing streams or will get the earth by direct purchase from landowners.

Failure of components

There is always a risk of failure of individual components in pumping stations and treatment plants. The impact of such failure will minimize through:

- Redundancy of components and systems (stand-by pumps, redundancy of power supply).
- Use of high quality components from manufacturers with a known history for quality.
- Availability of spare parts
- Well-trained and efficient Operation and Maintenance organization.

3.11 Present Status of the Project

The project is now in initial stage. Preliminary and design of P2 and P3 package is almost completed. Engagement of DBO contractor for Package-1 (P1) is under process. Acquisition of land is under process. Physical development and construction works has not yet started which was observed during recent site visit on January 2018.

The project authority DESWSP of DWASA received the approval letter on 5th May 2015 of EIA report from DoE after submitting related document for Water Treatment Plant under Dhaka Environmentally Sustainable Water Supply Project (DESWSP) of Dhaka WASA. In the approval letter, it was mentioned in clause 16 that “The project authority shall apply for environmental clearance certificate along with NOCs from other relevant agencies for

operational activity to the Narayangonj District office of DoE at Narayngonj with a copy to the head office of DoE Dhaka.

During the preparation of EIA and approval period the project was not matured or framed of all the components of the whole project. A discussion meeting done on 12.01.2017 with Md. Nazmul Ahsan, Director Technical and Md. Shamsuzaman Sarker, Assist Director of DoE Dhaka regarding the Geotechnical Investigation study, changes of pipe dia and detail of component need update of EIA of approved EIA report. Mr. Ahsan and Sarker suggested that prepare and submit after update of EIA report under same memo issued of EIA approval letter. However, over the time all the six project component framed under three package P1 (3 components), P2 (1 component) and P3 (2 Components) of DESWS project. Distribution of pipeline work at Uttara framed as P3.1and P3.2 under package-3. During design stage, it changes the raw and treated water pipe diameter; perform geotechnical investigation borehole study for soil stability, suitability and safe design of pipeline. Hence, the update of the EIA is prepared as per requirement of all the component of the project for all the contractors. In order to fulfil the requirement of update of the approved EIA, the sub-consultant revised the report and updates the EIA considering all the environmental issues. Since the engagement of DBO contractor for P1 until not finalized, hence implementation of the project will get delay.

The project authority collected the No Objection Certificate (NOC) from relevant agencies for operational activity of the project **(Appendix-5)** and updated the EIA report. As per approval letter from DoE the project authority now applying with updated EIA report including No Objection Certificate (NOC) for issuing environmental clearance certificate to DoE district office at Narayangonj with a copy to Head office Dhaka.

3.12 Tentative Schedule of the Project Implementation

Project implementation entity will maintain all time schedule and management guided by the project management unit **(Appendix-4).**

4.0 BASELINE DESCRIPTION

4.1 Introduction

As part of the Environmental Impact Assessment (EIA) of the project, an environmental baseline survey carried out in areas surrounding the project site. The specific objectives of the baseline study were to gather information on the existing physical environment, biological-ecological environment and socio-economic environment of the areas in and around the project site to gather and assess peoples' perception on different aspects of the proposed project in and around the project area. The baseline survey report provides a detailed description of the existing conditions of physical, biological as well as the socio-economic environment in and around the project area. A Social Impact Assessment (SIA) and Resettlement Action Plan (RAP) have also been prepared for the DESWS project and are presented in separate covers.

This Chapter describes the existing physical environment of areas in and around the project site based on the baseline survey and other studies (e.g., water quality, air and noise level measurements) carried out as a part of the present study. Relevant information on climate, topography and drainage, geology and soils, hydrology and water resources, air quality, noise level, and water quality have been described in this Chapter.

4.2 Project Location

The package 1 of the project is raw water intake at the Meghna River with structure with 2000 MLD capacity along with 22 km raw water pipeline and new WTP at Gandharbpur having capacity 500 MLD. The project location is shown in the following Figure 4-1: Project location showing intake at Bishnondi, Meghna river to Gandharpur WTP -

Figure 4-1: Project location showing intake at Bishnondi, Meghna river to Gandharpur WTP

4.2.1 Topographic map

Topographic feature of this projected area and alignment are presenting in Figure 4-2: Topographic mapping of MDSC package 2 and 3; including package 1.

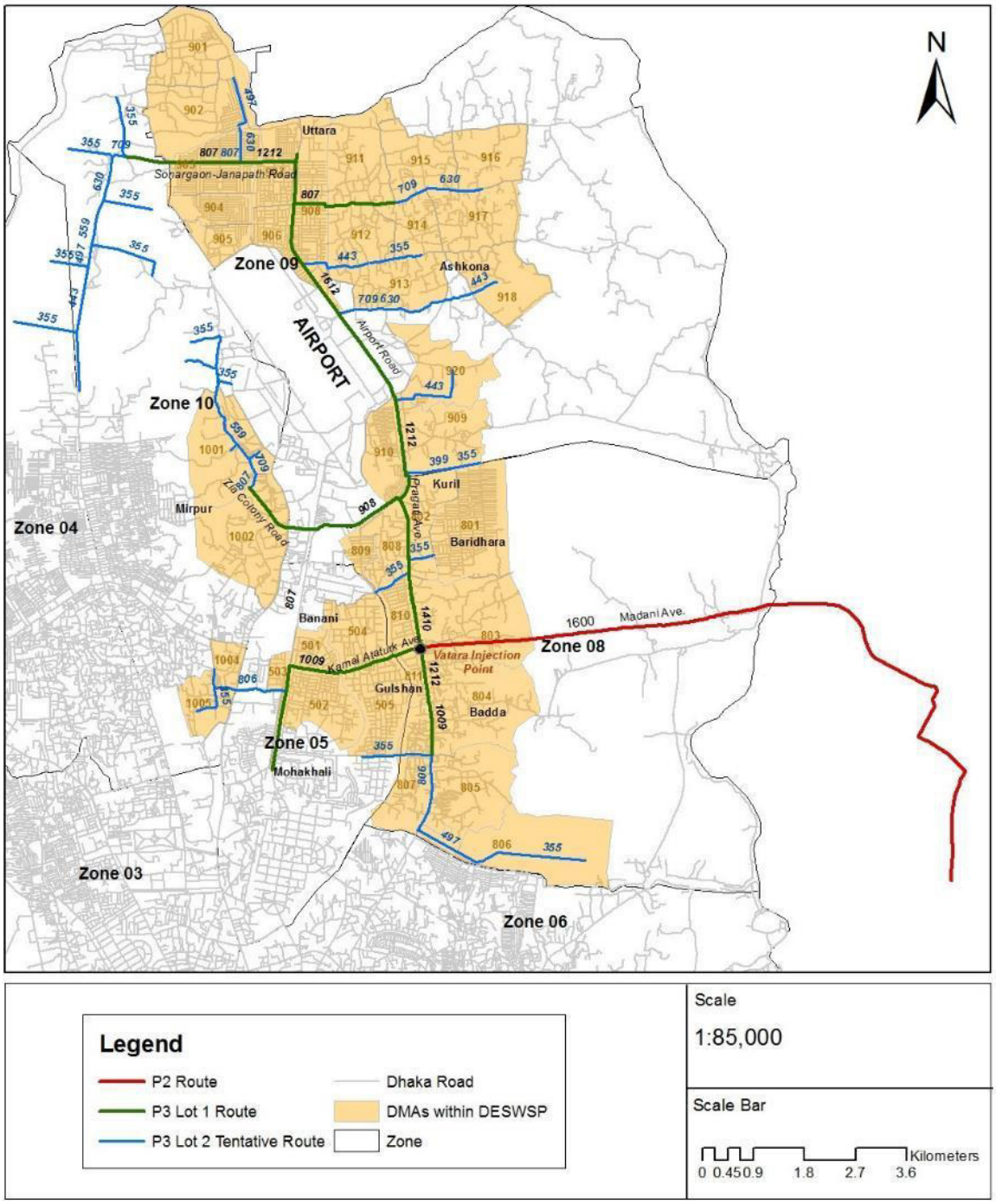


Figure 4-2: Topographic mapping of MDSC package 2 and 3; including package 1

The intake structure will be designed for the full design capacity of 2,000 MLD in the year 2030. The intake structure will receive raw water from the Meghna River, and the water will flow by gravity to the pump sump in the pumping station, located near the riverbank. The intake structure and the pump station shall be designed for the 100-year flood level and 50-year low levels in Meghna River. The intake structure serves as a pre-sedimentation chamber to settle larger particles. A pre-chlorination facility is also included in order to avoid organic growth in the transmission line. Coarse/Rough and fine screens will be included in the intake structure and at the inlet to the pump sump for removing coarse and fine suspended materials.

In Feasibility Study, the proposed abstraction accounts from Meghna River for only 0.6% of the lean flow for 2035, and about 0.2% of the maximum flow for 2035. These levels of abstraction are within the safe levels of the river and will not adversely impact downstream uses or adversely impact the ecological flows of the Meghna River.

The baseline is prepared considering the project activities and their possible impact on the physiochemical and biological environment (Table 4-1) as follows:

Table 4-1: Project activities and their possible impact

Activities	**Possible impact**
Design Stage	
Design Development for WTP at Gandharpur and pipe network	Social impact
Incorporation of EIA recommendation to Design	Social impact
Survey investigation including soil investigation	Social impact
Implementation of land acquisition and RAP	Social impact
Construction Stage	
Excavation and disposal of soil and debris	Impact on soil and water
Relocation of utilities and allocation of utilities for construction	Impact on soil and water
Transportation and storage of construction material at site	Impact on air, water and soil
Land acquisition	Social impact
River training at intake location for construction of intake (if any)	Impact on river flow and ecological
Construction of intake	Impact on river flow and ecological
Construction of water treatment plant	Impact on noise, air, water and soil
Construction of pump and layout of pipes	Impact on noise, air, water and soil
Construction of road along the pipe	Impact on noise, air, water and soil
Construction of bridge, culvert and other water regulating structures	Impact on noise, air, water, soil and ecological
Construction of other infrastructures	Impact on noise, air, water, soil and ecological
Supplies of utilities	Impact on noise, air, water and soil
Testing and commissioning of the treatment plant, pump station and pipe	Impact on noise, air, water and soil
Operational stage	
Uptake of water form Meghna River	Impact on river flow and ecological

4.3 Climatic Condition

Bangladesh is located in the central part within the Asiatic monsoon region where the climate is tropical. Relatively small size of the country and generally low-lying area cause moderate variation in terms of temperature, precipitation, relative humidity and wind speeds.

The region has a tropical climate. There are two marked seasons: the rainy seasons from May to October, during which more than 85% of the total annual rainfall occurs and the dry season from November to April. The beginning of the rainy season varies from year to year, heavy rains may commence anywhere between mid-April and early June and may end anywhere between the end of September and mid-November.

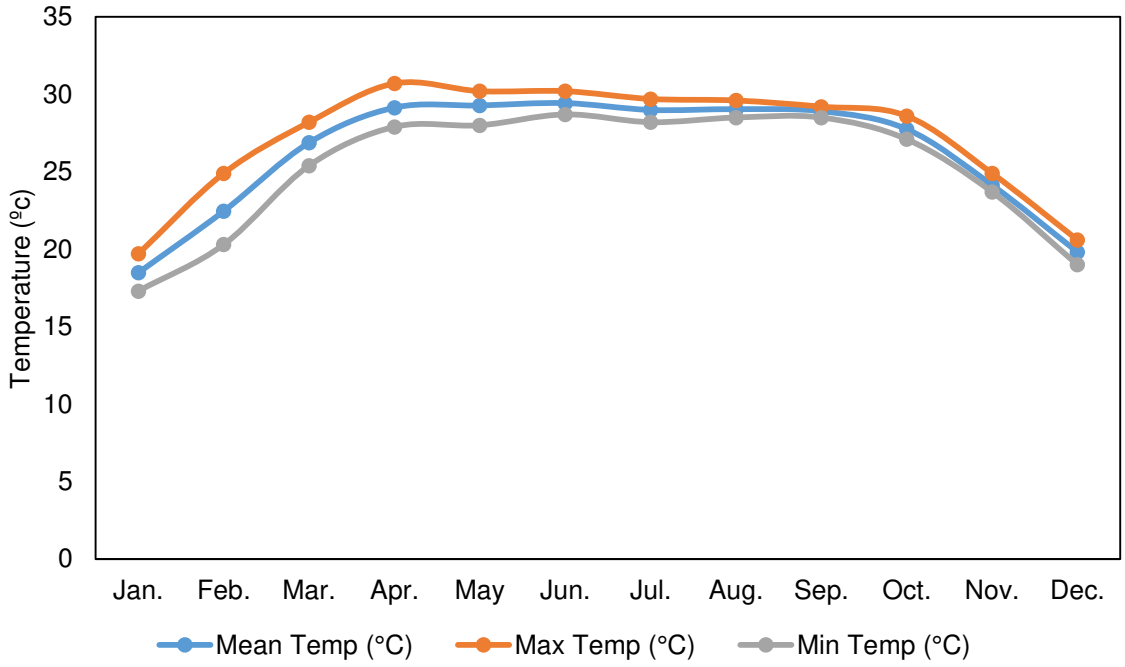
Different meteorological data like rainfall, temperature, relative humidity and wind speeds are described in the following sub-sections.

4.3.1 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. 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. The maximum temperature in summer season rises up to 40°C or more. 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 north-western part of the country.

From the previous 10 years monthly temperature data it can be observed that the minimum temperature was observed 17.3 degrees centigrade in January of 2011 and maximum temperature 30.7-degree centigrade was observed in April 2014. Monthly Average Maximum, Minimum and Mean Temperature during 2006-2016 shown in Figure 4-3.

Figure 4-3: Monthly average, maximum, minimum and mean temperature during 2006-2016

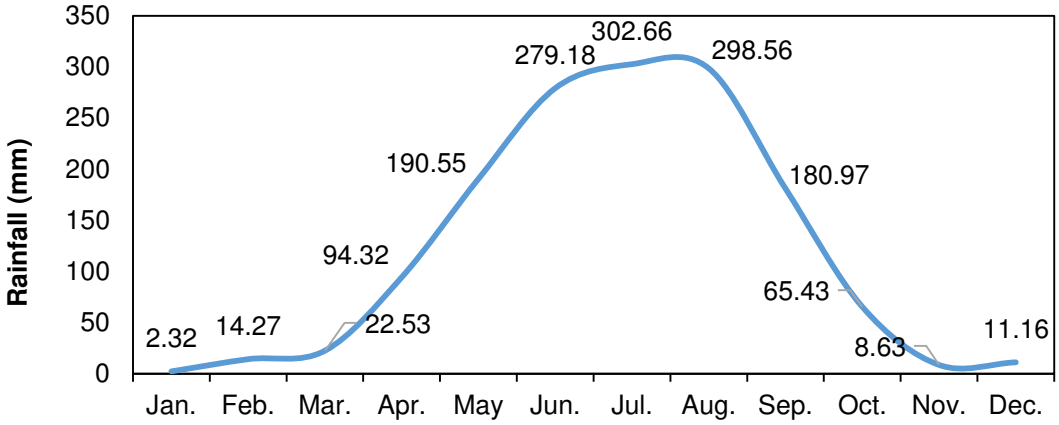


4.3.2 Rainfall

The single most dominant element of the climate of Bangladesh is the rainfall. Because of the country's location in the tropical monsoon region, the amount of rainfall is very high. However, there is a distinct seasonal pattern in the annual cycle of rainfall, which is much more pronounced than the annual cycle of temperature.

From the previous 10 years, monthly rainfall data it can be observed that the minimum average rainfall was observed 3.55mm in January and maximum average rainfall was observed 390.60mm in July. Monthly Average Rainfall Pattern during 2006-2016 shown in Figure 4-4.

Figure 4-4: Monthly average rainfall pattern during 2006-2016

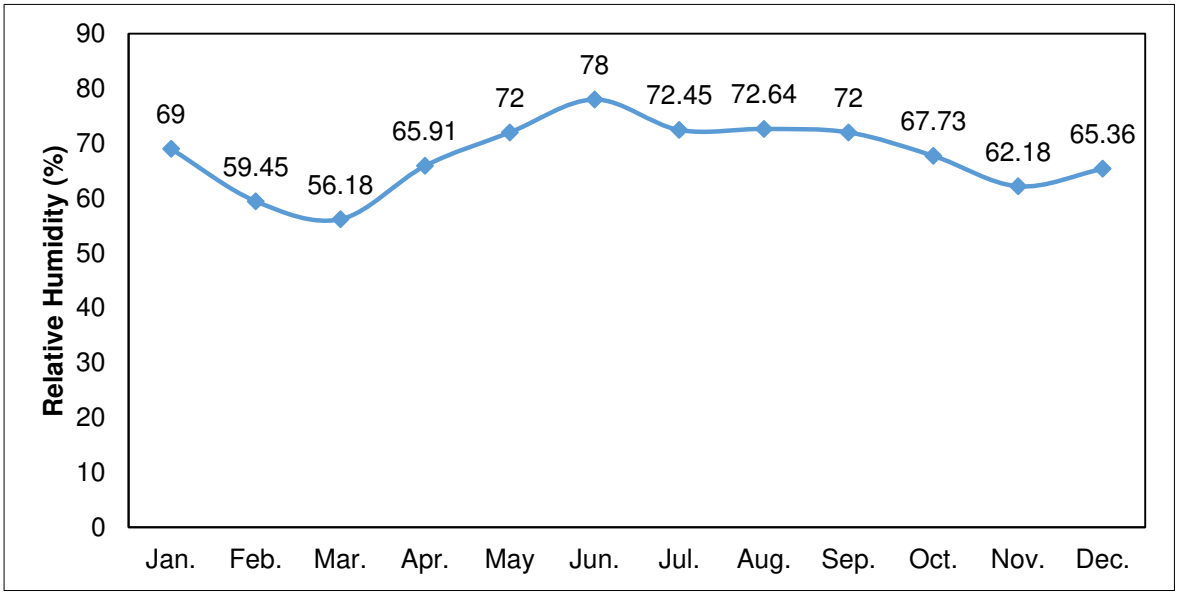


4.3.3 Humidity

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.

From the previous 10 years monthly humidity data it can be observed that the minimum average humidity was observed 56.18mm in March and maximum average humidity was observed 78.00mm in June. Monthly Average Humidity of the Project Site during 2006-2016 shown in Figure 4-5.

Figure 4-5: Monthly average humidity of the project site during 2006-2016



4.3.4 Wind speed and Wind direction

The predominant wind directions at the project site are from the south and southeast. From November to February, the wind directions are from north to northeast and from March to October, it is from south to southeast. It can be observed from **Figure 4-6** (a) and (b) that the maximum wind speed prevails during the month of May, which is 7.3 m/s.

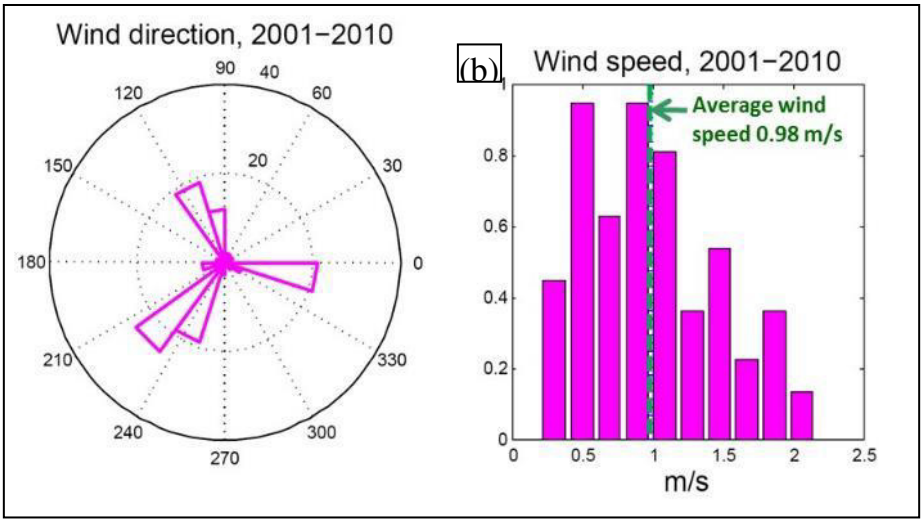


Figure 4-6: (a) Monthly maximum wind speed direction and (b) average wind speed 2001-2010

Source: Bangladesh Meteorological Department (BMD)

4.3.5 Storm

In addition, important factors of the weather in Bangladesh are the seasonal storm-events that can occur additional to the monsoon season:

- Tropical Storms do occur during the summer months from April until June and then from September until December. These cyclones occur almost every year in Bangladesh through their intensity varies from year to year.
- Tornados are common in Bangladesh as it is one of the most frequently hit countries in the world, behind the United States and Canada.

With regard to this meteorological data, the Contractor shall take care to avoid any inflow of surface water or precipitation water to the investigation or construction sites particularly trial pits, construction pits, boreholes, shafts etc.

4.3.5.1 Weather condition monitoring during sample collection

Field monitoring and collection required to consider weather condition also. Handheld mobile device used for analysis the field condition during sample collection. On time visual inspection, also take into consideration. Historical data collected form the Bangladesh Meteorological Department (BMD) that also uses for analysis.

4.4 Geology and Soils

4.4.1 Treated Water Mains and borehole locations for P2

The treated water pipeline transmission main starting from Gandharbpur Treatment Plant to Near US Embassy. Borehole and subsequent activities of the P2 are presenting in Table 4-2.

Table 4-2: Borehole and activities of the P2

Sl. No	Component	Activities of the components
1.	• P2 14 km of new pipeline from Gandharbpur to an injection point near US Embassy.	139 Boreholes • Pipeline; • Access road; • Access road earthworks; • River crossings and; • Ancillary pipeline structures and infrastructure; • Valves;

Sl. No	Component	Activities of the components
		• Thrust blocks.

The water supply from the Gandharbpur WTP will serve the population, as listed in the following Table 4-2.

Package P 3.1 and P 3.2 reinforcements starting from US Embassy to DMAs at Uttara and Airport areas. Various project elements of the P2 and P3 components are shown in Table 4-3.

Table 4-3: Borehole and activities of the P3.1 & P3.2

Sl. No	Component	Activities of the components
Package 3	• **P3.1 Distribution reinforcement** 23 km: within the existing network • **P3.2 Distribution reinforcement** 56 km: Small distribution pipe to DMA (Additional area)	132 Boreholes • Pipeline; • Access road; • Access road earthworks; • River crossings and; • Ancillary pipeline structures and infrastructure; • Valves; • Thrust blocks.

This IEE Report only covers the boreholes and all necessary activities in connection with the drilling of the boreholes. All other project elements have addressed in the existing and approved EIA Report.

4.4.2 Geology and Ground Conditions

Bangladesh covers a major part of the Bengal delta, one of the largest in the world. The Ganges-Brahmaputra delta basin or the Bengal basin includes part of the Indian state of West Bengal in the west and Tripura in the east. Dhaka is situated on the southern tip of a Pleistocene terrace, the Madhupur Tract. Two characteristic geological units cover the city and surrounding areas; the Madhupur Clay of the Pleistocene age and alluvial deposits of recent age. The Madhupur Clay is the oldest sediment exposed in and around the city area and characterized by reddish plastic clay with silt and very fine sand particles. This Madhupur Clay unconformable overlies the Dupi Tila Sand of Plio-Pleistocene age, which is composed of medium to coarse yellowish-brown sand and occasional gravel.

The channels and depressions within the city are floored by recent alluvial floodplain deposits and are subdivided into Lowland Alluvium and Highland Alluvium. The alluvial deposits are composed of fine sand, silt and clay in different combinations.

The area of the planned pipelines from the Treatment plant at Gandharbpur to the outskirts of Dhaka City will cross the Old Brahmaputra River (old river course before an earthquake changed the main course into the “Jamuna channel”), the Shitalakhya River and the Balu River. These rivers have had a significant impact on the geology and geotechnical properties of the soils because they cover the whole investigation area with alluvial deposits related to the old and new floodplains

The alluvial soils of these floodplains mainly consist of ridges of loamy material like silty clays and silty sands with large areas of shallow clays in the basins. The soil pattern can become more irregular close to river channels due to more recent deposits. With regard to the youngest activities (natural as well as anthropogenic) organic soils of swamps may be found locally as well as areas where the ground level has been raised using loose sands (hydraulic sand filling) dredged and pumped from nearby rivers. The Geological Map of Bangladesh is shown in Figure 4-8. In order to identify the Geology of the projected area several GI has run. Figure 4-7: Alignment of P2, P3.1 & P3.2 component of borehole geotechnical Investigation presenting the alignment of the projected area. Other geotechnical investigation map has presented in **Appendix 6.**

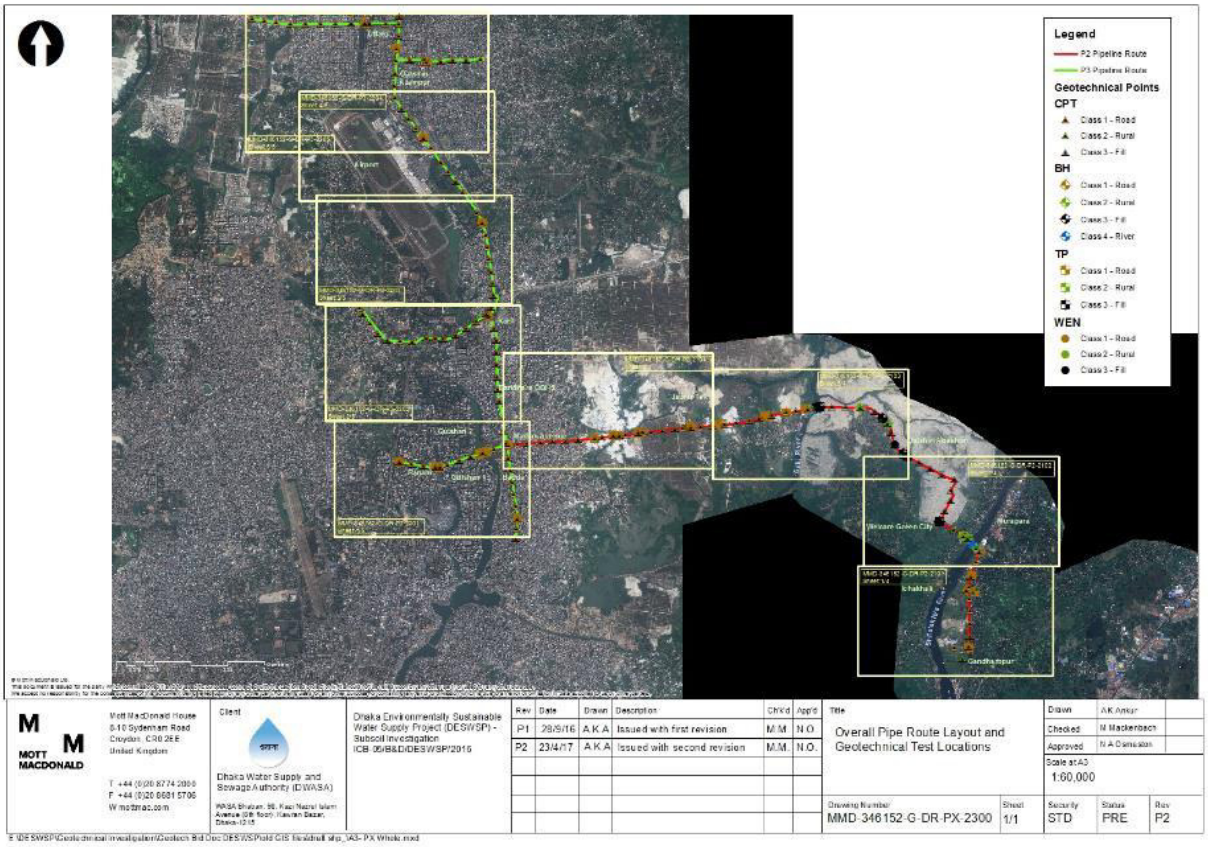


Figure 4-7: Alignment of P2, P3.1 & P3.2 component of borehole geotechnical

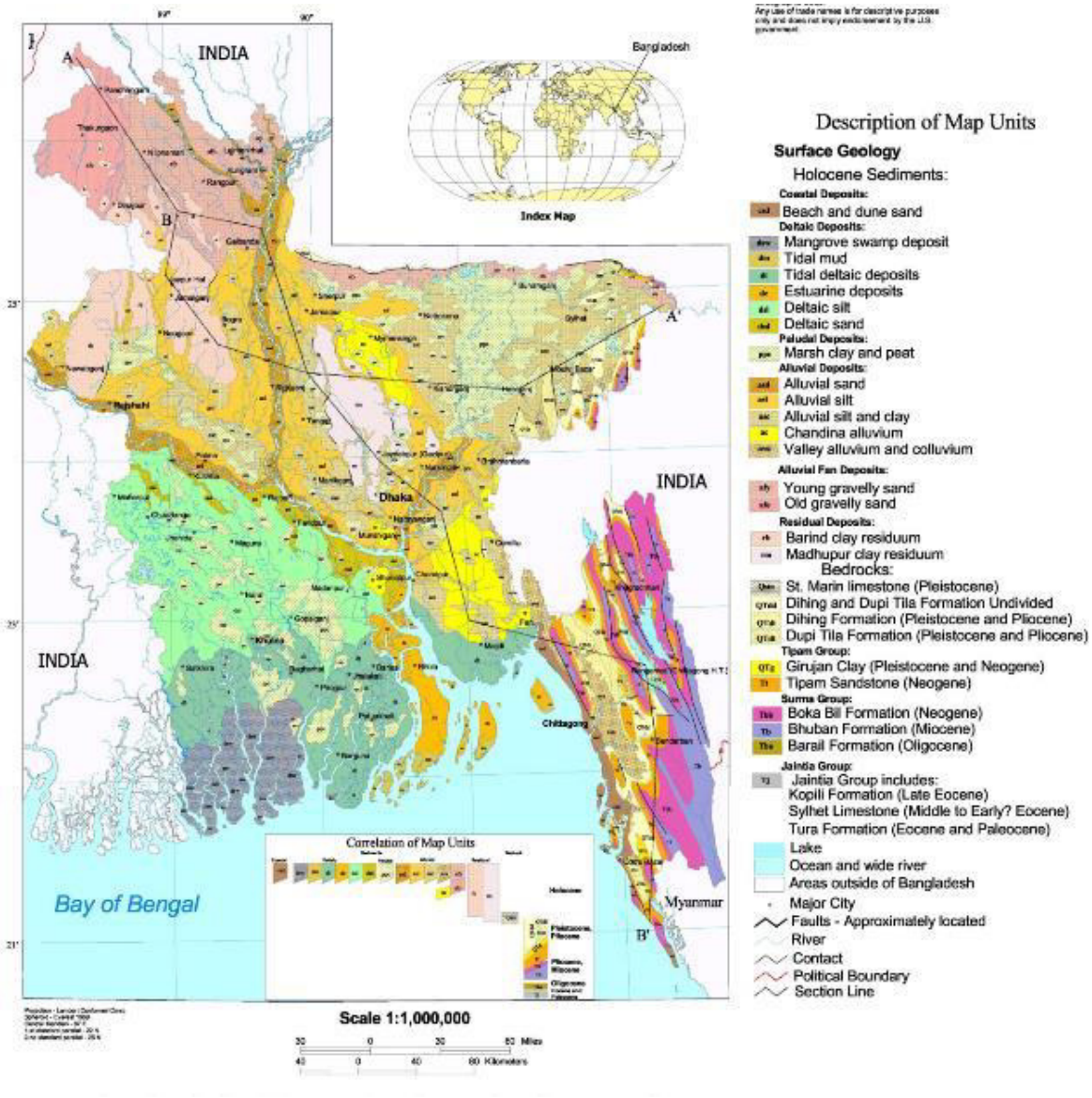


Figure 4-8: Geological map of Bangladesh

4.4.2.1 Tectonics

Tectonic framework of Bangladesh is divided into two major tectonic units: (i) Stable Precambrian Platform in the northwest and (ii) Geosynclinals basin in the southeast. A third unit, a narrow northeast-southwest trending zone called the Hinge Zone separates the above two units almost through the middle of the country.

The Dhaka city area does not show any surface folding. However, a large number of faults and lineaments strike N-S and E-W. Aerial photography interpretation and the nature of the stream courses recognize NE-SW and NW-SE trends. All four sides of the city are bounded by major faults. These faults are important as they contribute to the potential for a seismic activity affecting the Dhaka area.

The huge thickness of sediments in the basin is a result of tectonic mobility or instability of the areas causing rapid subsidence and sedimentation in a relatively short span of geologic time. The Geosynclinals Basin is subdivided into two parts, i.e; fold belt in the east and a foredeep to the west. The fold belt is characterized by folding of the sedimentary layers into a series of anticlines (upward folds) and synclines (downward fold).

So, the sedimentary layers are mostly horizontal to sub-horizontal and are free from major

tectonic deformation in the foredeep area covering the central part of the basin and this is expressed as a river to delta plain topography of the land.

The Madhupur Clay formation broke into several “fault blocks”, indicating previous fault activity in the deeply seated bedrock. Some faults and lineaments have been identified within Dhaka area (Ansary, Noor & Rashid, 2004):

- Baunia Lineament, west of Dhaka Zia International Airport, is characterized by sigmoidal fractures.
- Bansi Fault, marked by the Bansi River, in the West of Dhaka, is characterized by sharp fault scarps, hanging valleys, abnormal ground level and springs.
- Turag Lineament, marked by the Tongi River, in the North of Dhaka, is characterized by abnormal ground level.
- Madhupur Fault (NNW-SSE) has been observed to be associated by two earthquake epicenters of younger events with magnitudes between 6 and 7 (Hoque et al., 1994).

These faults should not directly influence the investigation and construction activities but they outline the high seismic and tectonic activities in the area and this must be considered (e.g. liquefaction of soils) in all packages of the project. Tectonic Framework of Bangladesh shown in Figure 4-9.

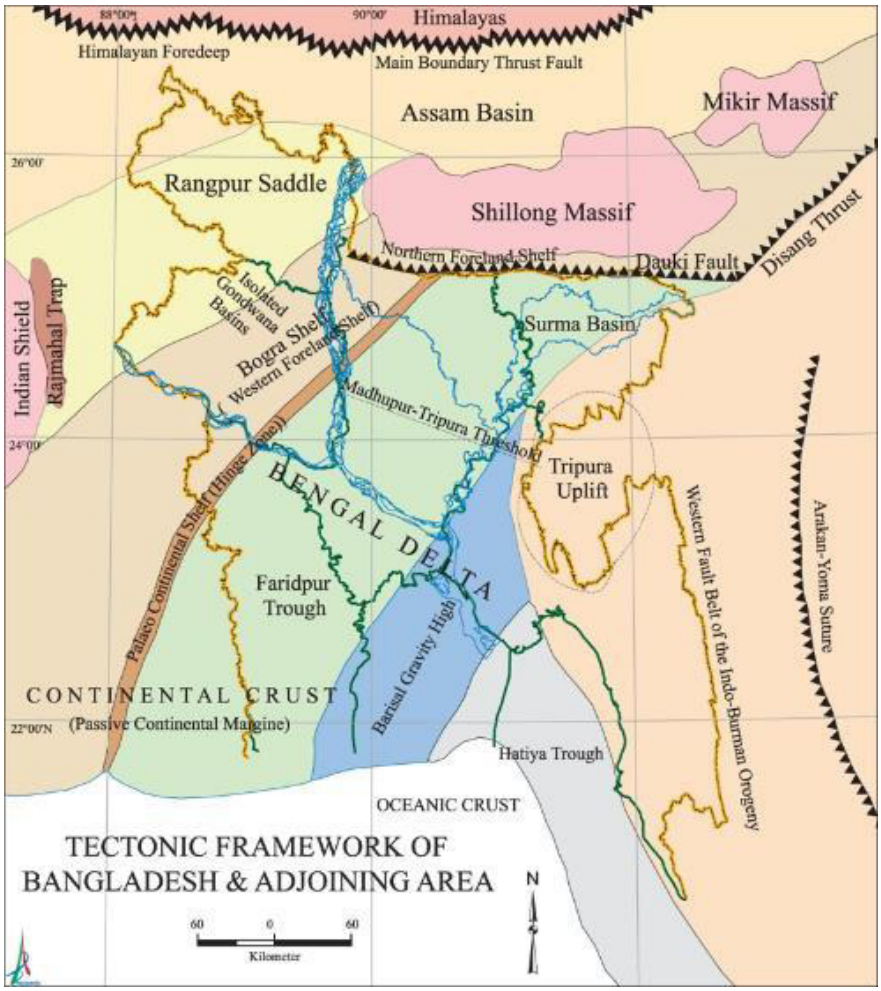


Figure 4-9: Tectonic framework of Bangladesh

4.4.2.2 Earthquakes

Bangladesh lies in the Burma basin, which was formed by the continent collision of India to the North, and subduction of ocean crust beneath the Burma continental crust to the east. Bangladesh is surrounded by regions of high seismicity, which include the Himalayan Arc and Shillong Plateau in the North, the Burmese Arc, and the Arakan Yoma anticlinorium in the

East. The country has a long history of seismic activity related to its proximity to the Himalaya.

In addition to flooding, the city of Dhaka can be severely affected by earthquakes as it has already happened in the past. Intensities of VI, VII, and VIII have already been registered in the city. The National Building Code of Bangladesh (BNBC 1993) includes three seismic zones, and Dhaka is located on the second one with a zoning coefficient equivalent to the 15% of gravity (z=0.15g). The maximum magnitude close to Dhaka in 1990 was 7.5. (Richter).

Some of the most spectacular examples of earthquake damage have occurred when soil deposits have lost their strength and appeared to flow as fluids. In this phenomenon, termed liquefaction, the strength of the soil is reduced, often drastically, to the point where it is unable to support structures or remain stable. Because it only occurs in saturated soils, liquefaction most commonly observed near rivers, bays and other bodies of water. Liquefaction phenomena can affect buildings, bridges, buried pipelines and other constructed facilities in many different ways.

The intent of the seismic zoning map is to give an indication of the Maximum Considered Earthquake (MCE) in different parts of the country. In probabilistic terms, the maximum considered earthquake motion might be considered to correspond to having a 2% probability of exceedance within a period of 50 years. The country divided into four seismic zones with different levels of ground motion. Table 4-4 includes a description of the four seismic zones. Figure 4-10 presents the boundaries of the four seismic zones. The project located in seismic zone 2, which is a moderate seismic zone. Seismic zone coefficient of zone 2 is 0.20 and seismic zone coefficient of Narayanganj is 0.20.

Dhaka is located in a seismic zone II[5] , referred to as the medium risk zone for an earthquake. In the medium-risk zone, shocks of moderate intensity are possible, with a probable maximum magnitude of 6-7 on the Richter scale. Seismic events in Bangladesh are relatively infrequent, but historically, have been severe, such as the earthquakes of 1930 and 1950 that caused widespread damage throughout the country, and the earthquake of 2004 that damaged large parts of Dhaka City. To address any potential impacts due to seismic activities, provisions of the Bangladesh National Building Code (BNBC) 1993 and 2006 shall be strictly followed in the detailed designs of project components, apart from consideration of seismic vulnerability in the specifications for the design and construction of the works, including the choice of pipe materials and pipe-laying methods for the transmission mains.

Table 4-4: Seismic zones of Bangladesh

Seismic Zone	Location	Seismic Intensity	Seismic Zone Coefficient, Z
1	Southwestern part including Barisal, Khulna, Jessore, Rajshahi	Low	0.12
2	*Lower central and Northwestern part including Noakhali, Dhaka, Pabna, Dinajpur as well as southwestern corner including Sundarbans.*	*Moderate*	*0.20*
3	Upper central and northwestern part including Brahmanbaria, Sirajganj, Rangpur	Severe	0.28
4	Northwestern part including Sylhet, Mymensingh, Kurigram	Very Severe	0.36

Figure 4-10: Seismic zoning map of Bangladesh

4.4.2.3 Liquefaction

Liquefaction does not occur at random, but is restricted to certain geologic and hydrologic environments, primarily recently deposited sands and silts in areas with high ground water levels. Generally, the younger and looser the sediment, and the higher the water table, the more susceptible the soil is to liquefaction. Sediments most susceptible to liquefaction include Holocene (less than 10,000-year-old does) delta, river channel, flood plain, Aeolian deposits, and poorly compacted fills.

Liquefaction has been most abundant in areas where ground water lies within 10m of the ground surface; few instances of liquefaction have occurred in areas with ground water deeper than 20m. Dense soils, including well-compacted fills, have low susceptibility to liquefaction.

The liquefaction phenomenon by itself may not be particularly damaging or hazardous. Only when some form of ground displacement accompanies liquefaction or ground failure is it destructive to the built environment. For engineering purposes, it is not the occurrence of

liquefaction that is of prime importance, but its severity or its capability to cause damage. Adverse effects of liquefaction can take many forms. These include:

- flow failures
- lateral spreads
- ground oscillation
- loss of bearing strength
- settlement
- Increase lateral pressure on retaining walls.

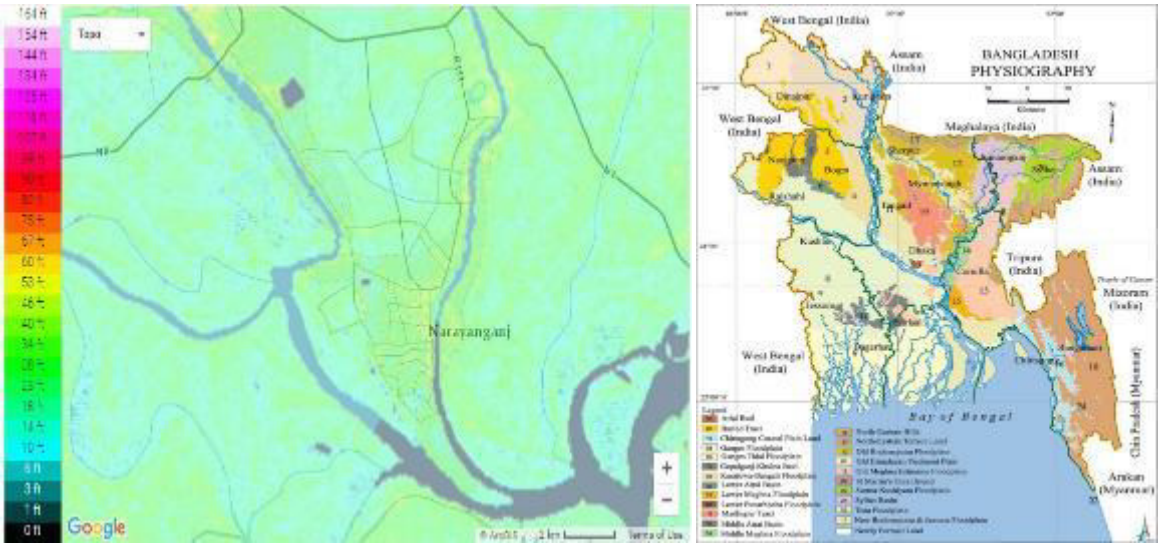
4.4.2.4 Topography

Dhaka is located mostly on river deposits at the southern fringe of the Madhupur Tract, which is an elevated Pleistocene inlier. Large parts of the city are located on this inlier, which is surrounded by very young riverine sediments occupying the surrounding valleys. The elevation of the inlier tract varies from 2 to 14 m above mean sea level, and the drainage patterns within can be either dendritic or trellis. The terraces are surrounded by the Ganges-Meghna floodplain in the south, the old Brahmaputra floodplain in the east, and the Jamuna floodplain in the west.

The topographic elevation in the project area is reflected in specific landforms as “high” lands, lowlands, depressions, and abandoned channels. Around the outskirts of Dhaka, the rivers Buriganga, Turag, and Balu drain a complex of low areas, which are a system of low-lying alluvial plains. The average elevation here is less than 2 m above mean sea level. Broad streams cut through the central high area and fall into this unit. The broad streams are locally known as *khals*, and the broad depressions are called *bils*.

The project area is spread over the Madhupur tract and old Brahmaputra Flood plain. Figure 4-11: Topographic feature (a) and topographic view (b) of Bangladesh and the project area.

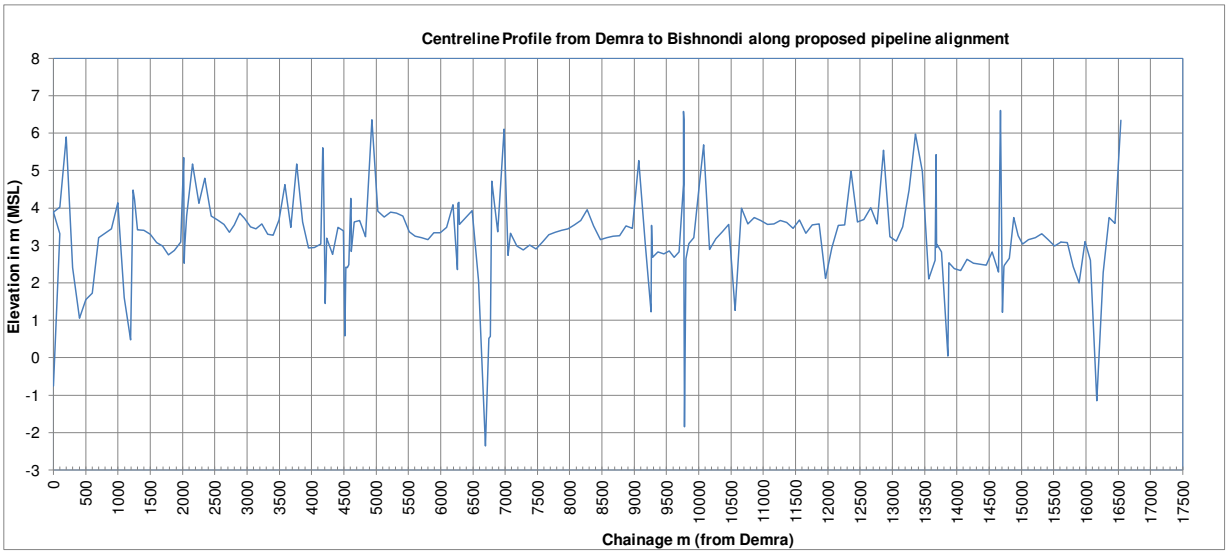
Figure 4-11: Topographic feature (a) and topographic view (b) of Bangladesh and the project area.



4.4.3 Soils

Land profile from Demra to Bishnondi at the intake point along the proposed pipe line alignment is shown in the figure. It shows that average elevation of the land is in between 3-4 m above Mean Sea Level (MSL). Table 4-5: Land profile from Demra to Bishnondi along proposed alignment of pipeline *illustrating.*

Table 4-5: Land profile from Demra to Bishnondi along proposed alignment of pipeline



Source: GPS DATA WGS 84

The proposed site is a part of the mid-lower Ganges-Brahmaputra River floodplain as per the national classification. In this region, the soil is predominantly silty with silty loams on ridges and silty clay loams in depressions.

Since the treatment plant is proposed to be constructed on low land, earth filling will be required to raise the height of the plinth above the flood level.

(A detailed geologic profile along the pipe-line is provided in **Appendix-7.)**

4.5 Hydrology and Drainage

4.5.1 Surface Water Resources

The river system in the Dhaka watershed includes Dhaleswari, Turag, Tongi Khal, Buriganga, Balu, Bangshi, and Shitalakhya Rivers. Dhaka is primarily surrounded by three rivers: Buriganga on the southwest, Turag in the northwest, and Balu in the northeast. The Shitalakhya River flowing by the southeastern part of Greater Dhaka is also included in the surrounding river system. More than 40 canals within the city were originally using for drainage.

Dhaka region is in the natural floodplain of the various rivers in the area, and functioned as an important breeding ground for many aquatic species in the past. This function is still evident in the seasonal flooding that affects large parts of the city. The floodplain function has been further degraded by the construction of embankments to protect the city from flooding, and particularly from infilling to reclaim land, which reduces the water retention capacity of these areas and increases flooding both upstream and downstream.

Due to encroachment and disposal of solid and liquid wastes into these canals, several areas of the city have become vulnerable to water logging. All the rivers receive untreated sewage and industrial liquid wastes and municipal waste through the major canal systems, as well as from direct disposal. The surface water quality in the two river systems and other surface water bodies, e.g. *khals* and ponds, is quite poor with very high biological oxygen demand (BOD), chemical oxygen demand (COD), and *E-coli* content, indicating discharge of untreated industrial effluents and domestic sewage. The organic pollution of the rivers is mainly caused by the poor state of sewerage and sanitation systems of the Dhaka urban area.

The most polluted water bodies are the Buriganga and Shitalakhya Rivers, Tongi Khal, and the canal system in Dhaka East, where very low dissolved oxygen levels of 1.5-4 mg/l reflect contamination caused by organic waste, domestic sewage, and chemical residues from factories. These water bodies are almost biologically dead during the dry season. The high BOD levels of 10-30 mg/l in the Buriganga and Shitalakhya Rivers (the standard BOD is 6

mg/l) reflect mainly the high density of untreated industrial wastewater discharged into the rivers. Some tidal backflow of relatively clean water from the Meghna and Dhaleswari Rivers results in dilution of contaminants in the southern reaches of both the Buriganga and Shitalakhya Rivers, to a limited extent. The high ammonia levels, particularly in the canal system in Dhaka East, the Balu River, and the southern reaches of the Buriganga River reflect the discharge of sewage into these waterways. Ammonia in Dhaka East area increases from 0.3 mg/l in October to more than 20 mg/l in March-April, almost 20 times higher than the national environmental quality standard (1.2 mg/l). The index of water pollution in the rivers of Dhaka is illustrated in Figure 4-12 below.

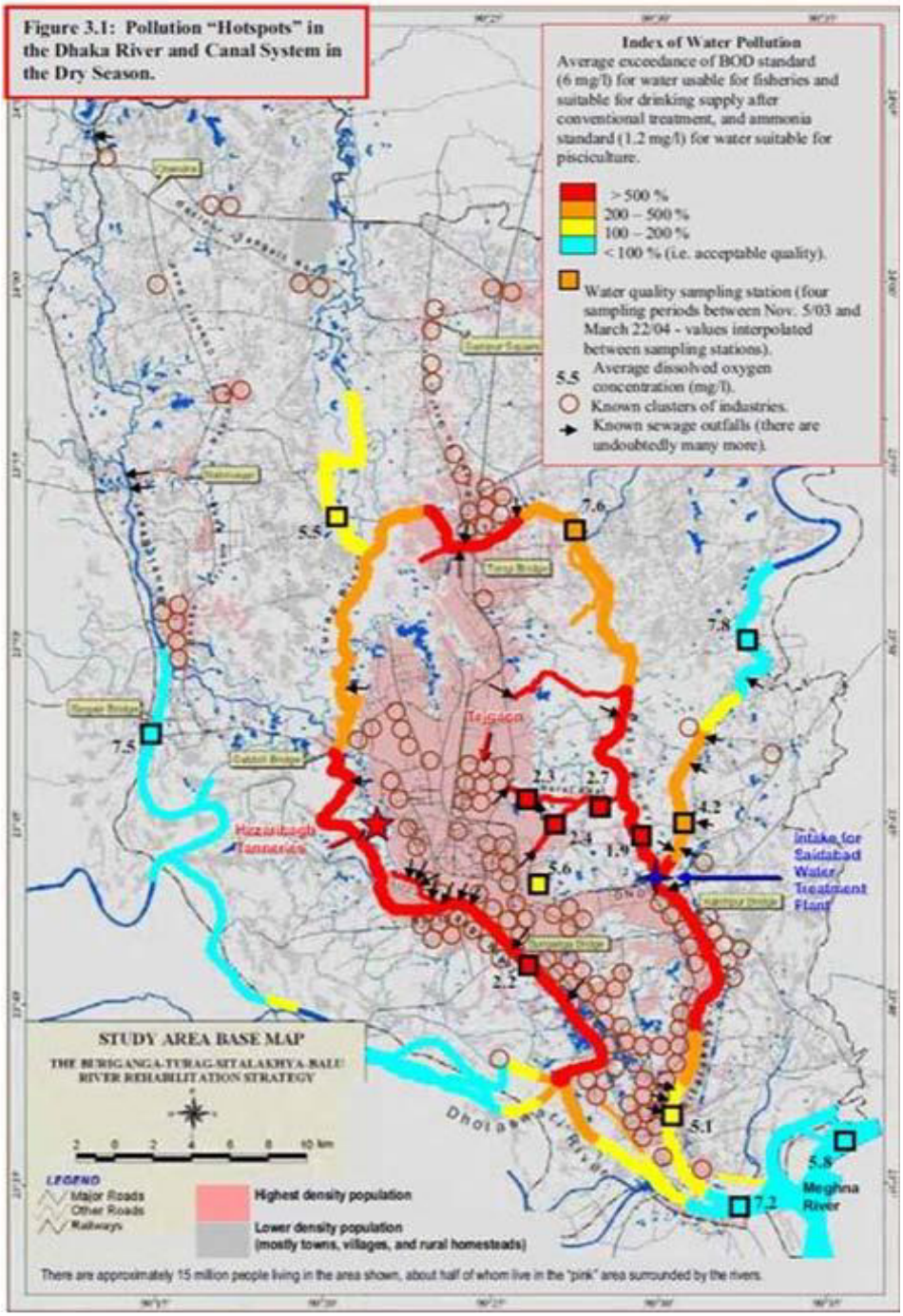


Figure 4-12: Index of water pollution in Dhaka rivers

Source: Dhaka Metropolitan Development Plan, SEA, 2007.

Given the high pollution levels in the Dhaka rivers, in line with the provisions of the ECA 1995

(Section 5)[7], through a gazette notification dated 1 September 2009, the High Court declared the four rivers surrounding Dhaka, namely Buriganga, Turag, Balu, and Shitalakhya, as ecologically critical areas. Subsequently, pollution-creating activities detrimental to the water and aquatic life in those rivers have been declared forbidden.

The proposed treated water mains from the Gandharbpur WTP cross Shitalakhya at Murapara and the Balu River along the RAJUK road leading to the US Embassy. Consultations were held with the DoE on the clearance requirements for laying transmission mains at these river crossings. There is no management plan prepared for the four rivers of Dhaka, and specific protocols or management actions for taking up infrastructure activities around these rivers have not been laid down. While no specific clearance requirements exist for interventions/activities around these four rivers, it was explained that control of pollution, hunting, disposal of wastes, etc. were to be taken care of by project proponents. Accordingly, projects shall incorporate specific measures in addition to adoption of good engineering and construction practices so as to ensure that there is no significant impact on the watercourses.

4.5.1.1 Hydrological consideration

Based on data taken at Bhairab Bazar (approximately 20 km upstream from Bisnondi) gauging station from year 2000 to 2009, it was possible to carry out an approximate statistical determination of the flows in Meghna as

Q95= 3815 m^3/s

Q05=11630 m^3/s

Q50= 4037 m^3/s

The highest recorded flow in Meghna was reported in 1988 as 19500 m^3/s at Bhairab Bazar. It has been reported that low flows during dry season may reach 2500 m^3/s Figure 4-13.

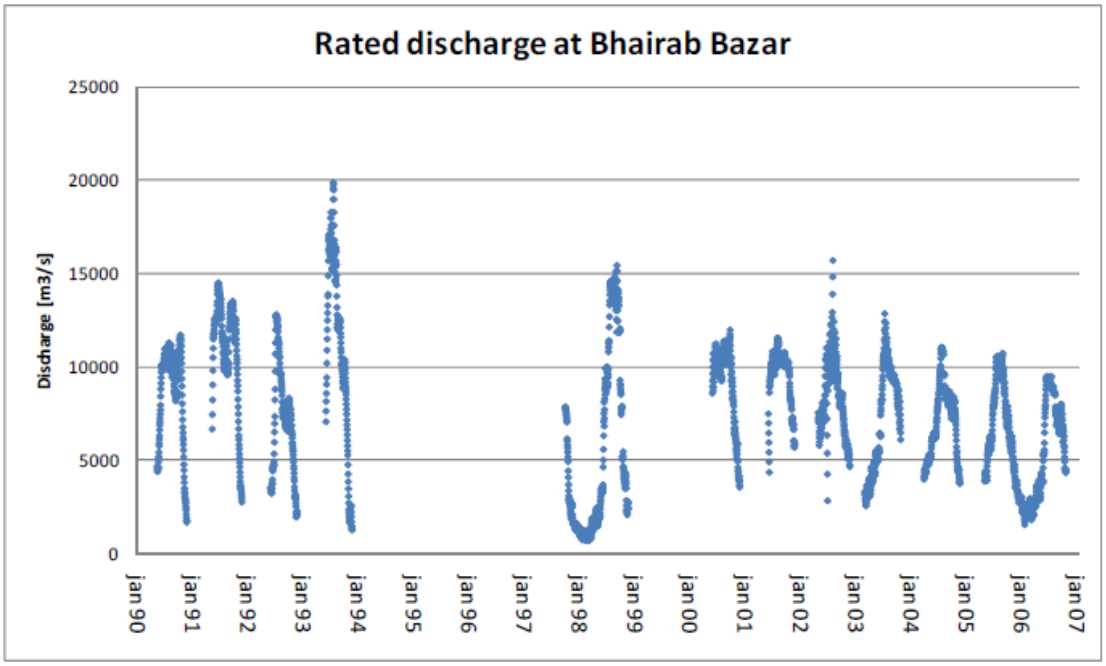


Figure 4-13: Discharge at Bhairab Bazar (approximately 20 km US from Bishnondi)

The analysis of the water level data (1999-2009) obtained from BWDB Gauge station at Meghna River Narsingdi (2 km upper than Bishnandi) is shown in the following Figure 4-14 &

[7] Section 5 of ECA, Declaration of Ecologically Critical Areas, specifies that (1) if the government is satisfied that, due

Figure 4-15 for high tide and low tide.

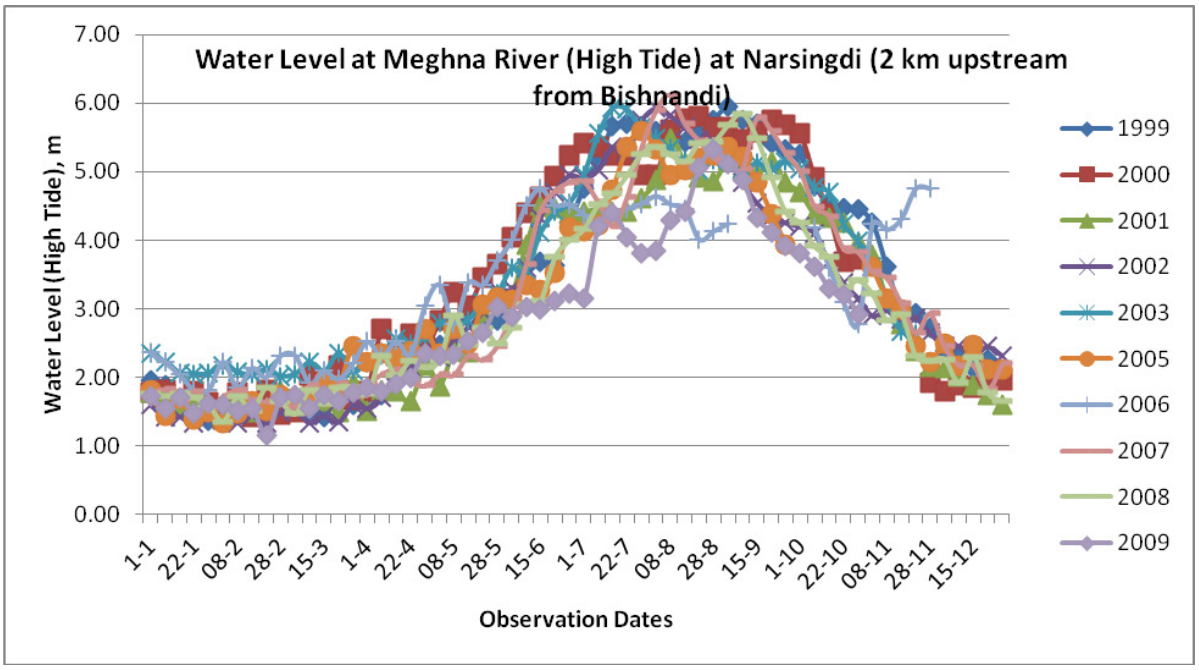


Figure 4-14: Temporal water level data for high tide at Narsingdi (2 km u/s of Bisnandi)

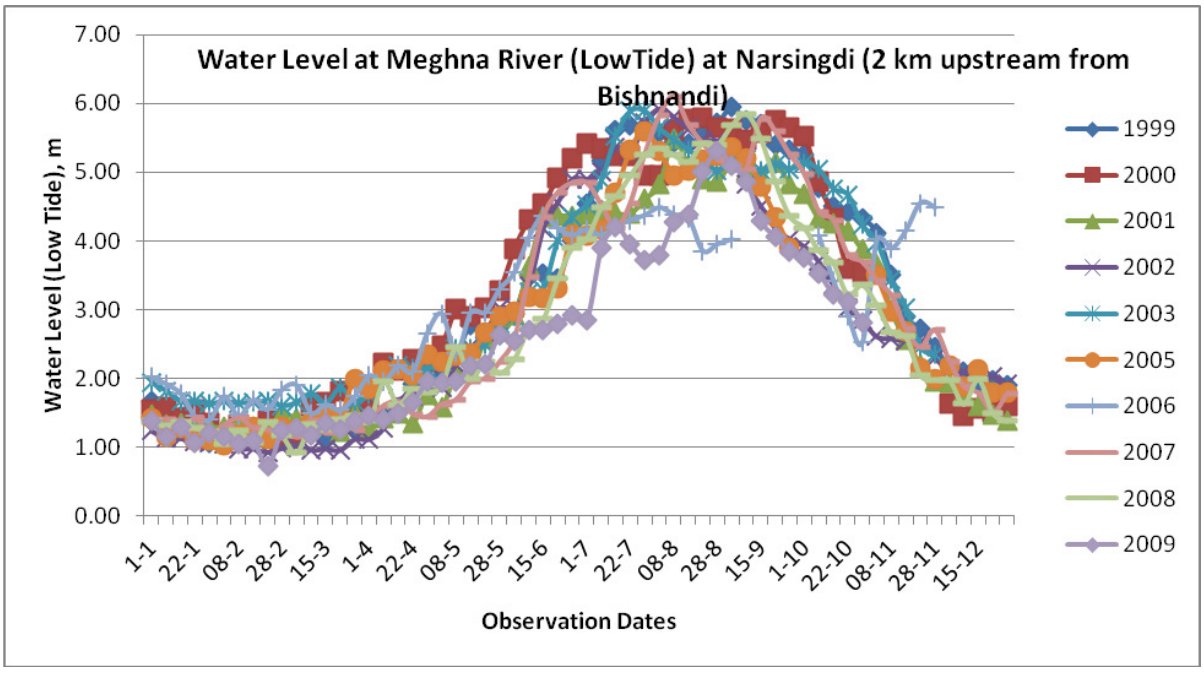


Figure 4-15: Temporal Water level data for low tide at Narsingdi (2k, u/s of Bisnandi)

Since there are no water level measurements at Bishnondi on the Meghna the water level variation has been obtained in the Feasibility Study from the General Model (MIKE11 model) of Bangladesh available at IWM. The model has been run for a period of 20 years, from 1987-2006 using topography and calibration data from 2000. The model is calibrated/validated from year to year. However, when running a long continuous period, a single set of model parameters is used. This means that the model results may be less accurate in some years than in others. Moreover, the model has results stored at daily intervals, wherefore the minimum water levels will not be accurate since these are tidally influenced.

Despite of these deficiencies it is necessary for design purposes to apply maximum and minimum water levels with 50-year and 100-year return period. Such values have been derived from the model results. The 50-year and 100-year maximum have been determined to be 7.75 m and 8.20 m respectively. The 50-year and 100-year minimum have been determined to be 1.18 m and 1.07 m respectively. The statistical method applied is most promising for the maximum determination, and less good for the minimum prediction. The latter is due to the tidal influence on the water level during the dry season. It should be emphasized that the data behind the analysis stem from a mathematical model which is only partly calibrated, thus the actual values may in reality vary.

The water levels in the Meghna vary approximately 4-5 metres throughout the year. This has significant impact on the shape of the river channels and the stability hereof. The variation in water level in two distinct seasons, dry-and wet season, means that a clear dry season and a wet season channel can be identified along the rivers. One effect of this is that the bed shear stress in the vicinity of the banks during the wet season is larger than if the channel was u-shaped. Another effect is that the wet season banks are not as high as if the rivers have u-shaped cross sections.

4.5.2 Navigation

In the project area navigation facility is available and the pipeline alignment is crossing the Balu and Shitalakhya River. During the borehole investigation, which takes place only punctual and short-term, the location will be demarked for awareness and information and hence navigation will not be affected. After the completion of the geotechnical investigation (GI) work the small area disturbances will be gone and navigation can freely move in the Shitalakhya and Balu River.

4.5.3 Results of former investigations

The soil profile on the western bank of the Meghna River shows primarily alluvial fine sand with different portions of silt. Following the transmission line in western direction up to the Shitalakhya River the pipeline will pass from a zone dominated by alluvial sand into a zone where the soil profiles are dominated by alluvial silt. This silt varies between pure silt, sandy silt and clayey silt and shows often an inhomogeneous composition in the horizontal as well as in the vertical distribution. After the Shitalakhya River, the pipeline is passing the floodplain of the Balu River and reaching the area of Dhaka the surface covering materials change to more clayey character, typical for the Madhupur clay residuum as well as for the marsh clay and peat of the Paludal sedimentation.

In the area of the Old Brahmaputra River the investigations describe a large variety in soil profile compared to “general assessment as alluvial silt” as a top layer of 3m – 5m thickness that is overlaying an approx. 30 m thick sand layer.

The earlier investigation for the feasibility study of the Dhaka Water Supply Sector Development Project 2010/2011 (DWSSDP) indicates that the floodplains of Old Brahmaputra River and Balu River show a more clayey silt to silty clay characterization and the floodplain of the Shitalakhya River shows a more sandy silt to partly clayey silt sedimentation.

In the area of Dhaka, the drill profiles show a wide range of more clayey layers at the top with thicknesses ranging from some meters (2m-3m) up to more than 20m overlaying silty to sandy sediments up to 25m thick (and more). Locally various sediments (fine sand, silt, clay) of the valley alluvium and colluvium overlay the clayey sediments.

Everywhere the natural stratigraphic sequence can be overburdened by anthropogenic material of land fillings (sands) and of city building activities (waste, rubble, sealing etc.).

As the subsoil shows highly inhomogeneous conditions and the current pipeline is far away from the areas that were investigated in the DWSSDP feasibility study a detailed summary of the above-mentioned study has not been carried out.

Nevertheless, it can be summarized that:

- The subsoil shows a wide range of loose materials e.g. fine sand, silt and clay. The composition is very inhomogeneous and the conditions can change fast and often (horizontal, vertical).
- The bulk densities can be very low (SPT N < 5) up to depths of more than 10m.
- Liquefaction (as geotechnical hazard) must be taken in consideration, especially in the saturated zone of poorly graded sand and silts.
- Although the most former investigation does not show any organic soils it cannot be ruled out that such soils occur locally. It is recommended that organic soils (peat etc.) are not approved for any foundation.

4.5.4 Groundwater Resources

The current information of the groundwater situation in the area of the pipeline is not comprehensive. The groundwater situation in the area of Dhaka and in the eastern floodplains is quite different. The groundwater level in the eastern areas is close to the ground level (< 2 m below surface) in the dry season and above ground level in the wet season (due to flooding). The groundwater level within Dhaka is much deeper, because the covering sediments of the Madhupur clay are an aquitard. The ground water level in the Dupi Tila Sand layer (Pliocene-age) varies from 15m to 75m below surface in the Upper Dupi Tila Aquifer and from 14m to 34m below surface in the Lower Dupi Tila Aquifer. The ground water situation is shown in Figure 4-16.

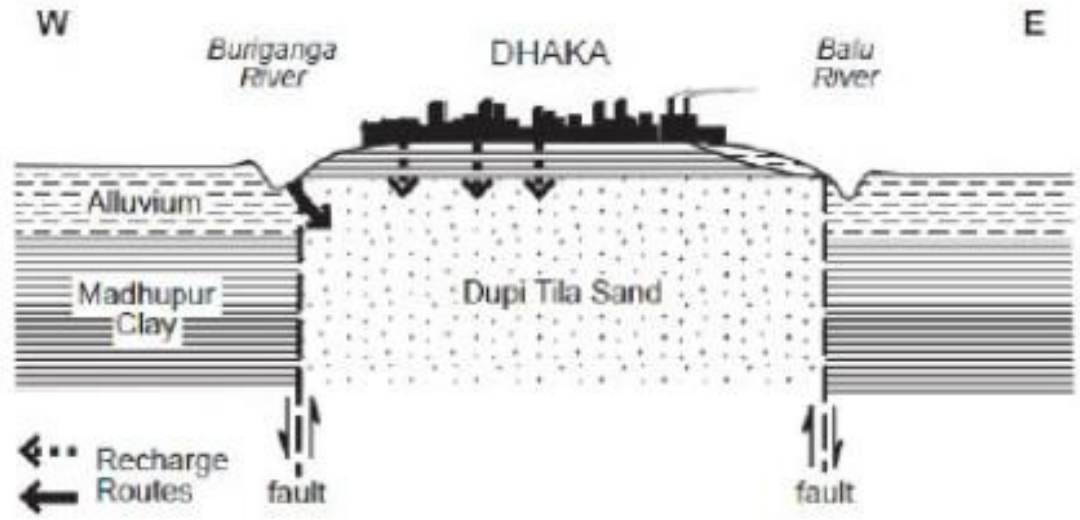


Figure 4-16: Ground level aquifers changing pattern (15m-75m)

(Source: Institute of Water Modelling)

Water aquifers are present beneath the vast majority of Bangladesh, which are being recharged by the major river systems and by infiltration of rainwater. Most ground water is available within 5 m of the surface. This level fluctuates seasonally, approaching the ground surface over most of the country during the months July to September.

Local ground water represents a stable source of water for various activities including irrigation (both shallow and deep tube wells), domestic purposes (hand pumps) and industrial applications (deep tube wells).

The local groundwater level is lowered to approximately 6 m below ground level during the dry seasons, with levels returning to their normal position before the end of the monsoon. This fall in ground levels is an entirely natural process that arises because of the hydrological link with the river.

There are three main aquifers in the central region of Bangladesh, where the Dhaka City region is located:

i) an upper (composite) aquifer, which can reach depths of 50 m and is covered with an upper silty clay layer of less than 20 m;
ii) a middle (main) aquifer of fine to heavy sands, which is generally 10-60 m deep, and in most areas is hydraulically connected with the composite aquifer above; and
iii) A deep aquifer of medium, medium-to-fine, or medium-to-coarse sand, which is generally found at depths below 100 m.

Nevertheless, there can be layers of water within the anthropogenic fillings as well as in the valley alluvium and colluvium sediments, which are overlaying the Madhupur clay aquitard.

The preliminary assessment of the ***coefficient of permeability K [m/s] of the soil layers might summarized as:***

- Sand from 1 x 10^{-4} m/s to 5 x 10^{-5} m/s
- Silt from 1 x 10^{-5} m/s to 1 x 10^{-7} m/s (from sandy to clayey)
- Clay, silty approx. 1 x 10^{-8} m/s

[This means in effect for the Contractor that water can be expected wherever excavation or drilling is carried out. Larger quantities and higher groundwater levels can be expected in the floodplain areas.]

In Dhaka region, about 80% of the domestic water supply is obtained from the middle aquifer, extracted by tube wells throughout the city. Recent studies have shown that water levels have fallen dramatically, and suggest that the aquifer may be changing from a confined to an unconfined condition, which could make it vulnerable to contamination. The groundwater quality is slightly acidic, the high nitrate content exceeding the permissible limit of the prescribed environmental quality standards.

Extraction of groundwater is presently from the upper Duptilia aquifer and the lower Duptilia aquifer under Dhaka city. DWASA operates approximately 550 deep wells and in addition to this there are approximately 1300 private wells. As of June 2009, groundwater constituted about 87% of the total water supply by DWASA. There are today approximately 550 DTW, extracting approximately 1640 MLD (sometimes reported as high as 1918 MLD /1/). The water is being distributed in local networks (with smaller dimensions). These local networks are interlinked; however, there is no overall transmission between areas in Dhaka.

The upper aquifer is in stressed condition and recharge is less compared to the abstraction, causing severe drawdown of groundwater table. It has been evaluated that the groundwater table is falling with 2-3 m/year as a result, according to ADB (2007) around 50% of DTWs in the upper aquifer will become inoperative by 2015 and groundwater production will reduce substantially.

The present existing groundwater extraction from the upper aquifer is approximately 600 -700 Mm^3/y (1648 -1918 MLD) and 44 Mm^3/y (120 MLD) in the lower aquifer.

IWM has prepared a groundwater model and estimated that the existing water table in the upper aquifer will stabilize after 16 months if extraction is stabilized on 600 m^3/year (1650MLD).

The lower Duptila aquifer is currently exploited at 44 Mm^3/day (120 MLD) from 28 wells. Available IWM numerical modelling indicates that abstraction could be increased to 139 Mm^3/day from 94 boreholes if 4 hours recovery are permitted very day. There is some uncertainty about the safe extraction and the actual safe extraction from the upper and lower

groundwater and a conservative approach has been taken in this study.

4.6 Air Quality

4.6.1 Environmental monitoring

Environmental information and ground information collection is one of the major part to identify the baseline status. The ambient air quality monitoring assignment was to develop the environmental baseline condition for the trend analysis and to support the development of the DESWS project. The Enviro Consultants Ltd. monitored ambient air quality in areas having high traffics in the peak time.

Representative samples of ambient air quality were collected through high volume sampler at six selected locations along the pipeline route where heavy traffic and people congregate was observed. The duration of sampling time was 24 hours for each of the location. Actual sampling location were located in the field using a hand held GPS. The measurement of air pollutants were carried out as per equivalent of USEPA approved methods and standard method.

4.6.2 Sampling methods for ambient air quality

Particulate matter monitoring is usually accomplished with a High Volume Respirable Dust Sampler (Model APM 460 NL) and, AAS 271 mini for measurement for PM_{10} and $PM_{2.5}$ and with attachment AAS 118 for measurement of SO_2, NOx and O_3, which has a vacuum type device that draws air with particulate matter through a dried filter paper. Particles within the range of 100 to 0.1 microns diameter are ordinarily collected on glass fiber filter. The vacuum pump of the instrument sucks the ambient air with a blower at a flow rate that allows suspended particles to pass to the filter surface. This sampling filter paper was dried up in the laboratory and the weight difference of the amount of SPM, PM_{10} and $PM_{2.5}$ content measured in microgram per cubic meter of air collected over a period of 8, 24 and 24 hours respectively.

4.6.3 Laboratory testing methods for ambient air quality

SO_2, NOx CO and O_3 ambient gases were collected through absorbing reagent by using attachment of high volume sampler (Model AAS 271 mini and attachment AAS 118) and bubbler sampling collection method. Potassium-tetra-chloro-mercurate, sodium arsenite solution and Potassium di hydrogen phosphate, di sodium hydrogen phosphate and potassium iodide was used as absorbing reagent for SO_2, NOx and O_3 respectively. The collected samples were transported to the laboratory for analysis. The content of these samples were measured in micro grams per cubic meter of air pass through the absorbent. The samples were analyzed following colorimetric method in Enviro Quality Laboratory. CO was measured by digital CO meter. The environmental quality parameters test report is attached in **Appendix-8.**

In order to identify the baseline condition- 6 major location of the projected area has selected. Six monitoring locations are Chaitankanda (Bishnandi), Shejan Point, Gandharbpur, Murapara near LGED Bridge, Gulshan-2 near US Embassy, Uttara (House Building) and all monitoring locations Table 4-6.Mapping unit name GW1, NL1 SW1 & AAQ1, AAQ2, SW2, GW2, NL2, AAQ3, NL3, SW3, GW3, AAQ4, SW4, GW4, NL4, AAQ5, NL5, SW5, GW5 and AAQ6, NL6, SW6, GW6 respectively Figure 4-17.

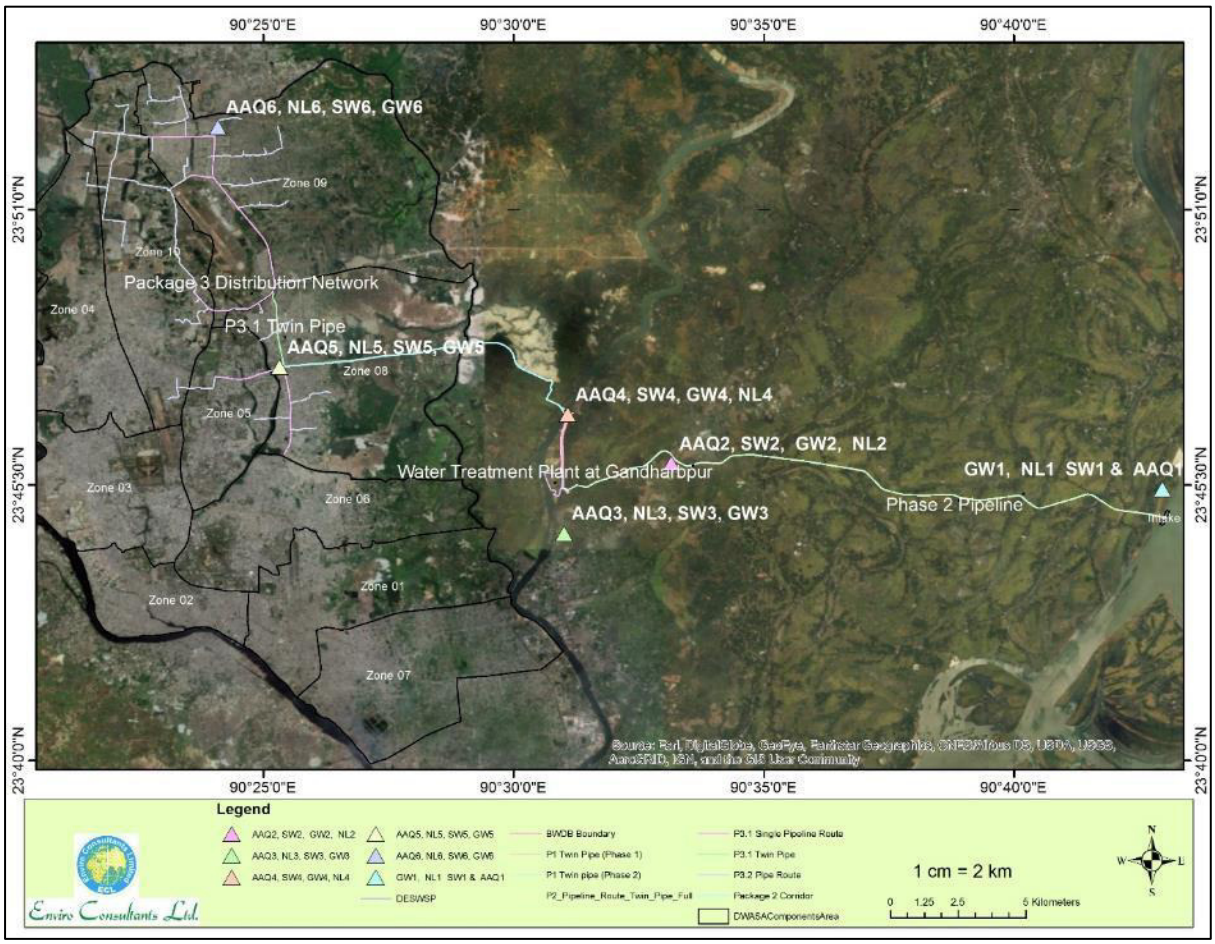


Figure 4-17: Environmental monitoring location of the projected area

Table 4-6: Monitoring location of the projected area

ID	Monitoring Location	Map Content Name	Latitude DMS	Longitude DMS	Latitude DD	Longitude DD
1	Chaitankanda (Bishnandi)	GW1, NL1 SW1 & AAQ1	23° 45' 25.340" N	90°42' 58.075" E	23.757039	90.716132
2	Shejan Point	AAQ2, SW2, GW2, NL2	23° 45' 56.027" N	90° 33' 9.582" E	23.765563	90.552662
3	Gandharbpur	AAQ3, NL3, SW3, GW3	23° 44' 32.211" N	90° 31' 0.680" E	23.742281	90.516856
4	Murapara Near LGED Bridge	AAQ4, SW4, GW4, NL4	23° 46' 54.454" N	90° 31' 5.109" E	23.781793	90.518086
5	Gulshan-2 Near US Embassy	AAQ5, NL5, SW5, GW5	23° 47' 51.508" N	90° 25' 19.683" E	23.797641	90.422134
6	Uttara (House Building)	AAQ6, NL6, SW6, GW6	23° 52' 38.886" N	90° 24' 5.976" E	23.877468	90.40166

Air quality in the Dhaka city and its neighboring areas is deteriorating with rapid urbanization and industrialization. During detail, survey of update of EIA stage air quality was monitored in 6 locations Table 4-7. Figure 4-18: Ambient air quality analysis of all components location and Results are presented below:

Table 4-7: Ambient air quality (AAQ) monitoring locations

Pac. No.	Project Packages	Lo. No.	Monitoring Location	Parameters
1	P1 Raw Water Intake, Pipeline & Water Treatment Plant	1	Chaitankanda (Bishnandi)	(24-hour monitoring for 2 days at 6 locations) SPM PM_{10} $PM_{2.5}$ SO_2 NO_x CO O_3
		2	Shejan Point	
		3	Gandharbpur	
2	P2 Treated Water Pipeline Transmission Main Starting from Gandharbpur Treatment Plant to Near US Embassy	4	Murapara Near LGED Bridge	
		5	Gulshan-2 Near US Embassy	
3	P3 (Lot 1, Component 3.1) (23 km Major Distribution Pipe) P3 (Lot 2, Component 3.2) (56 km Small Distribution pipe to DMA)	6	Uttara (House Building)	

Source: Primary field monitoring and test analysis

Chaitankanda (Day)

Chaitankanda (Might)

Gandharbpur (Day)

Gandharbpur (Night)

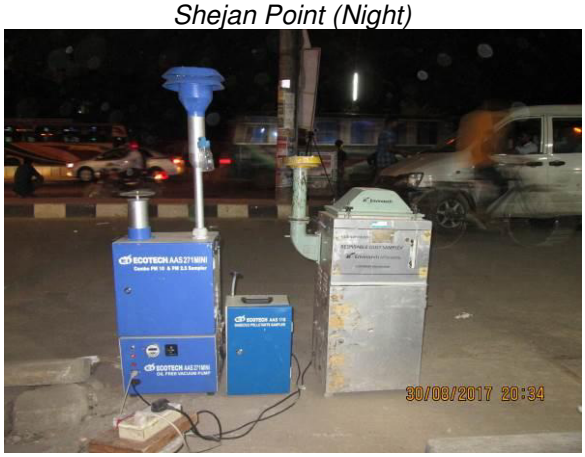
Murapara (Near LGED Bridge) (Day)

Murapara (Near LGED Bridge) (Night)

Shejan Point (Day)

Shejan Point (Night)

Gulshan-2 Near US embassy (Day)



Gulshan-2 Near US embassy (Night)

Uttara (House Building) (Day)

Uttara (House Building) (Nilght)

Figure 4-18: Ambient air quality analysis of all components location

In the rural areas, however the ambient air quality is relatively good. Below Table 4-8: Ambient air quality result presenting.

Ambient Air Quality was monitored from six different places along the pipeline route starting from intake point. Test Results of Ambient Air Quality from these different places are presented in Table 4.8. All the test reports from the laboratories are shown in **Appendix-8**. Table 4.8 shows that SPM value is higher than standard for three Sejan point, Gulshan-2 near US embassy and Uttara (House Building) locations. PM_{10} values exceeded for Sejan point only and NOx, SO_2, O_3, and CO values are within DoE standards for all the locations.

Table 4-8: Ambient air quality results

S. N	Locations	Concentration						
		SPM µg/m³	**$PM_{2.5}$ µg/m³**	**PM_{10} µg/m³**	**SO_2 µg/m³**	**NO_X µg/m³**	**O_3 µg/m³**	**CO ppm**
01	Chaitankanda	111.17	22.21	56.81	< LOD	9.22	34.93	Nil
02	Shejan Point	567.50	56.32	168.18	6.92	89.64	7.46	Nil
03	Gandhabpur	109.46	19.85	43.40	< LOD	32.92	< LOD	Nil
04	Murapara,	156.40	23.87	51.37	< LOD	17.25	< LOD	Nil
05	Gulshan	272.98	27.63	61.37	< LOD	29.66	5.05	Nil
06	Uttara	272.93	32.11	77.55	< LOD	64.55	5.28	Nil
Duration (hrs)		8	24	24	24	24	8	1
DoE Standard		200	65	150	365	100	157	40
Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West Geake	Jacob & Hochheiser	Photometric	Digital Meter

The present concentration is measured during update of EIA stage. It is observed that NO_x and SO_2 were found within the DOE standard.
(Table 4-8).

4.7 Noise level

4.7.1 General

Sound is transmitted through air when an object moves, like water flowing over rocks, or air passing through vocal cords. This movement causes air waves, similar to ripples in water. When these waves reach human ears, they are transformed into sound. Sound is usually measured in decibels (dB). A decibel is a relative measure that is accompanied by a reference scale. Technically, sound pressure is 20 times the logarithm (base 10) of the ratio of the pressure level of any sound to the reference sound pressure in decibels. Sound (noise) levels can be measured and quantified in several ways. All of them use the logarithmic decibel (dB) scale. The dB scale is logarithmic to accommodate the wide range of sound intensities found in the environment. Table 4-10: Ambient noise level monitoring locations shows typical sound levels generated by common indoor and outdoor activities, along with its effect on human Table 4-11.

Noise level data were collected in the same locations as air samples, at six locations, 24 hours at different traffic congested areas.

4.7.1 Noise Generation, Transmission, and Reduction

4.7.1.1 Noise Sources

Sound is a pressure wave that decreases over distance from the source. Noise attenuation is typically described as a set reduction in decibel level per doubling of distance from the source. Depending on the nature of the noise source, sound propagates at different rates. Measures of sound level from a source should specify the distance from the source. The standard reference distance for sound levels at the source is 50 feet. The two most common types of

noise are point source and line source. During the field visits the noise levels along the **P2 component** route starting from Gandharbpur Treatment plant to the US Embassy were low, typical for this mainly *rural area, with a few local exceptions* (Madani Ave, market and Bazar area). The **P3 component** is located in an urban and busy area and therefore the observed noise levels were high. These are discussed in more detail below.

4.7.1.2 Point Source Noise

Point source noise is associated with noise that remains in one place for extended periods, such as with construction activities. A few examples of point sources of noise are pile drivers, jackhammers, rock drills, or excavators working in one location. Noise from a single traveling vehicle is also considered point source noise. Point source noise is commonly measured in peak decibel levels or the highest value of a sound pressure over a stated time interval. Noise from a point source spreads spherically over distance where the wave spreading creates a dome effect, traveling in all directions equally from the source. The standard reduction for point source noise is 6 dB per doubling of distance from the source.

4.7.1.3 Line Source Noise

Line source noise is generated by moving objects along a linear corridor. Highway traffic is the best example of line source noise. Line source noise levels are measured as an average over time rather than peak levels measured in point source noise. Noise from a line source spreads cylindrically, spreading outward along the length of a line. The standard reduction for line source noise is 3 dB per doubling of distance from the source (compared to 6 dB for point source noise).

4.7.1.4 Noise Reduction Factors

The contractor shall monitor the baseline ambient noise levels as well as conduct noise measurements in order to comply with national noise standards, especially if there are complaints about noise from the drilling sites. Natural factors such as topography, vegetation, and temperature can further reduce noise over distance. This section covers a few of the common factors and their applicability in increasing the noise reduction per doubling of distance from the source.

4.7.1.5 Hard Site versus Soft Site

A hard site exists where sound travels away from the source over a generally flat, hard surface such as water, concrete, or hard-packed soil. These are examples of reflective ground, where the ground does not provide any attenuation. The standard attenuation rate for hard site conditions is 6 dB per doubling of distance for point source noise and 3 dB per doubling of distance from line sources.

When ground cover or normal unpacked earth (i.e., a soft site) exists between the source and receptor, the ground becomes absorptive to sound energy. Absorptive ground results in an additional noise reduction over distance of 1.5 dB per doubling of distance. Added to the standard reduction rate for soft site conditions, point source noise attenuates at a rate of 7.5 dB per doubling of distance, and line source noise decreases at a rate of 4.5 dB per doubling of distance.

4.7.1.6 Topography, Vegetation, and Atmospheric Factors

A break in the line of sight between the noise source and the receptor can result in a 5 dB reduction. Dense vegetation can reduce noise levels by 5 dB for every 100 feet of vegetation, up to a maximum reduction of 10 dB (USDOT, 1995). Atmospheric conditions can also affect the rate of sound attenuation. Sound travels farther during periods of higher humidity and also in colder temperatures. Wind can reduce noise levels by as much as 20 to 30 dB at long distances (USDOT, 1995). The influences of vegetation, topography, and atmospheric conditions as noise reduction factors can vary greatly and are often impossible to quantify. Therefore, these factors are generally not taken into account in environmental noise analysis, which likely results in predicted noise levels that are higher than actual noise levels.

4.7.1.7 Environmental Conditions

Baseline (ambient) noise levels vary greatly and depend on site-specific factors. Environmental factors can elevate baseline noise near the source, masking construction noise. The same environmental factors occurring near the receptor can change the receptor's perception of how loud construction noise is, or hide it completely.

Weather conditions such as wind or rainfall can increase baseline noise. Locations near rivers or streams have higher baseline noise levels as well. As with the atmospheric conditions described above, these environmental factors are variable and may be impossible to quantify, so they are rarely taken into account in noise models. If no record is available with concerned authorities a baseline condition may be established by performing onsite noise measurements with a hand-held noise meter.

4.7.1.8 Traffic Noise

Identifying the amount and type of traffic helps to determine the baseline (ambient) noise conditions. The level of highway traffic noise depends on the volume of traffic, the speed of the traffic, and the volume of trucks in the flow of traffic (USDOT, 1995). Generally, the loudness of traffic noise is increased when traffic is heavier, when traffic speed is increased, and when a greater proportion of the traffic flow is heavy trucks. For traffic volume, 2,000 vehicles per hour sounds twice as loud as (or is 10 dBA higher than) 200 vehicles per hour (USDOT, 1995). As stated earlier, a noise that is increased by 10 dBA sounds twice as loud to the listener. Vehicle noise is a combination of noises produced by engines, exhaust, and tires. The loudness of traffic noise can also be affected by the condition and type of roadway, road grade, and the condition and type of vehicle tires. Predictions of noise from vehicles are usually based on reference energy mean emission levels, which correspond to the noise level expected from a single vehicle at the standard 15m distance.

4.7.1.9 Construction Noise

One of the easiest things to identify and one of the hardest things to quantify is noise associated with the actual construction of the project. How much noise will construction activities generate, how often will it occur, and how long will it last are all questions that should be answered in the assessment. This section provides an introduction to equipment noise characteristics that might be expected for typical construction projects. Construction is usually performed in a series of steps or phases, and noise associated with different phases can vary greatly. However, similarities in noise sources allow typical construction equipment to be placed into one of three categories: heavy equipment, stationary equipment, or impact equipment.

4.7.1.10 Heavy Equipment

Heavy equipment can be defined as earth-moving equipment, such as excavating machinery like excavators, backhoes, and front loaders, as well as handling equipment like graders, pavers, rollers, and dump trucks. Noise levels at 50 feet from heavy equipment range from about 72 to 97 dB (**Error! Reference source not found.**). These numbers were identified rom several studies, and represent the range of reported values. During the phase of construction using heavy equipment, noise is generated more or less at a constant level. Therefore, noise levels can be equated to an average hourly level.

Table 4-9: Noise ranges at 50 feet from common construction equipment

Equipment	dBA	Equipment	dBA
Heavy trucks (avg.)	82 – 96	Backhoe (avg.)	72 – 90
Grader (avg.)	79 – 93	Paver (+grind) (avg.)	85 – 89
Excavator (avg.)	81 – 97	Front loader (avg.)	72 – 90
Crane (avg.)	74 – 89	Generator (avg.)	71 – 82
Pile driver (peak)	81 – 115	Jackhammer/rock drills (avg.)	75 – 99
Concrete mixer (avg.)	75 – 88	Roller (vg.)	72 – 75

Compressor (avg.)	73 – 88	Pumps (avg.)	68 – 80

Sources: Western Highway Institute (1971)

4.7.1.11 Stationary Equipment

Stationary equipment such as pumps, power generators, and air compressors generally runs continuously at relatively constant power and speed. Noise levels at 50 feet from stationary equipment can range from 68 to 88 dB, with pumps typically in the quieter range. An averaged noise level may be assumed for stationary equipment because of its fixed location and constant noise pattern.

4.7.1.12 Impact Equipment

This category includes pile drivers, jackhammers, pavement breakers, rock drills, and other pneumatic tools where a tool bit touches the work. The noise from jackhammers, breakers, rock drills, and pneumatic tools comes from the impact of the tool against the material. These levels can vary depending on the type and condition of the material. Noise levels at 50 feet from impact equipment, including jackhammers and rock drills, can range from 75 to 99 dB. An impact pile-driving hammer is a large piston-like device that is usually attached to a crane. The power source for impact hammers may be mechanical, air steam, diesel, or hydraulic.

In most impact drivers, a vertical support holds the pile in place, and a heavy weight, or ram, moves up and down, striking an anvil that transmits the blow of the ram to the pile. In hydraulic hammers, the ram is lifted by fluid, and gravity alone acts on the down stroke. Vibratory hammers can also be used on projects. A vibratory pile-driving hammer has a set of jaws that clamp onto the top of the pile. The pile is held steady while the hammer vibrates the pile to the desired depth. Because vibratory hammers are not impact tools, noise levels are not as high as with impact pile drivers. However, piles installed with a vibratory hammer must often be proofed, which involves striking the pile with an impact hammer to determine its load-bearing capacity, possibly with multiple impacts. In this case, noise is elevated to levels associated with impact pile driving.

The highest in-air noise from pile driving results from the impact of the hammer dropping on the pile, particularly when hollow steel piles are used. Noise assessments by USDOT have documented peak levels of 110 dB and 105 dB, 50 feet away from driving steel piles. Although stationary equipment noise and heavy equipment noise can be averaged over a period, pile driving noise consists of a series of peak events. Generally, noise from pile driving has been reported at peak levels. Therefore, it is usually assumed that noise at the highest levels documented is commonly generated by pile driving. For the purposes of this assessment, 110 dB is the best descriptor of typical peak noise levels associated with pile driving.

4.7.2 Methods used for Noise level testing

Noise levels (Sound level Meter. Model-SL-4033SD) (A-Weighted) were measured using precision sound level meter for 24 hours duration and Leq were calculated. The measurements were carried out according to the equivalent method of USEPA approved methods. The collected noise level data were analyzed and used in preparation of the report.

4.7.3 Baseline Noise Conditions

Existing ambient noise levels can serve as a baseline from which to measure potential disturbance caused by project activities. Below Figure 4-19: Noise level monitoring enlisted.

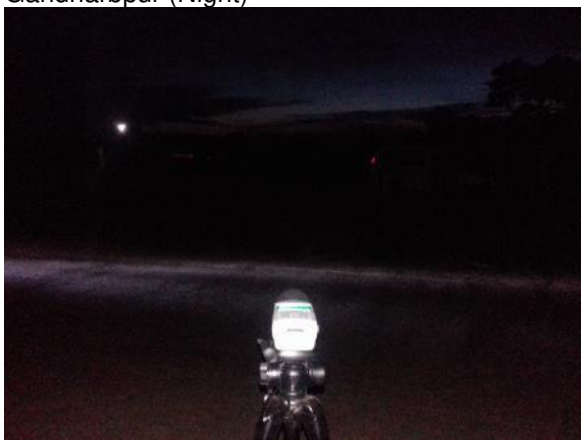
Chaitankanda (Bishnandi) (Day)

Chaitankanda (Bishnandi) (Night)

Gandharbpur (Day)

Gandharbpur (Night)

Murapara Near LGED Bridge (Day)



Murapara Near LGED Bridge (Night)

Shejan Point (Day)

Shejan Point (Night)

Gulshan-2 Near US Embassy (Day)

Gulshan-2 Near US Embassy (Night)

Uttara (House Building) (Day)

Uttara (House Building) (Night)

Figure 4-19: Noise level monitoring

Ambient noise was analyzed at IEE stage. Monitored results are presented below Table 4-11. According to DoE Table 4-12: Noise quality standards, by zone and time of day presenting.

Table 4-10: Ambient noise level monitoring locations

Pac. No.	Project Packages	Lo. No.	Monitoring Location	Land Use
1	P1 Raw Water Intake, Pipeline & Water Treatment Plant	1	Chaitankanda (Bishnandi)	Residential/agricultural
		2	Shejan Point	Industrial
		3	Gandharbpur	Residential
2	P2 Treated Water Pipeline Transmission Main Starting from Gandharbpur Treatment Plant to Near US Embassy	4	Murapara Near LGED Bridge	Commercial
		5	Gulshan-2 Near US Embassy	Industrial
3	P3 (Component 3.1) (23 km Major Distribution Pipe) P3 (Component 3.2) (56 km Small Distribution pipe to DMA)	6	Uttara (House Building)	Commercial

Table 4-11: Ambient noise level analysis in dB (A)

SN	Location	Result in dB - A		DoE (Bangladesh) Noise Standard for Mixed Area (Schedule-1), Leq	
		Leq		Day Time (6 AM-9 PM)	Night Time (9 PM- 6 AM)
		Day	Night		
01	Chaitankanda	68.76	65.52	60	50
02	Shejan Point	72.00	68.84	60	50
03	Gandhabpur	73.41	68.91	60	50

04	Murapara	71.72	66.61	60	50
05	Gulshan	79.66	75.18	60	50
06	Uttara	87.22	75.89	60	50
Method/Instrument				**Sound Level Meter Model: SL – 4033SD**	

Table 4-12: Noise quality standards, by zone and time of day

Zone Class	Limits in dB(A)	
	Daytime (6 am – 9 pm)	Nighttime (9 pm – 6 am)
Silent zone	45	35
Residential zone	50	40
Mixed (residential/commercial/industrial) zone	60	50
Commercial zone	70	60
Industrial zone	75	70

Source: Department of Environment (DoE), Bangladesh

The present noise level at update of EIA stage was monitored at six locations. It is observed that one area was found exceeding the standard of DOE Mixed (residential/ commercial/ industrial) zone.

4.8 Water quality

For establishing baseline condition with respect to water quality, surface water and groundwater quality were established. Figure 4-20 & Figure 4-21: Ground water sample collection points presented.

4.8.1 Methodology for water sampling and test analysis

Prior to commencing the fieldwork for the Project, a whole day hands-on training has been provided to the environmental field officers on August 2017 in order to improve the quality of the fieldwork and to train them industry best practice. The purpose of the training was to (a) establish, (b) implement, and (c) maintain documented sampling plans and field procedures for environmental monitoring which was designed and authorized by the Team Leader. The sub–consultant maintained high standard of sampling plans and procedures, which included the following issues:

(a) Tests to define the variability and/or repeatability of the environmental monitoring results
(b) Measures to assure the accuracy of the method, which include the calibrations
(c) Strictly maintain the technical holding time of all samples and be tested within technical holding time
(d) Sampling plans and procedures are address the factors to be controlled to ensure the validity of the environmental sampling results

All the equipment used to test the field parameters of surface and groundwater were properly cleaned with distils water before and after testing in each location. All beakers used for the laboratory analysis was also neutralized and disinfected for next sampling and testing to avoid cross contaminations.

4.8.1.1 Sampling Procedure

Field officers always maintained predefined documented procedures for sample handling and storing to protect the integrity and identity of the samples.

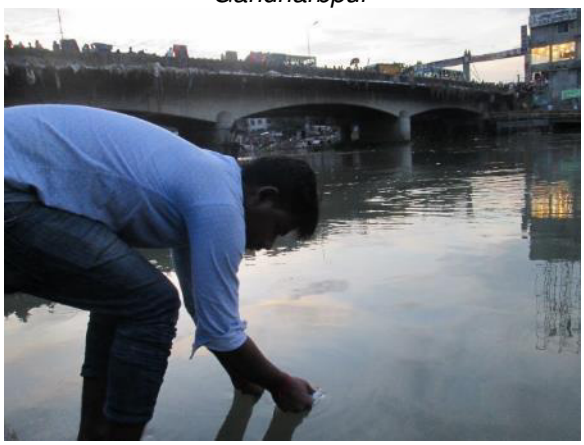
All the grab samples collected were immediately stored at 4^{O}C in cooler box and transported to the analytical laboratory directly from the field.

Samples were collected in plastic bottles and stored in cool box, which were transported to ECL laboratory. For BOD_5 analysis, samples were collected in BOD bottles and kept in cooler box transported to ECL laboratory within 6 hours. Figure 4-20 and Figure 4-21 presenting water sample collection of surface water and ground water respectively.

Chaitankanda (Bishnandi)

Gandharbpur

Murapara Near LGED Bridge



Uttara (House Building)

Figure 4-20: Sample collection for surface water quality analysis

For analysis of COD Samples has been collected in pre-cleaned plastic bottles, kept in cooler box, and transported to the ECL laboratory within 6 hours. After that, samples were stored in refrigerator at 4^{0}C.

4.8.1.2 Laboratory testing method of water

Few physic-chemical parameters such as Temperature, pH, EC, TDS, DO and BOD, COD, TSS of surface and groundwater quality were tested were tested in ECL laboratory. Analytical methods used during the laboratory testing were in line with the American Public Health Association's 'Standards Methods for the Examination of Water and Wastewater" 2005.

The project proponent had primarily given the sites for monitoring of surface and ground locations.

4.8.2 Surface water quality of the projected area

Water quality monitoring of Meghna River at the proposed intake location at Bishnondi was carried out as part of the FS. The results are presented in **Table 4-15**.

i) Survey of seasonal variation:

a) Monthly samples: June and July 2010
b) Weekly samples: The weekly basis sampling periods were March, April, and May 2010.
c) Field test analysis: The following test parameters were analyzed: temperature, pH, conductivity, turbidity, dissolved oxygen (DO), ammonia, and H_2S, using portable instruments.

ii) Survey for special pollutant:

d) One sample was collected from each point in the wet season in July 2010, and one sample was collected during the dry season in April 2010.
e) The following parameters were analyzed: nitrate (NO_3), COD, phosphate, aluminium, barium, chromium (hexavalent), cadmium, lead, mercury, zinc, arsenic, chloride, sulfate, fecal coliform, total suspended solids (TSS), total dissolved solids (TDS), hydrogen sulfide, pesticide, and TOC in the laboratory.

iii) Survey for daily variation:

f) Hourly sampling and analysis were conducted once at each sampling location, both in the dry season (March 2010) and the wet season (July 2010).
g) Field test analysis: The following parameters were analyzed: temperature, pH, conductivity, turbidity, dissolved oxygen (DO), ammonia, and H_2S using portable instruments.

Table 4-13: Surface water quality–Meghna river

Sl. no	Parameter	Units	Monitoring Location	
			Bishnondi (M1)	Baidder Bazar (M2)
1.	Temperature	C	30.2	29.9
2.	pH		7.55	7.4
3.	Conductivity	µs/cm	108.95	109.07
4.	Dissolved oxygen (DO)	mg/l	5.9	5.95
5.	Turbidity	NTU	28.025	24.625
6.	Ammonia (NH_4)	mg/l	0.38	0.375
7.	Nitrate (NO_3)	mg/l	0.45	41.65
8.	Chemical oxygen demand (COD)	mg/l	6.0	14.0
9.	Phosphate (PO_4)	mg/l	0.09	0.07
10.	Aluminum (Al)	mg/l	<BDL>	<BDL>
11.	Barium (Ba)	mg/l	<BDL>	<BDL>
12.	Chromium (Cr)	mg/l	0	0.005
13.	Cadmium (Cd)	mg/l	<BDL>	<BDL>
14.	Lead (Pb)	mg/l	<BDL>	0.02
15.	Mercury (Hg)	mg/l	0	0
16.	Zinc (Zn)	mg/l	0.045	0.055
17.	Arsenic (As)	mg/l	0	0
18.	Chloride (Cl)	mg/l	5.5	7.5
19.	Sulfate (SO_4)	mg/l	9	10.5
20.	Fecal coliform (FC)	CFU/100 ml	101	433
21.	Total suspended solids (TSS)	mg/l	8.0	14
22.	Total dissolved solids (TDS)	mg/l	143	73.5
23.	Hydrogen sulfide (H_2S)	mg/L	0.005	0.01

Source: Feasibility Report, 2011.

Weekly, Monthly and Quarterly Samples were collected from Bishnondi Intake point (Chaitankanda, Bishnondi) and total fourteen months were monitored. Several tested parameters have analyses in DPHE Central Laboratory, BCSIR and BUET laboratory, Dhaka **(Appendix-9).**

The surface water samples were collected from six selected locations, which is shown in Table 4-14. Six samples were collected and the results are provided in Table 4-14.

The physical parameters include temperature, pH, EC, TDS, TSS, DO, and BOD_5 and COD and as that were tested in the field immediately after collection of samples through field test kit. For laboratory test, samples were preserved properly in cooler box during storage and transportation to the laboratories maintaining chain of custody. The concentration of various parameter is shown in Table 4-14.

Table 4-14: Surface water quality of the monitoring location

Location of the sample collection	**Concentration of Surface Water**						
	Parameter						
	pH	DO	BOD_5	COD	TDS	EC	TSS
		mg/l	mg/l	mg/l	mg/l	µS/cm	mg/l
01 Mehna River, Chaitankanda	7.5	6.5	3.7	16	36	72	49
02 Canal, Shejan Point	7.5	0.6	33	112	342	669	120
03 Shitalakha River, Gandharbpur	7.7	6.4	7.6	32	130	261	68
04 Shitalhaya River, Murapara	7.7	6	7.8	48	135	264	50
05 Pond, Glushan	8.1	5.8	14.1	73.5	87	170	31
06 Turag River, Uttara	7.5	4.7	11.7	48	77	152	62
Bangladesh (DoE) Standard for Surface Water (Schedule- 3-A)	6.5 – 8.5	≥5	≤10	NYS	NYS	2250	NYS

(Source: Field-monitoring report; August 2017)

All the water quality parameters are observed to be well within the stipulated standards of inland water quality. The increase in DO concentration indicates the presence of organic pollution at M1 and M2, and the increase in nitrate concentration at M2 can be attributed to agricultural run-off.

The current water quality parameters indicate low levels of pollution, which can be attributed to absence of any major pollution sources upstream along the Meghna, coupled with dilution factors of the river system. However, given the need for sustained protection of the water source, adequate protection measures and planning of upstream developments need to be implemented through inter-agency coordination.

Water quality monitoring is going on in different points in Meghna river. Test Results at Bisnandi (4 dates ;Feb 15, 22 March 01 & 08 , 2014, samples collected by the existing DWASA water monitoring contractor and at Baidder Bazar intake, Haria, Sonargaon, Narayanganj (3 dates : July 13, August 24 & Sept 28, 2013), water samples collected by EGIS EAW-IWM are presented in the following table. More results for Bisnandi (up to September 2014) are tabulated in **Appendix-8**.

Table 4-15: Water quality monitoring report

SL	Parameter	Unit	Bangladesh Drinking water Standard ECR '97	Meghna River at Bisnandi				Meghna River at Baidder Bazar		
				15-Feb, 2014	22-Feb, 2014	01-Mar, 2014	08-Mar, 2014	13-Jul, 2013	24-Aug, 2013	28-Sep, 2013
1	Turbidity	NTU	10	1.26	1.88	0.09	2.45	6.87	17.1	13.00
2	TDS	mg/l	1000	48	51	55	62	35	20	27
3	TSS	mg/l	10	1.00	4.6	2.00		11	13	24
4	COD	mg/l	4					8	7	8.5
5	BOD	mg/l	0.2					1.0	0.4	0.6
6	Iron	mg/l	0.3-1.0					0.38	0.44	0.32
7	Ammonia	mg/l	-	0.5	0	0	0	0.001	0.004	0.001
8	Ammonium	mg/l	0.5					0.23	0.354	0.274

Source: Monthly water quality monitoring reports.

4.8.3 Groundwater Quality

There are three main aquifers in the central region of Bangladesh, where the Dhaka City region is located. Table 4-16: Quality of groundwater sample from different has presented below:

i) an upper (composite) aquifer, which can reach depths of 50 m and is covered with an upper silty clay layer of less than 20 m;
ii) a middle (main) aquifer of fine to heavy sands, which is generally 10-60 m deep, and in most areas is hydraulically connected with the composite aquifer above; and
iii) a deep aquifer of medium, medium-to-fine, or medium-to-coarse sand, which is generally found at depths below 100 m.

In Dhaka region, about 80% of the domestic water supply is obtained from the middle aquifer, extracted by tube wells throughout the city. Recent studies have shown that water levels have fallen dramatically, and suggest that the aquifer may be changing from a confined to an unconfined condition, which could make it vulnerable to contamination. The groundwater quality is slightly acidic, the high nitrate content exceeding the permissible limit of the prescribed environmental quality standards.

Groundwater is periodically monitored by DWASA. The result of a latest monitoring is presented below. Figure 4-21 presenting the sample collection locations. Table 4-17: Borehole locations water quality monitoring report has attached.

Chaitankanda (Bishnandi)

Gandharbpur

Gulshan-2 Near US Embassy

Uttara (House Building)

Figure 4-21: Ground water sample collection

All the groundwater samples were collected from tube well along the project Route. The water quality of the six locations satisfy the DoE potable water quality standards and is the water is suitable for human consumption because the physical, chemical parameters are found satisfactory and within DoE and WHO standards.

The water sample of Board Bazar also acceptable for using as drinking water because most of the parameter are satisfying the standard of DoE, though COD and BOD is little higher compare to DoE standard. The concentration of iron and arsenic found in this water also satisfy the DoE and WHO standards. The groundwater test analysis of all the six location shows that all the parameters are within DoE and WHO standard. It is found that DO of groundwater sample is lower than DoE standard which is 6 mg/L at Chaitankanda and Sejan point. BOD and COD of groundwater sample is satisfactory.

All other parameters are also within the limits of DoE and WHO standards. The groundwater is suitable for human consumption. The analyses of parameters have been done in and ECL laboratories in Dhaka and laboratory test results are provided in **Appendix-8**.

Table 4-16: Quality of groundwater sample from different locations

SN	Parameter	Unit	Chaitankanda	Shejan Point	Gandoubpur	Murapara	Glushan	Uttra	Bangladesh (DoE) Standard for Ground Water
1	pH		7.9	7.7	7.7	7.4	7.8	7.5	6.5 – 8.5
2	DO	mg/l	5.5	5.8	6.1	6.3	6	6.7	6
3	COD	mg/l	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	4
4	TDS	mg/l	550	403	528	588	155	167	1000
5	EC	µS/cm	1104	791	1004	1133	292	329	NYS
6	Fe	mg/l	1.42	< LOD	0.015	< LOD	< LOD	< LOD	0.3-1
7	As	mg/l	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	0.05

Table 4-17: Borehole locations water quality monitoring

Ref.	Location	GPS	Sample Type	Sulphate (ppm)	Chloride (ppm)	Magnesium (ppm)	Nitrate (ppm)

p-164/175	WTP site	N 23 45' 42.5" E 90 30' 52.9"	Water	119.4	106.38	25.33	
p-164/175	WTP site	N 23 45' 38.6" E 90 30' 41.5"	Water	159.57	141.84	29.7	
p-164/175	WTP site	N 23 45' 36" E 90 30' 49"	Water	104.4	88.65	20.09	
p-20/175	WTP site	N 23 45' 42.4" E 90 30' 41"	Soil @ 1.5 m depth	98.7	78.6	26.2	
p-23/175	WTP site	N 23 45' 38.6" E 90 30' 41.5"	Soil @ 28.5 m depth	169.7	159.5	38.4	
p-25/175	WTP site	N 23 45' 35.0" E 90 30' 49.0"	Soil @ 31.5 m depth	160.5	124.1	32.2	
p-30/175	WTP site		Soil @ 0.95 – 1.35 m depth	0.201	0.483	8	
p-30/175	WTP site		Soil @ 0.95 – 1.35 m depth	0.163	0.851	8	
p-31/175	WTP site		Soil @ 0.95 – 1.35 m depth	0.135	0.881	8	
p-31/175	WTP site		Soil @ 19.5 m depth	0.399	0.283	8	
p-182/182	BH-17, pipeline, about 2 km from WTP	N 23 45' 41.3" E 90 32' 0.9"	Water	64.4	41.6	21.2	4.33
p-181/182	BH-13, pipeline, midway between WTP and intake	N 23 45' 33.8" E 90 37' 13.7"	Water	43.5	22	19.3	4.16
p-180/182	BH-11, pipeline, about 4 km from intake	N 23 45' 4.7" E 90 40' 16.3"	Water	34.7	19.7	22.4	4.48
p-179/182	BH-09, pipeline, about 1.5 km from intake	N 23 45' 11.1" E 90 41' 44.5"	Water	69.4	48	13.7	4.12
p-178/182	BH-03, Intake	N 23 44' 51.7" E 90 42' 49.7"	Water	72.2	85	26.9	3.98
			WHO Guideline	**250**	**250**		
			ECR '97 Limit	**400**	**150-600**	**30-35**	

(References were made from Subsoil investigation reports, June 2014)

4.9 Baseline: Levels of abstraction at the intake

Based on data taken at the Bhairab Bazar gauging station on the Meghna River from 2000 to 2009, approximate statistical flow determinations have been carried out at IEE level:

Q_{95}[8] = 3,815 m^3/sec

Q_5[9] = 11630 m^3/sec

Q_{50} = 4037 m^3/sec

Q mean (of actual measurements): 7,720 m^3/sec.

The proposed abstraction (for the designed intake of 1,050 MLD of raw water from Meghna) accounts for 0.3% of the lean flow (Q_{95}) for 2035, and about 0.1% of the maximum flow (Q_5) for 2035. These levels of abstraction will minor affect downstream uses or the ecological flows

8 Q_{95} - The flow of a river which is exceeded on average 95% of the time—the lean flow.

9 Q_5 - The flow of a river which is exceeded on average 5% of the time—maximum flow

of the Meghna River.

4.10 Fisheries

4.11 Species in Meghna River

The indigenous species of fish in the Meghna River include hilsa, rui, katla, mighel, kalibaus, and pangas. None of these species are considered sensitive or protected, and are generally available in the inland rivers of Bangladesh. While the breeding ground for smaller fishes is all over the watercourse, there are defined grounds for larger fishes like hilsa. Barisal and Chandpur and the downstream stretches are the major breeding grounds along the Meghna.

The spawning grounds of major fish species like rui, katla, hilsa, pangas, and galda chingri have been identified and earmarked as fish sanctuaries[10], wherein concerted efforts towards conservation of the fish habitat and protection of the diversity are undertaken. The DoF undertakes necessary measures to stop indiscriminate fishing of gravid female and undersized fish. The nearest hilsa sanctuary is Chandpur, about 130 km downstream of the proposed intake location.

During the field visit at Bisnandi in August 2017 the Figure 4-22: Commonly available fish in Meghna river**.**

are presented in Figure 4-21: As per discussion with Fisheries Officer at Araihazar Upazila followed by field visit it was found from the last two years Hilsa fish including Jatka are found and increase every year at Bisnandi and 2 km downstream of intake location. Table **4-18: Hilsa sanctuary area and fishing ban period** represent.

Though hilsa breeding in the Meghna River and estuary happens throughout the year, there is a distinct peak observed in the months of September and October and a minor peak in the months of January to March. DoF prohibits the fishing of jatka for the months of March and April to ensure sustained yield. For other types of fishes (rui, katla, pangas, kalibaus, etc.) ideal temperature and other environmental conditions are essential for proper and normal breeding. Many fishes breed after and before rains.

Figure 4-22: Commonly available fish in Meghna river.

10 Four sites in the coastal areas of the country have been declared as *Hilsa* sanctuaries under the Protection and Conservation of Fish Act-1950 for the effective conservation of *Jatka* in the major nursery areas and the maintenance of fish bio-diversity. Consultations with the BFRI, Chandpur, and DoF on potential impacts on the fish sanctuaries confirmed that the intake is about 130 km upstream, and the quantum of extraction at the intake is not significant and will have no impacts on the fish diversity in the river.

Table 4-18: Hilsa sanctuary area and fishing ban period

S.No	*HILSA* Sanctuary Area	Ban period
1	From Shatnol of Chandpur district to char Alexander of Laxmipur (100 km of lower Meghna estuary)	March to April
2	Madanpur/Char Ilisha to Char Pial in Bhola district (90 km area of Shahbajpur river, a tributary of the Meghna River)	March to April
3	Bheduria of Bhola district to Char Rustam of Patuakhali district (nearly 100 km area of Tetulia River)	March to April
4	Whole 40 km stretch of Andharmanik River in Kalapara Upazila of Patuakhali district	November to January

Source: IEE report

During IEE consultations with the DoF and BFRI officials at the research station at Chandpur confirmed that (i) there are no areas identified as significant breeding grounds along Meghna near to the proposed intake, and the nearest breeding ground is the Chandpur sanctuary about 130 km downstream from the site; (ii) the proposed abstraction rates of less than 0.3% of the leanest flow shall not significantly impact the fish population or the livelihood of the fishermen communities; and (iii) suitable nets and screens have to be designed at the intake location to minimize impacts on fishes, especially during the lean season.

4.12 Pollution sources in vicinity of the proposed intake

Consultations and site visits confirmed that there are no major pollution sources or development activities, existing or planned, within 25 km of the proposed intake. The pollution has not been significant at the intake location as of this writing, due to lack of any industrial activities upstream, as well as dilution.

Manikpur ferry ghat. Located about 2 km upstream of the proposed intake at Bishnondi, the Manikpur ferry ghat functions as a crossing point for passengers and vehicles to Dhaka from the Narayanganj district. Apart from a large ferry operated by the RHD every 30 minutes, there are 30 smaller vessels used for passenger movement. Being a transit node, the ferry ghat has about 50 eateries and shops that have developed around it, patronized by the passengers. There are no waste collection or toilet facilities at the ghat, and the waste generated is directly discharged into the river. The quantum of waste, though not currently significant, needs to be addressed through provision of facilities for waste collection and sanitation at the ferry ghat location. Consultations with the fishermen at the intake location and at Manikpur ferry ghat revealed that discharge from industries can be a major cause of decline of fish population in the Meghna River. The fishermen said enforcement of regulations to prohibit industrial discharges into the Meghna will be critical to protecting the water source, and also to ensure that the livelihood of the fishermen is not impacted. The project proposes to provide sanitation and solid waste collection facilities at the ferry ghat location in an effort to communicate the need to protect the source and avoid direct discharge into the river.

Other locations: The textile dyeing units and rice mills in the vicinity of the intake are currently small-scale, and the cumulative wastes discharged will not be significant, given the scale of the receiving waters and the effect of dilution. However, given the need for source protection, PMU, with the guidance of the steering committee, shall work with the DoE in targeting treatment of effluents and prevention of direct discharges into the river. The other polluting sources in the vicinity of the proposed intake are as follows:

(i) Raipura, 5 km upstream (U/S) - a cluster of 10-15 small-scale textile dyeing units
(ii) Madhabdi, 9 km U/S - a cluster of 20 textile dyeing units
(iii) Sakerchar, Babur Hat, Narsingdi, 13 km U/S - a cluster of 30 textile dyeing units
(iv) Bhairab, 42 km U/S - rice mill effluent and 20 small-scale textile dyeing units
(v) Ashugonj, 45 km U/S - Ahsugonj Power Station (576 MW) and Ashugonj Fertilizer plant, apart from rice mills in Ashugonj

4.13 Tidal influence in Meghna River

The FS reported that no records exist to suggest that saline intrusion extends as far as Meghna Bridge. IWM reports that sea-based salinity does not intrude beyond the confluence of the Meghna and Padma Rivers, which is about 100 km downstream of the proposed intake. To enable a better understanding of the tidal influence, the project has initiated a continuous river water quality monitoring program that includes sampling for salinity upstream of the Meghna Bridge (approximately 25 km downstream of intake).

4.14 Other River/Water Crossings

The treated water mains cross Sitalakhya and Balu Rivers en route to the injection point at the US Embassy. In addition, the transmission mains alignment cuts across or passes close to several smaller streams (khals) and ponds. The list of such khals/water bodies along the transmission mains is presented in Table 4-19. To the extent feasible, the route shall be designed to avoid as many of the water bodies as possible.

Table 4-19: KHALS/water bodies near the transmission mains

S.No	Chainage	Name	Width/Area of the Water Body	Uses	Whether Impacted
Intake to Shezan juice factory					
1	0/800	*Khal* – Chaitan Kanda village	80 m	Irrigation, fishing	Yes
2	1/000	*Khal* – Bijoy Nagar	100 m	Irrigation, fishing	Yes
3	1/900	*Khal* Uchitpur Mouza	80m	Irrigation, fishing	Yes
4	3/500	Atadi (Kadirdi) mouza	90 m	Irrigation, fishing	Yes
5	4/300	Pond	0.8 ha	Fishing	No (50 m from alignment)
6	7/150	Pond (privately owned)	0.4 ha	Fishing, bathing	Yes
7	7/800	Pond (Kandi Mouza)	o.8 ha	Fishing, irrigation	No (about 150 m from alignment
8	8/700	*Khal* (Berarkul Mouza)	75 m	Fishing, irrigation	Yes
9	9/500	Khal	100 m	Irrigation, fishing	Yes
10	10/100	Pond Lenguridi Mouza	2 acres	Irrigation, fishing	Yes
11	14/000	*Khal* – subchannel of Sitalakhya	100 m	Polluted, receives flow from industrial units	Yes
12	16/600	Pond (private), South Golakandail Mouza	0.8 ha	Fishing, poultry waste fed to pangas fish	Yes
Shezan juice factory to Taraboo (Demra Bridge) along Dhaka-Sylhet highway					
13		Drain within the RoW	Width varying from 10m to 15m for a length of about 2 km along the highway	Not used by communities. Industrial wastes discharged at few locations	Yes
Gandharbpur to US Embassy					
14		Bhatara *Khal*	150 m	Irrigation, fishing	Yes
14		Kabadia *Khal*	80 m	Irrigation, fishing	Yes
15		Chhotaboraru *Khal*	100 m	Irrigation, fishing	Yes
16		Barai *Khal*	100 m	Irrigation, fishing	Yes

Source: IEE Report

4.15 Biophysical Environment

The project area is similar in character to many alluvial deltas in Bangladesh, with mixed crop vegetation. Rice, grains, and seasonal vegetables are the main crops in this area. Beside monoculture tree plantations, there are no forest areas. Terrestrial plants are mainly limited to crops and fruit trees planted in agricultural areas. The plants include low growing grasses and herbaceous vegetation, as well as other flora. The list of plant/tree species that are common in the project area was obtained through field visits and consultations with the forest department, and is presented in Table 4-20. No game inhabits the project areas and there are no endangered species or critical habitats in the project areas. The ecological environment is characterized by a human managed landscape.

4.15.1 Terrestrial Ecosystem

Terrestrial flora is classified according to their habitats. In the study areas, terrestrial floras are present mainly in the homestead regions, roadsides, village groves and cultivated lands. Homesteads and orchards include: betel nut, kadam, coconut, date palm, sofeda, mango, jackfruit, guava, grapefruit, pomelo, lemon, blackberries, plum, toddy palm, koroi, shisoo, shirish, rain tree, evcaiytta, bamboo, babla, jeol, neem, tamarind, banana, ipil-ipil, papaya, mehgani, debdaru, shimul, akashmoni, khai babla, jamrul, chalta, bel, amra, amloki, segun, etc. Roadside plantations include: datepalm, road chambol, koroi, krishnachura, rain tree, banyan, shisoo, babla, akashmoni, eucalyptus, mango, blackberries, raj koroi, etc. Fish species include rui, katal, thai puti, minar carp, silver carp, pabda, sheatfish. None of these species are listed in IUCN Red List. Table 4-21 shows various species in the area.

Table 4-20: Terrestrial flora found near intake and location of proposed treatment plant

Sl. No.	Local Name	Scientific Name	Status
Terrestrial Flora			
1.	Betel nut	Areca catechu	Fairly Common
2.	Mashkalai (type of pulse)	Phaseolus mungo roxb	Fairly Common
3.	Potato	Solanum tuberosum	Fairly Common
4.	Ground Nut	Arachis hypogea	Fairly Common
5.	Ginger	Zingiber officinale	Fairly Common
6.	Wheat	Triticum aestivum	Fairly Common
7.	Til	Sesamum indicum	Fairly Common
8.	Kumra	Cucurbita maxima	Fairly Common
Terrestrial Fauna (Reptiles) found near intake and location of proposed treatment plant			
1.	Anjila	Mabuya carinata	Common
2.	Dhura Shap	Amphiesma stolata	Common
3.	Matia Shap	Atretium schistosum	Common
4.	Tiktiki	Hemidactylus brooke	Common
5.	Daraish Shap	Ptyas mucosus	Fairly Common
6.	Gui Shap	Varanus nubulosus	Fairly Common
Terrestrial Fauna (Mammals) found near intake and location of proposed treatment plant			
1.	Babur	Pteropus giganteus	Common
2.	Idur	Mus musculus	Common
3.	Shial	Vulpes bengalensis	Common
4.	Chika	Pipistrellus. Sp	Common
5.	Beji	Herpestes	Fairly Common

Sl. No.	Local Name	Scientific Name	Status
Avifauna (Birds) found near the location of proposed treatment plant			
1.	Choroi	Passer domesticus	Common
2	Doyel	Opsychus sularis	Common
3.	Kak	Carvus splendens	Common
4.	Ghugho	Streptapelia Orientalis	Common
5.	Shalik	Stuma contra	Common
6.	Tuntuni	Orthotomus sutorius	Common
7.	Machranga	Helcyon smyrrensis	Fairly Common
8.	Haludpakhi	Oriolus xanthornus	Fairly Common
9.	Katthokra	Picus canus	Fairly Common
10.	Pecha	Tyto alba	Rare
Fish Fauna (Large fishes) at Meghna river near intake			
1	Rui	Labeo rohita	Common
2	Katla	Catla catla	Common
3	Kalibaush	Labeo calbasu	Common
4	Boal	Wallago attu	Common
5	Ayre	Sperata aor	Fairly Common
6	Bain	Mastacembelus armatus	Common
7	Chital	Chitala chitala	Fairly Common
8	Fasha	Setipinna phasa	Fairly Common
9	Bata	Liza Persia	Fairly Common
10	Magur	Clarius batrachus	Fairly Common
11	Dari	Scistura scaturigina	Fairly Common
12	Jatka	Tenualosa ilisha	Fairly Common
13	Chinri	Macrobrachium rosenbergii	Fairly Common
Fish Fauna (Small fishes) at Meghna River near intake			
1.	Pabda	Ompoc pabda	Fairly common
2	Golsha	Mystus cavasius	Fairly common
3.	Bele	Glossogobius giuris	Fairly common
4.	Tengra	Mystus vittatus	Common
5.	Puti	Puntius conchonius	Common
6.	Fali	Notopterus notopterus	Fairly common
7.	Kachki	Corica suborna	Fairly common
8	Mola	Amblypharyngodon mola	Common
9	Kakila	Xenentodon cancila	Fairly common
10	Chapila	Gudusia chapra	Fairly common
11	Kholisha	Colisha fasciatus	Common
12	Chingri	Macrobrachium eqidense	Common

Sl. No.	Local Name	Scientific Name	Status
13	Shol	Channa striates	Common
14	Taki	Channa punctatus	Common
15	Shing	Heteropneustes fossilis	Fairly common
16	Koi	Anabas testudineus	Fairly common
17	Gozar	Channa marulius	Fairly common
18	Chela	Chela cachius	
Insect Fauna at Meghna River near intake			
1.	Dragon fly nymph	Odonata	Fairly Common
2	Damsel fly nymph	Odonata	Fairly Common
3.	Water strider	Hemiptera	Fairly Common
4.	Midge	Diptera	Fairly Common
5.	Flies	Diptera	Fairly Common
6.	Ant	Hymenoptera	Common
7.	Caddisfly	Trichoptera	Fairly Common

Table 4-21: List of fresh water mollusks in the river Meghna near the intake

Common Name	Scientific Name	Class	Order	Family	Abundance	
					Intake area	Outfall area
Common Apple -Snail	Pila globosa	Gastropoda	Mesogastropoda	Pilidae	++	+
Brotia snail	Brotia costula	Gastropoda	Mesogastropoda	Pilidae	+++	++
Banded river snail	Bellamya bengalensis	Gastropoda	Prosobranchia	Viviparidae	++	+
Fresh water mussel	Parreysia corrugata	Bivalvia	Unionoida	Unionidae	+	+
Fresh water mussel	Parreysia caerulea	Bivalvia	Unionoida	Unionidae	++	+
Fresh water mussel	Lamellidense marginalis	Bivalvia	Unionoida	Unionoidae	+++	++
Fresh water mussel	Lamellidense jenkinsianus	Bivalvia	Unionoida	Unionoidae	+++	+
Status: +++Very common, ++Common, +Few, - Absent						

Table 4-22: Avifauna observed near the surveyed river

English Name	Scientific Name
Pond Heron	*Ardeola grayii*
Little Cormorant	*Phalacrocorax niger*
Black Kite	Milvus migrans
Brahminy Kite	Haliastur Indus
Red Vented Bulbul	Picnonotus cafer
House Crow	Corvus splendens
Tailor Bird	Orthotomus sutorius

Some birds feed on the river fishes and thus take part in the consumer level of the river ecosystem.

Between the aquatic vegetation's Helencha and Duckweed were not observed much in the intake. In general, aquatic vegetation was less in this area. This might be due to heavy current in the river.

Table 4-23: List of aquatic vegetation seen in the visiting site

Common Name	Scientific Name	Abundance near Intake point
Water hyacinth	Echhornia crassipes	++
Ipomea	Ipomea aquatica	+
Helencha	Altenanthera philloxiroides	+
Duckweed	Spirodella sp	+
Status: ++Common, +Few		

Herbs and shrubs grown near the visiting area was observed and listed below. These species should be conserved for ecological balance.

Table 4-24: List of vegetation's (herbs and shrubs) grown near the visiting site

Local Name	Scientific Name	Local Name	Scientific Name
Junka	Sida cordata	Bish Katali	Persicaria hydropiper
Banmorich	Croton bonplandianum	Nakful	Synedrella nodiflora
Fulkuri	Ageratum conizoides	Bara-Halkus	Leucas cephalotes
Kanai	Commelina erecta	Bondhoney	*Scoparia dulcis*
Notey Shak	*Amarathus viridis*	Joshorilata	Mikania cordata
Ban-palang	Rumex dentatus	Helencah	Altenanthera philloxiroides
Durba	Cynodon dactylon	Sitki	*Phyllanthus reticulatus*
Chanchi	Alternanthera sessilis	Pichas-Ban	Lippia aka
Ghagra	*Xanthium indicum*	Ban-Ghagra	Urena lobata
Vat	Clerodendrum viscosum	Lalverenda	Jatropha glandulifera
Kutus Kata	Lantana camara	Dhekia	Christella dentate
Verenda	Ricinus communis	Dhanighas	Brachiaria reptans
Kanta begun	Solanum sisymbrifolium	Tridhara	Tridax procumbens

This biosurvey data might not reflect the actual biodiversity of that area. One species found in the monsoon might not see in the winter. Extensive survey over the year might give an actual status of biodiversity. Present biosurvey list is a snapshot prepared based on the species found during the survey time.

4.15.2 Aquatic Ecosystem

There are numerous fishing grounds, fresh water fish habitats such as Shitalakhya and Balu rivers, *khals*, ponds, and ditches along and around the pipeline route, providing shelter, feeding, and spawning grounds for different types of fresh water fish. These include catfish (*magura* and *shing*), carps (*katla, rui, and mrigal*), minor carps (*puti*), and others (*tengra, boal, mola, shol*) as well as prawns, particularly the popular small prawns, locally known as *ichha*. Small fishes are frequent, particularly during early monsoon and pre-winter season. In the winter season, there is less fish in the Balu and Shitalakhya Rivers due to pollution. The fish species found in the Balu and Shitalakhya Rivers and the water bodies in the P2 and P3 project area as gathered during the consultations with the fishermen and communities in the surrounding locations are presented in Table 4-25 below.

Table 4-25: Fish species available in water bodies along the transmission mains

Local Name	English Name	Scientific Name
Bai-la -	Awaous guamensis	
Baim	Zigzag eel/tire-track eel	Mastacembelus armatus
Bata/bangna	Bata	Labeo bata
Boal	Wallago	Wallago attu
Magor/shing	Indian torrent catfish	Amblyceps mangois
Chitol	Clown knifefish	Chitala chitala
Darkina	Slender rasbora	Rasbora daniconius
Gutum	Annandale loach	Lepidocephalichthys annandalei
Kalibaus	Orange-fin labeo	Labeo calbasu
Katol	Catla	Catla catla
Koi	Climbing perch	Anabas testudineus
Magur	African catfish /north African Catfish	Clarias gariepinus
Mrigol	Mrigal	Cirrhinus cirrhosus
Pangas	Yellowtail catfish	Pangasius pangasius
Punti (fish)	Puntio barb	Puntius puntio
Shoul	Snakehead murrel	Channa striata
Snake eel *(kuicha)*	Long-fin snake-eel	Pisodonophis cancrivorus
Tara baim	Lesser spiny eel	Macrognathus aculeatus
Tengra		Batasio batasio
Tilapia	Mozambique tilapia	Oreochromis mossambicus
Source: Field visits and consultations		

4.15.3 Forests and Protected Areas

There are no protected areas, forests, wetlands, environmentally sensitive areas, or endangered species in or within the project sites.

4.15.4 Wetland

A stretch of about 8 km of treated water transmission mains from the Shitalakhya Bridge until the Bhatara *Khal* passes through low-lying areas, which are part of eastern Dhaka's low laying areas and water bodies. Major portions of these areas have been filled and developed for large-scale townships by private developers. The project does not propose any additional filling of low-lying areas or water bodies, as the treated water transmission mains will be accommodated within the available road RoW.

4.15.4.1 Protection Measures: Roadside Plantations

There are tree plantations by the RHD along the raw water transmission mains along the Dhaka-Sylhet highway (between Shezan juice factory and Taraboo (Demra) Bridge, and along treated water mains from Gandharbpur WTP to the injection point at the US embassy, passing for 3 km along the road managed by the BWDB along the Sitalakhya River, and subsequently along the RAJUK 100-ft road. The tree species are common species characteristic of the district, and include mahogany, eucalyptus, plum, rain tree, koroi, neem, akasmoni, debdaru, and mango.

The proposed locations for the intake at Bishnondi WTP at Gandharbpur and the Greenfield transmission main corridors are predominantly rice fields or low-lying areas. The trees in these identified locations are common species found in the district, including mango, and plum.

4.15.5 Cultural, Religious, and Archaeological Sites

The project sites are not located within any sensitive historical, cultural, and archaeological areas. There is a small graveyard at the location of the water treatment plant, and there are religious properties along the transmission alignments. Efforts to avoid and minimize impacts on these areas and structures through slight alignment shifts shall be taken as part of the detailed design. If unavoidable, impacts shall be addressed in consultation with the affected stakeholders as per the provisions of the RP for common properties.

4.16 Socio-economic environment

4.16.1 Population and Human Settlement

The project is spread east-west through Araihazar and Rupganj upazilla of Narayanganj district in Bangladesh. At the east end of the project, the intake is on the bank of Meghna river at Bishnanadi Union (adjacent GPS: N 23° 44' 45.821", E 90° 42' 45.186"), which is about 2km downstream (south) of Manikpur Ferry Ghat/crossing. The proposed pipelines and road are mostly through agricultural land. West end of the project, the Water Treatment Plant is located at Gandhrabpur village of Murapara Union of Rupganj Upazilla (GPS: N 23° 45' 32.422", E 90° 30' 50.119").

Araihazar Upazila (Narayanganj district): area 183.35 sq km, located in between 23°40´ and 23°53´ north latitudes and in between 90°35´ and 90°45´ east longitudes. It is bounded by Narsingdi Sadar Upazila on the north, Homna Upazila on the south, Banchharampur Upazila on the east and Rupganj and Sonargaon Upazilas on the west.

Rupganj Upazila (Narayanganj district): area 176.16 sq km, located in between 23°42´ and 23°54´ north latitudes and in between 90°28´ and 90°37´ east longitudes. It is bounded by Kaliganj (gazipur) and Palash Upazilas on the north, Sonargaon Upazila on the South, Araihazar and Narsingdi Sadar Upazilas on the east, Demra, Khilgaon, Badda and Khilkhet Thanas on the West.

Population of Araihazar Upazila: Total 331566; male 171482, female 160084; Muslim 319854, Hindu 116553, Buddhist 22, Christian 28 and others 9.

Population of Rupganj Upazila: Total 403629; male 215019, female 188610; Muslim 379879, Hindu 23466, Buddhist 106, Christian 59 and others 119.

Water bodies near Araihazar Upazila main rivers are Meghna and Brahmaputra and near Rupganj Upazilla main rivers are Shitalakshya and Balu.

Administration of Araihazar Thana was formed in 1921 and it was turned into an Upazila in 1983. Administration of Rupganj Thana was turned into an Upazila in 1983.

(Source: Banglapedia, Census and Upazila)

4.16.2 Economic Activities

Main sources of income of Araihazar: Agriculture 28.48%, non-agricultural labourer 8.29%, commerce 20.19%, transport and communication 4.84%, industry 15.13%, service 5.96%, construction 1.40%, religious service 0.26%, rent and remittance 3.44% and others 12.01%. Main crops are paddy, jute, wheat, potato, mustard seed, and vegetables.

Ownership of agricultural land of Araihazar: Landowner 50.89%, landless 49.11%; agricultural landowner: urban 54.11% and rural 50.76%.

Main sources of income of Rupganj: Agriculture 22.72%, non-agricultural labourer 3.14%, industry 9.19%, commerce 21%, transport and communication 6.58%, service 19.75%, construction 1.98%, religious service 0.18%, rent and remittance 3% and others 12.46%. Main crops are paddy, jute, wheat, sugarcane, mustard, vegetables.

Ownership of agricultural land of Rupganj: Landowner 44.07%, landless 55.93%; agricultural landowner: urban 46.97% and rural 43.44%.

(Source: Banglapedia, Census and Upazila)

4.17 Cultural, Religious, and Archaeological Sites

Archaeological heritage and relics at Araihazar: Two-storied building with 108 rooms (Sadasardi), mazars of Hazrat Garibullah Shah (R) and Jangali Shah (R) at Haizadi, coloured glass decorated Durga Mandir, house of Zamindar Birendra Roy Chowdhury, Dighipar Math (Araihazar), single-domed Jami Mosque (Uchitpur).

Archaeological heritage and relics at Rupganj: Bajra Mosque, residence of Mura Para Zamindar, Mura Para Shahi Mosque, At-ani Mosque and Tara Mosque at Gandharbapur, Brahmangaon Jami Mosque, Golakandail Kalim Shah Jami Mosque.

(Source: Banglapedia, Census and Upazila)

The project sites are not located within any sensitive historical, cultural, and archaeological areas. Though it is not a major religious/cultural destination, there is a small graveyard at the location of the water treatment plant, as well as religious properties along the transmission alignments. Efforts to avoid and minimize impacts on these areas and structures through slight alignment shifts shall be taken up as part of the detailed design. If unavoidable, impacts shall be addressed in consultation with the affected groups as per the provisions of the RP for common properties. The list of cultural properties in the vicinity of the transmission mains is summarized in Table 4-26 below.

Table 4-26: List of cultural properties along the transmission mains

SL No.	Name	Location	Chainage	No. of Floors
1	Haji Islam Uddin Darul Ulum Iskamia Madrasa	Shejan Juice Factory, Bhulta	0+000 to 0+500	4
2	Rupshi Mosjid	Kornogop, Rupshi	5+000 to 5+500	3
3	Borpa Jame Mosjid	Borpa, Rupshi	4+000 to 4+500	2
4	Rupshi Bus stand Mosjid	Rupshi	4+000 to 4+500	1
5	Al Maksud Jame Mosjid	Max, Borabo, Tarabo	6+000 to 6+500	1

Source: IEE report

4.18 Infrastructure and Utilities

There are sufficient infrastructures to support the project activities. The existing roads are adequate to take the load of increased traffic during the construction and operation of the project.

Regarding the availability of services, as water supply and sewage disposal is handled by DWASA, therefore, if additional facilities needed that can be created. For services like gas and electricity cooperation from respective departments would be necessary. Cooperation for the construction of pipelines along road alignments is necessary from

- RHD
- RAJUK
- LGED
- BWDB
- BIWTA, DNCC, DSCC

DWASA will maintain this cooperation and provide adequate services to maintain the project.

4.18.1 Development Activity around the Project Area

The key development activities around the proposed project locations are summarized in Table 4-27 below.

Table 4-27: Major development activities around the project locations

Sl. No	Location	Description	Remarks
1	Manikpur ferry	The ferry ghat by BIWTA, with ferry service	2 km upstream

Sl. No	Location	Description	Remarks
	ghat	operated by RHD, has been witnessing increasing traffic, resulting in development of over 100 shops at the location.	of intake
2	Health and Nutrition Institute, Manikpur	A 121-ha piece of land has been acquired by the government for siting the health and nutrition institute. The project is under implementation.	2 km upstream of intake
3	Industries	Private industries are proposed in the vicinity of the WTP location. Access road leading to the proposed WTP site and beyond is being developed to enable better access to the industries.	Within 1 km of the WTP at Gandharbpur
4	Brick kilns and large-scale residential development	Agricultural lands closer to the intake are approached for development as brick kilns, while certain stretches closer to the Dhaka- Sylhet highway are proposed for residential/ industrial development.	Along transmission mains alignment from intake to Bhulta
5	Bridge across Sitalakhya River	LGED is implementing a two-lane bridge across Sitalakhya.	About 2 km from the proposed WTP
6	Other infrastructure projects	Projects in water supply and sanitation,	Along the treated
Source: IEE report			

5.0 IDENTIFICATION AND EVALUATION OF POTENTIAL IMPACTS

This chapter includes the information about the development activities consecutive impacts. Also includes the package wise impacts where possible. In this designed packages construction impact almost same for all packages. Extensively has designed for package one components. Package 1 consists three component where intake point has ecological, land acquisition, resettlement,

5.1 Common Impact for all packages

This section provides information about all three packages common impact information is whereas package 1 describes relatively water intake and water treatment related impacts. Package 2 provides the information about transmission line related impacts. Rest of the part will include the impacts associated with distributary line of the package threes component 3.1 and 3.2.

5.1.1 Ecological Impacts

The alignment passes through roadside, agriculture fields and low-lying areas. There are no environmentally sensitive areas approximately the proposed transmission and distribution pipeline. However, borehole-drilling activities not disturbs the acquisition and resettlement of private agricultural lands but construction stage several vegetation and trees need to clear as side clearance activity. Cutting of trees in private lands will be avoided or at least minimized. The contractor, who will also take care for the saplings for the duration of his contract, will implement compensatory plantation for trees lost at a rate of 10 trees for every tree cut.

5.1.2 Land acquisition and resettlement

The proposed intake site on the banks of the Meghna River at the Bishnondi village is on private agricultural lands owned by 88 families. The crops cultivated are rice, other grains, and vegetables. There are no residential/commercial structures within the identified lands. A resettlement plan in line with the SPS (2009) was prepared based on census and socioeconomic surveys of the affected persons to address the impacts due to land acquisition and resettlement in the project and are presented in separate covers. During the implementation of the project, it is necessary to implement the resettlement and provide necessary compensation to affected people. It is the responsibility of WASA to monitor the implementation of resettlement action plan for success of the project. ***Summary of the area acquisition and its impacts:***

1. For P1 widely 31m area acquire along all pipeline length
2. In P2 widely along all pipeline 20 m area will acquire
3. Pipeline under 10m of the waterway bed level will maintain
4. Filling of ponds/borrow pits with sand
5. DWASA acquired land from Gandharbpur in 1982, which is very fertile and can grow almost all kind of vegetables; sugarcane and jute are cultivated here. Most of the landowners live on agriculture; therefore, losing land is losing income to them.

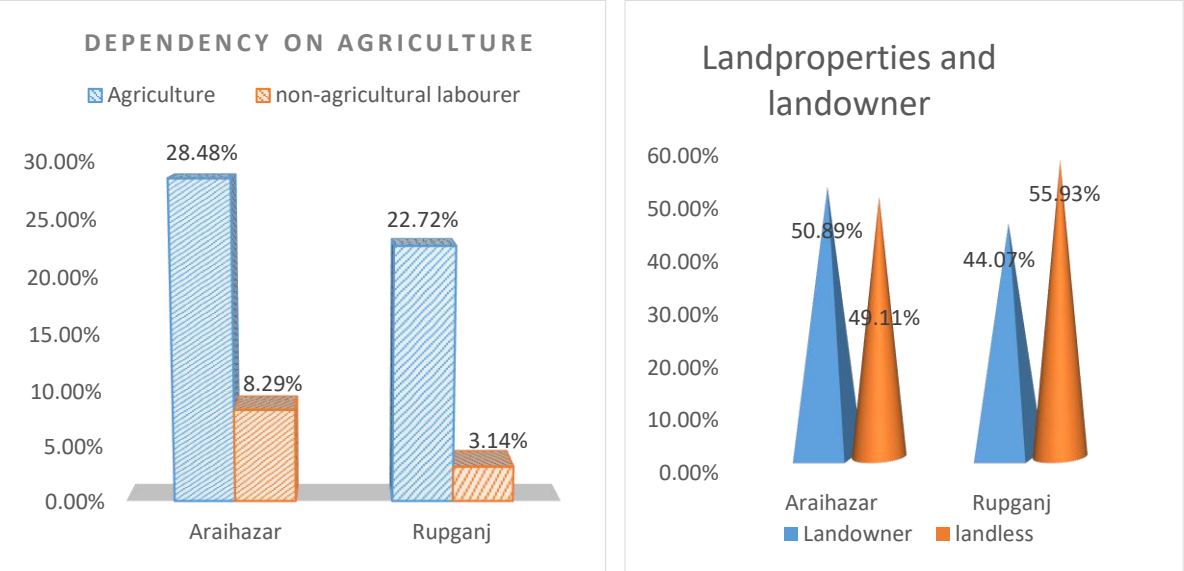


Figure 5-1: Profession and landowner information in two major areas in this project

(Source: Banglapedia, Census and Upazila)

Figure 5-1 also shows that- In Araihazar, 28.48% people's primary profession is agriculture and 8.29% survive their livelihood focusing as agricultural labor. Figure 5-1 showing Araihazar and Rupganj areas professional status respectively. Main crops are paddy, jute, wheat, potato, mustard seed, and vegetables. In Araihazar: 50.89% farmers cultivate in their own land and 49.11% people are landless work as day labor in agricultural field Figure 5-1.

In this above circumstances, it is clear there have huge impact on agricultural farmers. Rather that, some private land and settlement also disrupted during this development work. Subsequent mitigation measures also discussed in mitigation plan section.

5.1.3 Impact on Socio-economic Environment

A Census in January - October 2016 and Resurvey in December 2016 result shows that, Environment associated socioeconomic impacts at the ***point of WTP*** is large. Almost 232 household have 1148 person will affect by this activity whereas, 106 farmer, 31-business man and 12 are Wage Laborers (unskilled) employed in Business Enterprises. However, 43 nos. Primary Structures, nine Secondary Structures and Trees (Including Banana and Bamboo) will affect 561 nos.

Report of the Resettlement Plan report shows that, for construction of ***Water Intake Area (WIA) – SECTION 1*** total land required 8.65 Ha. In this section cultivativated land is 5.75 Ha. Total Vulnerable HHs of this point is 51, and the Total Affected Population is 535 persons.

Census in January - October 2016 and Resurvey in December 2016 of RP experts shows that, income generated community's Distribution of AHs by Annual Income is the range is 48,000 - 15,12,000 (BDT). RP team has Updated Budget for Providing Necessary Compensations to the AHs. From the information of the RP team presenting that, Replacement Cost of the Structure, trees and crops are 10,685,424 BDT.

The resettlement plan prescribes compensation for the affected structures, both primary and secondary at replacement cost. According to the inventory of losses survey, two categories of structures comprising living house and shops were affected due to the project interventions. Rates of structures have been assessed through property valuation survey. Recent development projects in the region were also consulted in this respect.

The AHs are entitled to compensation for affected sanitary latrine and tube wells as per policy of the resettlement plan. A number of 3 Tube-wells and 40 latrines will be affected.

Transitional Allowance depicted that a number of 33 AHs will receive BDT 23,76,000 as transitional Allowance at the rate of 400 for 180 days (6 months) the official minimum wage (8 HHs for full loss of 9 residential structures, 21 HHs for full loss of 26 business structures and 4 HHs for full loss of 8 residential along with business structures). according to original entitlement matrix

The RP has kept provision for paying compensation for big and medium size trees, banana, and bamboos only. Some bamboo trees were found on government land planted by the local people for their own use. In addition, some fruit trees were found without timber value such as guava, papaya, banana, etc. The EM does not have provision for small trees, as it was grown naturally.

The business enterprises were classified as large-scale and small and medium type business based on the nature of business and investment amount. A total of 31 small size businesses including one residence-cum-business have been affected. Compensation/resettlement benefits calculated based on policy matrix of the RP.

The employees of shops are entitled to have resettlement benefits as per policy of the resettlement plan. 12 unskilled employees were affected by the project.

At the meeting, which held on 3rd December, 2017, one issue was pending to solve that who will be entitled for getting vulnerable grant either the APs or AHs. Saswati G. Belliappa, Social safeguard Officer of ADB decided that its optional for DAWSA; it will be dependent on vulnerable criteria selection, if number of vulnerable is counted as per household, then grant will be provided to the households, not to each member. The resettlement plan prescribes resettlement benefits such as one time moving assistance for vulnerable households at the rate of 1625/HH/month for one year.

Livelihood restoration and enhancement of vulnerable household is very sensitive issue. Specific program design to improve, or at least restore livelihood means is one of the main objective of RP. RP proposes livelihood program budget to enhance their skill as well as for livelihood assistance. This indicative budget prepared for training on expected occupation choices and grants for livelihood Restoration.

Estimated Budget for replacement value of land and others feature for ***Section-2*** is 94, 07,63,710 BDT. Whereas, Compensation for Land (in Acre) Private Land required most of the portions 927,521,474 BDT and Compensation for land (in Acre) GoB Land 132,42,236 BDT.

Estimated Replacement Value for Primary Structures and Secondary structure is **152,230,635 BDT** whereas Primary structure replacement cost is high, the figure is 161,564,071 BDT

Table 5-1: Estimated cost for trees

F	Compensation for Trees	Unit	Total Quantity	Rate per Unit	Estimated Budget in BDT
F.1	**Fruit Bearing**				
1	Big	Nos.	229	1987.77	455,199
2	Medium	Nos.	383	888.25	340,200
3	Small	Nos.	1338	476.61	637,704
4	Plant	Nos.	1281	242.15	310,194
	Sub-Total F.1		**3231**		1,743,297
F.2	**Timber Type**				
1	Big	Nos.	122	1701.64	207,600
2	Medium	Nos.	184	811.41	149,299
3	Small	Nos.	679	512.22	347,797
4	Plant	Nos.	334	297.01	99,201
	Sub-Total F.2		**1319**		**803,898**
F.3	**Medicinal Plant**				
1	Big	Nos.	5	1920	9,600
2	Medium	Nos.	20	620	12,400

F	Compensation for Trees	Unit	Total Quantity	Rate per Unit	Estimated Budget in BDT
3	Small	Nos.	43	562.79	24,200
4	Plant	Nos.	19	552.63	10,500
	Sub-Total F.3		**87**		**56,700**
F.4	**Other Type of Tree**				
1	**Banana**	Nos.	1,104	100	**110,400**
2	**Bamboo**	Nos.	611	150	**91,650**
	Sub-Total F.4		1715		**202,050**
	Total of Trees (F.1 to F.4)		**6,352**		**2,805,946**

Estimated Business Restoration Grants 5,250,000 estimated Cost for Crops Compensation for Vulnerable Households 23,754,500, provision for Livelihood and Income Restoration 80,830,000.

5.1.4 Impact on Health and Safety and mitigation measures

5.1.4.1 Impact Origin

As there might be hazards to the plant workers, employees and technical personnel, provisions need to be made by the project for protecting occupational health, including protection of workers from hazards/fires/spillage etc. as well as protection of workers' health and assurance of safe drinking water supply and sanitation. The workers who work inside the treatment plant face occupational health hazard due to different operation processes.

5.2 Design Impacts for All Components

Site selection of construction work camps, stockpile areas, storage areas, and disposal areas. The detailed design shall identify suitable locations for these facilities near to the project locations. However, if it is deemed necessary to locate elsewhere, sites to be considered shall not promote social instability and result in destruction of property, vegetation, irrigation, and water bodies.

None of these temporary facilities shall be located (i) within 500 m of residential areas and rivers identified as ecologically critical areas (ECA), Balu and Sitalakhya Rivers, and (ii) within 100 m of other water courses and khals. Though the contractor will be free to decide locations, a list of feasible locations shall be included in the design specifications and plan drawings for approval by the PMU.

Site selection of sources of materials. To mitigate the potential environmental impacts, locations of quarry sites and borrow pits (for loose material other than stones) will be included in the design specifications and plan drawings, for approval by the PMU. Priority of sites shall be investigated during detailed design stage. If other sites are necessary, these shall be located away from population centers, drinking water intakes and streams, cultivable lands, and natural drainage systems, and in structurally stable areas, even if these are some distance from construction activities. It shall be the design-build contractor's responsibility to verify the suitability of all material sources, and to obtain the approval of the relevant government agencies, as required.

Asbestos cement pipes: The alignment of the transmission mains is mostly outside the urban areas of Dhaka, and it is unlikely that asbestos cement pipes will be encountered during the laying of the transmission mains. In the event of accidental discovery of asbestos cement pipes, these will be left in situ, undisturbed, so there will be no deliberate excavation of asbestos cement pipes.

The contractor will (i) train all personnel (including manual laborers) to enable them to understand the dangers of asbestos cement pipes and to be able to recognize them in situ; (ii) report to management immediately if asbestos cement pipes are encountered; and (iii) develop and apply an asbestos cement management plan.

The contractor, as part of the detailed designs, shall develop a protocol to be applied in any instance that asbestos cement pipes are found, to ensure that appropriate action is taken. This shall be based on the approach recommended by the United States Environmental Protection Agency (USEPA), and among other things, shall involve (i) developing reporting procedures to inform the environmental officer of the PMU immediately if asbestos cement pipes are encountered; and (ii) requiring the SC to develop and apply an asbestos cement management plan, as part of the overall health and safety plan, to protect both workers and citizens in case of accidental uncovering of asbestos cement pipes.

Impacts to common property resources and other private assets due to the proposed components shall be addressed through alternative arrangements for the communities and stakeholders, as part of the designs.

Impacts arising from the inappropriate designs of proposed facilities would in general include poor design of sludge drying beds, etc. These shall be addressed through adoption of good practices as part of the detailed design.

The resettlement impacts are summarized in the project's resettlement plan. Impacts are limited to economic displacement in the form of loss of land, assets, income sources, and means of livelihoods as a result of involuntary resettlement.

5.2.1 Construction Impacts

The impacts during construction will include typical construction-related impacts associated with construction of water intakes and treatment plants and the laying of transmission lines. While the nature of these impacts is not expected to be significant, the magnitude is, given the size and scale of the proposed facilities. However, these impacts are known and can be addressed through good engineering practices and specific mitigation measures for minimization of construction impacts on sensitive receptors and communities in the vicinity of locations and alignments.

5.2.1.1 Spoil removal from construction sites

During construction period, all work will generate associated waste like spoil from construction work, spoil from dredging activity and contaminated oil and grease mix soil will impact nearby area. These type of spoil waste need safe disposal to landfill site.

5.2.1.2 Impacts due to work camps

Operation of work camps can cause temporary air and noise pollution from machine operation, and water pollution from storage and use of fuels, oils, solvents, and lubricants.

5.2.1.3 Impact on Occupational Health & Safety

Although work provides many economic and other benefits, a wide array of workplace hazards also present risks to the health and safety of people at work. These include but are not limited to, "chemicals, biological agents, physical factors, adverse ergonomic conditions, allergens, a complex network of safety risks," and a broad range of psychosocial risk factors. Some of the machines used in construction of intake, laying-pipelines and in the treatment plant, involve moving parts, sharp edges, hot surfaces and other hazards with the potential to crush, burn, cut, shear, stab or otherwise strike or wound workers if used unsafely.

5.3 Impacts associated with P1 components

5.3.1 Impacts on fisheries/river ecology

Intake structure at Meghna river may provide two-fold impact on the fiheries and river ecology: 1) if the intake velocity is higher than the fish swimming velocity of Key fish species like Hilsa, jatka or any other small fishes or any other river ecology 2) if the proposed volume of abstraction cause impact on fisheries or river ecology or downstream users. Impacts on ecology and downstream uses for proposed abstraction.

The proposed abstraction accounts for only 0.3% of the lean flow (Q_{95}) for 2035, and about 0.2% of the maximum flow (Q_5) for 2035. There is no available model on the effect of abstraction on morphology and ecology of the river. There is no allowable abstraction limit for

river in Bangladesh. However, allowable abstraction limit for different river ecology (such as macrophytes, macro-invertebrates, fish) for different types of UK Rivers were analyzed (**Appendix -10**). The Meghna river can be considered as river type B. In no case lowest allowable abstraction is below 10%. However, for the least ecologically sensitive rivers, maximum abstractions in the range 15–35% of the natural flow were proposed, depending on the flow magnitude and time of year. For the most sensitive rivers, the maximum abstraction proposed was in the range 7.5–25%. There the proposed abstraction (0.3% of the lean flow (Q95) and about 0.2% of the maximum flow (Q_5) for 2035 is minor.

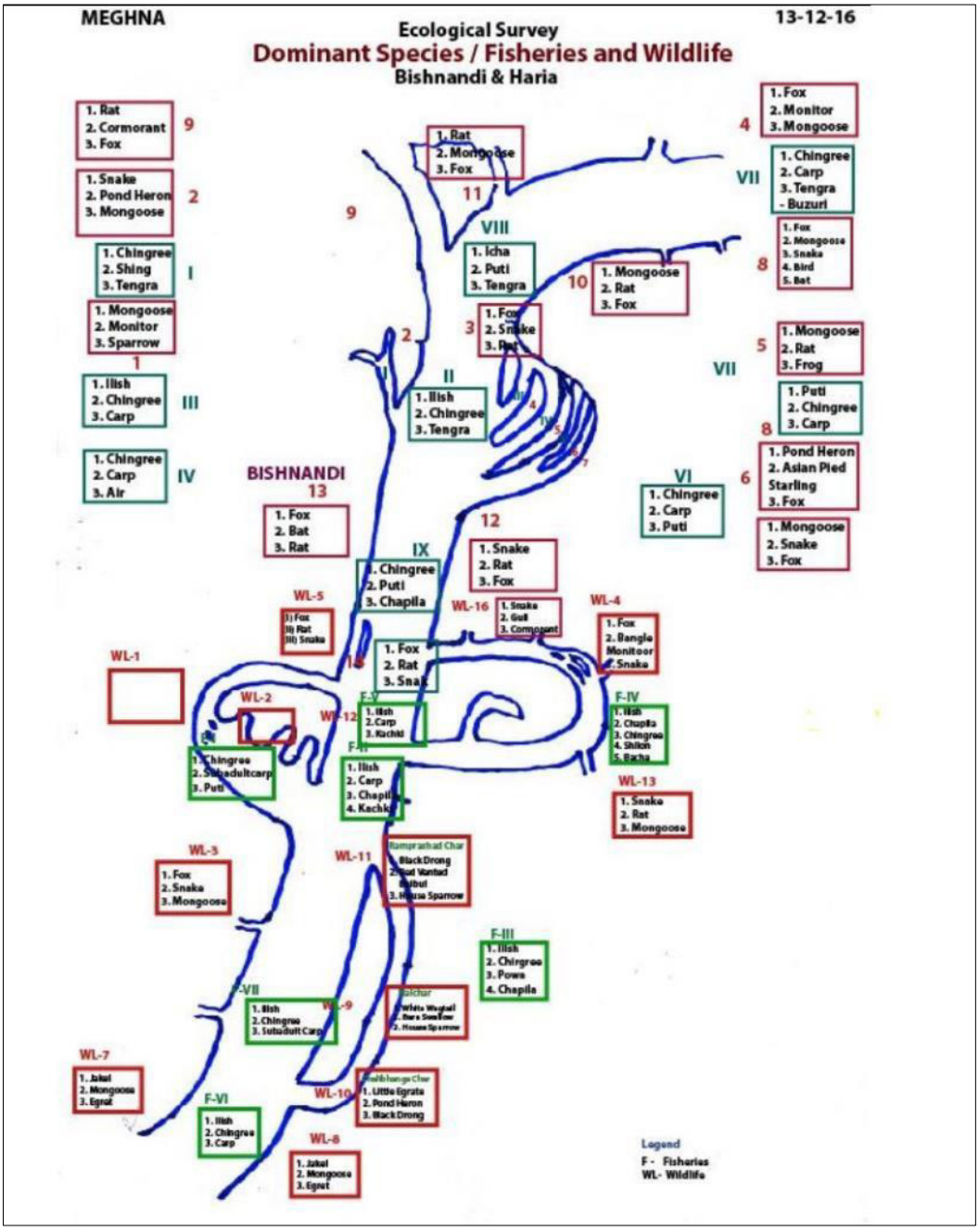


Figure 5-2: Possible impact on different Species

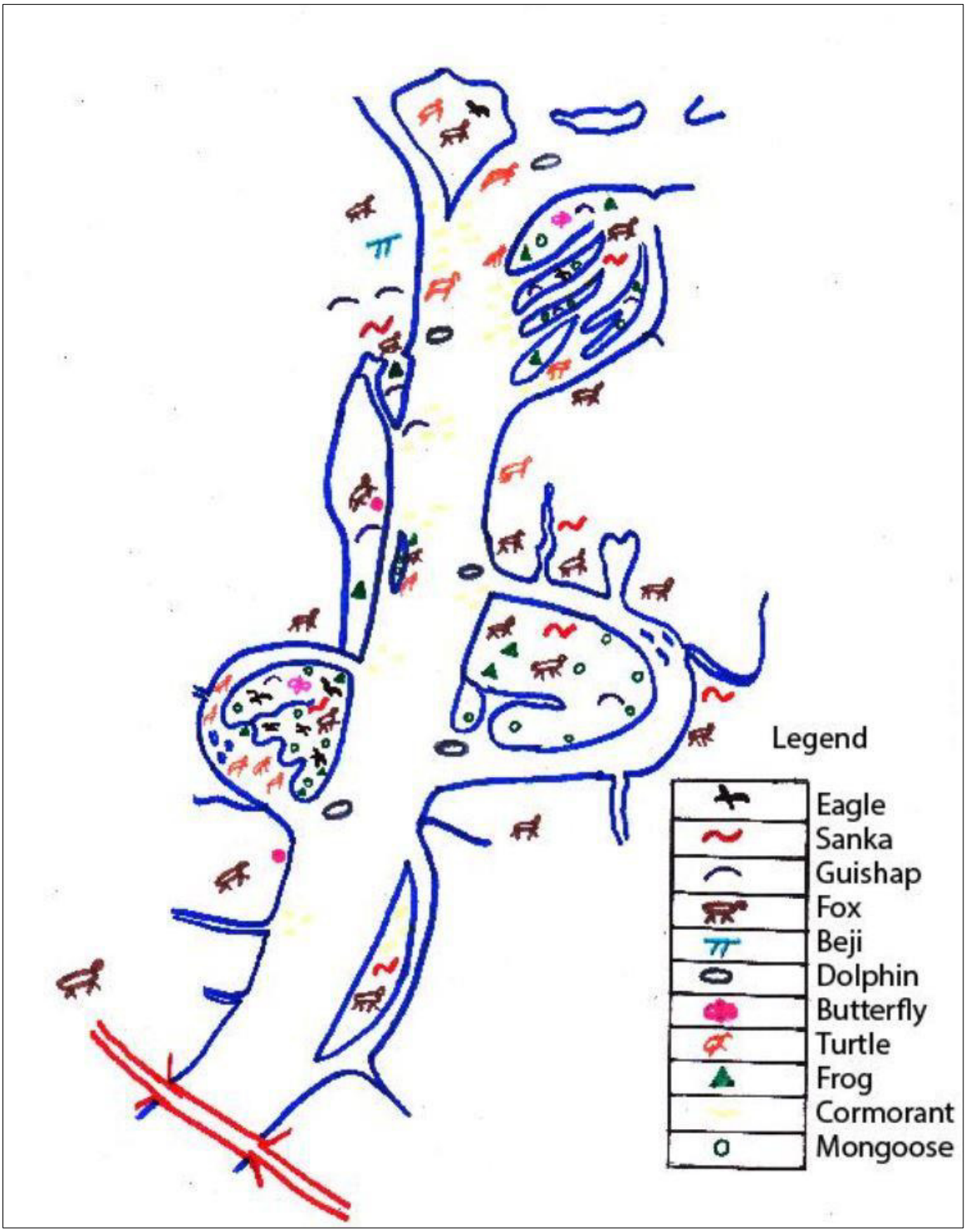


Figure 5-3: Impacts on wildlife

This minor level of abstraction is considered not to adversely affect downstream uses or ecological flows of the Meghna River. Further, these levels of abstraction are not envisaged to result in any flow modifications, which can potentially lead to salinity intrusion or impacts on downstream water uses.

5.3.2 Upstream pollution impacts

The water quality-monitoring program carried out as part of the feasibility study confirmed that the key water quality parameters at the intake location are within permissible limits for inland surface waters designated for use for water supply after conventional treatment. The current low levels of pollution can be attributed to the absence of any major pollution sources upstream along the Meghna, coupled with dilution factors in the river system.

5.3.3 Transmission Mains—Intake to Gandharbpur WTP

A 31 m-wide, 17.2 km-long corridor is proposed to accommodate the transmission mains from intake to the Shezan juice factory on the Dhaka-Sylhet highway junction. From Shezan juice factory to the Gandharbpur WTP, a 25 m-wide corridor running for 4.5 km is proposed. The alignment passes through agriculture fields and low-lying areas. There are no environmentally sensitive areas in the vicinity of the proposed transmission main/access road. Land acquisition and resettlement of private agricultural lands are envisaged. The impacts are being addressed through the provisions of the RP. Cutting of trees in private lands will be minimized. Compensatory plantation for trees lost at a rate of 10 trees for every tree cut will be implemented by the design-build contractor, who will also maintain the saplings for the duration of his contract. Impact on inland water bodies, including khals and fishponds, will be addressed in the detailed designs through appropriate measures to provide for cross-drainage to minimize severance impacts. Traffic management plans and spoil management plans shall be prepared as part of the detailed designs.

5.3.4 Construction Impact

During construction period pedestrian and vehicle movement and business will be restricted and hampered for all the 6 components along the pipeline route. During construction period generate dust, air, gaseous, noise, solid waste, liquid waste and water pollution and affect quality of surrounding environmental as a result life style will also affected.

5.3.5 Increased flooding caused by P1 road embankment

During high flood road embankment under P1 may affect and damage the crops. This may happen if opening of water way are inadequate passage.

5.3.5.1 Impact on Employment and Family Finance

The project envisages providing permanent employment of substantial number of skilled and unskilled personnel during its operation phase. This would obviously help to present unemployment burden of the country to some extent. A person with an average gross salary of about Tk. 3000 per month will able to increase his family income by Tk. 100 per day. This will definitely provide an opportunity to improve his basic living standard. Apart from this direct benefit, there would other indirect beneficial impacts on national economy through foreign investment.

5.3.6 Operation and Maintenance (O&M) Impacts

5.3.6.1 Impact generated from Plant operation

In this projected area has some environmentally, sensitive areas and the efforts to incorporate environmentally sound designs to minimize impacts (as part of the design of the components), the impacts during the maintenance and operation of the proposed facilities will not be significant for unused spare parts, oil, mobile, grease and other compositions.

5.3.6.2 Sludge handling

During operation of the WTP, physical and chemical sludge will generate. The drinking water treatment sludge usually contains colloidal iron and alum hydroxides, colloidal or dissolved organic matter, clay, silt and microorganisms.

5.3.6.3 WTP Treated water handling

Several solids sometimes pollute intake water in the waterbody. After separating sludge, pollutant water will retreated to release into waterbody. If not possible, the treated water will reserve into an artificial waterbody adjacent of the construction side for horticulture gardening purpose.

5.3.6.4 Hazardous Chemical Handling

Sometimes heavy metal and hazardous chemical contains in water. This may cause the

livelihood of the dependent fauna.

5.3.6.5 Increased sewage generation

The increased wastewater volume from Zone 05 and 08, due to the additional water supply of 262 MLD, will be fully addressed by the ongoing government-funded Dasherkandi sewage collection system and STP (500 MLD) development project (Phase 1 Priority Projects).

While Zones 04 and 09 have yet no funding for facilities to treat their share of the increased water supply (178 MLD and 60 MLD respectively), but it will generate further sewage problem.

5.3.6.6 Impact on landscape

Industrial building when not designed in considering the local landscape, and then it creates visual intrusion to the people. The present plant changes the local landscape of the area to some extent by converting an agricultural green area into a built-up area. The present plant is relatively compact and of modern appearance which does not provide any significant visual intrusion.

5.4 Impacts associated with P2 components

5.4.1 Agriculture and irrigation channel Impact

A 31 m-wide, 17.2 km-long corridors is proposed to accommodate the transmission mains from intake to the Shezan juice factory on the Dhaka-Sylhet highway junction. From Shezan juice factory to the Gandharbpur WTP, a 25 m-wide corridor running for 4.5 km is proposed. The alignment passes through agriculture fields and low-lying areas. There are no environmentally sensitive areas approximately the proposed transmission main/access road. There have irrigation channel vicinity of the projected area. Relatively in the adjacent area of Vulta to Navagram area. Land acquisition and resettlement of private agricultural lands are envisaged. The impacts are being addressed through the provisions of the RP.

(i) loss of productive agricultural lands and conservation of topsoil;
(ii) impacts on low-lying areas and water bodies, wherein protection measures are required to minimize impacts on water quality, disposal of wastes/debris in the water bodies, and potential disruption of flows;

5.4.2 De-watering of construction excavations - water disposal

During excavation for construction of pipeline de-watering will be require at the low land and near river area. Disposal of this water need proper management system otherwise it will affect the construction work.

5.4.3 Construction Impact on River Crossing and Meghna Intake Points

In this projected area, have some major crossing points. For instances- Sitalakhya River crossing by micro-tunneling method (0.5 km), Balu River crossing at Baraid by micro-tunneling for a length of 0.25 km; and Balu River crossing to Vatara near US Embassy for a length of 6.5 km and finally treated water from Gandharbpur 1 WTP will be conveyed to the US Embassy injection point through one 1,600-mm pipe.

Further, on from the injection point, 1,000 mm-1,600 mm diameter feeder mains will be laid along major arterial roads, connecting at strategic points based on the Dhaka water distribution model designed and operated for DWASA. In this settings, construction activities at the river crossings will be carried out in conformance with the conditions laid down by the BIWTA in the permit for river crossings. The vertical shafts shall be located outside the watercourse or riverbed to minimize migration of contaminated soil or water into the river. The contractor shall identify suitable locations for disposal of the soil and water from the tunnel. Precautionary measures will be taken by the contractor to ensure that there is no disposal of construction wastes/materials into the river or on the shores. The construction activities and operations for the river crossings will be planned to ensure that interference of cargo boats, navigation-including fishermen, and passenger movements-are minimal. The construction activities and laying of pipes will be carried out in such a manner that the dredging activities of the river are not affected.

Trenching and backfilling operations at the stream crossings will be carried out in the lean seasons, when the flow will be minimum. In case of crossings at existing minor bridges and culverts, the contractor will ensure that there is no impact/ disturbance to the bridges/culverts due to crossing of the water pipelines.

5.4.4 Impacts on Fisheries and local transits

(i) air, noise, and vibration impacts due to construction vehicles, equipment, and machinery in the vicinity of construction site and inhabited sections, in addition to dust control during construction activities;
(ii) Impacts on the river courses and the water quality during the construction of the transmission mains across the rivers Shitalakhya and Balu;
(iii) management of spoil disposal due to the excavation for the transmission mains;
(iv) Safety measures during construction including traffic diversions;
(v) management of sites temporarily used for construction activities, including borrow areas, construction camps, etc. and rehabilitation of the sites after completion of the temporary use; and
(vi) Impacts on community health and safety hazards posed to the public, specifically in inhabited areas.

In addition to these measures, environmental measures that will be implemented as part of good engineering practices during construction are laid down in the EIA. A checklist for safety during construction is provided in **Appendix-11**.

5.5 Impacts associated with P3 components

Package 3 comprises the distribution line near US embassy. In this distribution line, somewhere small scales waterbody and local transits. In order to manage these impacts some measure might be helpful. Such as bypass route construction and dewatering of construction excavations.

5.5.1 By pass route and De-watering of construction excavations

During excavation for construction of pipeline de-watering will be require at the low land and near river area. Dewatering water will pump into adjacent reservoirs for temporary shift this water. After work complete, the water will refill within its own source. Disposal of this water need proper management system otherwise; it will affect the construction work.

5.5.2 Labor recruitment and associated impacts

Labor recruitment and mismanagement sometimes create risks. In metropolitan areas, labors without knowledge about traffic system make hamper the work. However, is a matter of company Who has the right to determine whom he shall and shall not employ, but still, the project proponent shall employ local people wherever possible and to give preference to employment of the land less and jobless people. This will ensure the real benefit for the poorest of the poor.

5.6 Rapid Environmental Assessment Checklist

Checklist is comprehensive lists of environmental effects and impacts indicator designed to stimulate the analysts to think broadly about possible consequences of contemplated actions (Munn, 1979).

Table **5-2** represents the checklists developed for the present plant.

It should be noted that identification indicated in the Checklists are based on assuming that no negative impacts mitigation measures are undertaken.

Table 5-2: Rapid environmental assessment checklist

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area…?			
Densely populated?	√		
Heavy with development activities?		√	
Adjacent to or within any environmentally sensitive areas?		√	
Cultural heritage site		√	
Protected Area		√	
Wetland	√		
Mangrove		√	
Estuarine		√	
Buffer zone of protected area		√	
Special area for protecting biodiversity		√	
Bay		√	
B. Potential Environmental Impacts Will the Project cause…			
pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		√	
hazard of land subsidence caused by excessive groundwater pumping?		√	
conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		√	
unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?		√	
delivery of unsafe water to distribution system?		√	
over pumping of groundwater, leading to salinization and ground subsidence?		√	
excessive algal growth in storage reservoir?		√	
increase in production of sewage beyond capabilities of community facilities?		√	
impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		√	
Impact on fish and fisheries		√	
overflows and flooding of neighboring properties with raw sewage?		√	
hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		√	
environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?		√	

Screening Questions	Yes	No	Remarks
health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in sewage flow and exposure to pathogens in sewage and sludge?		√	
inadequate disposal of sludge from water treatment plants?		√	
inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		√	
impairments associated with transmission lines and access roads?		√	
health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals..		√	
impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services.		√	
deterioration of surrounding environmental conditions due to rapid urban population growth, commercial and industrial activity and increased waste generation to the point that both man-made and natural systems are overloaded and the capacities to manage these systems are overwhelmed?		√	
degradation of land and ecosystems (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests)?		√	
dislocation or involuntary resettlement of people		√	
degradation of cultural property, and loss of cultural heritage and tourism revenues?		√	
occupation of low-lying lands, floodplains and steep hillsides by squatters and low-income groups, and their exposure to increased health hazards and risks due to polluted industries?		√	
water resource problems (e.g. depletion/degradation of available water supply, deterioration for surface and groundwater quality, and pollution of receiving waters?		√	
air pollution due to urban emissions?		√	
social conflicts between construction workers from other areas and local workers?		√	
road blocking and temporary flooding due to land excavation during rainy season?		√	
Noise and dust from construction activities?	√		Project will avoid construction work during night

Screening Questions	Yes	No	Remarks
Traffic disturbances due to construction material transport and wastes?	√		May cause some concern occasionally
Temporary silt runoff due to construction?		√	
Hazards to public health due to ambient, household and occupational pollution, thermal inversion, and smog formation?		√	

5.7 Impact Identification Checklist

Impact identification has also been carried out according to different project phases by using checklist method, which also provides specific idea of the impact. The methodology basically incorporates a list of environmental components which might be affected with the anticipated level of impact with respect to different project activities. Combining these lists as horizontal and vertical axis for the matrix allows the identification of cause effect relationship between the specific activities and impact levels.

Table 5-3: Effect of project activities on environmental parameters due to project location

Physico-chemical parameters	Environmental examination (SEIs without mitigation)						
	Positive impact			No impact	Negative impact		
	Low	Moderate	High		Low	Moderate	High
Land value depreciation		√					
Loss of land displacement from homestead				√			
Loss of land displacement from agriculture				√			
Damage to nearby operation				√			
Disruption to drainage pattern					√		
Inadequacy of buffer zone				√			
Encroachment into precious ecology				√			

Table 5-4: Effect of project activities on physico-chemical environmental parameters in construction phase

Physico-chemical parameters	Environmental examination						
	Positive impact			No impact	Negative impact		
	Low	Moderate	High		Low	Moderate	High
Water and soil quality					√		
Traffic flow					√		
Air quality					√		
Noise level						√	

Table 5-5: Effect of project activities on ecological parameters during construction

phase

Ecological parameters	Environmental examination						
	Positive impact			No impact	Negative impact		
	Low	Moderate	High		Low	Moderate	High
Wetlands					√		
Homestead vegetables					√		
Forest cover				√			
Fisheries and macro-invertebrates					√		
Aquatic plants					√		

Table 5-6: Effect of project activities on socio-economic parameters during construction phase

Socio-economic parameters	Environmental examination						
	Positive impact			No impact	Negative impact		
	Low	Moderate	High		Low	Moderate	High
Human settlement	√						
Health and well being					√		
Navigation				√			
Transportation					√		
Employment		√					

Table 5-7: Effect of project activities on physico-chemical environmental parameters during operation phase

Physico-chemical parameters	Environmental examination						
	Positive impact			No impact	Negative impact		
	Low	Moderate	High		Low	Moderate	High
Water and soil quality			√				
Traffic flow	√						
Air quality				√			
Noise level				√			

Table 5-8: Effect of project activities on ecological parameters during operational phase

Ecological parameters	Environmental examination						
	Positive impact			No impact	Negative impact		
	Low	Moderate	High		Low	Moderate	High
Wetlands		√					
Homestead vegetables			√				
Forest cover	√						
Fisheries and macro-invertebrates				√			
Aquatic plants				√			

Table 5-9: Effect of project activities on socio-economic parameters during

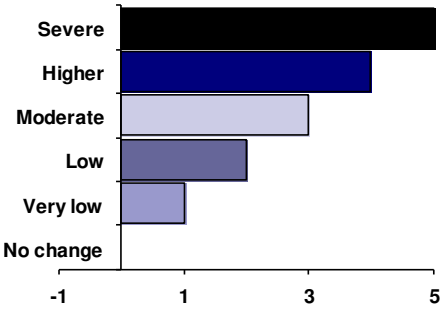
operational phase

Socio-economic parameters	Environmental examination						
	Positive impact			No impact	Negative impact		
	Low	Moderate	High		Low	Moderate	High
Health and well being			√				
Navigation				√			
Transport	√						
Employment		√					
Industrial activities		√					
National economy		√					

5.8 Evaluation of environmental impacts

The assessment of the beneficial and adverse changes in environment resources or values resulting from a proposed project has the following aspects:

- Essential Elements
    1. **Identification** of possible positive or negative impacts of the project.
    2. **Quantifying** impacts with respect to common base.
    3. Preparation of **mitigation** plan to offset the negative impacts.
- Environmental Impact Value
- Vi = Relative change of the environmental quality of parameters
- Wi= Relative importance or weight or parameter
- N = total number of environmental parameters
- Changes of environmental parameters
    1. Severe (+5 or -5)
    2. Higher (+4 or -4)
    3. Moderate (+3 or -3)
    4. Low (+2 or -2)
    5. Very Low (+1 or -1)
    6. No change (0)



These aspects are incorporated to evaluate the environmental impact of the project, which has been presented in Table 5.9. The analysis indicates that cumulative impact of the project is slightly negative. However, things can turn positive by following proper mitigation measures, which has been discussed in the EMP.

Table 5-10: Environmental impact evaluation (without mitigation)

ENVIRONMENTAL PARAMETERS	Relative Importance Value	Degree of Impact	EIV
I. **ECOLOGICAL**			
Fisheries	10	-2	
Forest	5	0	
Tree Plantation	2	+2	
Wetland/Wetland Habitat	4	0	
Nuisance Plant / Eutrophication	1	-1	-17
II. **PHYSICO-CHEMICAL**			
Erosion and Siltation	2	-1	
Regional Hydrology/Flooding	6	-1	
Drainage Congestion/Water logging	5	-1	
Obstruction to Waste Water Flow	3	0	
Dust Pollution/Noise Pollution	2	-1	-15

ENVIRONMENTAL PARAMETERS	Relative Importance Value	Degree of Impact	EIV
III. **HUMAN INTEREST**			
Loss of Agricultural Lands	8	-3	
Employment Opportunities	8	+4	
Navigation/Boat Communication	3	-2	
Commercial and Service Facilities	6	+3	
Industrial Activities	3	+2	
Irrigation Facilities	2	0	
Landscape	2	-1	+24
Total Environmental Impact Value			-8

6.0 ANALYSIS OF ALTERNATIVES

This section examines alternatives to the proposed project site, technology, design, and operation in terms of their potential environmental impacts, and the feasibility of mitigating these impacts. It also states the basis for selecting alternative options for the component. The analysis of alternatives for the project components was carried out as part of the feasibility study, and has been taken forward and confirmed during the PPTA and the preparation of IEE. During the EIA preparation, a set of pipeline alignment and treatment plant site alternatives analysis was performed and presented in the approved EIA report. During the update of EIA report no other alternative options found feasible and based on pipeline route alignment was fixed.

6.1 No Project Options

From a purely physical environmental point of view, the 'do-nothing` is preferable to any project implementation, since it would avoid creation of any of the adverse impacts associated with the project. However, the potential socio-economic benefits to the nation would be foregone and drinking water is essential part human life, improvement of life style, national productivity growth and Sustainable Development Goal (SDG) would be hampered.

The very increasing trend of the population putting extra pressure on the scarce water resources of the Dhaka city area. The total production capacity of DWASA is 2247.47 Million MLD (both groundwater and surface water). Apparently, DWASA is unable to fulfill current water demand through their capacity (Dhaka Water Supply and Sewerage Authority, 2009).

However, DWASA has never reached its production target and actual production for groundwater and surface water is 1831.20 MLD and 256.30 MLD respectively with a demand-supply gap of 160 MLD. Moreover, if we account 31.68 percent Unaccounted for Water (UFW) or system loss between production and end-user level then real supply would be 1426.18 MLD. The statistics imply that almost half of the population in Dhaka city are deprived of getting DWASA projected standard water requirement (150 l/p/d). To supply water in Dhaka city, DWASA runs 560 deep tube wells (DTWs) and four surface water treatment plants (SWTPs). In this circumstances there is no positive options to unimplemented this project.

It is concluded that the 'No Project Options' alternative is unacceptable, and the potential socio-economic benefits of implementation of such project far outweigh the adverse impacts, all of which can be controlled and minimized to an allowable level.

7.0 ENVIRONMENTAL MANAGEMENT AND MITIGATION PLAN

7.1 Organization Management Aspects

Executive responsibility for project management commonly involves a number of organizations, each with specific responsibilities for particular aspects during the pre-construction, construction and operation and maintenance phases.

7.1.1 Pre-construction Phase

Prior to contractor mobilization and the commencement of construction, environmental management will cover six principal groups of activities:

- Review of EIA and put additional mitigation/enhancement measures as necessary for all sub-projects;
- Preparation of a detailed Environmental Management & Monitoring Plan (EM&MP) but with sections, which deal with any additional matters relating to specific project activities. The EM&MP will address fully the nature and extent of other related agencies/departments involvement in environmental management, and will provide cost estimates for environmental management and monitoring;
- Preparation of detailed designs which give due consideration to minimization of adverse impacts and benefit enhancement;
- Preparation of tender and construction contract documentation which contains appropriate clauses to allow control of impacts arising from construction activities;
- Preparation of a Resettlement Action Plan (RAP), or more correctly, a Land Acquisition Plan (LAP), since no major resettlement is anticipated;
- Acquisition of land and property to accommodate the proposed works.

Responsibility for reviewing of EIA, preparation of the EM&MP, detailed design, and the preparation of tender and contract documentation lies with the study and design consultants, who are providing this service to DWASA. Overall responsibilities for environmental management in these respects will, therefore, lie with the consultant's Team Leader, supported by his environmental team, and the contract document specialist.

The management, design and supervision consultant will be responsible for preparing site plans showing the extent of land that will have to be acquired in order to accommodate the project works, together with an estimate of land and property acquisition costs, for inclusion in the project budget.

7.1.1.1 Water Safety Plan

The water sector in Bangladesh has made significant efforts to develop and implement water safety plans (WSPs) for rural and urban water supplies. The World Health Organization promotes the use of water safety plans in the third edition of the Guidelines for Drinking Water Quality as a key component of an overall water safety framework. The results of the study had been very positive and the success of a diverse range of organizations in implementing WSPs.

The features of WSPs are such that they ought to be dynamic and would require regular review and updating as new information is obtained about performance of WSPs, hazards and risk events. Apart from that, on a broader perspective, for the overall WSP implementation vis-à-vis identification of its limitations, area of improvement etc. a workable but adequately robust surveillance system is a prerequisite. Furthermore, there is also a strong urge to have close linkage with WQ monitoring system.

A well-built Water Safety Framework (WSF) with implementation guidelines is expected to provide such system and linkages in place. A water quality-monitoring proposal is provided in the EIA report. It is recommended that the design of the treatment provided by Design Build Contractor should encompass a WSF linked with WQ monitoring, which will be implemented during construction and operation of the water treatment plant.

7.1.2 Construction Phase

7.1.2.1 Mitigation the Impacts on fisheries/river ecology

Intake screens are to be designed according to the swimming characteristics of Hilsa (the key species in the Meghna), to ensure that the impacts on Hilsa as well as the smaller fish, including the jatka, are minimized. It is reported[11] that hilsa is a fast swimming fish up to 80 km/day average 71 km/day (82 cm/sec), therefore, its swimming velocity is not critical for screen design. However, as per the recommendation of National Marine Fisheries Service, National Oceanic and Atmospheric Administration (NOAA), US Department of Commerce for large river, the critical velocity for very small fish (less than 60 mm fork length) can be considered as 0.4 ft/sec (12 cm/sec) for active fish screen and 0.2 ft/sec (6 cm/sec) for passive screen. It is recommended in Water Works Engineering: planning, design & operation book[12] to use approach velocity for intake screen as 8 cm/sec for large river. Therefore, it is recommended here to use 8 cm/sec approach velocity for screen mesh. For Screen mesh openings as per the recommendation of NOAA it is recommended that opening shall not exceed 3/32 inch (2.38 mm) for woven wire or perforated plate screens, or 0.0689 inch (1.75 mm) for profile wire screens, with a minimum 27% open area. It is also recommended to provide screen in the direction of flow to escape small fish and spawn from the screen as shown in the picture **Figure 7-1**.

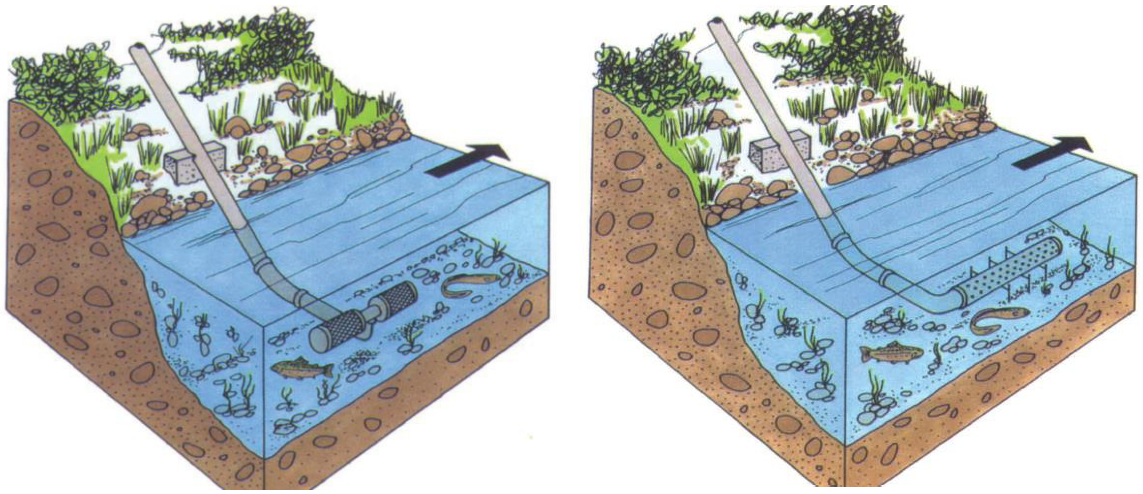


Figure 7-1: Possible fish strainer placement into river.

Finally, it is also recommended for consulting a fisheries expert as part of the detailed design (Figure 7-2: Fish strainer cross-section and types) to provide inputs on the design of the intake screen to minimize impacts on fish. Final design and the Figure 7-3: Cross-sectional view of the pipeline area presenting.

[11] UNDP. 1985. Bay of Bengal Programme on Marine Fisheries Resources Management: A review of the biology and fisheries of *Hilsa ilisha* in the upper Bay of Bengal.

[12] **Water Works Engineering**: planning, design & operation, by – Syed R. Qasim, Edward M. Motley, Guang Zhu, Eastern Economy Edition, PHI Learning Pte. Ltd. ISBN-978-81-203-2153-3

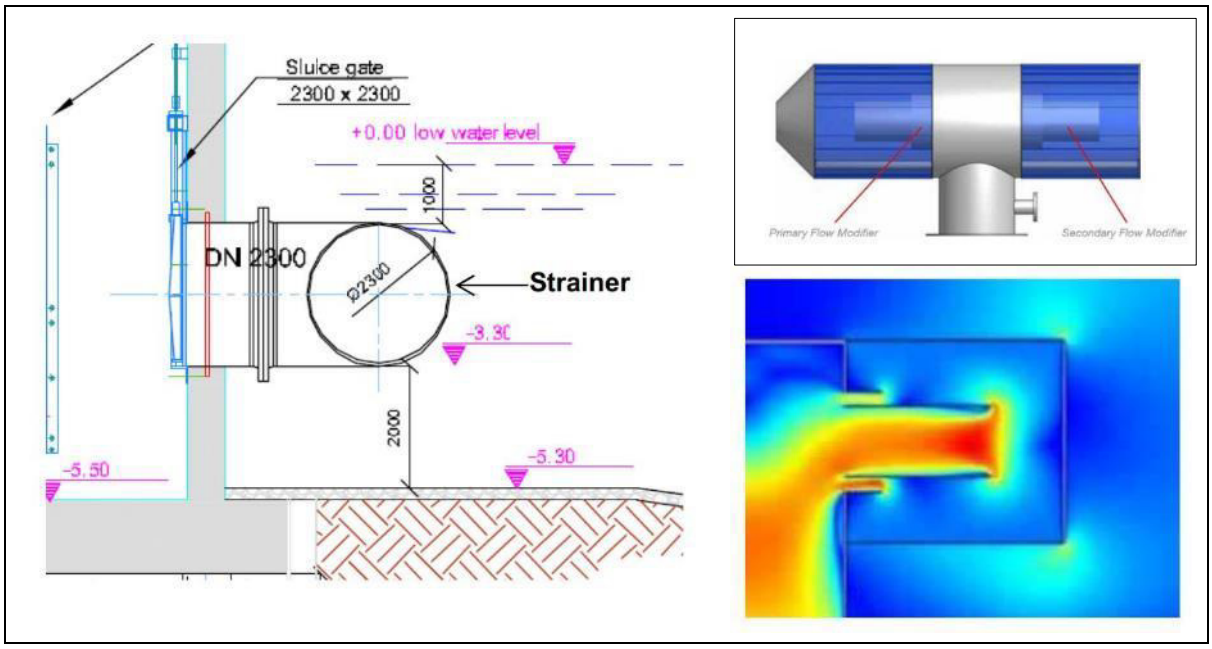


Figure 7-2: Fish strainer cross-section and types

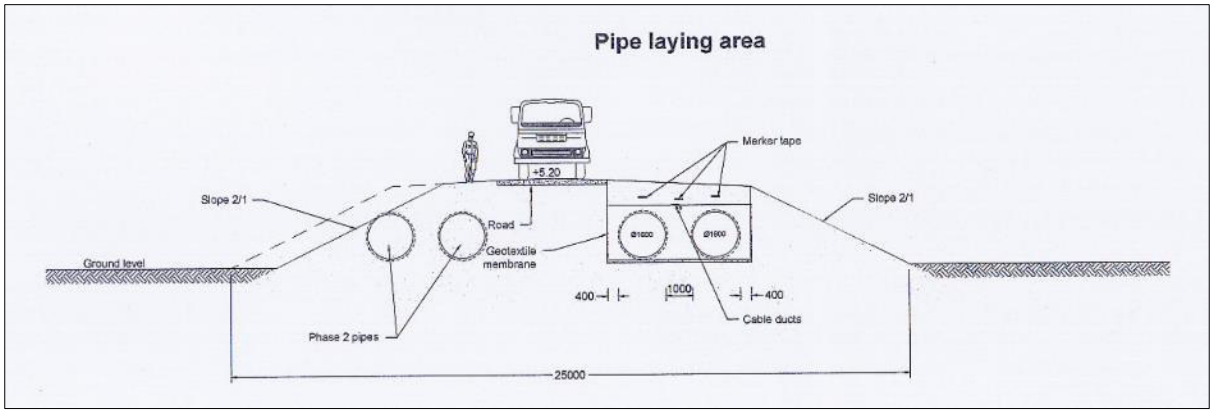


Figure 7-3: Cross-sectional view of the pipeline area

Efforts to minimize such impacts will be integrated into the detailed designs by the fisheries expert.

Table 7-1: Hydraulic calculation of strainers

Phase	Un	Phase 1 + 2	Phase 1 + 2	Phase 1	Phase 1
Mode of running	Normal	Unclogging	Normal	Unclogging	
WTP production flow	MLD	1000	1000	500	500
Flow (22 h per day)	m^3/s	12,63	12,63	6,32	6,32
Type of strainer	-	T72	T72	T72	T72
Strainer in service	un	5	4	3	2
Flow per strainer	m_3/s	2,5	3,2	2,1	3,2
Diameter	m	1,82	1,82	1,82	1,82
Perimeter	m	5,72	5,72	5,72	5,72
Length of active part	m	2,6	2,6	2,6	2,6
Working surface	m_2	14,9	14,9	14,9	14,9
Water velocity at entrance	m/s	0,2	0,2	0,1	0,2

7.1.2.2 Source protection by restricting fish culture to upstream

Water intake point need to be out of pollution. Several bacteria and coliform contaminate almost all-surface water of the Bangladesh. However, exacerbate behavior among fisheries community at upstream will put extra pressure on waste and sludge management of the plant. Upstream (within 5-10 km) fish cultivation's rest food, excreta and other sludge will mix with water which will hampered intake raw water quality. In these circumstances, all type of cultivation in upstream within 5-10 km need to be restricted.

Protection of the source through regulation of upstream developments, especially discharge of industrial effluents (either untreated or partially treated), has been identified as a key policy level intervention requiring inter-departmental coordination. While consultations with the other line departments, such as the Department of Industries and the BWDB, do not indicate future large-scale industrial development upstream of the intake, enforcement of discharge standards and treatment of industrial wastes in industrial clusters, both in case of small-scale textile units and the larger industrial units in Ashuganj, shall be critical to ensure the long-term protection of the water quality at the intake.

The mandate of water quality protection and ensuring compliance to discharge standards rests with the DoE. Accordingly, DoE has established water quality monitoring stations at various locations along major rivers, including across Meghna River. Further, the DoE, through the district level offices, monitors compliance to discharge standards in the industrial units under operation. In addition to these, given the need for additional measures to ensure sustained protection of water quality at the Bishnondi source, seasonal water quality monitoring upstream of the intake up to Ashuganj is proposed. Implementation and will be continued during the operation stage by DWASA.

Based on the analysis of the water quality results, the major sources of pollution, levels of dilution, and responsible institutions shall be identified. In addition, a semi-annual field visit by the environmental officer of the PMU, along with the environmental specialist of the consultant team and the representative of the district office of the DoE, to various locations within 50 km upstream of the intake up to Ashuganj shall be carried out. These visits shall enable identification and reporting to the PMU on any potential issues with respect to change in land uses, pollution sources, etc. The findings of the water quality analysis and the field visits, along with recommendations towards source protection, shall be summarized and presented as part of the semi-annual environmental monitoring reports. Issues pertaining to source protection shall be taken up in the steering committee meetings and provide a forum for addressing inter-agency issues towards protection of the water quality at the intake. Given that DoE is a member of the steering committee, the DoE representative shall follow up on the recommendations from the committee and monitor actions taken to address water pollution risks. In addition, it is recommended that DWASA initiate the preparation of a water safety plan as an adjunct to the EMP, at least as it would pertain to watershed protection and monitoring measures.

While the waste discharges from the existing Manikpur ferry ghat are not significant in terms of quantum of wastes, provision of sanitation facilities and waste collection facilities at the ghat (as part of the project) will provide a good starting point to communicate the need for protection of source and to avoid direct discharges into the river.

Recommendation for the River ecology protection

1. Upstream of intake point must be restricted
2. No case type fish culture
3. Biodiversity of river and water quality would be affected at intake point if the fish farming through case culture were allow.
4. River water is likely to be polluted if chemical feed is used for case culture fish farming at upstream of intake point

7.1.2.3 Fabrication and beautification the intake points and treatment plant site

In order to make suitable place of water intake point need to take some measure such as tree plantation, protection of the riverbanks and subsequent manner. All of these activities focus the sustainable management of the intake points. In order to make treatment location out of contamination safety measure against nuisance will take into consideration. As restriction area, this location also beautify by planting tree and refurnishing the existing feature.

7.1.2.4 Disinfection of Bacteria in WTP site

In the circumstances of the treated water quality standard, based on the DoE and WHO standard some disinfection measure need to treat the intake water of Meghna River. Intake water needs to carry proper treatment. Chlorination might be suitable options for disinfection of the treated water in low cost. Full requirement of the treated water are presenting in **Appendix-3.**

7.1.2.5 Green belt construction in Waterbody filling locations

In the pond, filling location geotextile bag will use to protect the bank and slope in order to prevent the soil erosion. If time and cost permits the all waterbody, filling locations will construct green belt. Subsequent other measure also includes these points.

7.1.2.6 Occupational Health and safety

Safe and good occupational health status of the employees and workers is important for not only the persons working in the plant, but also for the better plant operation and maintenance. Protective clothing and accessories should be provided to the workers, who would be subjected to exposure to hazardous substances and situation. Regular medical check-up is to be done to ensure the soundness of health of the employees and workers. Pollution control measures are to be duly adopted as necessary, including noise and odor control, so that there would not be any negative occupational health impact. Insurance for all employees should be taken out. A senior Medical officer with sufficient background and experience in occupational health problems should coordinate this issue and would be responsible for drawing up and implementing a detailed and regular program for ensuring health safety for all the workers in the industrial unit.

Environmental management during the construction phase is essentially concerned with controlling impacts, which could result from the activities of the DBO contractor, through enforcement of those contract clauses which relate to environmental protection. It is important to recognize that the clauses relating to control of construction impacts will not themselves have any effect unless they are fully implemented and enforced.

Primary responsibility for construction supervision and contract management will lie with the Engineer, as defined in the construction contract who is the Project Director. He has overall responsibility for environmental management during the construction phase. It is anticipated that the Engineer will be assisted in construction supervision by staff from management, design and supervision consultant, and that day-to-day responsibilities for site supervision, including environmental management aspects, will lie with the Engineer's Representative, who will have specific powers and responsibilities delegated to him by the Engineer.

The Consultant's Environmental Specialist will review the effectiveness of approaches adopted towards environmental management and monitoring.

During the site clearance and earthwork, it the necessary to be careful about the following:

- No soil erosion occurs, plantation can be done to protect soil erosion
- No landslides occurs
- No siltation occurs at the disposal site of soil and debris.

7.1.2.7 Regression Redress Mechanism for Occupational Health and Safety

To address the occupational health and safety issues of workers during construction several method has identified. After identification of these affect, GRM and its structure has suggested

by RP team, this study team also found this useful. Figure 7-4 presenting the stationary body of the proposed personnel.

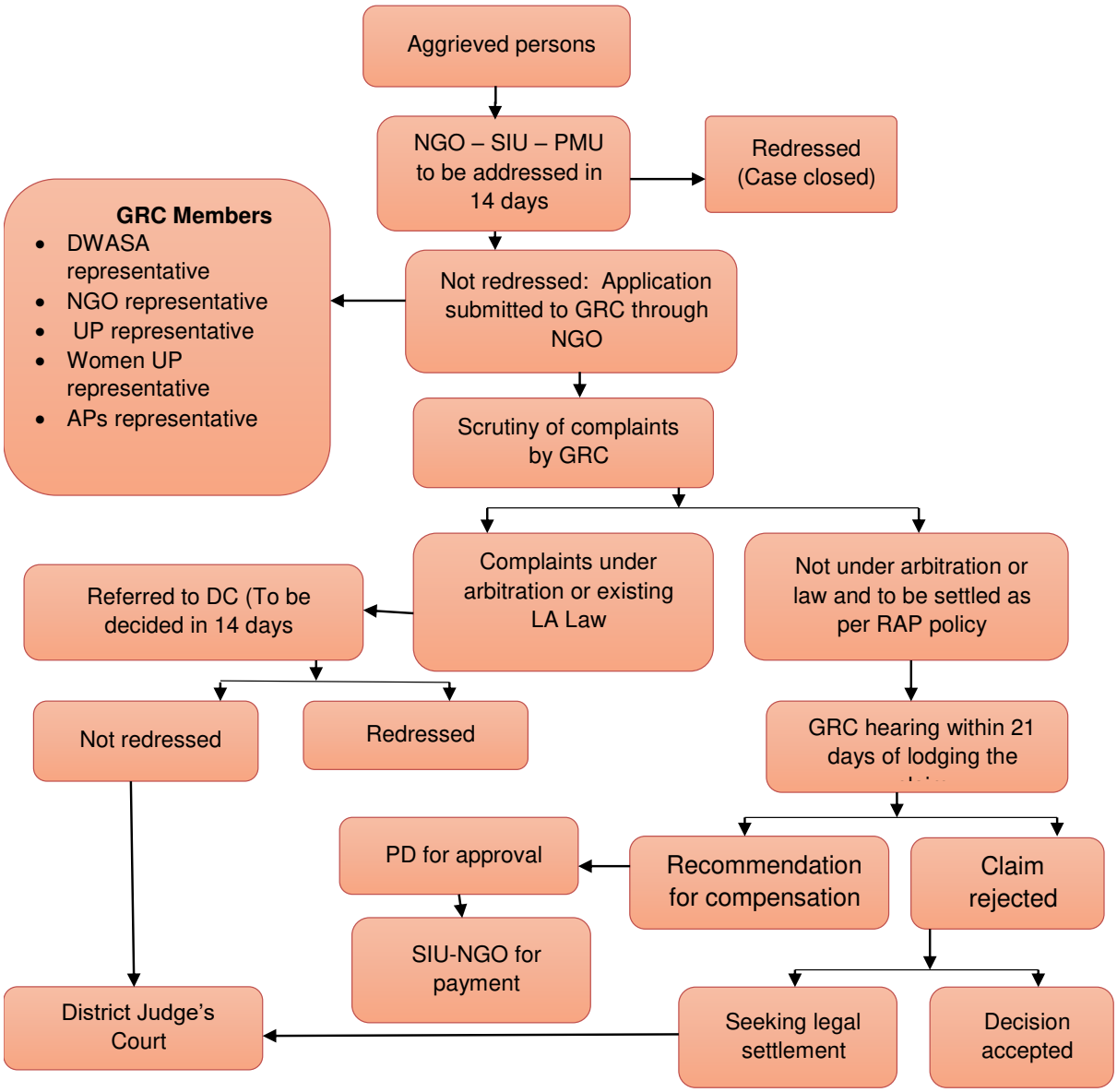


Figure 7-4: GRM for worker and suffered community and its institutional body.

(Source: RP Report, 2016)

The construction contractor will implement major requirement, which is given below-

i) develop and implement a site-specific health and safety plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use personal protective equipment; (c) health and safety training[13] for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;

ii) ensure that qualified first aid can be provided at all times, and equipped first aid stations shall be easily accessible throughout the site;

iii) Provide medical insurance coverage for workers;

13 Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips, and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities.

iv) secure all installations from unauthorized intrusion and accident risks;
v) provide supplies of potable drinking water;
vi) provide clean eating areas where workers are not exposed to hazardous or noxious substances;
vii) provide health and safety orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present, and ensure also that visitor/s do not enter hazard areas unescorted;
ix) Ensure the visibility of workers through their use of high-visibility vests when working in or walking through heavy equipment operating areas;
x) Ensure moving equipment is outfitted with audible back-up alarms;
xi) mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and
xii) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day. The use of hearing protection shall be enforced actively.

7.1.2.8 Work camps

Potential impacts are negative, but short-term and reversible by mitigation measures. The construction contractor will be required to:

i) consult with the environment specialist of the PMU before locating work camps, sheds, and construction plants;
ii) minimize removal of vegetation and disallow cutting of trees;
iii) provide water and sanitation facilities for employees;
iv) prohibit employees from cutting trees for firewood;
v) train employees in the storage and handling of materials which can potentially cause soil contamination;
vi) recover used oil and lubricants and reuse or remove from the site;
vii) manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
viii) remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and
ix) request PMU to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

7.1.2.9 Accident prevention and monitoring

The contractor shall appoint an accident prevention officer at the site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the work, the contractor shall provide whatever is required by this person to exercise this responsibility and authority. The contractor shall send, to the SC, details of any accident as soon as practicable after its occurrence. The contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the SC may reasonably require.

7.1.2.10 Community health and safety

Hazards posed to the public, specifically in high-pedestrian areas, may include traffic accidents and vehicle collision with pedestrians. Potential impact is negative, but short-term and reversible by mitigation measures. The construction contractor will be required to:

i) plan routes to avoid times of peak-pedestrian activities;
ii) liaise with PIU/SC in identifying high-risk areas on route cards/maps;
iii) maintain regularly the vehicles and use manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure; and

iv) provide road signs and flag persons to warn of dangerous conditions.

7.1.2.11 Traffic safety during construction

Along the stretches of the transmission mains proposed to be laid on existing roads, the contractor shall follow the following measures towards ensuring traffic safety during construction. The contractor shall take all necessary measures for the safety of traffic during construction and provide, erect, and maintain such barricades, including signs, marking, flags, lights, and flagmen as per the traffic management plan submitted by the contractor and approved by the SC. Before taking up any construction, an agreed phased program for the regulation of traffic on the highway shall be drawn up in consultation with the SC, and approved by the RHD/RAJUK as the case of road ownership may be.

The barricades erected on either side of the carriageway/portion of the carriageway closed to traffic shall be of strong design to resist violation, and painted with alternate black and white stripes. Red lanterns or warning lights of similar type shall be mounted on the barricades at night and kept lit from sunset to sunrise.

At the points where traffic is to deviate from its normal path (whether on temporary diversion or part of the width of the carriageway), the channel for traffic shall be clearly marked with the aid of pavement markings, painted drums, or a similar device to the directions of the SC. At night, the passage shall be delineated with lanterns or other suitable light source.

One-way traffic operation shall be established whenever the traffic is to pass over part of the carriageway inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns/lights.

On both sides, suitable regulatory/warning signs as approved by the SC shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins, and the other 120 m away. The signs shall be of approved design and of reflective type, as directed by the SC.

All the signs, delineators, and pavement markings shall be maintained in a clean and bright condition at all times, and adequate lighting and other arrangements shall be maintained for proper visibility during the passage of the work area, until such time they are required and as directed by the SC. The temporary travel way shall be kept free of dust by frequent applications of water.

7.1.2.12 Resettlement Impacts Compensation

In the rare case when it is impossible to avoid minor damage of private property (e.g. loss of crops, trees) only then proper compensation will be provided based on Development Organization for the Rural Poor (DORP) assessment on the spot of the specific borehole location. There must be a written compensation arrangement and consent between property owner and contractor before the drilling works begin.

The resettlement plan also recognizes any other associated costs of implementation of the resettlement program such as the operation cost for an RP implementing NGO. Apart from these, the RP has kept a provision of contingency at a rate of 10% of the total budget provision to meet unforeseen expenses during implementation of the RP. Below Figure 7-5: Project entity and implementation scenario illustrated.

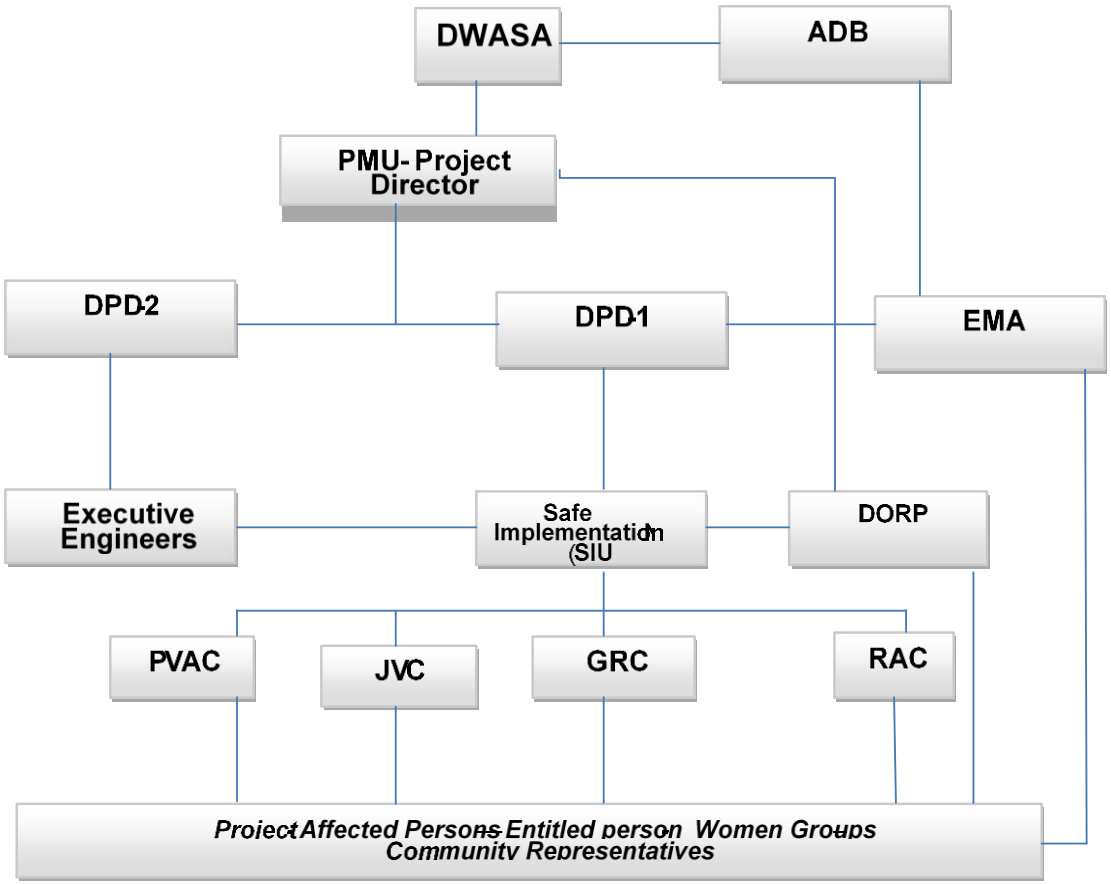


Figure 7-5: Project entity and implementation scenario

(Source: RP Report, 2016)

7.1.3 Operation and Maintenance Phase

7.1.3.1 Mitigation measures for hazardous chemical solid waste

It should not contain heavy metal and toxic chemicals. After dehydration and drying, the sludge is proposed to use as fill material for lowlands as reclaimed land for public parks, roadsides, golf courses, lawns and home in nearby areas after analyzing characteristics of the sludge. If it does not contain any toxic chemical such as plastic or wood parts then it will try to reuse. If not possible then it will use as fill material.

7.1.3.2 Plant operation

With the careful siting of the project components to avoid environmentally, sensitive areas and the efforts to incorporate environmentally sound designs to minimize impacts (as part of the design of the components), the impacts during the maintenance and operation of the proposed facilities will not be significant. There will be beneficial impacts on the communities due to the improved access to potable water and minimization of extraction of groundwater.

The proposed systems of the various project components, including the intake and WTP, shall not require major repairs or refurbishments, and shall operate with little maintenance beyond routine actions required to keep the pumps and other equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any repairs will be small-scale, involving manual, temporary, and short-term works like regular checking and recording of performance for signs of deterioration and servicing and replacement of parts, and is unlikely to result in significant environmental impacts.

7.1.3.3 Mitigation of the metallic effluents

Some of the previous expertise about recovery of most alum available at the coagulation sludge will need to implement here. The recovery process involved the following steps: concentrating the sludge from 5% to 20% solids, acidification with sulfuric acid, separating the supernatant liquid, decolorizing it using charcoal, filtration, concentrating the solution by evaporation, and finally crystallization to obtain nearly pure alum crystals. The effects of operating variables on the efficiency of recovery were also studies. The recovered alum was tested in coagulation runs using a jar-tester. Then this very promising will be implement in the large scale of this treatment plant (M.S.E. Abdo , K.T. Ewida & Y. M. Youssef, 2008)

7.1.3.4 Emergency and risk management

To address risks during the operation of the proposed facilities, DWASA shall prepare and implement an emergency action plan, which shall include environmental risks and potential pollution incidences. Capacity building and training of personnel on the emergency response systems and procedures shall be incorporated in the project.

7.1.3.5 Mitigating Measure of landscape impacts

One way by which the altered green area can be turned into its original visual quality is the plantation of trees around the build area. This plantation also creates buffer zones. Buffer Zones are spaces, which provide natural environmental protection from damage by external events. These spaces, in between any development projects, are usually remain vegetated, which can provide windbreaks, erosion control, sediment traps, sound insulation and visual screening.

A green belt should be developed by planting trees of various species in all possible open spaces within factory premises. Trees take carbon-di-oxide and discharge oxygen for their photosynthesis, which helps to clean the air. Some trees also able to absorb toxic pollutant in the air. It also maintains the ecological balance and improves scenic beauty.

7.1.4 Other Mitigation Measures

a) Disaster Management Plan

The project authority will take necessary disaster management plan to protect the properties from water logging/flood etc. In this regards all construction works would be made at higher level taking maximum flood level in consideration. The plant will be designed above maximum flood level so that risks of injuries, accident, any process failure and other natural disaster could be minimized.

b) Other Safety Provisions

Beyond the above measures, the project would also have full provision for fire fighting and first aid medical services. The project has provision for purchasing safety items such as musk, aprons, hand gloves etc. from its recurring annual expenditure.

Some of the impacts, which are expected to occur during the operational phase, are essentially related to the design of the project, and in this respect the principal environmental management functions are the responsibility of the design consultants. Matters relating to safety and risk management, will be the responsibility of the local authorities concerned.

Matters relating to routine and periodic maintenance, will be the responsibility of DWASA, and environmental management responsibilities will also lie with this body. The major part of environmental management at this stage is expected to be concerned with matters relating to maintenance and management of different units of treatment plant.

Management of runoff is important for this project. The landscape of the developed area should be such that the surface runoff is adequate and no water logging occurs. Sufficient drainage with adequate capacity should be ensured. During the implementation, this should be ensured by DWASA.

Disposal of liquid waste and sludge from the treatment plant is another important issue. A waste collection system will be in operation to handle solid wastes, oily rags, and used fuel

and lube oil filters in a leak-proof container that will be stored and disposed off at the landfill site, to ensure effective management of solid wastes at the treatment plant site. DWASA will ensure regular maintenance of the sludge-drying beds at the WTP. Utilization of dried sludge for horticultural/ agricultural purposes, as suitable, will be carried out. Disposal of alum sludge will be at the sanitary landfill site in Dhaka. Reuse of sludge will be explored after testing to meet government safety standards.

7.2 Implementation of Mitigation Measures

After mentioned table indicating sequentially in Table 7-2: Environmental impacts and mitigation measures for package -1

(Intake structure, raw water transmission main, and **WTP)**, Table 7-3: Environmental impacts and mitigation measures for package -2

(Treated water pipeline transmission main starting from Gandharbpur treatment plant to near us **embassy)** and Table 7-4: Environmental impacts and mitigation measures for package -3

(23 km major distribution pipeline, small distribution pipe to **DMA)**presents the mitigation measures proposed to address the environmental impacts during the various stages of project implementation. The measures required to be taken up for each of the three procurement packages in the project are highlighted. Based on the detailed designs, the measures will be further detailed, and stand-alone EMPs developed for each of the three contract packages and incorporated in the bid documents for implementation.

7.2.1.1 Environmental Impacts and Mitigation Measures for Package -1

After mentioned table sequentially indicating the overall Implementation and Mitigation Measures. Component wise plan are given below-

Table 7 2: Environmental Impacts and Mitigation Measures for Package -1 (Intake structure, Raw water Transmission main, and WTP).

Table 7 3: Environmental Impacts and Mitigation Measures for Package-2 (Treated Water Pipeline Transmission Main Starting from Gandharbpur Treatment Plant to Near US Embassy) and

Table 7 4: Environmental Impacts and Mitigation Measures for Package-3 (23 km Major Distribution Pipeline, Small Distribution pipe to DMA) presents the mitigation measures proposed to address the environmental impacts during the various stages of project implementation. The measures required to be taken up for each of the three procurement packages in the project are highlighted.

Implementation of EMP prepared based on the field observation, condition, primary data collection, detailed designs, professional judgment the measures will be further detailed, and stand-alone EMPs developed for each of the three contract packages separately and incorporated in the bid documents for implementation.

Table 7-2: Environmental impacts and mitigation measures for package -1

(Intake structure, raw water transmission main, and WTP)

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
1	**Design Stage**				
Component 1: Intake Structure	Location selection, design and layout - Construction camps and/or hot mix plants, storage areas, stockpiles, and disposal areas	Temporary	Moderate	The construction camps, hot mix plants, storage areas, stockpiles, and disposal areas will be located as per the following siting criteria – (i) at least 500 m away from habitations and areas notified as ecologically critical areas (ECA), and (ii) at least 100 m away from khals and other water bodies. At these locations, the contractor will work out layouts adhering to the air and water standards prescribed by DoE. Sites to be considered will not promote instability and result in the destruction of property, vegetation, irrigation, and/or drinking water supply systems. All locations will be included in the design specifications	Design Build Contractor, and SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				and plan drawings.	
	Land acquisition and resettlement impacts required due to the project components and sensitive land uses	Permanent	Significant	Land acquisition and resettlement impacts will be significant for Package 1, while mostly temporary impacts will occur for Packages 1 and 2. These impacts will be addressed through the RP. The design engineers will also take all measures to avoid sensitive local land uses, such as graveyards (e.g., the small graveyard at WTP site). This should be added to RAP.	PMU and RAP implementation NGO
	Agricultural and private land acquisition	Permanent	Significant	Cutting of trees in private lands will be minimized. Compensatory plantation for trees lost at a rate of 10 trees for every tree cut will be implemented by the design-build contractor, who will also maintain the saplings for the duration of his contract.	PMU and RAP implementation NGO
	Seismic considerations in design of structures	Permanent	Moderate	The designs of the project components, including intake structures and transmission mains, will conform to Bangladesh National Building Code, 2006.	Design Build Contractor, and SC
	Borehole construction impact considerations	Temporary	Moderate	During Borehole construction- mitigation issues are- traffic congestion, Dusting (air pollution), Water pollution (Seepage, chemical contamination from Bentonite and other chemicals), Waste disposal, casting areas effect, river crossing areas influence etc. Splashing demand to reduce air/dust pollution, traffic monitoring staff appointment or working on night, chemical and other waste disposal measure required proper maintenance. Cashion like bordering measure for collecting sample from riverbed need to consider etc.	
	Build Intake structure at Bishnandi; Including Pump station, sub-station, WTP etc.	Permanent	Significant	Camp construction and their proper waste dumping station, proper screen design for fish prevent, WTP Gandharbpur with safe net chemical handling procedure, pond filling and nuisance measurement. Proper maintenance by the authority.	PMU with support from SC Design Build Contractor

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
Component 2: Transmission main from Intake to Gandharbpur WTP	Damage to trees and clearance of vegetation at the project locations	Permanent	Moderate	**Intake and WTP:** Only trees that will require removal within the proposed construction areas of the sites will be cut. After the finalization of the designs and layout of the project components, the trees within proposed construction areas will be marked. For trees not proposed to be cut, taking all precautions to protect them from any damage from construction activities, including placement of tree guards will be taken up.	PMU with support from SC Design Build
				Transmission mains: Trees within the corridor of impact (area required for construction) will be felled after prior approval.	Contractor
				Tree Plantation: Log trees will be planted at the suggested/appropriate distances on both slopes of the service roads, which will surplus the loss of trees cut by many times. The social plantation model as followed by the MoEF can be followed in such cases.	
	Assets/facilities lost, including common property resources and religious structures	Permanent	Moderate	Designs to be worked out to minimize impacts on these assets. Compensation and assistance will be provided in accordance with the provisions of the RP.	Design Build Contractor, and SC
				Designs to ensure cross-drainage through the provision of balancing culverts and sufficient cross-movement, including movement of fishes, shall be done to minimize severance impacts on khals and fish ponds cut across by the alignment.	
	Soil erosion	Permanent	Moderate	The measures to address soil erosion at the proposed facilities will consist of measures as per design, or as directed by the SC to control soil erosion, sedimentation, and water pollution. All temporary sedimentation, pollution control works, and maintenance thereof will be deemed incidental to the earthwork or other items of work.	Design-Build Contractor and SC
Component 3: WTP at Gandharbpur	Relocation of utility lines along the transmission mains	Permanent	Moderate	All utilities and services impacted due to the proposed components will be shifted/relocated, with prior approval of the concerned agencies.	PMU
	Identification of sources of materials	Permanent	Moderate	The contractor, at the detailed design stage, shall (i) identify all potential material sources; (ii) propose quarry sites and sources permitted by the government, and (iii) verify the suitability of all material sources and obtain approval of SC.	Design Build Contractor / SC
	Drinking water availability and water arrangement	Temporary	Moderate	Prior to the initiation of construction activities, the contractor will be responsible for the arrangement of water in every workplace at	Design Build Contractor / SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				suitable and easily accessible places for the whole construction period. Sufficient supply of cold potable water should provide and maintain at the construction camps and other ancillary work areas.	
	Impacts on water abstraction and ecological flows of Meghna River, especially in lean flow	Permanent	Moderate	The proposed abstraction accounts for 0.31% of the lean flows for the ultimate intake capacities of 1,050 MLD (2035). Therefore, no impacts on downstream uses or impairment of ecological flows in Meghna River envisaged.	PMU
	Impacts on fisheries in Meghna River	Permanent	Moderate	Design of the water intake should carried out to avoid impacts on hilsa fish, the key species found in Meghna River requiring protection. The design of the intake screen will be based on the following key considerations as per the recommendations of the fisheries expert of the SC:	Contractor, with technical guidance from the fisheries
				1. The screen face will be oriented in the same direction as the flow.	expert of the Supervision MDSC
				2. The water velocity flowing through the structure against which the fish will have to swim must be lower than the critical fishes' swimming capability and it recommended that the approach intake velocity should not be more than 8 cm/sec.	
				3. Screens will be located at the bottom of the watercourse to prevent entrainment of sediment and aquatic organisms associated with the bottom area.	
				4. Screen sizes will be determined based on assessment of fish sizes at the location and the swimming characteristics of hilsa and it recommended that the opening shall not exceed 3/32 inch (2.38 mm) for woven wire or perforated plate screens, or 0.0689 inches (1.75 mm) for profile wire screens, with a minimum 27% open area. It recommended providing a screen in the direction of flow to escape small fish and spawn from the screen as shown in the picture also.	
				5. Impact on inland water bodies, including khals and fishponds, will address in the detailed designs through appropriate measures to provide for cross-drainage to minimize severance impacts. Traffic management plans and spoil management plans shall be prepared as part of the detailed designs.	

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
	Pollution control and IEC activities upstream of the source, including sanitation facilities and waste collection facilities at Manikpur ferry Ghat	Permanent	Moderate	In consultation with the BIWTA, the design of sanitation facilities and solid waste collection facilities need to carry out within lands belonging to the BIWTA. The NGO implementing the RP shall assigned responsibilities to carry out. Awareness campaigns on source protection at key locations within 50 km upstream of the source.	Design Build Contractor, and SC
	Sludge management and disposal	Temporary	Moderate	Design of WTP to include sludge-drying beds, and sludge management plan to be prepared.	Design Build Contractor / SC
	Locations for disposal of spoil	Permanent	Moderate	**Transmission mains**: The contractor as part of the spoil management plan will prepare a utilization plan for the disposal of the earth resulting from the excavation. It envisaged that nearly 90% of the excavated earth will be utilized for the construction of the access road embankments. The sites for disposal of the remaining quantities need to identify prior to finalization of the designs, and the same incorporated into the BoQs. **Transmission mains within road RoW:** The entire volume of spoil generated from the trenches laid for the transmission mains will be required for refilling upon laying of the pipes. The contractor will identify locations for temporary storage of spoil outside the RoW. The identification of suitable locations carried out by the contractor in line with the siting criteria for temporary construction areas defined in item 1.8.	Design Build Contractor, and SC
	Update EIA	Temporary	Moderate	The draft EIA updated based on detailed designs and submitted to ADB for review, approval, and disclosure prior to the commencement of work.	Design Build Contractor / SC / DWASA
	Environmental clearance	Temporary	Moderate	The draft EIA will be updated to prepare government's EIA implemented as a single unified document and submitted to DoE as part of environmental clearance requirement. The EC is to obtain prior to the commencement of civil works.	Design Build Contractor / SC / DWASA

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
2	**Construction Stage**				
Construction Phase common measure for all component	Safety measures during construction -First aid -Malaria risk	Temporary	Moderate	At every workplace, a readily available first aid unit, including an adequate supply of sterilized dressing material and appliances, will be provided as per the factory rules. Suitable transport will be provided to facilitate the transfer of injured or ill persons to the nearest hospital. At every workplace and construction camp, equipment and nursing staff will be provided. The contractor will, at his own expense, conform to all anti-malaria instructions given to him by the SC. All relevant provisions of the Bangladesh Labor Act, 2006 and Bangladesh National Building Code, 2006 will be adhered to, concerning the provision of adequate safety measures during construction. The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches, and safe means of entry and egress.	Design Build Contractor and SC
	Conflict among the work personnel and labor	Temporary	Moderate	Proper work distribution plan with maintenance authority.	Build Contractor
	Construction Impact	Temporary	Moderate	During construction period pedestrian and vehicle movement and business will be restricted and hampered for all the components along the pipeline route. Environmental quality is also affected as a result life style and income will be will also affected.	Build Contractor
	Hygiene in the construction camps and sites	Temporary	Moderate	All temporary accommodations will be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking, and washing. Safe drinking water in sufficient quantity for the workforce will be provided at the construction site as well as at the construction camps. Adequate toilets, separate for women and men, shall be provided at the construction sites, with septic tanks.	Design Build Contractor and SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				Garbage bins will be provided in the camps and regularly emptied, and the garbage disposed of in a hygienic manner. Adequate health care will be provided for the workforce. Unless otherwise arranged for by the local sanitary authority, the local medical health or municipal authorities will make arrangement for disposal of excreta. On completion of the works, all such temporary structures will be cleared away, all rubbish burned, excreta tank and other disposal pits or trenches filled in and effectively sealed off, and the outline site left clean and tidy, at the contractor's expense. The site will be restored to pre-project conditions through the removal of all extraneous material on site.	
	Worker health & safety Risk caused by force majeure	Temporary	Minor	All reasonable precaution will be taken to prevent danger to the workers and the public from fire, flood, drowning, etc. Specifically, the contractor will (i) provide medical and accident insurance for workers; (ii) provide first aid in the construction campsite; and (iii) provide access to hospitals/clinics within the project site that can be accessed in case of emergency by arranging necessary transport for safe carriage of the injured.	Design Build Contractor and SC
	Child labor Risk of contractors or subcontractors hiring child labor in the construction activities.	Temporary	Minor	• National laws on child labor will strictly followed. No child labor will be allow by the contractors or subcontractors in any of the project activities.	
	Accident prevention and work safety procedures -May loss or injury of human	Temporary	Moderate	• Awareness of workers about hazardous materials and proper handling methods. Warning signs, labels and signals. Provide helmets, safety shoes and other PPE for workers in accordance with accident prevention and work safety procedures	
	Dust Pollution • Impact Sources Emissions from construction related traffic and machinery. • Dust from works, carrying machinery equipment to the site, and traffic from trucks and vehicles.	Temporary	Moderate	The contractor will (i) take every precaution to reduce the levels of dust at construction sites, and not exceeding the pre-project ambient air quality standards; (ii) fit all heavy equipment and machinery with air pollution control devices that are operating correctly; (iii) reduce dust by spraying stockpiled soil, excavated materials, and spoils; (iv) cover with tarpaulin vehicles transporting soil and sand; and (v) cover stockpiled construction materials with tarpaulin or plastic sheets.	Design Build Contractor and SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
	• Create nuisance • Road damage			• Implement measures in Environmental Code of Practice of Air Quality Management. Dust generation will be restricted as much as possible and water sprinkling carried out as appropriate, especially where earth moving and excavation are carries out. • Emissions during bore logs digging, equipment and traffic will comply with ADB EHS guidelines and will be monitored. Spray of water is suggested in the road and construction sites Capacity of truck load should stay below capacity of road	
	River Water Pollution	Temporary	Moderate	Protect river water during construction of intake screen and river training work. Confined the river water area of intake screen to prevent the turbidity, DO level of water and fish.	Design Build Contractor and SC
	Air pollution (SPM, $PM_{2.5}$, PM_{10}, SOx, NO_2 and CO) • Impairment of air quality may have an impact on geotechnical investigation workers, local residents and surrounding environment • Air pollution generates from exhaust of engines. • During GI bore logs work Emission from drilling vehicle and machine			• Drilling and transport vehicles shall move only in-designated areas and roads. • Water dry drilling areas and access roads to reduce dust emissions • Minimize traffic in villages and other residential areas • Reduce vehicle speed in drilling areas and access roads to 10 km/h • Machines and vehicles must be regularly examined and maintained to comply with requirements of technical specifications Repair and maintain access roads, as necessary	Design Build Contractor and SC
	Noise and Vibration from construction equipment	Temporary	Moderate	The contractor will ensure (i) regular maintenance of vehicles, equipment, and machinery to keep noise from these at a minimum; and (ii) all vehicles and equipment used for construction will be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers will be checked, and if found to be defective, will be replaced.	Design Build Contractor and SC
	Temporary measures for construction activities around habitations/ institutional uses	Temporary	Moderate	The contractor will provide the following measures during the laying of transmission mains for sections in the vicinity of habitations and commercial and institutional areas, to minimize access and livelihood disruption: (i) place walkways and metal sheets where required to maintain access across trenches for people and vehicles;	Design Build Contractor and SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				(ii) increase workforce in front of critical areas such as institutions, places of worship, business establishments, hospitals, and schools; (iii) consult businesses and institutions regarding operating hours and factoring this into work schedules; and (iv) provide signboards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints.	
	Emission from construction vehicles, equipment, and machinery	Temporary	Moderate	All vehicles, equipment, and machinery used for construction will be regularly maintained to ensure that pollution emission levels comply with the relevant requirements of DoE. Copies of conformance will be submitted regularly to the SC.	Design Build Contractor and SC
	Environmental pollution / human health Stockpiling of construction materials, excavated earth/spoil from trenches	Temporary	Moderate	Due consideration will be given to material storage and construction sites such that it doesn't cause any hindrance to daily traffic movement. The contractor will (i) consult with implementing agency on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; (ii) avoid stockpiling of earth fill, especially during the rainy season, unless covered by tarpaulins or plastic sheets; (iii) prioritize reuse of excess spoils and materials in the construction works; and (iv) protect surface water bodies from any source of contamination, such as oily wastes, debris, and spoils that will degrade its quality. • Excavated material shall not enter surface waters, surface water banks or impede flows - in particular, the following shall be done: • do not dump material in surface waters, at river banks or in flooding areas, in case rivers have been blocked remove the material	Design Build Contractor / SC
	Movement of construction vehicles Oil spillage, grease and lubricant	Temporary	Moderate	The movement of construction materials and equipment, to the extent possible, will be plan along major roads, with the exception of access roads to the site. In the event of movement of construction vehicles and equipment on the narrow roads, strengthening of these roads will be carried out, and timing of movement of heavy vehicles worked out to avoid peak hours and nighttime, and to ensure minimal disturbances to the communities and the resident population along these roads. • Maintenance will be conducted at safe distance from watercourses so that no oil spills can enter the water.	Design Build Contractor and SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				Contaminated soil should be excavated and disposed properly in a confined place outside inundation areas	
	Contamination of soil and groundwater quality			• The soil contaminated with drilling mud should be avoided For effluents to be discharged from work place, camps, and offices, treatment arrangements such as retention ponds and septic tanks will be incorporated in the facility designs.	
	Archaeological property chance find	Permanent	Moderate	In the event of an archaeological chance find at the construction site, the contractor will prevent workmen or any other persons from removing and damaging any chance find artifacts and will, immediately upon discovery thereof, inform the SC of such discovery and carry out the SC's instructions for dealing with the same, awaiting which all work will be stopped for 100 m in all directions from the site of discovery. The SC will seek direction from the Department of Archaeology before instructing the contractor to resume work on the site.	Design Build Contractor and SC
	Loss of access to residents, businesses, and institutions during construction.	Temporary	Moderate	The contractor will provide safe and convenient passage for vehicles and pedestrians through diversions to and from side roads, and property access connecting the project roads. The contractor will ensure that (i) the construction works do not interfere with the convenience of the public or access to, use, and occupation of public or private roads, or any other access to properties, whether public or private. Temporary access to properties adjacent to the construction site will be provided through the construction of ramps with concrete slabs for use of pedestrians and light vehicles; (ii) in critical areas such as institutions, operating hours are factored into work schedules and workforce is increased for speedy completion; (iii) advance information on works to be undertaken including appropriate signage, is provided; and (iv) the diversion is done in coordination with the traffic police division for necessary rerouting of traffic and traffic management.	Design-Build Contractor and SC
	Damages to utilities and services during construction	Permanent	Moderate	**The contractor will be required to:** (i) plan for immediate attendance by the service providers to any damages to utilities during construction; (ii) replace (or compensate for) public and private physical structures damaged due to construction or vibration; and (iii) provide prior public information about the likely disruption of services. In consultation and with support from DWASA, the	Design-Build Contractor and SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				contractor will provide alternative arrangements for water supply in the event of disruption beyond a reasonable time, for instance, through tankers.	
	Compensation • Loss or impairment of private property			• written compensation arrangement and consent between property owner and contractor	
	Clearing of construction camps and restoration	Temporary	Moderate	The contractor will prepare site restoration plans for approval by the SC. The plan will be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish burned, excreta or other disposal pits or trenches filled in and effectively sealed off, and the site left clean and tidy, at the contractor's expense. The site will be restored to pre-project conditions through the removal of all extraneous material on site. During the site clearance and earthwork, it the necessary to be careful about the following: □ No soil erosion occurs, plantation can be done to protect soil erosion □ No landslides occurs □ No siltation occurs at the disposal site of soil and debris.	Design Build Contractor and SC
Component 1: Intake Structure	Dewatering of trenches	Temporary	Moderate	For dewatering of groundwater encountered during construction of trenches, the contractor shall work out arrangements for dewatering in consultation with the SC. Prior to discharging the water in the trench onto private lands or watercourses, consent of the landowner confirming his acceptance to receive the groundwater shall be submitted to the SC. In areas connected to a sewerage system, the contractor shall carry out the dewatering after obtaining permission from DWASA for the volume of water to be discharged, after payments of any charges towards the treatment of the water at the STP. The contractor shall, in consultation with the SC, work out appropriate vector control measures to minimize health impacts on the surrounding communities, during the excavation of the trenches.	Design-Build Contractor and SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
Component 2: Transmission main from Intake to Gandharbpur WTP	Quarry/borrow pit operations	Permanent	Moderate	**Responsibility of the contractor to**- (i) obtain approval of implementing agency if new quarries and borrow sites are necessary (ii) store stripped materials as not to disrupt natural drainage and protect them to prevent erosion and migration of soil particles into surface waters; (iii) provide temporary ditches and/or settling basins to collect run-off water and to prevent erosion and contamination of surface water; (iv) plant exposed areas with suitable vegetation at the earliest opportunity and prevent ponding of water through temporary drains discharging to natural drainage channels; (v) restore sites after construction activities by stabilizing contours and slopes, spreading stripped materials to promote percolation and re- growth of vegetation, and draining any standing water. Land utilized for quarry sites access roads will also restored, and (vi) ensure adequate safety precautions during transportation of quarry material from quarries to the construction site (vii) Ensure all employee and labor covered by proper PPE and safety net program. Vehicles transporting the material will cover to prevent spillage.	Design-Build Contractor and SC
	Disposal of bituminous wastes / construction waste / debris / cut material	Temporary	Moderate	For project components involving demolition of structures, the contractor will prepare and implement a waste management plan. Safe disposal of the extraneous material will be ensured in the pre-identified disposal locations. To enable minimization of waste disposal and do this in an environmentally safe manner, the waste management plan will For ***component 1and 3***: (i) recover used oil and lubricants and reuse or remove from the site; (ii) manage solid waste according to the following preference hierarchy: reuse, recycle, and dispose of in designated areas; For ***component 2:*** (iii) reuse bituminous waste generated in road construction, based on its suitability for reuse, to the maximum extent possible. Cut material generated because of construction will be utilized as filling material. Remaining material if any will be disposed of safely at the disposal sites; (iv) remove all wreckage, rubbish, or temporary structures that are no longer required; and (v) restore pre-	Design Build Contractor and SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				project environmental conditions through the implementation of environmental restoration work.	
	Stripping, stocking, and preservation of topsoil	Permanent	Moderate	The topsoil from productive agricultural lands at the intake site, Gandharbpur WTP, borrow areas, and areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. The stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile will be restricted to 2 m. Stockpiles will not be surcharged or otherwise loaded, and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles will be covered with gunny bags or tarpaulin. It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked, either before stripping or when in stockpiles. Such stockpiled topsoil will be returned to cover the disturbed area and cut slopes.	Design-Build Contractor and SC
	Water crossings for the pipelines for khals and ponds	Permanent	Moderate	Trenching and backfilling operations at the stream crossings will be carried out in the lean seasons when the flow will be minimum. In case of crossings at existing minor bridges and culverts, the contractor will ensure that there is no impact/ disturbance to the bridges/culverts due to the crossing of the water pipelines.	Design-Build Contractor and SC
	River crossings required for the transmission lines at the Sitalakhya and Balu Rivers by micro-tunneling	Permanent	Moderate	The construction activities at the river crossings will be carried out in conformance with the conditions laid down by the BIWTA in the permit for river crossings. The vertical shafts shall be located outside the watercourse or riverbed to minimize migration of contaminated soil or water into the river. The contractor shall identify suitable locations for disposal of the soil and water from the tunnel. Precautionary measures will be taken by the contractor to ensure that there is no disposal of construction wastes/materials into the river or on the shores. The construction activities and operations for the river crossings will be planned to ensure that interference of cargo boats, navigation—including fishermen, and passenger movements-are minimal. Advance notices of disruption, if any, will be disclosed. The construction activities and laying of pipes will be carried out in such a manner that the dredging activities of the river are not affected.	Design-Build Contractor and SC

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
Component 3: WTP at Gandharbpur	Use of explosive materials	Permanent	Moderate	Except as may be provided in the contract or ordered or authorized by the SC, the contractor will not use explosives. The contractor will, at all times, take every possible precaution, and will comply with appropriate laws and regulations relating to the importation, handling, transportation, storage, and use of explosives and will, at all times when engaged in blasting operations, post sufficient warning flagmen. The contractor will carry out the use of explosive materials only after obtaining written approval of the SC of the procedures to be followed.	Design-Build Contractor and SC
	Material handling at site	Temporary	Moderate	All workers employed for mixing asphaltic material, cement, concrete, etc. will be provided with protective footwear and goggles. Workers engaged in welding works will be provided with welder's protective eye shields. The use of any toxic chemical will be strictly in accordance with the manufacturer's instructions.	Design Build Contractor and SC
	Soil and water pollution due to fuel, lubricants, and construction waste	Temporary	Moderate	The fuel storage and vehicle cleaning area will be stationed such that runoff from the site does not drain into the water bodies/ponds abutting the construction sites. Oil interceptors will be provided at construction vehicle parking areas, vehicle repair areas, and workshops, ensuring that all wastewater flows into the interceptor prior to its discharge. All work sites will be cleaned and restored to pre-project conditions. Discharge standards promulgated under Schedule 10, standards for waste from industrial units or projects waste will be strictly adhered to.	Design Build Contractor and SC
3	**Operation Stage**				
Component 1: Intake Structure	Impacts on downstream uses at the intake point	Permanent	Moderate	Assessment of flows will be done annually by DWASA, especially during the lean season, to ensure that there is no impact on the downstream uses.	DWASA
	Effectiveness of intake screens	Permanent	Moderate	DWASA will periodically monitor the effectiveness of the intake screens, in terms of fish sizes and quantities of fish passing through the screen. Any modifications to the screen as required will be taken up in consultation with the fisheries department. Prevent upstream at least 5 km of aquaculture system which will pollute the river water	DWASA

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
	Occupational health and safety at the intake /treatment facilities	Permanent	Moderate	DWASA will establish procedures and systems to maintain sound occupational health and safety for the personnel at the various facilities, including the use of PPE, provision of training on occupational health and safety to all workers, etc. To address environmental risks, during the operation of the facilities, DWASA will develop and implement an emergency action plan, which will include training and systems on emergency response systems and procedures.	DWASA
	Source protection - water quality	Permanent	Moderate	Continuous water quality monitoring at the upstream locations as defined in the monitoring plan will be carried out, in addition to semi-annual field visits by DWASA jointly with the DoE representative to assess any potential polluting activities/ threats. The findings shall be documented, taken up, and presented to the steering committee for decision.	DWASA/ DoE
	Survival of trees, maintenance, of landscaping, and the green buffer zone	Permanent	Moderate	Proper care will be taken to increase the survival rate of saplings, like regular watering, pruning, provision of tree guards, provision of manure for better nourishment, etc., including timely replacement of perished saplings.	DWASA
Comp. 2	Environmental conditions	Permanent	Moderate	DWASA will undertake seasonal monitoring of air, water, noise, and soil quality through an approved monitoring agency. The parameters to be monitored, frequency and duration of monitoring, as well as the locations to be monitored will be as per the monitoring plan prepared.	DWASA
Component 3	Management of sludge at the treatment plant	Permanent	Moderate	During operation of the WTP, physical and chemical sludge will generate. This drinking water treatment sludge usually contains colloidal alum hydroxides, colloidal or dissolved organic matter, clay, silt and microorganisms. It should not contain heavy metal and toxic chemicals. After dehydration and drying the sludge is proposed to use as fill material for lowlands as reclaimed land for public parks, roadsides, golf courses, lawns and home in nearby areas after analyzing characteristics of the sludge if it doesn't contain any toxic chemical. The disposal of the alum sludge is proposed at the landfill site of Dhaka at Matuail, about 10 km from the proposed WTP if it is not possible to use as fill material after confine. Aluminium can also	DWASA

Sl No	Environmental Issues Impact Sources	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				recover from sludge by using acid and separate the aluminium contaminant.	
	Effective maintenance of the sludge-drying beds at the WTP	Permanent	Moderate	DWASA will ensure regular maintenance of the sludge-drying beds at the WTP. Utilization of dried sludge for horticultural/ agricultural purposes, as suitable, will be carried out. Disposal of alum sludge will be at the sanitary landfill site in Dhaka. Reuse of sludge will be explored after testing to meet government safety standards.	DWASA
	Management of solid waste at the treatment plant	Permanent	Moderate	A waste collection system will be in operation to handle solid wastes, oily rags, and used fuel and lube oil filters in a leak-proof container that will be stored and disposed of at the landfill site, to ensure effective management of solid wastes at the treatment plant site.	DWASA

7.2.1.2 Environmental Impacts and Mitigation Measures for Package -2

Table 7-3: Environmental impacts and mitigation measures for package -2

(Treated water pipeline transmission main starting from Gandharbpur treatment plant to near us embassy)

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
1	Design Stage				
Component 4: Treated Water Pipeline Transmission Main Starting from Gandharbpur Treatment Plant to Near US	Damage to trees and clearance of vegetation at the project locations	Permanent	Moderate	**Intake and WTP:** Only trees that will require removal within the proposed construction areas of the sites will be cut. After the finalization of the designs and layout of the project components, the trees within proposed construction areas will be marked. For trees not proposed to be cut, taking all precautions to protect them from any damage from construction activities, including placement of tree guards will be taken up.	PMU with support from SC Design Build
				Transmission mains: Trees within the corridor of impact (area required for construction) will be felled after prior approval.	Contractor
				Tree Plantation: Log trees will be planted at the suggested/appropriate distances on both slopes of the service roads, which will surplus the loss of trees cut by many times. The social plantation model as followed by the MoEF can be followed in such cases.	
	Assets/facilities lost, including common property resources and religious structures	Permanent	Moderate	Designs to be worked out to minimize impacts on these assets. Compensation and assistance will be provided in accordance with the provisions of the RP.	Design Build Contractor, and SC
				Designs to ensure cross-drainage through the provision of balancing culverts and sufficient cross-movement, including movement of fishes, shall be done to minimize severance impacts on khals and fish ponds cut across by the alignment.	
	Soil erosion	Permanent	Moderate	The measures to address soil erosion at the proposed facilities will consist of measures as per design, or as directed by the SC to control soil erosion, sedimentation, and water pollution. All temporary sedimentation, pollution control works, and maintenance thereof will be deemed incidental to the earthwork or	Design-Build Contractor and SC

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				other items of work.	
2	**Construction Stage**				
Construction Phase common measure for all component	**Safety measures during construction** -First aid -Malaria risk	Temporary	Moderate	At every workplace, a readily available first aid unit, including an adequate supply of sterilized dressing material and appliances, will be provided as per the factory rules. Suitable transport will be provided to facilitate the transfer of injured or ill persons to the nearest hospital. At every workplace and construction camp, equipment and nursing staff will be provided. The contractor will, at his own expense, conform to all anti-malaria instructions given to him by the SC. All relevant provisions of the Bangladesh Labor Act, 2006 and Bangladesh National Building Code, 2006 will be adhered to, concerning the provision of adequate safety measures during construction. The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches, and safe means of entry and egress.	Design Build Contractor and SC
	Conflict among the work personnel and labor	Temporary	Moderate	Proper work distribution plan with maintenance authority.	Build Contractor
	Hygiene in the construction camps and sites	Temporary	Moderate	All temporary accommodations will be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking, and washing. Safe drinking water in sufficient quantity for the workforce will be provided at the construction site as well as at the construction camps. Adequate toilets, separate for women and men, shall be provided at the construction sites, with septic tanks. Garbage bins will be provided in the camps and regularly emptied, and the garbage disposed of in a hygienic manner.	Design Build Contractor and SC
				Adequate health care will be provided for the workforce. Unless otherwise arranged for by the local sanitary authority, the local medical health or municipal authorities will make arrangement for disposal of excreta.	

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				On completion of the works, all such temporary structures will be cleared away, all rubbish burned, excreta tank and other disposal pits or trenches filled in and effectively sealed off, and the outline site left clean and tidy, at the contractor's expense. The site will be restored to pre-project conditions through the removal of all extraneous material on site.	
	Worker health & safety Risk caused by force majeure	Temporary	Minor	All reasonable precaution will be taken to prevent danger to the workers and the public from fire, flood, drowning, etc. Specifically, the contractor will (i) provide medical and accident insurance for workers; (ii) provide first aid in the construction campsite; and (iii) provide access to hospitals/clinics within the project site that can be accessed in case of emergency by arranging necessary transport for safe carriage of the injured.	Design Build Contractor and SC
	Child labor Risk of contractors or subcontractors hiring child labor in the construction activities.	Temporary	Minor	• National laws on child labor will strictly followed. No child labor will be allow by the contractors or subcontractors in any of the project activities.	
	Accident prevention and work safety procedures -May loss or injury of human **Dust Pollution** • Impact Sources Emissions from construction related traffic and machinery. • Dust from works, carrying machinery equipment to the site, and traffic from trucks and vehicles. • Create nuisance Road damage	Temporary Temporary	Moderate Moderate	• Awareness of workers about hazardous materials and proper handling methods. Warning signs, labels and signals. Provide helmets, safety shoes and other PPE for workers in accordance with accident prevention and work safety procedures The contractor will (i) take every precaution to reduce the levels of dust at construction sites, and not exceeding the pre-project ambient air quality standards; (ii) fit all heavy equipment and machinery with air pollution control devices that are operating correctly; (iii) reduce dust by spraying stockpiled soil, excavated materials, and spoils; (iv) cover with tarpaulin vehicles transporting soil and sand; and (v) cover stockpiled construction materials with tarpaulin or plastic sheets. • Implement measures in Environmental Code of Practice of Air Quality Management. Dust generation will be restricted as much as possible and water sprinkling carried out as appropriate, especially where earth moving and excavation are carries out.	Design Build Contractor and SC

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				• Emissions during bore logs digging, equipment and traffic will comply with ADB EHS guidelines and will be monitored. Spray of water is suggested in the road and construction sites Capacity of truck load should stay below capacity of road	
	Air pollution (SPM, $PM_{2.5}$, PM_{10}, SOx, NO_2 and CO) • Impairment of air quality may have an impact on geotechnical investigation workers, local residents and surrounding environment • Air pollution generates from exhaust of engines. • During GI bore logs work Emission from drilling vehicle and machine			• Drilling and transport vehicles shall move only in-designated areas and roads. • Water dry drilling areas and access roads to reduce dust emissions • Minimize traffic in villages and other residential areas • Reduce vehicle speed in drilling areas and access roads to 10 km/h • Machines and vehicles must be regularly examined and maintained to comply with requirements of technical specifications Repair and maintain access roads, as necessary	
	Noise and Vibration from construction equipment	Temporary	Moderate	The contractor will ensure (i) regular maintenance of vehicles, equipment, and machinery to keep noise from these at a minimum; and (ii) all vehicles and equipment used for construction will be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers will be checked, and if found to be defective, will be replaced.	Design Build Contractor and SC
	Temporary measures for construction activities around habitations/ institutional uses	Temporary	Moderate	The contractor will provide the following measures during the laying of transmission mains for sections in the vicinity of habitations and commercial and institutional areas, to minimize access and livelihood disruption: (i) place walkways and metal sheets where required to maintain access across trenches for people and vehicles; (ii) increase workforce in front of critical areas such as institutions, places of worship, business establishments, hospitals, and schools; (iii) consult businesses and institutions regarding operating hours and factoring this into work schedules; and (iv) provide signboards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints.	Design Build Contractor and SC

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
	Emission from construction vehicles, equipment, and machinery	Temporary	Moderate	All vehicles, equipment, and machinery used for construction will be regularly maintained to ensure that pollution emission levels comply with the relevant requirements of DoE. Copies of conformance will be submitted regularly to the SC.	Design Build Contractor and SC
	Environmental pollution / human health Stockpiling of construction materials, excavated earth/spoil from trenches	Temporary	Moderate	Due consideration will be given to material storage and construction sites such that it doesn't cause any hindrance to daily traffic movement. The contractor will (i) consult with implementing agency on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; (ii) avoid stockpiling of earth fill, especially during the rainy season, unless covered by tarpaulins or plastic sheets; (iii) prioritize reuse of excess spoils and materials in the construction works; and (iv) protect surface water bodies from any source of contamination, such as oily wastes, debris, and spoils that will degrade its quality. • Excavated material shall not enter surface waters, surface water banks or impede flows - in particular, the following shall be done: do not dump material in surface waters, at river banks or in flooding areas, in case rivers have been blocked remove the material	Design Build Contractor / SC
	Movement of construction vehicles Oil spillage, grease and lubricant	Temporary	Moderate	The movement of construction materials and equipment, to the extent possible, will be plan along major roads, with the exception of access roads to the site. In the event of movement of construction vehicles and equipment on the narrow roads, strengthening of these roads will be carried out, and timing of movement of heavy vehicles worked out to avoid peak hours and nighttime, and to ensure minimal disturbances to the communities and the resident population along these roads. • Maintenance will be conducted at safe distance from watercourses so that no oil spills can enter the water. Contaminated soil should be excavated and disposed properly in a confined place outside inundation areas	Design Build Contractor and SC
	Contamination of soil and groundwater quality			• The soil contaminated with drilling mud should be avoided For effluents to be discharged from work place, camps, and offices, treatment arrangements such as retention ponds and septic tanks	

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				will be incorporated in the facility designs.	
	Archaeological property chance find	Permanent	Moderate	In the event of an archaeological chance find at the construction site, the contractor will prevent workmen or any other persons from removing and damaging any chance find artifacts and will, immediately upon discovery thereof, inform the SC of such discovery and carry out the SC's instructions for dealing with the same, awaiting which all work will be stopped for 100 m in all directions from the site of discovery.	Design Build Contractor and SC
				The SC will seek direction from the Department of Archaeology before instructing the contractor to resume work on the site.	
	Loss of access to residents, businesses, and institutions during construction.	Temporary	Moderate	The contractor will provide safe and convenient passage for vehicles and pedestrians through diversions to and from side roads, and property access connecting the project roads. The contractor will ensure that (i) the construction works do not interfere with the convenience of the public or access to, use, and occupation of public or private roads, or any other access to properties, whether public or private. Temporary access to properties adjacent to the construction site will be provided through the construction of ramps with concrete slabs for use of pedestrians and light vehicles; (ii) in critical areas such as institutions, operating hours are factored into work schedules and workforce is increased for speedy completion; (iii) advance information on works to be undertaken including appropriate signage, is provided; and (iv) the diversion is done in coordination with the traffic police division for necessary rerouting of traffic and traffic management.	Design-Build Contractor and SC
	Damages to utilities and services during construction	Permanent	Moderate	**The contractor will be required to:** (i) plan for immediate attendance by the service providers to any damages to utilities during construction; (ii) replace (or compensate for) public and private physical structures damaged due to construction or vibration; and (iii) provide prior public information about the likely disruption of services. In consultation and with support from DWASA, the contractor will provide alternative arrangements for water supply in the event of disruption beyond a reasonable time, for instance, through tankers.	Design-Build Contractor and SC

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
	Compensation • Loss or impairment of private property Clearing of construction camps and restoration	Temporary	Moderate	• written compensation arrangement and consent between property owner and contractor	Design Build Contractor and SC
				The contractor will prepare site restoration plans for approval by the SC. The plan will be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish burned, excreta or other disposal pits or trenches filled in and effectively sealed off, and the site left clean and tidy, at the contractor's expense. The site will be restored to pre-project conditions through the removal of all extraneous material on site. During the site clearance and earthwork, it the necessary to be careful about the following:	
				□ No soil erosion occurs, plantation can be done to protect soil erosion	
				□ No landslides occurs	
				□ No siltation occurs at the disposal site of soil and debris.	

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
Component 4: Treated Water Pipeline Transmission Main Starting from Gandharbpur Treatment Plant to Near US Embassy	Quarry/borrow pit operations	Permanent	Moderate	**Responsibility of the contractor to**- (i) obtain approval of implementing agency if new quarries and borrow sites are necessary (ii) store stripped materials as not to disrupt natural drainage and protect them to prevent erosion and migration of soil particles into surface waters; (iii) provide temporary ditches and/or settling basins to collect run-off water and to prevent erosion and contamination of surface water; (iv) plant exposed areas with suitable vegetation at the earliest opportunity and prevent ponding of water through temporary drains discharging to natural drainage channels; (v) restore sites after construction activities by stabilizing contours and slopes, spreading stripped materials to promote percolation and re- growth of vegetation, and draining any standing water. Land utilized for quarry sites access roads will also restored, and (vi) ensure adequate safety precautions during transportation of quarry material from quarries to the construction site (vii) Ensure all employee and labor covered by proper PPE and safety net program. Vehicles transporting the material will cover to prevent spillage.	Design-Build Contractor and SC
	Disposal of bituminous wastes / construction waste / debris / cut material	Temporary	Moderate	For project components involving demolition of structures, the contractor will prepare and implement a waste management plan. Safe disposal of the extraneous material will be ensured in the pre-identified disposal locations. To enable minimization of waste disposal and do this in an environmentally safe manner, the waste management plan will For ***component 1and 3***: (i) recover used oil and lubricants and reuse or remove from the site; (ii) manage solid waste according to the following preference hierarchy: reuse, recycle, and dispose of in designated areas; For ***component 2:*** (iii) reuse bituminous waste generated in road construction, based on its suitability for reuse, to the maximum extent possible. Cut material generated because of construction will be utilized as filling material. Remaining material if any will be disposed of safely at the disposal sites; (iv) remove all wreckage, rubbish, or temporary structures that are no longer required; and	Design Build Contractor and SC

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
				(v) restore pre-project environmental conditions through the implementation of environmental restoration work.	
	Stripping, stocking, and preservation of topsoil	Permanent	Moderate	The topsoil from productive agricultural lands at the intake site, Gandharbpur WTP, borrow areas, and areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. The stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile will be restricted to 2 m. Stockpiles will not be surcharged or otherwise loaded, and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles will be covered with gunny bags or tarpaulin. It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked, either before stripping or when in stockpiles. Such stockpiled topsoil will be returned to cover the disturbed area and cut slopes.	Design-Build Contractor and SC
	Water crossings for the pipelines for khals and ponds	Permanent	Moderate	Trenching and backfilling operations at the stream crossings will be carried out in the lean seasons when the flow will be minimum. In case of crossings at existing minor bridges and culverts, the contractor will ensure that there is no impact/ disturbance to the bridges/culverts due to the crossing of the water pipelines.	Design-Build Contractor and SC
	River crossings required for the transmission lines at the Sitalakhya and Balu Rivers by micro-tunneling	Permanent	Moderate	The construction activities at the river crossings will be carried out in conformance with the conditions laid down by the BIWTA in the permit for river crossings. The vertical shafts shall be located outside the watercourse or riverbed to minimize migration of contaminated soil or water into the river. The contractor shall identify suitable locations for disposal of the soil and water from the tunnel. Precautionary measures will be taken by the contractor to ensure that there is no disposal of construction wastes/materials into the river or on the shores. The construction activities and operations for the river crossings will be planned to ensure that interference of cargo boats, navigation—including fishermen, and passenger movements-are minimal. Advance notices of disruption, if any, will be disclosed. The construction activities and laying of pipes will be carried out in such a manner that the dredging activities of the river are not affected.	Design-Build Contractor and SC

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
3	Operation Stage				
Comp. 4	Environmental conditions	Permanent	Moderate	DWASA will undertake seasonal monitoring of air, water, noise, and soil quality through an approved monitoring agency. The parameters to be monitored, frequency and duration of monitoring, as well as the locations to be monitored will be as per the monitoring plan prepared.	DWASA

7.2.1.3 Environmental Impacts and Mitigation Measures for Package -3

Table 7-4: Environmental impacts and mitigation measures for package -3

(23 km major distribution pipeline, small distribution pipe to DMA)

Sl No	Environmental Issues	Duration/ Extent	Magnitude	Mitigation Measures	Responsibility
1	Design Stage				
Component 4: 23 km Major Distribution Pipe; Component 6: Small Distribution pipe to DMA	Damage to trees and clearance of vegetation at the project locations	Permanent	Moderate	**Intake and WTP:** Only trees that will require removal within the proposed construction areas of the sites will be cut. After the finalization of the designs and layout of the project components, the trees within proposed construction areas will be marked. For trees not proposed to be cut, taking all precautions to protect them from any damage from construction activities, including placement of tree guards will be taken up.	PMU with support from SC Design Build
				Transmission mains: Trees within the corridor of impact (area required for construction) will be felled after prior approval.	Contractor
				Tree Plantation: Log trees will be planted at the suggested/appropriate distances on both slopes of the service roads, which will surplus the loss of trees cut by many times. The social plantation model as followed by the MoEF can be followed in such cases.	
	Assets/facilities lost, including common property resources and religious structures	Permanent	Moderate	Designs to be worked out to minimize impacts on these assets. Compensation and assistance will be provided in accordance with the provisions of the RP.	Design Build Contractor, and SC
				Designs to ensure cross-drainage through the provision of balancing culverts and sufficient cross-movement, including movement of fishes, shall be done to minimize severance impacts on khals and fish ponds cut across by the alignment.	
	Soil erosion	Permanent	Moderate	The measures to address soil erosion at the proposed facilities will consist of measures as per design, or as directed by the SC to control soil erosion, sedimentation, and water pollution. All	Design-Build Contractor and SC

				temporary sedimentation, pollution control works, and maintenance thereof will be deemed incidental to the earthwork or other items of work.	
2	**Construction Stage**				
Construction Phase common measure for all component	**Safety measures during construction** -First aid -Malaria risk	Temporary	Moderate	At every workplace, a readily available first aid unit, including an adequate supply of sterilized dressing material and appliances, will be provided as per the factory rules. Suitable transport will be provided to facilitate the transfer of injured or ill persons to the nearest hospital. At every workplace and construction camp, equipment and nursing staff will be provided. The contractor will, at his own expense, conform to all anti-malaria instructions given to him by the SC. All relevant provisions of the Bangladesh Labor Act, 2006 and Bangladesh National Building Code, 2006 will be adhered to, concerning the provision of adequate safety measures during construction. The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches, and safe means of entry and egress.	Design Build Contractor and SC
	Conflict among the work personnel and labor	Temporary	Moderate	Proper work distribution plan with maintenance authority.	Build Contractor
	Hygiene in the construction camps and sites	Temporary	Moderate	All temporary accommodations will be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking, and washing. Safe drinking water in sufficient quantity for the workforce will be provided at the construction site as well as at the construction camps. Adequate toilets, separate for women and men, shall be provided at the construction sites, with septic tanks. Garbage bins will be provided in the camps and regularly emptied, and the garbage disposed of in a hygienic manner.	Design Build Contractor and SC
				Adequate health care will be provided for the workforce. Unless otherwise arranged for by the local sanitary authority, the local medical health or municipal authorities will make arrangement for disposal of excreta.	

				On completion of the works, all such temporary structures will be cleared away, all rubbish burned, excreta tank and other disposal pits or trenches filled in and effectively sealed off, and the outline site left clean and tidy, at the contractor's expense. The site will be restored to pre-project conditions through the removal of all extraneous material on site.	
	Worker health & safety Risk caused by force majeure **Child labor** Risk of contractors or subcontractors hiring child labor in the construction activities.	Temporary Temporary	Minor Minor	All reasonable precaution will be taken to prevent danger to the workers and the public from fire, flood, drowning, etc. Specifically, the contractor will (i) provide medical and accident insurance for workers; (ii) provide first aid in the construction campsite; and (iii) provide access to hospitals/clinics within the project site that can be accessed in case of emergency by arranging necessary transport for safe carriage of the injured. • National laws on child labor will strictly followed. No child labor will be allow by the contractors or subcontractors in any of the project activities.	Design Build Contractor and SC
	Accident prevention and work safety procedures -May loss or injury of human **Dust Pollution** • Impact Sources Emissions from construction related traffic and machinery. • Dust from works, carrying machinery equipment to the site, and traffic from trucks and vehicles. • Create nuisance Road damage	Temporary Temporary	Moderate Moderate	• Awareness of workers about hazardous materials and proper handling methods. Warning signs, labels and signals. Provide helmets, safety shoes and other PPE for workers in accordance with accident prevention and work safety procedures	Design Build Contractor and SC
				The contractor will (i) take every precaution to reduce the levels of dust at construction sites, and not exceeding the pre-project ambient air quality standards; (ii) fit all heavy equipment and machinery with air pollution control devices that are operating correctly; (iii) reduce dust by spraying stockpiled soil, excavated materials, and spoils; (iv) cover with tarpaulin vehicles	

				transporting soil and sand; and (v) cover stockpiled construction materials with tarpaulin or plastic sheets. • Implement measures in Environmental Code of Practice of Air Quality Management. Dust generation will be restricted as much as possible and water sprinkling carried out as appropriate, especially where earth moving and excavation are carries out. • Emissions during bore logs digging, equipment and traffic will comply with ADB EHS guidelines and will be monitored. Spray of water is suggested in the road and construction sites Capacity of truck load should stay below capacity of road	
	Air pollution (SPM, $PM_{2.5}$, PM_{10}, SOx, NO_2 and CO) • Impairment of air quality may have an impact on geotechnical investigation workers, local residents and surrounding environment • Air pollution generates from exhaust of engines. • During GI bore logs work Emission from drilling vehicle and machine			• Drilling and transport vehicles shall move only in-designated areas and roads. • Water dry drilling areas and access roads to reduce dust emissions • Minimize traffic in villages and other residential areas • Reduce vehicle speed in drilling areas and access roads to 10 km/h • Machines and vehicles must be regularly examined and maintained to comply with requirements of technical specifications Repair and maintain access roads, as necessary	
	Noise and Vibration from construction equipment	Temporary	Moderate	The contractor will ensure (i) regular maintenance of vehicles, equipment, and machinery to keep noise from these at a minimum; and (ii) all vehicles and equipment used for construction will be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers will be checked, and if found to be defective, will be replaced.	Design Build Contractor and SC
	Temporary measures for construction activities around habitations/ institutional uses	Temporary	Moderate	The contractor will provide the following measures during the laying of transmission mains for sections in the vicinity of habitations and commercial and institutional areas, to minimize access and livelihood disruption: (i) place walkways and metal	Design Build Contractor and SC

				sheets where required to maintain access across trenches for people and vehicles; (ii) increase workforce in front of critical areas such as institutions, places of worship, business establishments, hospitals, and schools; (iii) consult businesses and institutions regarding operating hours and factoring this into work schedules; and (iv) provide signboards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints.	
	Emission from construction vehicles, equipment, and machinery	Temporary	Moderate	All vehicles, equipment, and machinery used for construction will be regularly maintained to ensure that pollution emission levels comply with the relevant requirements of DoE. Copies of conformance will be submitted regularly to the SC.	Design Build Contractor and SC
	Environmental pollution / human health Stockpiling of construction materials, excavated earth/spoil from trenches	Temporary	Moderate	Due consideration will be given to material storage and construction sites such that it doesn't cause any hindrance to daily traffic movement. The contractor will (i) consult with implementing agency on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; (ii) avoid stockpiling of earth fill, especially during the rainy season, unless covered by tarpaulins or plastic sheets; (iii) prioritize reuse of excess spoils and materials in the construction works; and (iv) protect surface water bodies from any source of contamination, such as oily wastes, debris, and spoils that will degrade its quality. • Excavated material shall not enter surface waters, surface water banks or impede flows - in particular, the following shall be done: do not dump material in surface waters, at river banks or in flooding areas, in case rivers have been blocked remove the material	Design Build Contractor / SC
	Movement of construction vehicles Oil spillage, grease and lubricant Contamination of soil and groundwater quality	Temporary	Moderate	The movement of construction materials and equipment, to the extent possible, will be plan along major roads, with the exception of access roads to the site. In the event of movement of construction vehicles and equipment on the narrow roads, strengthening of these roads will be carried out, and timing of movement of heavy vehicles worked out to avoid peak hours and nighttime, and to ensure minimal disturbances to the communities and the resident population along these roads.	Design Build Contractor and SC

				• Maintenance will be conducted at safe distance from watercourses so that no oil spills can enter the water. Contaminated soil should be excavated and disposed properly in a confined place outside inundation areas	
				• The soil contaminated with drilling mud should be avoided For effluents to be discharged from work place, camps, and offices, treatment arrangements such as retention ponds and septic tanks will be incorporated in the facility designs.	
	Archaeological property chance find	Permanent	Moderate	In the event of an archaeological chance find at the construction site, the contractor will prevent workmen or any other persons from removing and damaging any chance find artifacts and will, immediately upon discovery thereof, inform the SC of such discovery and carry out the SC's instructions for dealing with the same, awaiting which all work will be stopped for 100 m in all directions from the site of discovery.	Design Build Contractor and SC
				The SC will seek direction from the Department of Archaeology before instructing the contractor to resume work on the site.	
	Loss of access to residents, businesses, and institutions during construction. Damages to utilities and services during construction **Compensation** • Loss or impairment of private property Clearing of construction camps and restoration	Temporary Permanent Temporary	Moderate Moderate Moderate	The contractor will provide safe and convenient passage for vehicles and pedestrians through diversions to and from side roads, and property access connecting the project roads. The contractor will ensure that (i) the construction works do not interfere with the convenience of the public or access to, use, and occupation of public or private roads, or any other access to properties, whether public or private. Temporary access to properties adjacent to the construction site will be provided through the construction of ramps with concrete slabs for use of pedestrians and light vehicles; (ii) in critical areas such as institutions, operating hours are factored into work schedules and workforce is increased for speedy completion; (iii) advance information on works to be undertaken including appropriate signage, is provided; and (iv) the diversion is done in coordination with the traffic police division for necessary rerouting of traffic and traffic management.	Design-Build Contractor and SC Design-Build Contractor and SC Design Build Contractor and SC
				The contractor will be required to: (i) plan for immediate attendance by the service providers to any damages to utilities during construction; (ii) replace (or compensate for) public and private physical structures damaged due to construction or	

				vibration; and (iii) provide prior public information about the likely disruption of services. In consultation and with support from DWASA, the contractor will provide alternative arrangements for water supply in the event of disruption beyond a reasonable time, for instance, through tankers. • written compensation arrangement and consent between property owner and contractor The contractor will prepare site restoration plans for approval by the SC. The plan will be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish burned, excreta or other disposal pits or trenches filled in and effectively sealed off, and the site left clean and tidy, at the contractor's expense. The site will be restored to pre-project conditions through the removal of all extraneous material on site. During the site clearance and earthwork, it the necessary to be careful about the following: □ No soil erosion occurs, plantation can be done to protect soil erosion □ No landslides occurs □ No siltation occurs at the disposal site of soil and debris	
Component 4: 23 km Major Distribution Pipe; Component 6: Small Distribution pipe to DMA	Quarry/borrow pit operations	Permanent	Moderate	**Responsibility of the contractor to**- (i) obtain approval of implementing agency if new quarries and borrow sites are necessary (ii) store stripped materials as not to disrupt natural drainage and protect them to prevent erosion and migration of soil particles into surface waters; (iii) provide temporary ditches and/or settling basins to collect run-off water and to prevent erosion and contamination of surface water; (iv) plant exposed areas with suitable vegetation at the earliest opportunity and prevent ponding of water through temporary drains discharging to natural drainage channels; (v) restore sites after construction activities by stabilizing contours and slopes, spreading stripped materials to promote percolation and re-growth of vegetation, and draining any standing water. Land utilized for quarry sites access roads will also restored, and (vi) ensure adequate safety precautions during transportation of quarry material from quarries to the construction site (vii) Ensure all employee and labor covered by proper PPE and safety net	Design-Build Contractor and SC

				program. Vehicles transporting the material will cover to prevent spillage.	
	Disposal of bituminous wastes / construction waste / debris / cut material	Temporary	Moderate	For project components involving demolition of structures, the contractor will prepare and implement a waste management plan. Safe disposal of the extraneous material will be ensured in the pre-identified disposal locations. To enable minimization of waste disposal and do this in an environmentally safe manner, the waste management plan will For ***component 1and 3***: (i) recover used oil and lubricants and reuse or remove from the site; (ii) manage solid waste according to the following preference hierarchy: reuse, recycle, and dispose of in designated areas; For ***component 2:*** (iii) reuse bituminous waste generated in road construction, based on its suitability for reuse, to the maximum extent possible. Cut material generated because of construction will be utilized as filling material. Remaining material if any will be disposed of safely at the disposal sites; (iv) remove all wreckage, rubbish, or temporary structures that are no longer required; and (v) restore pre-project environmental conditions through the implementation of environmental restoration work.	Design Build Contractor and SC
	Stripping, stocking, and preservation of topsoil	Permanent	Moderate	The topsoil from productive agricultural lands at the intake site, Gandharbpur WTP, borrow areas, and areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. The stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile will be restricted to 2 m. Stockpiles will not be surcharged or otherwise loaded, and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles will be covered with gunny bags or tarpaulin. It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked, either before stripping or when in stockpiles. Such stockpiled topsoil will be returned to cover the disturbed area and cut slopes.	Design-Build Contractor and SC
	Water crossings for the pipelines for khals and ponds	Permanent	Moderate	Trenching and backfilling operations at the stream crossings will be carried out in the lean seasons when the flow will be minimum. In case of crossings at existing minor bridges and culverts, the contractor will ensure that there is no impact/ disturbance to the bridges/culverts due to the crossing of the water pipelines.	Design-Build Contractor and SC

	River crossings required for the transmission lines at the Sitalakhya and Balu Rivers by micro-tunneling	Permanent	Moderate	The construction activities at the river crossings will be carried out in conformance with the conditions laid down by the BIWTA in the permit for river crossings. The vertical shafts shall be located outside the watercourse or riverbed to minimize migration of contaminated soil or water into the river. The contractor shall identify suitable locations for disposal of the soil and water from the tunnel. Precautionary measures will be taken by the contractor to ensure that there is no disposal of construction wastes/materials into the river or on the shores. The construction activities and operations for the river crossings will be planned to ensure that interference of cargo boats, navigation—including fishermen, and passenger movements — are minimal. Advance notices of disruption, if any, will be disclosed. The construction activities and laying of pipes will be carried out in such a manner that the dredging activities of the river are not affected.	Design-Build Contractor and SC
3	**Operation Stage**				
Component 4: 23 km Major Distribution Pipe	Environmental conditions	Permanent	Moderate	DWASA will undertake seasonal monitoring of air, water, noise, and soil quality through an approved monitoring agency. The parameters to be monitored, frequency and duration of monitoring, as well as the locations to be monitored will be as per the monitoring plan prepared.	DWASA

8.0 ENVIRONMENTAL MONITORING PLAN

8.1 Institutional Arrangements

DWASA will be the executing agency responsible for overall guidance and project implementation. Through a Project Director, DWASA will implement the project investments and will be responsible for overall planning, management, coordination, supervision, and progress monitoring of the Project. The DWASA will be responsible for day-to-day monitoring of project activities and will ensure compliance with the statutory and legal requirements of the Government, and ADB. The DWASA will prepare and submit an updated EIA and Project Monitoring Reports to ADB. **Error! eference source not found.** shows the organizational chart for updated EIA implementation

8.2 Implementation of Environmental Management Plan (EMP)

The DBO contractor will bring responsibility of implementation of EMP. EMP implementation will be the part of the DBO contract document. All cost for implementing EMP will be the part of the civil works contract and to be quoted by the contractor in their proposal as per this EIA.

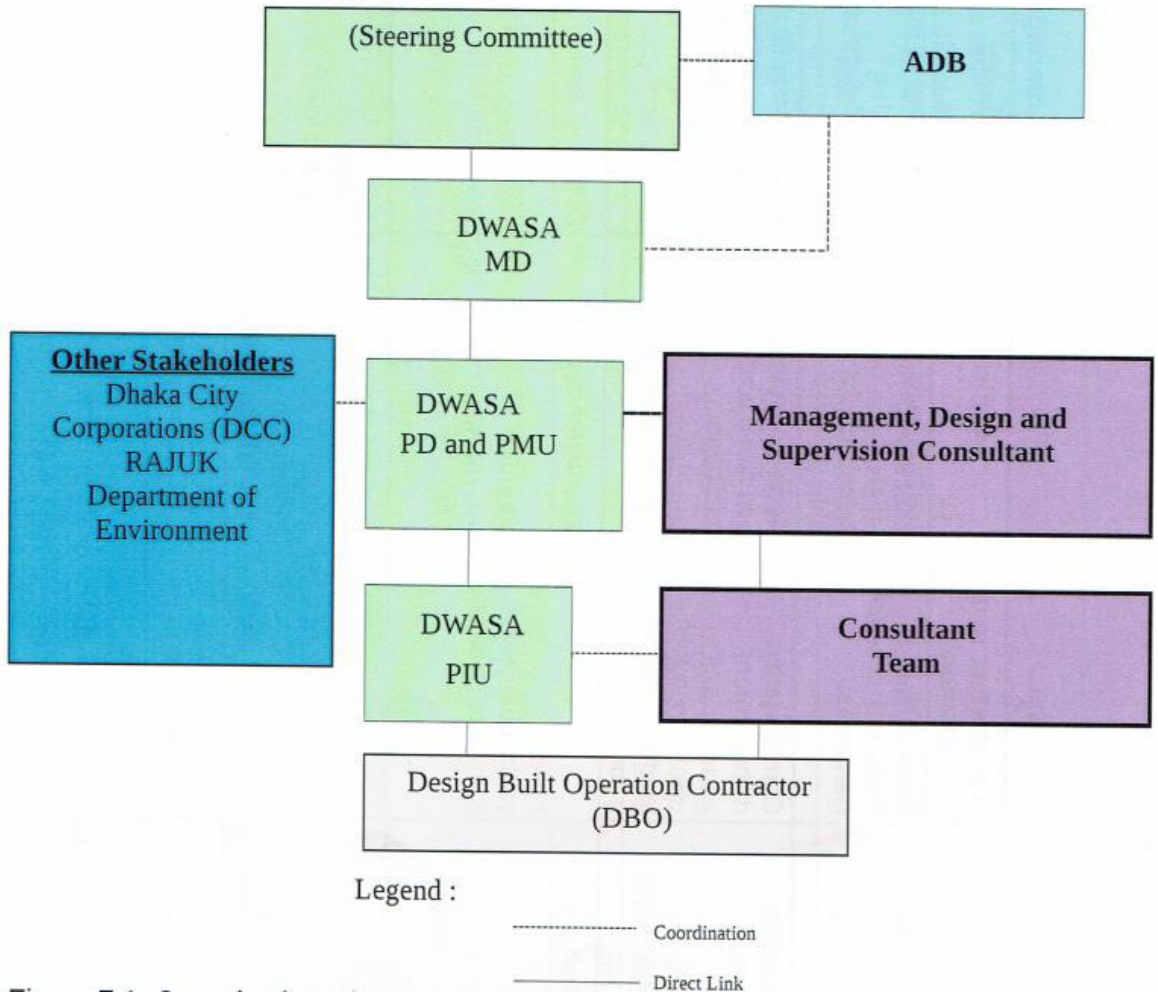


Figure 8-1: Organization chart for EIA implementation

This EIA will be the part of the contract document. Environmental monitoring will be done during

construction in three levels; namely monitoring development of project performance indicators done by the Environmental Specialist of the Design Supervision Consultant monitoring implementation of mitigation measures done by the Contractor; and overall regulatory monitoring of the environmental issues done by Environmental Officer of the DWASA. The environmental monitoring plan for the Project is presented in Table 8-1: Monitoring plan for proposed developments. The table shows proposed monitoring of all relevant environmental parameters, with a description of the sampling stations, frequency of monitoring, applicable standards and responsible agencies. The monitoring of the environmental attributes in the first season (first year of implementation) will be carried out prior to the start of implementation works at the site, and shall form a baseline for the environmental parameters. Monitoring will be the responsibility of civil works contractors who would likely outsource this responsibility.

8.3 Capacity Building

At present, the capacity on safeguards planning and implementation at DWASA is not adequate to handle safeguard implementation. To ensure effective implementation of environmental aspects as outlined in this EIA, a DWASA environmental safeguard officer/responsible person will be recruited to oversee Environment Management Plan (EMP) implementation ADB components. The Design Supervision Consultant's Environmental Specialists will train and assist the DWASA according to the training program outlined below, to ensure smooth implementation and monitoring of the EIA.

The proposed capacity building program will include (i) sensitization of DWASA staff and stakeholders on environmental management, including on the ADB, and Government of Bangladesh requirements on environment; (ii) capacity building programs to improve the capability of environment staff at all levels in carrying out/monitoring and implementing environmental management measures for the Project; and (iii) capacity building programs on environmental issues including quality monitoring. The Environmental Specialist of the Project Management Design and Supervision Consultant (PMDSC) will provide the basic training required for environmental awareness followed by specific aspects of infrastructure improvement projects along with environmental implications for projects. Specific modules customized for the available skill set will be devised after assessing the capabilities of the members of the Training Program and the requirements of the Project. The entire training would cover basic principles of environmental assessment and management mitigation plans and programs, implementation techniques, monitoring methods and tools. The proposed training program along with the frequency of sessions is presented in Table 8-2.

8.4 Detailed Environment Monitoring Plan

Table 8-1: Monitoring plan for proposed developments

Sl. No	Attributes	Stage	Parameters to be Monitored	Location	Frequency	Responsibility
1	Air Quality at each location of items (especially at road side)	Construction Stage	PM, SPM, SO_2, NOx, CO	at the construction areas (2 locations)	Once in a Year (dry season) for the entire construction period	Contractor, to be monitored through approved Monitoring Agency and PMU (DWASA and SC)
2	Noise Levels in silence zone	Construction Stage	Equivalent Day & Night Time Noise Levels	At WTP, and @ 2km intervals along the pipe alignment.	Twice in a year	Contractor, to be monitored through approved monitoring Agency and PMU (DWASA and SC)
		Operation Stage		At boundary of WTP	Once in a year	DWASA
3	Water quality	Construction stage	TDS, TSS, pH, Hardness, BOD and Feacal Coliform	At 150 m downstream of river / stream crossings and intake location.	Twice a year (pre monsoon and post monsoon) for the entire period of construction	Contractor, to be monitored through approved monitoring Agency and PMU (DWASA and SC)
4	Water Flow Rate	Construction and Operation phases	Q_{lean}	Nearest BWDB measurement gauge near intake	Once in a year	DWASA in conjunction with BWDB
5	Adequacy of solid waste management systems proposed to handle sludge and other treatment plant wastes	Post Construction Stage & Operation stage	Functionality of sludge drying beds. Disposal route for alum sludge.	WTP	Before, during and after the monsoons, annually for 3 years	DWASA
6	Survival Rate of	Operation Stage	Survival Rate of	Along the project	Twice a year till the	DWASA

Sl. No	Attributes	Stage	Parameters to be Monitored	Location	Frequency	Responsibility
	Plantation and landscaping		Proposed roadside plantations	road and in the landscaped portions within the WTP	trees reach a minimum height of 2m	
7	Socioeconomic monitoring	Operation Stage	Compensation disbursement accuracy and efficiency, public feedback on this issue.	Affected population who have faced land acquisition	Monthly basis till all compensations are paid and feedbacks gathered	DWASA

8.5 Environmental Budget

As part of good engineering practices in the Project, there have been several measures as erosion prevention, rehabilitation of borrow areas, safety, signage, provision of temporary drains, etc., the costs for which will be included in the design costs of the Project. The EIA costs include monitoring costs during construction and capacity-building costs on environmental management of which are absorbed into contractors work packages. The costs for training proposed include the costs incurred toward site visits, travel to the training program by participants, printing of training materials, and other logistic arrangements. The costs involved towards preparation of training material and training are covered in the consultancy budget for the Design Supervision Consultant. The budget for the environmental management costs for the Project is presented in Table 8-3 below.

The cost estimates mentioned in Table 8-4 is an indicative price. The bidder can provide their own reasonable quoted rate. The bidder will include the detail cost of EMP in the Summary Cost Table 8-5. Though during construction phase need all components monitoring. But operation phase need only two locations monitoring. These two points are *Intake point at Bishnondi and Gandharpur (WTP)*

Table 8-2: Training modules for environmental management

Program	Description	Participants	Form of Training	Duration	Trainer /Agency
Introduction And sensitization to environment issues	Sensitization on Environmental concerns Environmental impacts of urban infrastructure improvement projects Environmental regulations of the Government and ADB environmental regulations Coordination between departments for implementation of environmental issues	DWASA engineers / management team, officials responsible for implementing the Project, and other DWASA Officials	Workshop	One-day workshop during construction	Project Management, Design and Supervision Consultant's Environmental Specialist/ DWASA
Project training on hazards, health, safety and environmental issues pertaining to the Project	Sensitization and training for engineering and Management professionals, to be involved in on-site execution and operation of the proposed facilities.	DWASA engineers/ management team	Workshops, site visits	Three days at during construction	Tailor made training programs by the Safety Board of Bangladesh (ISBB), College Engineering Staff etc. organized by Contractors
EMP implementation	Implementation of EMP Identification of environment impacts Monitoring and reporting for EMP Public interactions and consultations Coordination for	DWASA engineers, officials responsible for implementing the Project, and other DWASA/	Lectures and field visit	Two-day session at construction stage	Project Management, Design and Supervision Consultant's Environmental Specialist

Program	Description	Participants	Form of Training	Duration	Trainer /Agency
	consents with various departments Monitoring formats filling and review of impacts	Design Supervision Consultant staff			

Table 8-3: Environmental monitoring costs during construction of (package 1 for 3 components)

Component	Stage	Item	Unit Cost (BDT)	Quantity (Yearly)	Total Costs (BDT)
Awareness, Warning signs, labels and signals Accident	During Construction	Ensuring that HSMP works right on the track	--	--	150,000
Campsite waste disposal facilities	During Construction	Avoid disease	75,000	2	150,000
Air Pollution	During Construction	Measurement of SPM, PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO. (2 locations)	100,000	4	400,000
Water Pollution	During Construction	Measurement of pH, EC, Turbidity, DO, Coli form, BOD, NH_4N Oil and Grease	15,000	4	60,000
Waste	During Construction	Collection, transportation and dumping of waste at authorized dumping sites. Minimization of volume and recycling.	--	--	600,000
Noise	During Construction	Periodical maintenance of construction vehicles and installation of sound insulation cover	5,000	12	60,000
Drinking Water supply and sanitation	During Construction	Arsenic free water/ Treatment and test cost	10,000	12	120,000
Reporting on Environmental Monitoring	During Construction	Quarterly Monitoring Report	150,000	4	600,000
Grand Total	**In Word Tk. Twenty-one lac forty thousand only**				**2,140,000**

Table 8-4: Environmental monitoring costs during construction of (package 2 for 1 component)

Component	Stage	Item	Unit Cost (BDT)	Quantity (Yearly)	Total Costs (BDT)
Awareness, Warning signs, labels and signals Accident	During Construction	Ensuring that HSMP works right on the track	--	--	150,000

Component	Stage	Item	Unit Cost (BDT)	Quantity (Yearly)	Total Costs (BDT)
Campsite waste disposal facilities	During Construction	Avoid disease	75,000	2	150,000
Air Pollution	During Construction	Measurement of SPM, PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO. (2 locations)	100,000	4	400,000
Water Pollution	During Construction	Measurement of pH, EC, Turbidity, DO, Coli form, BOD, NH_4N Oil and Grease	15,000	4	60,000
Waste	During Construction	Collection, transportation and dumping of waste at authorized dumping sites. Minimization of volume and recycling.	--	--	600,000
Noise	During Construction	Periodical maintenance of construction vehicles and installation of sound insulation cover	5,000	12	60,000
Drinking Water supply and sanitation	During Construction	Arsenic free water/ Treatment and test cost	10,000	12	120,000
Reporting on Environmental Monitoring	During Construction	Quarterly Monitoring Report	150,000	4	600,000
Grand Total	**In Word Tk. Twenty-one lac forty thousand only**				**2,140,000**

Table 8-5: Environmental monitoring costs during construction of (package 3 for 2 components)

Component	Stage	Item	Unit Cost (BDT)	Quantity (Yearly)	Total Costs (BDT)
Awareness, Warning signs, labels and signals Accident	During Construction	Ensuring that HSMP works right on the track	**--**	**--**	150,000
Campsite waste disposal facilities	During Construction	Avoid disease	75,000	2	150,000
Air Pollution	During Construction	Measurement of SPM, PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO. (2 locations)	100,000	4	400,000
Water Pollution	During Construction	Measurement of pH, EC, Turbidity, DO, Coli form, BOD, NH_4N Oil and Grease	15,000	4	60,000
Waste	During Construction	Collection, transportation and dumping of waste at authorized dumping sites. Minimization of volume	--	--	600,000

Component	Stage	Item	Unit Cost (BDT)	Quantity (Yearly)	Total Costs (BDT)
		and recycling.			
Noise	During Construction	Periodical maintenance of construction vehicles and installation of sound insulation cover	5,000	12	60,000
Drinking Water supply and sanitation	During Construction	Arsenic free water/ Treatment and test cost	10,000	12	120,000
Reporting on Environmental Monitoring	During Construction	Quarterly Monitoring Report	150,000	4	600,000
Grand Total	**In Word Tk. Twenty-one lac forty thousand only**				**2,140,000**

Table 8-6: Quarterly environmental monitoring cost during O&M phase of P1 & P2 for intake and WTP.

Sl. No.		Parameters	No. of Location	Rate in BDT	Total Amount in BDT
1	Ground water	pH, DO, TDS, EC, Fe, As	2	10,000	20,000
	Surface water	pH, TDS, EC, Fe, DO, BOD, COD	2	12,000	24,000
	Ambient Air Quality	SPM, $PM_{2.5}$, PM_{10}, NOx, SO_2, CO, O_3	2	75,000	150,000
	Noise level	Leq (dBA) (Day and Night)	2	5,000	10,000
	Transport for carrying equipment, sampling and machine night time security charge (24 hours sampling)		3 days	10,000	30,000
	Monitoring Report preparation				100,000
	Total Amount in BDT in Word: Three Lac Thirty Four Thousand Only				**334,000**

9.0 CONSULTATION WITH STAKEHOLDER/ PUBLIC CONSULTATION

9.1 Approach

The team of environmental experts has contacted the local people through field workers local people. Meetings were arranged with the consent of the local stakeholders at scheduled venues chosen by the locals.

Besides, there were consultation meetings held with key government agencies, departments, and institutes to get their feedback on this project.

The following methodologies have been used for carrying out public consultations:

i. Local communities, individuals, and owners and employees of commercial establishments who are directly or indirectly affected were given priority while conducting public consultations.

ii. Walk-through informal group consultations were held in the proposed project component areas.

iii. The local communities were informed through public consultation, with briefing on project interventions, including its benefits; and

iv. The environmental concerns and suggestions made by the participants were listed, and discussed, and suggestions accordingly incorporated in the EMP.

To promote public awareness on the proposed bore log drilling activities, pipe laying especially among the potentially impacted communities/individuals;

Different techniques of consultation with stakeholders were used during project preparation (interviews, public meetings, group discussions, etc). A questionnaire was designed and environmental information was collected. Apart from this, a series of public consultation meetings were conducted during the study. Various forms of public consultations (consultation through adhoc discussions on-site) have been used to discuss the project and involve single stakeholders and communities in the planning process especially regarding project design and mitigation measures.

Key stakeholders included directly project-affected persons, owners of roads/houses/ residences and commercial shops/establishments who will suffer temporary access disruptions during drilling of boreholes activities, shopkeepers/businessmen from the project area, and daily commuters consulted randomly. In addition to a number of informal consultations conducted regularly in the project corridor, a total of 139 number of borehole drilling sites for P2 were selected on a stratified basis to ensure diversified representation, were consulted up to 17 April 2017 and 132 borehole sites for P3 on 16 April 17. Photographs of public consultation meetings are shown in Photo 1-4 at the end of this section. Detail of public consultation issues discussed and feedback received along with details of date, time, location, are summarized in Table 9-1 & Table 9-2 and signature of the participant list is shown in **Appendix-12**.

The EIA and other relevant documents will be made available at public locations in the city and posted on the DWASA and ADB websites.

The public consultation and disclosure program with all interested and affected partied will remain a continuous process throughout the project implementation

9.2 Involvement of NGOs, CBOs and Women's Organizations

The active involvement of NGOs and organizations representing women and other vulnerable groups is seen by DWASA as essential in fostering positive community participation in the program and ensuring that the views and wishes of the disadvantaged are heard and acted

upon. NGOs will perform a number of key roles in the project, in particular:

1. An NGO named "DORP" has been appointed by the PMU to organize and implement the consultation and disclosure activities described above, and the various awareness raising campaigns;
2. The concern consultant and resettlement expert engaged for monitoring the activities, with the help of the NGO, may fulfill the role of Training Coordinator in the PMU. They will organize training for DWASA staff, environment and resettlement cells, and CBOs in community level;
3. DORP NGOs will be assisted to the PMU with other technical tasks.

The consultation process so far has solicited inputs from a range of stakeholders, including government officials, experts, and researchers, including elected representatives, residents at the project locations, and project affected persons.

9.3 Major Findings

Table 9-1: Focus group discussion

Place and Date	Participants	Purpose of Consultation	Key issues discussed
Old Dayakandha Bazar, 800 m downstream of the proposed Bishnondi intake, Meghna River, 15-Jan-2013	Fishermen communities, farmers, elected representatives of Old Dayakandha Bazar No. of participants: 45	Consultations with the fishermen and community on the fishing activities, types of fishes, and understanding grievances of the communities, if any	• There are 200 families in the village dependent on fishing. The fishermen have a society that regulates fishing. During the lean flows of the year, the fishermen erect cages with • Bamboo, and expenses and profits are usually shared by families. • The fishermen revealed that the types of fishes caught are those generally found along the entire stretch of Meghna River, and include hilsa, katchki, prawn, katla, rui, puti, baim, bele, gozar, boal, pangash, tangram, poya, and different cat fishes. • No special or rare species have been encountered in this stretch. Species such as pabda and kalboush have become more rare in the past few years. The larger fishes are usually found in the deeper channels of the river, and the catch is significantly less along the banks of rivers and in shallow waters. • The community was aware of the arsenic contamination of groundwater and was averse to using it. • The community said that they have not had experiencedany salinity in river water, and mentioned that salinity intrusion was up to Chandpur, about 130 km downstream from Bishnondi. • The fishermen said that there are no specific locations identified as breeding grounds near the intake. The breeding season differs for different species, and as per the orders of the fisheries department, fishing is totally banned for particular periods. • Fishermen welcomed the project, and requested that there should be no adverse impacts on the

Place and Date	Participants	Purpose of Consultation	Key issues discussed
			water quality due to the proposed construction activities. The fishermen mentioned that degradation of water quality shall result in long-term losses to their livelihood, and requested that polluting industries
Bishnondi village, intake, Meghna River 19-Jan-2013	Village residents, affected land owners, elected representatives, and Chairman Araihazar Upazilla. No. of participants: 60	Consultations with the communities on the proposed intake facility, land acquisition impacts	• Policy for entitlements of the affected people and cut-off date for listing of affected properties were explained to the people. • The communities said that acquisition of land will result in loss of agricultural lands, their only source of livelihood • The communities requested that land and structures affected be paid for at market rates, and compensation and other assistance be paid before displacement. • The communities were informed that ADB policy on resettlement will be conformed to, all impacts will be compensated for at replacement costs, and there will be a mechanism for grievance redressal in the project .
Manikpur ferry ghat, Meghna River	Shopkeepers at the ferry ghat location, boat operators, passengers using the ferry ghat No. of participants: 30	Consultations with the stakeholders on the nature of pollution at the ghat site, and potential efforts required to minimize pollution	• This is a new ferry ghat, which has been operational for less than a year. There are two ferries that transport vehicles and passengers across the river, in addition to about 30 smaller boats for passenger crossing. • About 50 small-scale shops have been established on government land, catering to the needs of the passengers. • Currently there are no waste management or toilet facilities at the ghat, and waste is discharged directly into the river. The shopkeepers confirmed that in the event of any facilities being created by the project for toilets/waste collection and management, they would maintain and operate the same.

Table 9-2: Focus group discussion outputs during EIA

Place and Date	Participants	Purpose of Consultation	Key issues discussed and information exchanged
25-Aug-2014 Premises of Shahin Member GPS: N23°44´39.689˝ E90°42´44.568˝ (About 3km d/s of Manikpur Ferry port)	21 participants: Village residents, affected land owners, elected representatives	Consultation of the landowners of proposed Intake site and adjacent pipe line alignment.	• The owner was initially against this development which includes his land. But during this discussion he was very positive and was looking forward for the development. • There are no public school nearby. Therefore, a straight road along with the pipeline will improve the situation as the kids can have good access to public schools. • People complained that unplanned dredging for sand-mining to fill up the land for acquired land for the university near Manikpur port is causing river erosion. They urged to stop this kind of dredging by imposing some embargo as for the pollution sources upstream. • Previous project involving land acquisition (the university near Manikpur Ferry port) had not

Place and Date	Participants	Purpose of Consultation	Key issues discussed and information exchanged
			compensated the real owners of the acquired land rather, they have collected old documents from the land office and paid according to those which wrongly paid compensation to the previous owners. They does not want the same happening in this project. • They will prefer log-trees on the planned road sides. • The meeting informed that former honorable Minister or water resources and MP Mr. Ramesh Chandra Sen promised them to build embankment road on this side of the river in a public meeting a few days ago.
25-Aug-2014 Golakandail Union Parisad Office GPS: N23°46´50.818˝ E90°34´9.617˝ About 0.5km south of Golakandail (Vulta) Intersection (crossing of roads N2 & N105)	5 participants; Chairman and members of the union parisad.	To inform and collect feedback from the stakeholders.	• The Chairman ensured full cooperation to acquire land when that comes through an official order. • Rate of land price is quite high in this area compared to the intake area. Therefore, proper compensation package considering the local market price of land should be offered. • They demanded future extension of the treated water supply by DWASA in their locality.
26-Aug-2014 Char Gandhrarbpur, Rupgang. WTP area.		To inform and collect feedback from the local landowners.	• DWASA acquired land from this char in 1982 at a very low price. They have paid only Tk. 99 lakh for almost 360 acre of land. The rate was Tk. 20,000 per Bigha. But to get that money they had to pay middlemen. Some did not even get any compensation. There is a water body nearby and later DWASA have sold 7-acre of land to WAPDA by Tk. 7 cror. The farmers still need proper compensation for their land. • This land is very fertile and can grow anything. All kind of vegetables, sugarcane and jute is cultivated here. Most of the land owners lives on agriculture therefore, losing land is losing income to them. • Present market price for land is about Tk. 1 cror per bigha. The landowners will be happy even if they get half or one third of that price. Alternatively providing jobs to the farmers is also acceptable. But DWASA have started constructing boundary walls without their consent. The people are annoyed and will protest. • About 30% of population of this area are educated-unemployed. Arranging jobs for them can be a solution.

9.4 Public Consultations

The formal consultation meetings carried out with the communities are summarized in Table

9-3. In addition, during the site visits and social surveys, extensive smaller group discussions on specific environment and social issues were held. Suggestions and concerns of the affected persons focused mostly on temporary impact. Specific concerns with respect to pedestrian and vehicle movement, dust, noise, solid waste and liquid drilling mud pollution participation of communities during drilling, carrying out drilling activities without any adverse impacts on the water quality of the river, etc. have formed the basis for formulation of the mitigation measures, and have been incorporated in the EMP.

Table 9-3: Details of public consultations

Sl. No.	Place, Date	Participants	Purpose of Consultation	Key Issues Discussed
1	DORP office, Rupgonj, of the proposed P2 pipeline location Date: 17.04.2107	Local community and elites, teacher, farmers, serviceman and businessman. No. of participants: 25	Consultations with the local people and community on the GI 139 borehole drilling and pipeline on P2 component activities and understanding grievances of the communities, if any	• Awareness campaign should be done before starting the borehole drilling. • The area of borehole drilling will be cordon off by caution tape in order to restrict the area. • No trees and establishment, structure will be affected during the borehole drilling. • There are few families in the village may temporarily impacted due to bore log drilling work. • Noise less equipment should be used • Dust pollution should be suppressed by water spraying • The community was aware of the arsenic contamination of groundwater and was averse to using it. • During survey found there is no loss of crops, trees, business and structure, prepare and provide detail compensation if any of the affected person (APs) for pipeline construction and laying • The community said that they have not any objection regarding soil test through borehole drilling and pipeline laying along the P2 alignment. • The contractor should be asked for to avoid any damage of trees, utility service line damage, pedestrian and vehicle movement and have flexibility of freedom to shift the location of borehole point by few feet.
2	Dhaka North City Corporation, Uttara, Sector-6, of the proposed P3 pipeline location Date: 16.04.2107	CEO, Executive Engineer and commissioner of Dhaka north city corporation No. of participants:9	Consultations with the local commissioner and CEO of Dhaka North City corporation at Uttara on the GI 132 borehole drilling and pipeline laying on P3 component activities and understanding grievances of the communities,	• Awareness campaign should be done before starting the borehole drilling. • The major problem is pedestrian and vehicle movement during borehole drilling and pipeline construction since the area is very busy all the time. • The area of borehole drilling will be cordon off by caution tape in order to restrict the area. • No trees and establishment will be affected during the borehole drilling. • CEO request to perform the drilling work at night so the disturbance and noise generation will be less. Noise less equipment should be used • Dust pollution should be suppressed by water spraying • The community said that they have not any objection regarding soil test through borehole

			if any	drilling and pipeli laying along the P3 alignment. • Executive engineer of DNCC ask to provide the GI borehole log drawing for locating the utilities services at road side for avoiding cutting and damages by shifting the borehole location slightly if any. • Income loss should be compensated • The contractor should be asked for to avoid any damage of trees, utility service line damage, pedestrian and vehicle movement and have flexibility of freedom to shift the location of borehole point by few feet.

9.5 Plan for Continued Public Participation

The consultation process will be carried on during the subsequent drilling of borehole and pipe laying activities for P2 and P3 component with the stakeholders. The NGO DORP will perform the activities.

9.6 Grievance Redress Mechanism

A project-specific grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of AP's concerns, complaints, and grievances about the social and environmental performance at the level of the project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project.

DWASA has its own Grievance Redress Procedure (GRP)to address any dissatisfaction and complaints by residents regarding its activities. This is set out in the DWASA Resettlement Policy Framework (RPF). This procedure will be applied to address any complaints or grievances during implementation of the DESWSP.

DWASA policy as set out in its RPF is oriented towards resolving complaints at project level through negotiations with community leaders and representatives of Affected Persons (AP). For this program, these discussions will be conducted by the PMU, and will involve the AP and members of the relevant Zonal Level Coordination Committee (ZLCC), plus the Site Manager and Chief Engineer of the Construction Contractor if necessary. If a case cannot be resolved in this way it will be submitted to a Grievance Resolution Committee (GRC), led by the PMU Director, with two other members who are (i) a representative of the residents of the project area who is known to be a person of integrity and good judgment who commands respect, and (ii) a representative of a local NGO or CBO (in this case the NGO implementing the Resettlement Plan).

The Project Coordinator convenes a meeting of the GRC in the project area, and conducts proceedings informally to reach an amicable settlement between the parties. The report of the committee is recorded in writing, and attested copies are provided to the parties involved. For this program, the GRC will be required to meet and reach a decision within 14 days of receiving a complaint (verbally or in writing) from an AP or his representative. There will also be an appeals procedure where, if a person is dissatisfied with the ruling of the GRC, he or his representative may attend their next meeting to re-present the case. The committee will then re-consider the case in private, after which their decision is final. If the appellant is still not satisfied, he has the right to take his case to the public courts.

The project will establish a grievance redress mechanism to ensure greater accountability. DWASA will prepare a grievance redress mechanism, acceptable to ADB, and establish a special committee to receive and resolve complaints/grievances or act upon reports from stakeholders on misuse of funds and other irregularities, including grievances due to resettlement. The special committee will (i) make public the existence of this grievance redress mechanism; (ii) review and address grievances of stakeholders of the project, in relation to

either the project, any of the service providers, or any person responsible for carrying out any aspect of the project; and (iii) proactively and constructively respond to them. The GRM for the project is outlined below, and consists of three levels with time-bound schedules for addressing grievances.

The first level and most accessible and immediate venue for the fastest resolution of grievances is the PMU, chiefly through the PMU environmental officer and project director. The contact phone number of the PMU will be posted in public areas in the project area and construction sites. Grievances will be resolved through continuous interactions with affected persons, and the PMU will answer queries and resolve grievances regarding various issues, including contractor performance, environmental impacts of the project (noise, air, traffic, etc.), land acquisition, structures acquisition, livelihood impacts, entitlements, and assistance. Corrective measures will be undertaken at the field level itself within 7 days. All grievances will be documented, with full information on the person (name, address, date of complaint, etc.) and the issue.

Should the grievance remain unresolved, the PMU's project director will activate the second level of the GRM by referring the issue (with written documentation) to the local grievance redress committee (GRC) of the DWASA, who will, based on review of the grievances, address them in consultation with the PMU resettlement officer and project director and affected persons. The local GRC will consist of the following persons: (i) project Director or project manager of DWASA (GRC chair); (ii) affected person or representative of the affected persons; (iii) representative of the local district commissioner's office; (iv) representative of the Department of Environment (DoE)'s divisional office; and (v) SC environmental specialist (national). A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern/issues. The process will promote conflict resolution through mediation. The local GRC shall meet as necessary when there are grievances to address. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 days.

The functions of the local GRC are as follows: (i) provide support to affected persons on problems arising from land acquisition (temporary or permanent), asset acquisition, and eligibility for entitlements, compensation, and assistance; (ii) record grievances of affected persons, categorize and prioritize them, and provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC. The PMU environmental officer will be responsible for processing and placing all papers before the PMU GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to see that formal orders are issued and decisions carried out. In the event that a grievance is not addressed by the PMU or GRC, the affected person can seek legal redress of the grievance in the appropriate courts, the third level of the GRM. The GRM proposed is depicted in Figure 9-1.

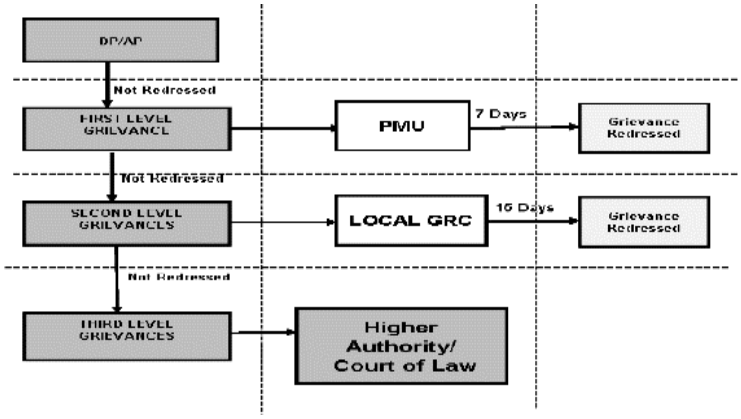


Figure 9-1: Grievance redress mechanism flowchart (GRM)

9.7 Summary

The basic concern of the affected people is to get proper compensation for their lost land and

livelihoods in a smooth manner without the interference of any middlemen. The discontents of the locals can be mitigated following proper resettlement plan, which has already been prepared as a separate document. Consultations are presenting in Below Figure 9-2, Figure 9-3

Figure 9-2: FGD at Golakandail

Figure 9-3: FGD beside intake site

Photo 1. Discussion on consultation meeting on EIA study for P3 component at CEO office at Dhaka North City Corporation in Uttara, Dhaka.

Photo 2. Discussion on consultation meeting with executive engineer on EIA study for P3 component at Dhaka North City Corporation at Uttara, Dhaka

Photo 3. Discussion on consultation meeting on EIA study at P2 component at DORP office, Gandharbpur, Rupgaonj, Narayangonj

Photo 4. Presentation on GI borehole drilling of P2 component at DORP office, Gandharbpur, Rupgaonj, Narayangonj

10.0 CONCLUSION AND RECOMMENDATION

DWASA received the approval letter on 5th May 2015 of EIA report from DoE after submitting require document for Water Treatment plant under Dhaka Environmentally Sustainable Water Supply Project (DESWSP) of Dhaka WASA. During the preparation of EIA and approval period it was not matured, it is all the components of the whole project. However, over the time there are some additional distribution pipeline work included in this project at Uttara as P3.2 under package-3, changing pipe diameter, geotechnical investigation etc. Hence the update of the EIA is require for all the component of the project. In order to fulfil the requirement of update of the approved EIA, the consultants revised the report and update the EIA considering all the environmental issues.

The proposed interventions will improve the environmental conditions in the Dhaka metropolitan areas through improved access to treated water, and significantly contribute to the DWASA's long-term objective to reduce the existing pressure on groundwater extraction.

Field visits and consultations with the stake holders and affected population were taken into considerations in the evaluation and mitigation proposals in this assessment report.

The citable impact of the plant is the impact of intake structure at Meghna river on the fisheries and river ecology. If the intake velocity is higher than the fish swimming velocity of Key fish species like Hilsa, jatka or any other small fishes or any other river ecology then there might have some impact on river ecology. Therefore, intake screens are to be designed according to the swimming characteristics of Hilsa (the key species in the Meghna), to ensure that the impacts on Hilsa as well as the smaller fish, including the jatka, are minimized. Therefore, it is recommended here to use 8 cm/sec approach velocity for screen mesh to avoid such impact. For screen mesh openings it is recommended that the opening shall not exceed 3/32 inch (2.38 mm) for woven wire or perforated plate screens, or 0.0689 inch (1.75 mm) for profile wire screens, with a minimum 27% open area. It is also recommended to provide screen in the direction of flow to escape small fish and spawn from the screen. It is further recommended for consulting a fisheries expert as part of the detailed design to provide inputs on the design of the intake screen to minimize impacts on fish. Efforts to minimize such impacts will be integrated into the detailed designs by the fisheries expert.

During operation of the intake and WTP, physical and chemical sludge will be generated. This drinking water treatment sludge usually contains colloidal aluminium hydroxides, colloidal or dissolved organic matter, clay, silt and microorganisms. It should not contain heavy metal and toxic chemicals. After dehydration and drying the sludge is proposed to use as fill material for lowlands as reclaimed land for public parks, roadsides, golf courses, lawns and home in nearby areas after analyzing characteristics of the sludge, if it doesn't not contain any toxic chemical. The disposal of the alum sludge is proposed at the landfill site of Dhaka at Matuail, about 10 km from the proposed WTP if it is not possible to use as fill material. Or aluminum can separated from alum sludge by using sulphuric acid and this can be used in many purposes.

Geotechnical Borehole Investigation Study: Geotechnical borehole investigation study done for P2 and P3 pipeline route strating from WTP to Uttara. A total of 139 number of borehole drilling sites for P2 and 132 borehole drilling site for P3 were selected on a stratified basis to ensure diversified representation. Public consultation was consulted on 17 April 2017 at DORF office at Gandharbpur and on 16 April 17 at North Dhaka City Corporation office and a number of informal consultations conducted in the project corridor

During geotechnical investigation activities of the river Balu and Shitalakhya navigation facility is available and the pipeline alignment is crossing the Balu and Shitalakhya River. Geotechnical borehole investigation, which takes place only punctual and short-term, the location will be demarked for awareness and information and hence navigation will not be affected. After the completion of the GI work, the small area disturbances will be gone and navigation can freely move in the Shitalakhya and Balu River.

Micro Tunnel for River Crossing: Package 2 comprises of treated water 13 km transmission line from Gandharbpur WTP to the injection point crosses two river entitled Sitalakhya and Balu River. Both the river ecology is very sensitive and treated as a protected area. MDS Consultant of this project fully concern both the rivers ecology and consider micro tunneling technology will be used for laying the pipeline 12 m below the river bed and maintain the BIWTA specified compliance rule, so that river ecology and navigation will not affect and hamper.

Fisheries Impact: Intake screens are to be designed according to the swimming characteristics of Hilsa (the key species in the Meghna), to ensure that the impacts on Hilsa as well as the smaller fish, including the jatka, are minimized. It is reported that hilsa is a fast swimming fish up to 80 km/day average 71 km/day (82 cm/sec), therefore, its swimming velocity is not critical for screen design. However, as per the recommendation of National Marine Fisheries Service, National Oceanic and Atmospheric Administration (NOAA), US Department of Commerce for large river, the critical velocity for very small fish (less than 60 mm fork length) can be considered as 0.4 ft/sec (12 cm/sec) for active fish screen and 0.2 ft/sec (6 cm/sec) for passive screen. It is recommended in Water Works Engineering: planning, design & operation book to use approach velocity for intake screen as 8 cm/sec for large river.

Intake Screen design: The citable impact of the plant is the impact of intake structure at Meghna river on the fisheries and river ecology. If the intake velocity is higher than the fish swimming velocity of Key fish species like Hilsa, jatka or any other small fishes or any other river ecology then there might have some impact on river ecology. Therefore, intake screens are to be designed according to the swimming characteristics of Hilsa (the key species in the Meghna), to ensure that the impacts on Hilsa as well as the smaller fish, including the jatka, are minimized.

Ecological: The alignment passes through roadside, agriculture fields and low-lying areas. There are no environmentally sensitive areas approximately the proposed transmission and distribution pipeline. Borehole-drilling activities not disturbs the acquisition and resettlement of private agricultural lands but construction stage several vegetation and trees need to clear as side clearance activity. Cutting of trees in private lands will be avoided or at least minimized. The contractor, who will also take care for the saplings for the duration of his contract, will implement compensatory plantation for trees lost at a rate of 10 trees for every tree cut.

A green belt should be developed by planting trees of various species in all possible open spaces within Intake and WTP premises and embankment side. Trees take carbon-di-oxide and discharge oxygen for their photosynthesis, which helps to clean the air. Some trees also able to absorb toxic pollutant in the air. It also maintains the ecological balance and improves scenic beauty.

Key construction stage impacts identified are loss of productive agricultural lands and destruction of topsoil; impacts on low-lying areas and water bodies; air, noise, and vibration impacts due to construction vehicles, equipment, and machinery; impacts on the river courses and the water quality during the construction of the transmission mains across the rivers and streams; soil disposal due to the excavation for the transmission mains; accident hazards;

impacts on community health and safety hazards posed to the public.

The impacts from construction and operation will be manageable, and no insurmountable impacts are predicted, provided that the EMP is included in each of the contract and its provisions implemented and monitored to their full extent.

It is to be noted that the resultant potential impacts can be offset through proven mitigation measures during the design and adoption of good engineering practices in construction and operation. The specific management measures laid down in the EIA effectively addresses any adverse environmental impacts due to the project. The effective implementation of the measures proposed will be ensured through the building up of capacity towards environmental management within the PMU, supplemented with the technical expertise of an environmental safeguards specialist as part of the design-build contractor. Further, the environmental monitoring plans provide adequate opportunities towards course correction to address any residual impacts during construction or operation.

There are no significant or irreversible environmental impacts envisaged due to the project interventions. The impacts are largely construction related, and can be addressed through adoption of good engineering practices during project implementation. While the project components are rather simple, the scale and magnitude of facilities proposed trigger the need for an effective integration of environmental measures at all stages of the project.

The project will have a positive impact in terms of production of pure drinking water supply from surface water conserving meager ground water, although a negligible amount (0.3%) would be abstracted from Meghna River during lean flow which off course would have negligible impacts on ecological flow and downstream uses. The other positive impact of the project will be employment during construction and operation phases. An outline of EMP has been given in the present report to mitigate/ enhance the impacts, which are expected to be occurred during operation phase of the project.

The findings of this EIA suggests that the project involves potential but limited environmental impacts to which further careful attention should be given in the construction, operation and maintenance of the project in order to minimize and offset the adverse effects. The possible negative impacts are not severe, and the adverse impacts if duly addressed could be minimized without much effort, though they would require attention and positive commitment from the DWASA authority. It is understood that DWASA will take necessary steps to control, and minimize any adverse impact to an acceptable level through institutional measures and incorporating standard engineering practices. The selected location for the construction of intake, WTP and transmission line for raw water and treated water is considered acceptable.

The location of the proposed project is environmentally acceptable as has already been mentioned. However, adequate and effective pollution prevention, abatement and control measures, proper and careful operation and maintenance, regular and effective environmental monitoring with adequate staff and budgetary provision, creation of an environmental Cell headed by project director, ensuring preventive management practices, adoption of the Disaster Risk Management Plan and reporting to DOE should be ensured.

During operation stage aluminum based sludge will generate after coagulation and flocculation process and will be store in a sludge thickening tank. Tis thicken sludge will be pumped to sludge-drying beds where the dried sludge will form cake. The dried cake will send to brick field for making brick or construction material or dispose to a confine area as final disposal.

Oil & grease and hazardous waste material should be dispose to a DoE registered vendor for proper management. During pipeline construction in the river, pond and canal will generate spoil from dredging activity and contaminated oil and grease mix soil will impact nearby area. These type of spoil waste need safe disposal to landfill site.

After ensuring the pure water supply it will generate waste water after use. The increased wastewater volume from Zone 05 and 08, due to the additional water supply of 262 MLD, will be fully addressed by the ongoing government-funded Dasherkandi sewage collection system and STP (500 MLD) development project (Phase 1 Priority Projects). For other area or zones generated wastewater need to STP for treatment.

However, no development can be expected without any adverse impact on environment. The beneficial impacts on the nation as well as human beings would only be meaningful and sustainable development would only be possible if the adverse effects were minimized through strict maintenance and control measures as adopted and further suggested for this project. Further, to mitigate adverse impact on environment, there should be strict observance of EMP guidelines as specified in the report. All this would need vigilant care and subsequent monetary involvement, and the project authority should take these into considerations. It is expected that DWASA will follow all environmental compatible steps during operation and maintenance by which it sets a positive example as an environment friendly water supply project. It is also expected that DOE will do surveillance monitoring of the project performance, particularly that of sludge management. DOE should also continue its encouragement for water supply project of DWASA for initiatives to save precious underground water resource and to ensure a better environment.

The potential benefits, which are expected due to the project, considered substantial, and will offset the anticipated negative impacts.

Therefore, it is concluded that:

There are no environmental grounds whatsoever as to why the project, as envisaged at present, should not be implemented. Hence, DOE should consider positively issuing the necessary clearance for implementation of such project.

Appendix-1: Approval letter of EIA DESWSP DWASA

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, Paribesh Bhaban
E-16 Agargaon, Dhaka-1207
www.doe.gov.bd

Memo No: DoE/Clearance/5231/2013/264 Date: 21 /05/2015

Subject: Approval of Environmental Impact Assessment (EIA) Report for Water Treatment Plant under Dhaka Environmentally Sustainable Water Supply Project of Dhaka WASA.

Ref: 1) Application dated 05/02/2015.

With reference to the above, the Department of Environment (DOE) is pleased to approve Environmental Impact Assessment Report for Water Treatment Plant at Gandharbpur, Rupganj under Dhaka Environmentally Sustainable Water Supply Project of Dhaka WASA .This approval authorizes and regulates the following activities:

1. Project Proponent may undertake activities for land development and infrastructural development of the said Sub-Component;
2. Project Proponent may open L/C (Letter of Credit) for importing machineries for the Sub-Component which shall also include machineries relating to pollution control devices;
3. Activities must be carried out in a competent manner. This includes:
   (a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
   (b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.
4. Construction works shall be restricted to day time hours so as to avoid/mitigate the disturbance of local lives as well as implementation schedules of the works shall be notified in advance to nearby residents.
5. Storage area for soils and other construction materials shall be carefully selected to avoid disturbance of the natural drainage.
6. Proper construction practices shall be followed that minimize loss of habitats & nursery sites.
7. In order to control noise pollution, vehicles & equipment shall be maintained regularly; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.
8. Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be demolished or destructed.
9. All the required mitigation measures suggested in the EIA report are to be strictly implemented and kept operative/functioning on a continuous basis.

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10. Any heritage sight, ecological critical area, and other environmentally and/or religious sensitive places shall be avoided during construction phase.
11. Resettlement plan should be properly implemented and people should be adequately compensated, where necessary.
12. Construction material should be properly disposed off after the construction work is over.
13. The Environmental Management and Mitigation Plan included in the EIA report shall strictly be implemented and kept functioning on a continuous basis.
14. Comprehensive Environmental Performance report, upon completion of the project shall have to be submitted to the Narayanganj District Office of DOE at Narayanganj with a copy to the Head Office of DOE in Dhaka describing actual intervention and rehabilitation at the project site.
15. Violation of any of the above conditions shall render this approval void.
16. The project authority shall apply for Environmental Clearance along with NOCs from other relevant agencies for operational activity to the Narayanganj District Office of DOE at Narayanganj with a copy to the Head Office of DOE in Dhaka.
17. This EIA Approval has been issued with the approval of the appropriate authority.

21.05.2015

(Syed Nazmul Ahsan)
Director (Environmental Clearance,c.c)
Phone # 8181778

Project Director
Dhaka Environmentally
Sustainable Water Supply Project
Dhaka WASA
WASA Bhaban(8th Floor), Room # 906
98, Kazi Nazrul Islam Avenue
Kawran Bazar, Dhaka-1215

Copy Forwarded to :

1. The Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
2. Director, Department of Environment, Dhaka Regional Office, Dhaka.
3. Deputy Director /Office In-charge, Department of Environment, Narayanganj District Office, Narayanganj.
4. Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

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Appendix-2: Terms of Reference (ToR) for EIA

Government of the People's Republic of Bangladesh
Department of Environment
www.doe-bd.org
Head Office, Paribesh Bhaban
E-16 Agargaon, Dhaka-1207

Memo No: DoE/Clearance/5231/2013/ 295 Date: 19, December, 2013

Subject: Approval of Terms of Reference (TOR) for Environmental Impact Assessment (EIA) in favour of Priority Works under Dhaka Environmentally Sustainal water supply **Project (DESWSP) of Dhaka WASA.**

Ref: Your application on 31 October 2013.

With reference to your letter dated 31.10.2013 for the subject mentioned above, the Department of Environment hereby gives approval of TOR for Environmental Impact Assessment (EIA) in favour of Water Treatment Plant at Gandharbpur under Dhaka Environmentally Sustainable Project subject to fulfilling the following terms and conditions.

1. Dhaka WASA shall conduct a comprehensive Environmental Impact Assessment (EIA) study considering the overall activity of the said Project in accordance with the TOR submitted to the DOE and additional suggestions provided herein.
2. The EIA report should be prepared in accordance with following indicative outlines:

1. Executive summary

2. Environmental Baseline Data
Following general aspects should be considered for baseline :
- GPS location, data sources, time period, representativeness, relevance to the identified and predicted impact, usefulness in comparing and evaluation of impact to find the significance of impacts.
- Baseline data must also relate to the monitoring plan that covers preparation, construction and operation phases of the project. Baseline data must be in consistent with monitoring plan in terms of location, timing, parameters and other conditions that imply for baseline data.

2.1. Project Data Sheet

a. Project location and area
- The location of the project and area involved

b Project Concept
- An outline of description of the concept and objectives of the project, the types of activities expected, and the development plans for achieving the objectives.

c Project Components
- Components of the project covering types of works proposed, locations, resources, infrastructure, utilities and service requirements, etc.

d Project Activities
- A list of the main project activities to be undertaken during: site clearing, site development, other associated developments and operation phase.

e Project schedule
- The phases and timing of the project activities.

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f **Resources and utilities demand**
- Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project.

2.2. Physical and chemical components

a **Map and survey information**
- Location map
- Cadastral map showing land plots (project and adjacent area)
- Topographic map for identifying catchment boundaries, general land use and terrain
- survey map showing contour information
- Aerial photograph

b **Geology and soil**
- Geological map showing geological units, fault zone, and other natural features
- Soil map and soil profile analysis. This may only be established from soil survey and geotechnical investigation (important for analysis for soil stability, cut and fill)
- Soil properties and composition

c **Hydrology and drainage**
- Catchment boundaries of rivers/lakes/canals which drain the project
- Hydrological characteristics of rivers in and around the project area, including flow, salinity and sediment load for varies return period
- Flood characteristics and historical records of flood events covering areas affected, height of flood and frequency
- Ground water potential and aspects of aquifer, such as recharge zones, ground water abstraction etc.
- Drainage system and drainage characteristics in the project area

d **Water quality and use**
- Water quality of the receiving water bodies likely to be affected by the project
- Beneficial uses of the water need to be established for rivers or any other water bodies likely to be impacted by the development. The locations of these water utilization should be identified in the map
- Sources of pollutants from existing and known future activities within the catchment of the rivers

e **Air quality and noise**
- Baseline data of the project site with respect to air quality and noise level
- Air pollutant and noise sources from existing and known sources

2.3. Ecological components

a **Habitats**
- Aquatic habitat likely to be impacted by the project
- Terrestrial habitat likely to be impacted by the project

b **Species and Population**
- Identification of population of flora and fauna to assess their conservation status of being rare, endemic and endangered
- Biodiversity of the project site

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2.4. Social and Economic Factors

a **Population**
- Population within and around the project area
- Organizational structure of communities and the degree of public awareness and response to the proposed project

b **Human settlement**
- Size and distribution of human settlement
- Community infrastructure, utilities and services available
- Housing and future requirements within the impacted area
- Historical/archaeological features of significance

c **Economic activities**
- Economic activities of population in and around the project area. Activities should include those that are dependent on resources which may be impacted by the project
- Income dependence on economic activities impacted directly or indirectly by the project
- Employment and economic returns to the population by the project

2.5. Infrastructure and utilities

a Availability of infrastructure to support the proposed project. Attention should focus on different transportation requirements due to project, increase in traffic to and from the project area

b Availability of utilities and services, especially water, gas and electricity supply, sewerage and waste disposal facilities to cater to the projected demand for such utilities and services

3. Identification and Prediction of Potential Impacts (identification, prediction and assessment of positive and negative impacts likely to result from the proposed project). Appropriate scientific and mathematical tools and models should be used to establish cause and effect relationship for prediction of impacts.

In identification and analysis of potential impacts'-the 'Analysis' part shall include the analysis of relevant spatial and non-spatial data. The outcome of the analysis shall be presented with the scenarios, maps, graphics etc. for the cases of anticipated impacts on baseline. Description of the impacts of the project on air, water, land, hydrology, vegetation-man maid or natural, wildlife, socio-economic aspect shall be incorporated in detail.

4. EVALUATION OF IMPACTS

The judgment of significance of impacts can be based on one or more of the following :

i. comparison with laws, regulation or accepted national or international standards
ii. reference to pre-set criteria such as conservation or protected status of a site, feature or species
iii. consistency with pre-set policy objectives
iv. consultation and acceptability with the relevant decision makers, local community or the general public.

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5. MITIGATION OF IMPACTS

Mitigation measures which may be considered including:

i. changing project layout, transport routes, disposal routes or locations, timing or engineering design;
ii. introducing pollution controls, waste handling, treatment and disposal, phased implementation and construction, engineering measures, monitoring, landscaping, social services or public education;
iii. compensation to restore, relocate or provision of concession for damage;
iv. most feasible, practicable, doable, cost effective, resource efficient and environment friendly alternative must be compared and selected.
v. Adequate measures to be taken, explored and documented to avoid public sufferings, nuisance and pollution of any kind during preparation, construction and operation phases.

6. Environmental Management Plan

(a)The responsibilities and actions required of the project initiator or implementing body should be identified in the EMP. Some of those responsibilities and actions include: allocation of institutional responsibilities for planning and management of environmental requirements, allocate responsibility to execute mitigation action, implement a programme of monitoring to check the effectiveness of mitigation measures, and if necessary, taking additional measures to correct or overcome the impact in question, in-house monitoring capacity building and allocation of budget.

(b) The EMP should recognize and include the following:

i. Management of soil erosion, land slides and siltation during site clearance and earth work
ii. Management of runoff
iii. Regulation of the types of activities allowed in the project activities in the project are at various phases of the project
iv. Management of liquid, solids, sludges and gaseous wastes generated from the project area
v. Environmental monitoring requirements
vi. Responsibilities and role of the project proponent for protection of environment
vii. Adequate measures to avoid and mitigate nuisance, pollution and public sufferings of any kind during preparation, construction and operational phases

(c)The program for monitoring should generally identify:

i. the type of monitoring required
ii. the location of monitoring
iii. the types of parameters to be measured (e.g. dissolve oxygen, if fisheries is important in a river)

(d) Monitoring parameters, location, timing, frequency and conditions must be in consistent with that of the baseline.

7. Management Plan/Procedures:

- For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or procedures, impacts, which are not capable of mitigation, will be identified as residual impacts. Both technical and financial plans shall be incorporated for proposed mitigation measures..
- An outline of the Environmental Management Plan shall be developed for the project.
- In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for

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developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).

8. Consultation with Stakeholders/Public Consultation
   - Ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project
   - Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)

9. Conclusion and Recommendations

3. Without approval of EIA report by the Department of Environment, Dhaka WASA shall not be able to open L/C in favor of importable machineries.
4. Without obtaining Environmental Clearance, Dhaka WASA shall not start operation of the projects.
5. Dhaka WASA shall submit the EIA along with a filled-in application for Environmental Clearance in prescribed form, the applicable fee in a treasury chalan, the no objection certificates (NOCs) from the local authority, NOC from forest department (if it is required in case of cutting any forested plant/trees-private or public) and NOC from other relevant agencies for operational activity etc. for each project to the Head office of DOE in Dhaka with a copy to Regional office of DOE in Dhaka.

19.12.2013

(Syed Nazmul Ahsan)
Deputy Director (Environmental Clearance)
and
Member Secretary
Environmental Clearance Committee
Phone # 8181778

Project Director
Dhaka Environmentally Sustainable Water Supply Project
Dhaka WASA
WASA Bhaban (8th Floor), Room#906
98, Kazi Nazrul Islam Avenue
Kawran Bazar, Dhaka-1215.

Copy Forwarded to :

1) The Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Dhaka Region, Dhaka.
3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

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Office of the Project Director
Dhaka Environmentally Sustainable Water Supply Project (DESWSP)
Dhaka Water Supply and Sewerage Authority
WASA Bhaban, 98, Kazi Nazrul Islam Avenue (8th Floor)
Kawran Bazar, Dhaka-1215
Email: pddeswsdp@gmail.com
Phone-+88-02-8189095, Web-site :www.deswsp-dwasa.com

Memo no: 46.113.618.00.00.W- 12 /DESWSP/ 216 **Date: 16.02.2014**

INVITATION FOR EXPRESSION OF INTEREST
(For Individual Consultant)

Date Issued: 16 February , 2014.
Project No. Loan 3051BAN : Dhaka Environmentally Sustainable Water Supply Project (DESWSP)
Deadline for Submission of EOIs: 26 February 2014
[Note: This notice is issued on a preemptive and non-committal basis]

1. The People's Republic of Bangladesh has applied for a loan from the Asian Development Bank (ADB) to Provide finance the proposed Dhaka Environmentally Sustainable Water Supply Project (DESWSP). The Dhaka Water Supply and Sewerage Authority (DWASA) is the executing agency of the project under the Local Government Division (LGD) of the ministry of Local Government , Rural Development and Cooperatives and intends to apply part of the proceeds of the loan to payment of **consulting services.**

2. DWASA now invites expression of interests (EOIs) from eligible individual national Environmental consultant to prepare the EIA report for the Dhaka Environmentally Sustainable Water Supply Project (DESWSP) according to the approved TOR by DOE under the proposed project.

The qualification and experience of the individual environmental consultant required for the assignment are as follows.

3. **No of the post : one**
4. **Selection method** Individual Consultant Selection (ICS)
5. **Duration of the service** : 90 days
6. **Educational Qualification** : The environmental Consultant should have a degree, preferably with Master's in civil / environmental engineering/ management/ science .
7. **Experience and adequacy for the assignment** : The consultant should have at least 10 years' experience in environmental impact assessments and environmental monitoring/management. He will also have at least 3 years of experience in administering ADB environmental safeguard policies. Experiences with international organizations shall be an added advantage.
8. **Brief description of the assignment:**
   1. Preparation of Environmental impact assessment (EIA) Report according to TOR approved by DOE for the project DESWSP.
   2. Conduct field surveys: collecting data to establish a baseline condition for levels of pollution or contamination for a site or area of consideration . Collection and incorporate all relevant data, studies and reports in EIA report related to the environment, screen and evaluate the direct and indirect environmental impacts and assess alternative options according to TOR
   3. Identifying measures to mitigate and monitor the environmental impacts, their cost estimate, and institutional arrangements, with public consultation with the stakeholders and in liaison with department of environment (DOE) Preparation of the EIA report following the standard format and providing required details
   4. Prepare the Environmental Management Plan to ensure compliance with the EIA.

1

9. The Terms of Reference (TOR) EIA report and ADB standard EOI format (template) for submitting EOIs can be obtained from the office of the undersign during the office hour (9 AM-5PM) or can be downloaded from DWASA websites: **www.dwasa.org.bd. And project website:** www.deswsp-dwasa.com **The EOI notice and TOR of the EIA report is also available at ADB website (http://cms.adb.org) and CPTU website www.cptu.gov.bd, and local Newspaper.**

10. EOIs submitted in other than the EOI standard template will be considered non-responsive and will not be evaluated. EOI standard template can be obtained from **ADB website** http://www.adb.org/site/business-opportunities/operational-procurement/consulting/documents

11. The Consultants shall be selected and engaged in accordance with the "*Guidelines on the Use of Consultants by ADB and its Borrowers (March 2013), as amended from time to time*".

12. Interested and eligible Consultant are invited to submit their EOIs either electronically/ on-line at www.adb.org or in hard copy (paper document in sealed envelope) both to be in the prescribed format by the deadline of **26 February 2014 up to 2.00 PM** to the address given below. If the consultant submits an EOI in both modes (electronic and hard copy), only the hard copy submission will be considered and evaluated. Those who submit the hard copy only, request to submit 02 (Two) hard copies (01 Original +01 Copy).
13. Under no circumstances will the ADB, DWASA or DESWSP be responsible for any cost incurred in submission of the EOI.
14. The procurement entity reserves the right to accept or reject any or all EOIs

13/2/2014

Md. Mahmudul Islam
Superintending Engineer &
Project Director
DESWS Project
Dhaka WASA

Memo no: 46.113.618.00.00.W- 12 /DESWSP/ 216 **Date: 13.02.2014**

1. The Managing Director, Dhaka WASA
2. The D.M.D (Admin/O&M/RP&D/Fin), Dhaka WASA
3. Chief Engineer, DWASA
4. Additional Chief Engineer (RPD), DWASA
5. The Superintending Engineer/Deputy Project Director----------DESWSP, DWASA
6. The Executive Engineer,---------- DESWSP, Dhaka WASA
7. Sr. Accounts Officer, DESWSP, DWASA
8. Senior System Analyst, Dhaka WASA-with the request to arrange publication of the EOI Notice in DWASA web-site
9. The Dy. Chief P.I.O, Dhaka WASA-with the request arrange publication of the EOI Notice in Two National Daily news papers (One in Bengali & One in English)
10. Deputy Director, CPTU, IMED, Dhaka-with the request to arrange publication of the EOI Notice in CPTU web-site
11. Country Director, BRM, ADB, Agargaon, Dhaka
12. Notice Board/Respective file.

2

Appendix-3: Environmental Standard According to DoE and WHO

NATIONAL ENVIRONMENT QUALITY STANDARDS

At present, there are environmental standards in operation in Bangladesh also promulgated under the Environment Conservation Rules of 1997. There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges, vehicular emissions, etc. The standards, commonly known as Environmental Quality Standards (EQS), are legally binding. The Bangladesh standards for ambient air, noise, odor, sewage, industrial effluent, and emission are furnished here. These are all in an authentic translation from original Bengali, citing the specific source.

National Standard for Inland Surface Water

Best Practice-Based Classification	pH	BOD (mg/l)	DO (mg/l)	Total Coliform Number/100
a. Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less
b. Water usable for recreational activity	6.5–8.5	3 or less	5 of more	200 or less
c. Source of drinking water for supply after conventional treatment	6.5–8.5	6 or less	6 or more	5,000 or less
d. Water usable by fisheries	6.5–8.5	6 or less	5 or more	---
e. Water usable by various process and cooling industries	6.5–8.5	10 or less	5 or more	5,000 or less
f. Water usable for irrigation	6.5–8.5	10 or less	5 or more	1,000 or less

Notes: 1. In water used for pisiculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.

2. Electrical conductivity for irrigation water – 2250 µmhoms/cm (at a temperature of 25°C); sodium less than 26%; boron less than 0.2%.

Source: Department of Environment (DOE)

National Standard of Drinking Water

Parameter	Unit	Standards	Parameter	Unit	Standards
1. Aluminum	mg/l	0.2	26. Hardness (as CaCO3)	mg/l	200 – 500
2. Ammonia (NH3)	mg/l	0.5	27. Iron	mg/l	0.3 – 1.0
3. Arsenic	mg/l	0.05	28. Kjeldahl nitrogen (total)	mg/l	1
4. Balium	mg/l	0.01	29. Lead	mg/l	0.05
5. Benzene	mg/l	0.01	30. Magnesium	mg/l	30 – 35
6. BOD5 20°C	mg/l	0.2	31. Manganese	mg/l	0.1
7. Boron	mg/	1.0	32. Mercury	mg/l	0.001
8. Cadmium	mg/l	0.005	31. Manganese	mg/l	0.1
9. Calcium	mg/l	75	32. Mercury	mg/l	0.001
10. Chloride	mg/l	150 – 600*	33. Nickel	mg/l	0.1
11. Chlorinated alkanes			34. Nitrate	mg/l	10
carbontetrachloride	mg/l	0.01	35. Nitrite	mg/l	<1
1.1 dichloroethylene	mg/l	0.001	36. Odor	mg/l	Odorless
1.2 dichloroethylene	mg/l	0.03	37. Oil and grease	mg/l	0.01
tetrachloroethylene		0.03	38. pH	--	6.5 – 8.5

trichloroethylene		0.09	39. Phenolic compounds	mg/l	0.002
12. Chlorinated phenols			40. Phosphate	mg/l	6
pentachlorophenol	mg/l	0.03	41. Phosphorus	mg/l	0
2.4.6	mg/l	0.03	42. Potassium	mg/l	12
trichlorophenol					
13. Chlorine (residual)	mg/l	0.2	43. Radioactive materials (gross alpha activity)	Bq/l	0.01
14. Chloroform	mg/l	0.09	44. Radioactive materials (gross beta activity)	Bq/l	0.1
15.Chromium (hexavalent)	mg/l	0.05	45. Selenium	mg/l	0.01
16. Chromium (total)	mg/l	0.05	46. Silver	mg/l	0.02
17. COD	mg/l	,, 4	47. Sodium	mg/l	200
18. Coliform (fecal)	n/100 ml	0	48. Suspended particulate matters	mg/l	10
19. Coliform (total)	n/100 ml	0	49. Sulfide	mg/l	0
20. Color	Hazen unit	15	50. Sulfate	mg/l	400
21. Copper	mg/l	1	51. Total dissolved solids	mg/l	1,000
22. Cyanide	Mg/l	0.1	52. Temperature	°C	20-30
23. Detergents	mg/l	0.2	53. Tin	mg/l	2
24. DO	mg/l	6	54. Turbidity	NTU	10[14]
25. Fluoride	mg/l	1	55. Zinc	mg/l	5

*In coastal area 1000. Reference: Bangladesh Gazette, Addendum, August 28, 1997 Source: Department of Environment (DOE)

Bangladesh Standards for Ambient Air Quality Schedule-2, Rule 12, Environment Conservation Rules of 1997 (Micrograms /Cubic Meter)

Sl. No.	Area	Suspended Particulate Matter (SPM)	Sulfur Dioxide (SO_2)	Carbon Monoxide (CO)	Oxides of Nitrogen (NOx)
Ka	Industrial and mixed	500	120	5000	100
Kha	Commercial and mixed	400	100	5000	100

[14] The FS advises producing treated water that conforms to WHO guidelines and Bangladesh drinking water quality ECR 1997. One of the two most important parameters reduced by the WTP is turbidity (the other is microbiological matter, by providing a multi-stage barrier). In Section 10.3, the FS quotes WHO and Bangladesh standards of 10 and 5 NTU respectively. We recommend that the turbidity in the treated water leaving the WTP should never exceed 1.0 NTU and that the operational guideline should be set at 0.5 NTU, to be achieved 95% of the time. The design of the process units and their controls should accommodate these recommendations. Operational procedures must be devised to achieve these recommendations. Computerized monitoring equipment must be provided and staff trained in its use to display real-time trends and record events. Laboratory staff must monitor, record, and report treated water quality parameters to review past trends and predict operational changes, if required.

Ga	Residential and rural	200	80	2000	80
Gha	Sensitive	100	30	1000	30

Source: Schedule-2, Rule 12, Environment Conservation Rules of 1997 (Page 3123, Bangladesh Gazette, 28 August 1997) (Own authentic translation from original Bengali).

Note : 1. Sensitive area includes national monuments, health resorts, hospitals, archaeological sites, educational institutions and other government designated areas (if any).
2. Any industrial unit located not in a designated industrial area will not discharge such pollutants, which may contribute to exceed the ambient air quality above in the surrounding areas of category 'Ga' and 'Gha'.
3. Suspended particulate matters mean airborne particles of diameter of 10 micron or less. Source: Department of Environment (DoE)

Bangladesh Standards for Noise

Sl. No.	Area Category	Standards Values (All Values in dBA)	
		Day	Night
Ka	Silent zone	45	30
Kha	Residential area	50	40
Ga	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
Gha	Commercial area	70	60
Umma	Industrial area	75	70

Source : Schedule 4, Rule-12, Environment Conservation Rules, 1997. (Page 3127, Bangladesh Gazette, 28 August 1997). Own authentic translation from original Bengali

Note : 1. Daytime is reckoned as the time between 6 a.m. and 9 p.m.
2. Nighttime is reckoned as the time between 9 p.m. and 6 a.m.
3. Silent zones are areas up to a radius of 100 m around hospitals, educational institutions, or special establishments declared or to be declared as such by the government. Use of vehicular horn, other signals, and loudspeakers is prohibited in silent zones.

Source: Department of Environment (DOE)

B**angladesh Standards for Odor**

Parameters	Unit	Values
Acetaldehyde	PPM	0.5-5
Ammonia	PPM	1-5
Hydrogen Sulfide	PPM	0.02-0.2
Methyl Disulfide	PPM	0.009-0.1
Methyl Mercaptan	PPM	0.02-0.2
Methyl Sulfide	PPM	0.01-0.2
Styrene	PPM	0.4-2.0
Trimethylamine	PPM	0.005-0.07

Source: Schedule 8, Rule 12, Environment Conservation Rules, 1997. (Page 3130, Bangladesh Gazette, 28 August 1997). Own authentic translation from original Bengali

Note :1. Regulatory standards at emission/discharge outlets (apply to those outlets which are higher than 5 meters) : Q = 0.108 x He2 cm, Where Q – gas emission rate (Nm3/hour), He – effective height of the outlet (m), Cm – above mentioned standard (ppm)

2. Where there is a range given for a parameter, the lower value will be used for warning and the higher value for initiation of legal procedure or punitive measures. Source: Department of Environment (DOE)

Bangladesh Standards for Sewage Discharge

Parameters	Unit	Values
BOD	mg/l	40
Nitrate	mg/l	250
Phosphate	mg/l	35

Suspended Solids (SS)	mg/l	100
Temperature	°C	30
Coliforms	number/100ml	1,000

Source: Schedule- 9, Rule-13, Environment Conservation Rules, 1997. (Page-3131 of Bangladesh Gazette of 28 August 1997) (Own authentic translation from original Bengali)

Note :1. These standards are applicable for discharge into surface and inland water bodies. 2. Chlorination is to be done before final discharge.

Source: Department of Environment (DOE)

Bangladesh Standards for Industrial and Project Effluent

Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public Sewer to Secondary Treatment Plant	Irrigable Land
1	Ammonical nitrogen (as elementary N)	mg/l	50	75	75
Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public Sewer to Secondary Treatment Plant	Irrigable Land
2	Ammonia (as free ammonia)	mg/l	5	5	15
3	Arsenic (as As)	mg/l	0.2	0.05	0.2
4	BOD5 at 20oC	mg/l	50	250	100
5	Boron	mg/l	2	2	2
6	Cadmium (as Cd)	mg/l	0.05	0.5	0.5
7	Chloride	mg/l	600	600	600
8	Chromium (as total Cr)	mg/l	0.5	1.0	1.0
9	COD	mg/l	200	400	400
10	Chromium (as hexavalent Cr)	mg/l	0.1	1.0	1.0
11	Copper (as Cu)	mg/l	0.5	3.0	3.0
12	Dissolved oxygen (DO)	mg/l	4.5-8	4.5-8	4.5-8
13	Electro-conductivity (EC)	µsiemens/cm	1,200	1,200	1,200
14	Total dissolved solids	mg/l	2,100	2,100	2,100
15	Fluoride (as F)	mg/l	2	15	10
16	Sulfide (as S)	mg/l	1	2	2
17	Iron (as Fe)	mg/l	2	2	2
18	Total kjeldahl nitrogen (as N)	mg/l	100	100	100
19	Lead (as Pb)	mg/l	0.1	1	0.1
20	Manganese (as Mn)	mg/l	5	5	5
21	Mercury (as Hg)	mg/l	0.01	0.01	0.01
22	Nickel (as Ni)	mg/l	1.0	2.0	1.0
23	Nitrate (as elementary N)	mg/l	10.0	Not yet set	10
24	Oil and grease	mg/l	10	20	10
25	Phenolic compounds (as C6H5OH)	mg/l	1.0	5	1
26	Dissolved phosphorus (as P)	mg/l	8	8	15
27	Radioactive substance	(to be specified by Bangladesh Atomic Energy Commission)			
28	PH		6-9	6-9	6-9

29	Selenium (as Se)	mg/l	0.05	0.05	0.05
30	Zinc (as Zn)	mg/l	5	10	10
31	Total dissolved solids	mg/	2,100	2,100	2,100
32	Temperature	°C (summer) °C (winter)	40 45	40 45	40 45
33	Suspended solids	mg/l	150	500	200
34	Cyanide	mg/l	0.1	2.0	0.2

Source: Schedule -10, Rule-13, Environment Conservation Rules, 1997 (Page 3132 - 3134 of Bangladesh Gazette of 28 August 1997) (Own authentic translation from original Bengali). Note:

These standards will be applicable for all industries other than those which are specified under "industrial sector specific standards."

These standards will have to be complied with from the moment of trial production in case of industries and from the very beginning in case of projects.

These standards will have to be met at any point of time and any sampling. In case of need for ambient environment condition, these standards may be made stringent.

Inland surface water will include drains, ponds, tanks, water bodies, ditches, canals, rivers, streams, and estuaries.

Public sewer means leading to full-fledged joint treatment facility comprising primary and secondary treatment.

Land for irrigation means organized irrigation of selected crops on adequate land determined on the basis of quantum and characteristics of wastewater.

If any discharge is made into public sewer or on land which does not meet the respective definitions in notes 5 and 6 above, then the inland surface water standards will apply.

Bangladesh Standards for Industrial and Project Emissions

Sn. No.	**Parameters**	**Values (in mg/Nm3)**
1	Particulates (ka) Power station of capacity of 200 MW or more	 150
Sn. No.	**Parameters**	**Values (in mg/Nm3)**
	(kha) Power station of capacity of less than 200 MW	350
2	Chlorine	150
3	Hydrochloric acid vapor and mist	350
4	Total fluoride (as F)	25
5	Sulfuric acid mist	50
6	Lead particulates	50
7	Mercury particulates	10
8	Sulfur dioxide (ka) Sulfuric acid production (DCDA* process) (kha) Sulfuric acid production (SCSA* process) (* DCDA : Double conversion, double absorption, SCSA : Single conversion, single absorption) Lowest height of stack for sulfur dioxide dispersion: (ka) Coal based power plant 500 MW or more 200 MW – 500 MW Less than 200 MW (kha) Boiler Steam per hour – up to 15 tons Steam per hour – more than 15 tons (Q = SO_2 emission in kg/hour)	kg/ton acid 4 100 275 m 220m 14(Q)0.3 11m 14(Q)0.3

9	Oxides of nitrogen (ka) Nitric acid production (kha) Gas based power stations 500 MW or more 200 – 500 MW Less than 200 MW (Ga) Metallurgical oven	 3 kg/ton acid 50 ppm 50 ppm 40 ppm 30 ppm 200 ppm
10	Kiln soot and dust (ka) Blast furnace (kha) Brick kiln (Ga) Coke oven (Gha) Lime kiln	Mg/Nm3 500 1000 500 250

Source : Schedule 11, Rule 13, Environment Conservation Rules, 1997 (Page 3135, 3136, Bangladesh Gazette, 28 August 1997) (Own authentic translation from original Bengali)

Source: Department of Environment (DOE)

SUMMARY OF SELECTED INTERNATIONAL WATER QUALITY STANDARD AND GUIDELINE

A. Selected drinking water quality guideline

WHO Categories	Parameters	Units	Bangladesh	WHO, 1993	EU, 1993	US-EPA
Bacteriological quality	Total coliforms Total coliforms	Counts/100 ml Number of samples/month	0	0	0 (i)	5%
	Fecal coliforms	n/100ml	0			
Inorganic Chemicals (of health significance)	Arsenic	mg/l	0.05	0.01(p)	0.01(c)	0.05
	Barium	mg/l	0.01	0.7		2
	Boron	mg/l	1	0.5 (p)	1 (c)	
	Cadmium	mg/l	0.005	0.003	0.005(c)	0.005
	Chromium	mg/l	0.05 (hexa) 0.05 (Total)	0.05(p)	0.05 (c)	0.1
	Copper	mg/l	1	2 (p)	2 (c)	1.3 (r:1.0)
	Cyanide	mg/l	0.1	0.07	0.05 (c)	0.2
	Fluoride	mg/l	1	1.5	1.5 (c)	4.0(r: 2.0)
	lead	mg/l	0.05	0.01	0.01 (c)	0.015
	Nickel	mg/l	0.1	0.02	0.02 (c)	
	Nitrate-NO_3	mg/l	10	50	50 (c)	10
	Nitrite-NO_2	mg/l	<1	3	0.5 (c)	1
	Manganese	mg/l	0.1	0.5 (p)	0.05 (l)	0.05 (r)
	Mercury	mg/l	0.001	0.001	0.001 (c)	0.002
	Selenium	mg/l	0.01	0.01	0.01(c)	0.05
Pesticides	Dieldrin	µg/l		0.03	0.03 (c)	
	Atrazine	µg/l		2	0.03 (c)	3
	DDT	µg/l		2	0.1 (c)	
	Gamma-HCH(Lindane)	µg/l		2	0.1 (c)	0.2
	Permethrin	µg/l		20	0.1 (c)	
	Pesticides total	µg/l			0.5 (c)	
Disinfectants and disinfectant by-products	Chlorine	mg/l		5		
Radioactive constituents	Gross Alpha activity Gross Beta activity	Bq/litre Bq/litre	0.01 0.1	0.1 1		

Aesthetic guidelines	Turbidity	NTU	10	5 (a)		
	Aluminum	mg/l	0.2	0.2 (a)	0.2 (i)	0.05-0.2(r)
	Ammonia - N	mg/l	0.5	1.5 (a)	0.5 (i)	
	Chloride	mg/l	150-600	250 (a)	250 (i)	250 (r)
	Copper	mg/l	1	1		
	Hydrogen sulfide - H2S	mg/l		0.05(a)		
	Iron	mg/l	0.3-1	0.3(a)	0.2 (i)	0.3 (r)
	Manganese	mg/l	0.1	0.1	0.05 (i)	0.05 (r)
	Dissolved Oxygen	mg/l	6		>5 (i)	
	pH		6.5-8.5	<8 (a)	6.9-9.5(i)	6.5-8.5 (r)
	Sodium	mg/l	200	200 (a)	200 (i)	
	Sulfate	mg/l	400	250 (a)	250 (i)	250 (r)
	Sulfides	mg/l	0		0.05(i)	
	Total dissolved solids	mg/l	1000	1000		500 (r)
	Electrical conductivity	µS/cm			2500 (i)	
	Zinc	mg/l	5	3 (a)		
	Residual chlorine	mg/l	0.2	0.6-1		
	Ca	mg/l	75			
	Detergent	mg/l	0.2			
	Magnesium	mg/l	30-35			
	Odor	mg/l	Odorless			
	Oil and grease	mg/l	0.1			
	Phenolic compound	mg/l	0.002			
	Colour	Hazen unit	15			
	Phosphate	mg/l	6			
	Phosphorus	mg/l	0			
	Potassium	mg/l	12			
	Temp.	O^C	20-30			
	Tin	mg/l	2			
	Silver	mg/l	0.02			
	Suspended particular matter	mg/l	10			
	Hardness as $CaCO_3$	mg/l	200-500			

	Kjeldhl Nitrogen total	mg/l	1			
	BOD_5at 20 O^C	mg/l	0.2			
	COD	mg/l	4			
	Benzene	mg/l	0.01			

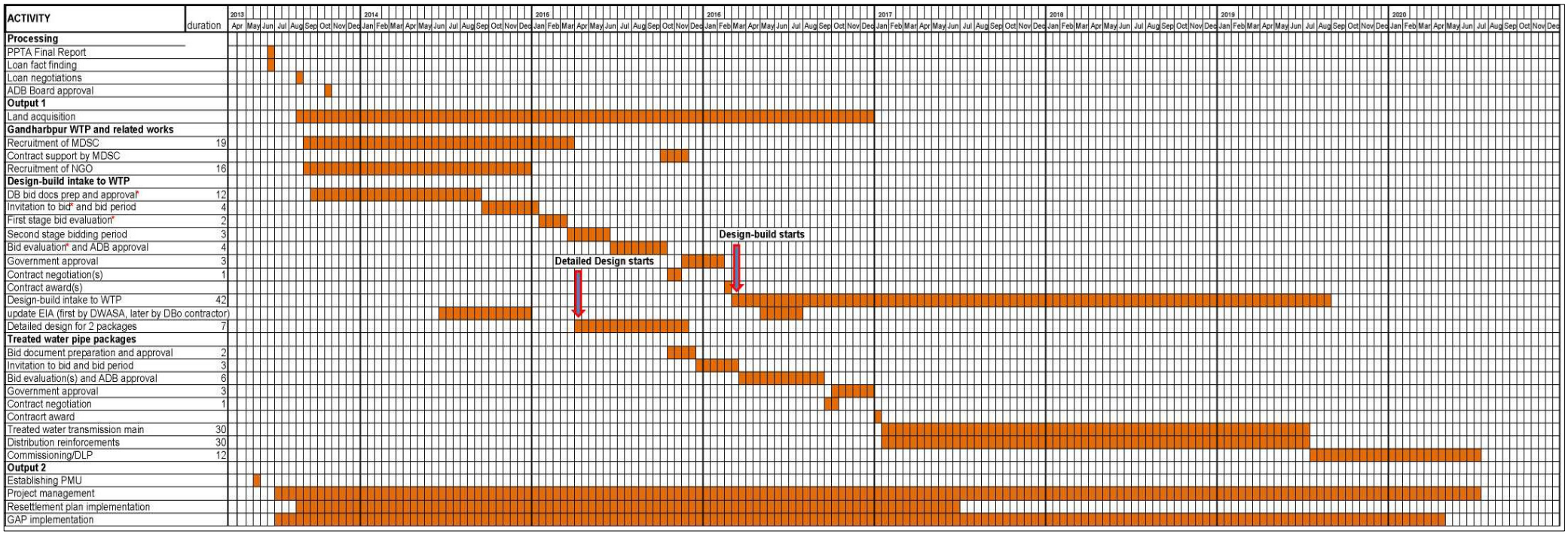
Sources: EU, 1998. Drinking water standards (EU Directive 98/83/EC). (i) Indicator parameter; (c) chemical parameter

US-EPA, 1974. Safe Drinking Water Act (SDWA), plus subsequent amendments. Maximum Contaminant Level (MCL) values (health, enforceable);

(r) Secondary Drinking Water Regulations (aesthetically recommended, but nonenforceable)

WHO, 1993. Guidelines for Drinking Water Quality. Second edition. (p) Provisional guideline value; (a) aesthetic guideline.

Appendix-4: Project Schedule



DB = design-build, DLP = defect liability period, DNI = distribution network improvement, DWASA = Dhaka Water Supply and Sewerage Authority, GAP = gender action plan, MDSC = management, design, and supervision consultant, MSC = management and supervision consultant, NGO = non-government organization, PMU = project management unit, WTP = water treatment plant.

* assisted by consultants engaged by ADB using PPTA savings

DBO package 1: Intake - raw water pipeline to Gandharbpur WTP - Gandharbpur WTP

Package 2: Treated water pipeline from WTP to the injection point

Package 3: Distribution reinforcements inside the network

Appendix-5: No Objection Certificate (NOC)

Letter FROM MD WASA for Land Acquisition TO Secretary, LGRD.

ঢাকা পানি সরবরাহ ও পয়ঃ নিষ্কাশন কর্তৃপক্ষ
ব্যবস্থাপনা পরিচালক এর কার্যালয়
ওয়াসা ভবন, ঢাকা ওয়াসা
৯৮, কাজী নজরুল ইসলাম এভিনিউ, কাওরান বাজার, ঢাকা।

স্মারক নং- ৪৬.১১৩.৬০১.০০.০০ G-4(V-2)/DESWSP/2566 তারিখ- 9.2.17

সচিব
স্থানীয় সরকার বিভাগ
স্থানীয় সরকার, পল্লী উন্নয়ন ও সমবায় মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ সচিবালয়, ঢাকা।

দৃষ্টি আকর্ষণঃ অতিরিক্ত সচিব (পানি), স্থানীয় সরকার বিভাগ। ATTENTION: ADD SECRETARY, LGRD

বিষয়ঃ ঢাকা এনভায়রনমেন্টালী সাসটেইনেবল ওয়াটার সাপ্লাই প্রজেক্ট, ঢাকা ওয়াসা এর অনুকূলে ৫৫.৯২ একর ভূমি অধিগ্রহণ সংক্রান্ত। SUB: 55.92 ACRES OF LAND ACQUISITION FOR DESWSP.

সূত্রঃ (১) ভূমি মন্ত্রণালয়ের অধিগ্রহণ-১, স্মারক নং-৩১.০০.০০০০.০৪৭.৪৭.০৩০.১৬-১৪৮, তাং-২১/০৬/২০১৬ খ্রিঃ
(২) জেলাপ্রশাসক, নারায়ণগঞ্জ এর স্মারক নং-০৫.৪১.৬৭০০.৩০২.১৪.০২২.১৬-২৭৩, তাং-২৭/০৭/২০১৬ খ্রিঃ
(৩) ভূমি মন্ত্রণালয়ের অধিগ্রহণ-১, স্মারক নং-৩১.০০.০০০০.০৪৭.৪৭.০৩০.১৬-২৪৮, তাং-২৪/০৯/২০১৬ খ্রিঃ
(৪) স্থানীয় সরকার বিভাগের স্মারক নং-৪৬.০৮৫.০১৬.০১.০০.০২০.২০১১.৭০৬, তাং-২৯/০৯/২০১৬ খ্রিঃ

উপর্যুক্ত বিষয় ও সূত্রের প্রেক্ষিতে জানানো যাচ্ছে যে, ওয়াসা কর্তৃক বাস্তবায়নাধীন ঢাকা এনভায়রনমেন্টালী সাসটেইনেবল ওয়াটার সাপ্লাই প্রজেক্ট এর পানি শোধনাগার নির্মাণ কাজের স্বার্থে নারায়ণগঞ্জ জেলার রূপগঞ্জ এলাকাধীন ৫৫.৯২ একর ভূমি অধিগ্রহণের ক্ষেত্রে ৩ ও ৪ নং সূত্রে বর্ণিত স্মারকের পত্রে অন্য সংস্থা কর্তৃক অধিগৃহীত সম্পত্তি ব্যবহারের বা রাস্তা ক্রসিং করার অনুমতিপত্র সংগ্রহপূর্বক প্রেরণের জন্য অনুরোধ করা হয়েছে। ইতোমধ্যে নিম্নবর্ণিত সংস্থাসমূহ হতে প্রাথমিক ছাড়পত্র/মতামত পাওয়া গিয়েছে।

১. রাজউকের ছাড়পত্র স্মারক নং-২৫.৩৯.০০০০.০৬৮.২৬.০৪৫.১৬-৫৭৬-স্থাঃ, তাং-২১/১২/২০১৬ (সংলাগ-'ক')।
২. স্থানীয় সরকার প্রকৌশলী অধিদপ্তরের ছাড়পত্র এলজিইডি/প্রঃ/নাঃগঞ্জ/আর-০১/২০১৭/২৫১, তাং-২৫/০১/২০১৭ (সংলাগ-'খ')।
৩. পানি উন্নয়ন বোর্ডের জমি ব্যবহারের জন্য ছাড়পত্র/মতামত (সংলগ্ন-'গ')।
৪. সড়ক ও জনপথ বিভাগের রাস্তা ক্রসিং করার ছাড়পত্র (সংলগ্ন-'ঘ')।

Initial 1. Permission to use land from RAJUK 2. LGED 3. BWDB 4. R&HD

এমতাবস্থায়, ঢাকা ওয়াসা'র ঢাকা এনভায়রণমেন্টালী সাসটেইনেবল ওয়াটার সাপ্লাই প্রজেক্টের প্রস্তাবিত পানি শোধনাগারের ট্রান্সমিশন মেইন স্থাপনের এ্যালাইনমেন্ট বরাবর রূপগঞ্জ এলাকায় অধিগ্রহণের জন্য প্রস্তাবিত ৫৫.৯২ একর জমি, 'স্থাবর সম্পত্তি অধিগ্রহণ ম্যানুয়েল ১৯৯৭' এর ১৯ নং অনুচ্ছেদের নির্দেশনা মোতাবেক ইতোপূর্বে প্রেরিত প্রস্তাবটি "কেন্দ্রীয় ভূমি বরাদ্দ কমিটির" অনুমোদনের লক্ষ্যে উপস্থাপনের জন্য ভূমি মন্ত্রণালয়কে অনুরোধ করার জন্য সবিনয়ে প্রেরণ করা হ'ল।

সংযুক্তঃ বর্ণনানুযায়ী।

MOTT MACDONALD MDSC, DESWSP			
Received: 13/02/2017			
Name	I	A	Sign
MIT/AZ	✓		
NO	✓		
LUIS	✓		
File: 346152/D			

প্রকৌশলী তাকসিম এ খান
ব্যবস্থাপনা পরিচালক
ঢাকা ওয়াসা।
ফোনঃ ৮১৮৯৬২৬

অনুলিপি সদয় অবগতির জন্য ঃ
১। জেলাপ্রশাসক, নারায়ণগঞ্জ। / TL, MDSC
২। অতিরিক্ত সচিব মহোদয়ের ব্যক্তিগত কর্মকর্তা, ভূমি মন্ত্রণালয় (অতিরিক্ত সচিব মহোদয়ের সদয় অবগতির জন্য)।

Received from PD

রাজধানী উন্নয়ন কর্তৃপক্ষ
রাজউক ভবন, ঢাকা।

স্মারক নং-২৫.৩৯.০০০০.০৬৮.২৬.০৪৫.১৬-৫৭৬-স্থাঃ তারিখ ঃ ২১/১২/২০১৬ইং 21.12.16

বিষয় ঃ বালুনদী থেকে ভাটারা পর্যন্ত মাদানী এভিনিউ তে পানির ট্রান্সমিশন পাইপ স্থাপনের অনুমোদন প্রসঙ্গে।

সূত্র ঃ স্মারক নং-৪৬.১১৩.৬০১.০০.০০.G-28/DESWSP/2156, তারিখ ঃ ২২/০৯/২০১৬ ইং।

উপর্যুক্ত বিষয় ও সূত্রের পরিপ্রেক্ষিতে জানানো যাচ্ছে যে, বালুনদী থেকে ভাটারা (বারিধারা) পর্যন্ত পানির ট্রান্সমিশন পাইপ স্থাপনের লক্ষ্যে মাদানী এভিনিউ এর Right of way ব্যবহারের বিষয়টি চেয়ারম্যান মহোদয় নিম্নেবর্ণিত শর্তে অনুমোদন করেছেন।

শর্তসমূহ ঃ

১) খনন ও পাইপ স্থাপনের সকল নক্সা নির্বাহী প্রকৌশলী, কেন্দ্রীয় ঢাকা (রাজউক) বিভাগ বরাবর দাখিল করতে হবে।

২) পানির পাইপ লাইন স্থাপনের পূর্বে রাস্তা মেরামতের জন্য রাজউক কর্তৃক নির্ধারিত প্রয়োজনীয় অর্থ চেয়ারম্যান, রাজউক বরাবর জমা প্রদান করে রাস্তা খননের অনুমতি পত্র গ্রহণ করতে হবে।

৩) বর্ণিত কাজ বাস্তবায়নের জন্য ওয়াসার প্রস্তাবমতে একটি MOU স্বাক্ষর করতে হবে।

এমতাবস্থায়, আলোচ্য রাস্তার ভূমি অধিগ্রহণ নক্সা ও As built নক্সা পরবর্তী প্রয়োজনীয় ব্যবস্থা গ্রহণার্থে এতদসংগে প্রেরণ করা হলো।

PERMISSION FROM RAJUK TO USE ROW, WITH CONDITION
1. DRAWINGS TO BE SUBMITTED
2. ROAD RESTORATION COST TO BE PAID BY DWASA.
3. MOU TO SIGN.

সংযুক্তঃ বর্ণনামতে।

প্রকৌশলী তাকসিম এ খান
ব্যবস্থাপনা পরিচালক
ঢাকা ওয়াসা, ঢাকা।

(সুশান্ত চাকমা)
সচিব
রাজধানী উন্নয়ন কর্তৃপক্ষ
ঢাকা।

স্মারক নং-২৫.৩৯.০০০০.০৬৮. তারিখ ঃ / /২০১৬ইং

সদয় অবগতি ও প্রয়োজনীয় ব্যবস্থা গ্রহনের জন্য অনুলিপি দেয়া হলোঃ- (জ্যেষ্ঠতার ভিত্তিতে নয়)
১। সদস্য (উন্নয়ন) রাজউক, ঢাকা।
২। প্রধান প্রকৌশলী (বাস্তবায়ন), রাজউক, ঢাকা।
৩। তত্ত্বাবধায়ক প্রকৌশলী (বাস্তবায়ন), রাজউক, ঢাকা।
৪। লিয়াজো অফিসার, রাজউক, ঢাকা (চেয়ারম্যান মহোদয়ের সদয় অবগতির জন্য)।

(সুশান্ত চাকমা)
সচিব
রাজধানী উন্নয়ন কর্তৃপক্ষ
ঢাকা।

রাজধানী উন্নয়ন কর্তৃপক্ষ
রাজউক ভবন, ঢাকা।

স্মারক নং-২৫.৩৯.০০০০.০৬৮.২৬.০৫৫.১৬-৫৭৬-উ.প. তারিখ ঃ২৭/১২/২০১৬ইং

বিষয় ঃ বাগুনদী থেকে ভাটারা পর্যন্ত মাদানী এভিনিউ তে পানির ট্রান্সমিশন পাইপ স্থাপনের অনুমোদন প্রসঙ্গে।

সূত্র ঃ স্মারক নং-৪৬.১১৩.৬০১.০০.০০.G-28/DESWSP/2156, তারিখ ঃ ২২/০৯/২০১৬ ইং।

উপর্যুক্ত বিষয় ও সূত্রের পরিপ্রেক্ষিতে জানানো যাচ্ছে যে, বাগুনদী থেকে ভাটারা (বারিধারা) পর্যন্ত পানির ট্রান্সমিশন পাইপ স্থাপনের লক্ষ্যে মাদানী এভিনিউ এর Right of way ব্যবহারের বিষয়টি চেয়ারম্যান মহোদয় নিম্নেবর্ণিত শর্তে অনুমোদন করেছেন।

শর্তসমূহ ঃ

১) খনন ও পাইপ স্থাপনের সকল নক্সা নির্বাহী প্রকৌশলী, কেন্দ্রীয় ঢাকা (রাজউক) বিভাগ বরাবর দাখিল করতে হবে।

২) পানির পাইপ লাইন স্থাপনের পূর্বে রাস্তা মেরামতের জন্য রাজউক কর্তৃক নির্ধারিত প্রয়োজনীয় অর্থ চেয়ারম্যান, রাজউক বরাবর জমা প্রদান করে রাস্তা খননের অনুমতি পত্র গ্রহণ করতে হবে।

৩) বর্ণিত কাজ বাস্তবায়নের জন্য ওয়াসার প্রস্তাবমতে একটি MOU স্বাক্ষর করতে হবে।

এমতাবস্থায়, আলোচ্য রাস্তার ভূমি অধিগ্রহণ নক্সা ও As built নক্সা পরবর্তী প্রয়োজনীয় ব্যবস্থা গ্রহণার্থে এতদসংগে প্রেরণ করা হলো।

সংযুক্তঃ বর্ণনামতে।

SAME AS PREVIOUS.

প্রকৌশলী তাকসিম এ খান
ব্যবস্থাপনা পরিচালক
ঢাকা ওয়াসা, ঢাকা।

(সুশান্ত চাকমা)
সচিব
রাজধানী উন্নয়ন কর্তৃপক্ষ
ঢাকা।

স্মারক নং-২৫.৩৯.০০০০.০৬৮.

তারিখ ঃ / /২০১৬ইং

সদয় অবগতি ও প্রয়োজনীয় ব্যবস্থা গ্রহনের জন্য অনুলিপি দেয়া হলোঃ- (জ্যেষ্ঠতার ভিত্তিতে নয়)

১। সদস্য (উন্নয়ন) রাজউক, ঢাকা।
২। প্রধান প্রকৌশলী (বাস্তবায়ন), রাজউক, ঢাকা।
৩। তত্ত্বাবধায়ক প্রকৌশলী (বাস্তবায়ন), রাজউক, ঢাকা।
৪। লিয়াজো অফিসার, রাজউক, ঢাকা (চেয়ারম্যান মহোদয়ের সদয় অবগতির জন্য)।

(সুশান্ত চাকমা)
সচিব
রাজধানী উন্নয়ন কর্তৃপক্ষ
ঢাকা।

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
স্থানীয় সরকার প্রকৌশল অধিদপ্তর
নির্বাহী প্রকৌশলীর কার্যালয়
চাঁনমারী, নারায়ণগঞ্জ
www.lged.gov.bd

উন্নয়নের গণতন্ত্র
শেখ হাসিনার মূলমন্ত্র

স্মারক নং-এলজিইডি/নিপ্রঃ/নাঃগঞ্জ/আর-০১/২০১৭/ ২৫১ তারিখঃ ২৫/০১/২০১৭ইং
25/01/2017

প্রতি

তত্ত্বাবধায়ক প্রকৌশলী ও প্রকল্প পরিচালক
DESWSP, ঢাকা ওয়াসা।

বিষয় ঃ ঢাকা ওয়াসার Dhaka Environmentally Sustainable Water Supply Project (DESWSP) শীর্ষক প্রকল্পের অধীনে রূপগঞ্জের গন্ধর্বপুর এলাকায় ৫০০ MLD ক্ষমতা সম্পন্ন পানি শোধনাগার নির্মাণের লক্ষ্যে মেঘনা নদী বিশনন্দী এলাকা হতে অপরিশোধিত পানি গন্ধর্বপুর শোধনাগার সাইটে আনার জন্য পাইপ লাইন এ্যালাইনমেন্ট হিসেবে LGED'র বিভিন্ন রাস্তা ক্রসিং এর অনুমতি প্রদান প্রসঙ্গে।

সূত্র ঃ Memo No-46.113.618.00.00.G-28/DESWSP/2475 Date: 17-01-2017.

উপরোক্ত বিষয় ও সূত্রের প্রেক্ষিতে জানানো যাচ্ছে যে, ঢাকা মহানগরবাসীর সুপেয় পানি সরবরাহ ব্যবস্থা নিশ্চিত করণের লক্ষ্যে ঢাকা ওয়াসা'র Dhaka Environmentally Sustainable Water Supply Project (DESWSP) শীর্ষক প্রকল্পটি সরকার কর্তৃক অনুমোদিত হয়েছে মর্মে সূত্রস্থ স্মারক মূলে জানা যায়। আরও জানা যায় যে, মেঘনা নদী হতে পানি উত্তোলন করে ট্রান্সমিশন লাইনের মাধ্যমে রূপগঞ্জের গন্ধর্বপুরে এনে প্রস্তাবিত শোধনাগারে পানি পরিশোধন করে ঢাকা মহানগরীতে সরবরাহ করা হবে। বর্ণিত প্রকল্পের আওতায় বিশনন্দী হতে গন্ধর্বপুর পর্যন্ত ২৩ কিঃমিঃ Water Transmission Line নির্মাণ করা হবে। সেজন্য আড়াইহাজার উপজেলার এলজিইডি'র আওতাভুক্ত বিভিন্ন রাস্তা শম্ভুপুরা এলাকার (মেঘনা নদীর পাড়ে), উচিৎপুরা বাজার, আতানন্দী, আতাদী, ধাঁপাতি, কামালদী, তিলচন্ডী, হাজী শাহদী, আতাবনী, কুমারবাগ, পাড়াগাঁও মন্দির, ইমবারনী, বালিয়াপাড়া স্থান দিয়ে এবং রূপগঞ্জ উপজেলার দক্ষিণবাগ চক, গোলাকান্দাইল, তেতলাব, ভুলতা, কর্ণগোপ, নোয়াগাঁও, গন্ধর্বপুর, রূপগঞ্জ, নাওড়া ক্রসিং এর নিমিত্তে ছাড়পত্র প্রদানের জন্য অনুরোধ করা হয়েছে। উক্ত অনুরোধের প্রেক্ষিতে নিম্নবর্ণিত শর্ত সাপেক্ষে ঢাকা ওয়াসা'র প্রস্তাবিত ট্রান্সমিশন লাইন ক্রসিং করার অনুমতি বিবেচনা করা হলো ঃ

১। এলজিইডি এবং ওয়াসা'র যৌথ সুপারভিশনে কার্য সম্পাদন করতে হবে। কাজের বিস্তারিত নক্সা এলজিইডি'কে সরবরাহ করতে হবে।
২। পানির লাইন স্থাপন কালে রাস্তার যানবাহন চলাচলে বিঘ্ন সৃষ্টি করা যাবে না। রাস্তার উপরে বা ঢালে কোন নির্মাণ সামগ্রী স্তুপাকারে (ইট, বালি, পাইপ, সিমেন্ট, রড সীটপাইল ইত্যাদি) কোন অবস্থাতেই রাখা যাবে না। প্রয়োজনে বাইপাস সড়ক নির্মাণ করতে হবে।
৩। পাইপ স্থাপনকালে বিদ্যমান রাস্তা বা কালভার্ট যাতে কোনভাবেই ক্ষতিগ্রস্থ না হয় সে বিষয়ে অত্যন্ত সতর্ক থেকে কাজ সম্পাদন করতে হবে এবং পানির পাইপ স্থাপনকালে কোন বৈধ স্থাপনা, রাস্তা বা রাস্তার ঢালের ক্ষতি হলে তা ওয়াসা কর্তৃপক্ষ নিজ দায়িত্বে মেরামত করে দিবে।
৪। পানির লাইন স্থাপনের কারণে রাস্তার কোন ক্ষয়-ক্ষতির আশংকা দেখা দিলে কিংবা অন্য কোন কারণে পানির লাইন স্থানান্তর করতে হলে ওয়াসা কর্তৃপক্ষ নিজ ব্যবস্থাপনায় ও খরচে তা সম্পন্ন করবে।
৫। পাইপ লাইন এর প্রস্তাবিত Alignment এর বরাবরে বিদ্যমান রাস্তা যাতে কোনভাবেই ক্ষতিগ্রস্থ না হয় সে বিষয়ে অত্যন্ত সতর্কতার সাথে উন্নত প্রযুক্তির মাধ্যমে কাজ সম্পাদন করতে হবে।
৬। বর্ষার সময় রাস্তার বাঁধের ক্ষতি হয় এমন কাজ করা যাবে না।
৭। পানির পাইপ লাইন স্থাপনের সময় মাটির উপর এবং নীচের সকল Utilities এর বিষয়ে সংশ্লিষ্ট দপ্তরের সহিত যোগাযোগ করে উহা অপসারন/পুনর্বাসনের প্রয়োজন হলে ঢাকা ওয়াসা প্রয়োজনীয় ব্যবস্থা নিবে।
৮। এলজিইডি সদর দপ্তরের নির্দেশনা মোতাবেক ক্ষতিপুরনের দাবি মিমাংসিত হবে।

1. DRAWING, JOINT SUPERVISION
2. NO TRAFFIC DISTURBANCE, BYPASS ROAD IF NEEDED
3. NO DAMAGE TO CULVERTS, DWASA SHOULD RESTORE.
4. EXISTING UTILITY TO BE SHIFTED BY DWASA.
5. ROADCUTTING SHOULD BE WITH MODERN TECH
6. ROAD CUTTING IN WET SEASON TO AVOID.
7. CONTACT TO SHIFT UTILITIES WITH AUTHORITY
8. FOLLOW LGED INSTRUCTION

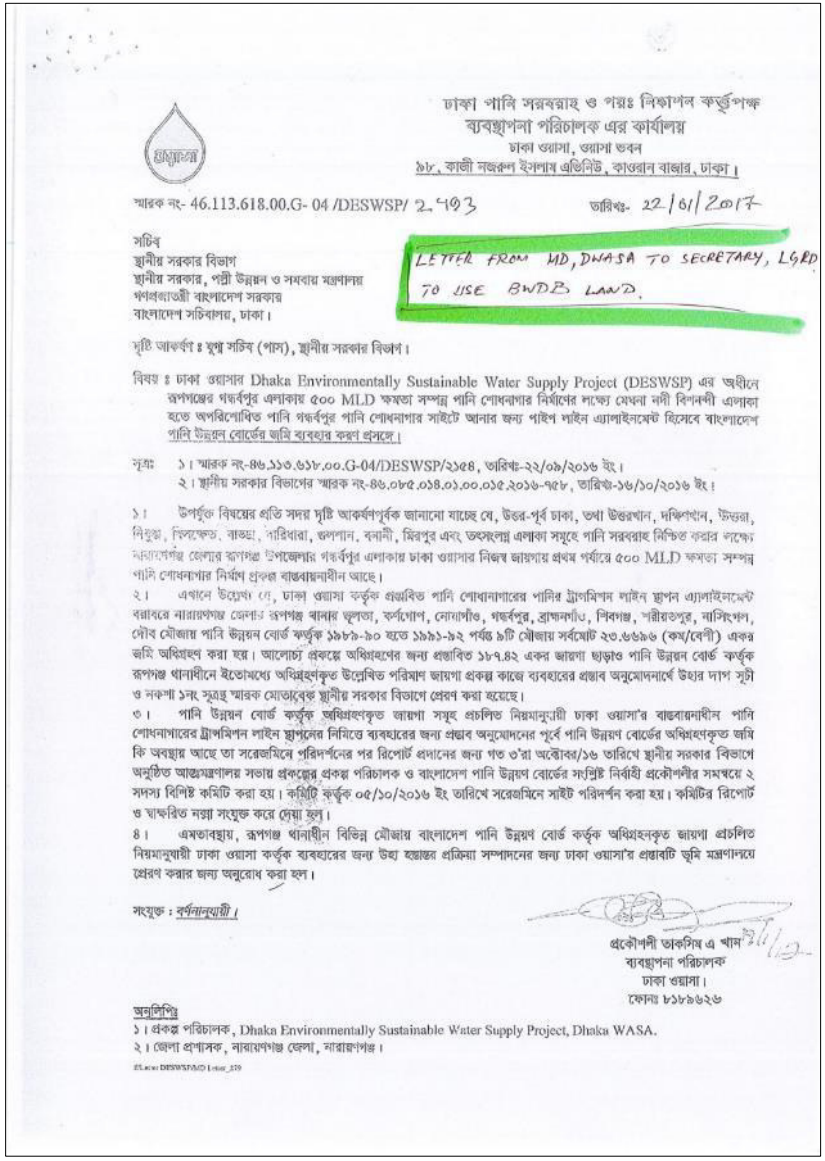
উপরোক্ত শর্ত সাপেক্ষে ঢাকা ওয়াসা'কে প্রস্তাবিত এলাকা সমূহ দিয়ে ট্রান্সমিশন পানির লাইন স্থাপনের জন্য এলজিইডি কর্তৃপক্ষ নির্মিত রাস্তা ক্রসিং করার প্রাথমিক অনুমতি দেয়া হলো।

PERMISSION FOR ROAD CUTTING FROM LGED, WITH CONDITIONS.

(মোহাম্মদ আকরামুল কবীর)
নির্বাহী প্রকৌশলী
ফোন ঃ ৭৬৪৫৯১০ (অফিস)
ই মেইল ঃ xen.narayanganj@lged.gov.bd

অনুলিপি ঃ
১। প্রধান প্রকৌশলী, এলজিইডি, আগারগাঁও, শেরেবাংলা নগর, ঢাকা-১২০৭।
২। অতিরিক্ত প্রধান প্রকৌশলী (নগর ব্যবস্থাপনা), এলজিইডি, আগারগাঁও, শেরেবাংলা নগর, ঢাকা-১২০৭।
৩। তত্ত্বাবধায়ক প্রকৌশলী, ঢাকা অঞ্চল, এলজিইডি, ৬২ পশ্চিম আগারগাঁও, শেরেবাংলা নগর, ঢাকা-১২০৭।
৪। উপজেলা প্রকৌশলী, এলজিইডি, উপজেলা ঃ আড়াইহাজার/রূপগঞ্জ, জেলা ঃ নারায়ণগঞ্জ।

Letter-1, P-24



ঢাকা পানি সরবরাহ ও পয়ঃ নিষ্কাশন কর্তৃপক্ষ
ব্যবস্থাপনা পরিচালক এর কার্যালয়
ঢাকা ওয়াসা, ওয়াসা ভবন
৬৮, কাজী নজরুল ইসলাম এভিনিউ, কাওরান বাজার, ঢাকা।

স্মারক নং- 46.113.618.00.G- 04 /DESWSP/ 2,493 তারিখ- 22/01/2017

LETTER FROM MD, DWASA TO SECRETARY, LGRD TO USE BWDB LAND.

সচিব
স্থানীয় সরকার বিভাগ
স্থানীয় সরকার, পল্লী উন্নয়ন ও সমবায় মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ সচিবালয়, ঢাকা।

দৃষ্টি আকর্ষণ ঃ যুগ্ম সচিব (পাস), স্থানীয় সরকার বিভাগ।

বিষয় ঃ ঢাকা ওয়াসার Dhaka Environmentally Sustainable Water Supply Project (DESWSP) এর অধীনে রূপগঞ্জের গন্ধর্বপুর এলাকায় ৫০০ MLD ক্ষমতা সম্পন্ন পানি শোধনাগার নির্মাণের লক্ষ্যে মেঘনা নদী বিশনন্দী এলাকা হতে অপরিশোধিত পানি গন্ধর্বপুর পানি শোধনাগার সাইটে আনার জন্য পাইপ লাইন এ্যালাইনমেন্ট হিসেবে বাংলাদেশ পানি উন্নয়ন বোর্ডের জমি ব্যবহার করণ প্রসঙ্গে।

সূত্রঃ ১। স্মারক নং-৪৬.১১৩.৬১৮.০০.G-04/DESWSP/২১৫৪, তারিখ-২২/০৯/২০১৬ ইং।
২। স্থানীয় সরকার বিভাগের স্মারক নং-৪৬.০৮৫.০১৪.০১.০০.০১৫.২০১৬-৭৫৮, তারিখ-১৬/১০/২০১৬ ইং।

১। উপর্যুক্ত বিষয়ের প্রতি সদয় দৃষ্টি আকর্ষণপূর্বক জানানো যাচ্ছে যে, উত্তর-পূর্ব ঢাকা, তথা উত্তরখান, দক্ষিণখান, উত্তরা, বিমুক্ত, খিলক্ষেত, বাড্ডা, বারিধারা, গুলশান, বনানী, মিরপুর এবং তৎসংলগ্ন এলাকা সমূহে পানি সরবরাহ নিশ্চিত করার লক্ষ্যে নারায়ণগঞ্জ জেলার রূপগঞ্জ উপজেলার গন্ধর্বপুর এলাকায় ঢাকা ওয়াসার নিজস্ব জায়গায় প্রথম পর্যায়ে ৫০০ MLD ক্ষমতা সম্পন্ন পানি শোধনাগার নির্মাণ প্রকল্প বাস্তবায়নাধীন আছে।

২। এখানে উল্লেখ্য যে, ঢাকা ওয়াসা কর্তৃক গ্রহণিত পানি শোধানাগারের পানির ট্রান্সমিশন লাইন স্থাপন এ্যালাইনমেন্ট বরাবরে নারায়ণগঞ্জ জেলার রূপগঞ্জ থানার ভূলতা, কর্ণগোপ, নোয়াগাঁও, গন্ধর্বপুর, ব্রাহ্মনগাঁও, শিবগঞ্জ, শরীয়তপুর, নাসিংগল, দৌব মৌজায় পানি উন্নয়ন বোর্ড কর্তৃক ১৯৮৯-৯০ হতে ১৯৯১-৯২ পর্যন্ত ৯টি মৌজায় সর্বমোট ২৩.৬৬৯৬ (কম/বেশী) একর জমি অধিগ্রহণ করা হয়। আলোচ্য প্রকল্পে অধিগ্রহণের জন্য প্রস্তাবিত ১৮৭.৪২ একর জায়গা ছাড়াও পানি উন্নয়ন বোর্ড কর্তৃক রূপগঞ্জ থানাধীনে ইতোমধ্যে অধিগ্রহণকৃত উল্লেখিত পরিমাণ জায়গা প্রকল্প কাজে ব্যবহারের প্রস্তাব অনুমোদনার্থে উহার দাগ সূচী ও নকশা ১নং সূত্রস্থ স্মারক মোতাবেক স্থানীয় সরকার বিভাগে প্রেরণ করা হয়েছে।

৩। পানি উন্নয়ন বোর্ড কর্তৃক অধিগ্রহণকৃত জায়গা সমূহ প্রচলিত নিয়মানুযায়ী ঢাকা ওয়াসা'র বাস্তবায়নাধীন পানি শোধনাগারের ট্রান্সমিশন লাইন স্থাপনের নিমিত্তে ব্যবহারের জন্য প্রস্তাব অনুমোদনের পূর্বে পানি উন্নয়ণ বোর্ডের অধিগ্রহণকৃত জমি কি অবস্থায় আছে তা সরেজমিনে পরিদর্শনের পর রিপোর্ট প্রদানের জন্য গত ৩'রা অক্টোবর/১৬ তারিখে স্থানীয় সরকার বিভাগে অনুষ্ঠিত আন্তঃমন্ত্রণালয় সভায় প্রকল্পের প্রকল্প পরিচালক ও বাংলাদেশ পানি উন্নয়ণ বোর্ডের সংশ্লিষ্ট নির্বাহী প্রকৌশলীর সমন্বয়ে ২ সদস্য বিশিষ্ট কমিটি করা হয়। কমিটি কর্তৃক ০৫/১০/২০১৬ ইং তারিখে সরেজমিনে সাইট পরিদর্শন করা হয়। কমিটির রিপোর্ট ও স্বাক্ষরিত নক্সা সংযুক্ত করে দেয়া হল।

৪। এমতাবস্থায়, রূপগঞ্জ থানাধীন বিভিন্ন মৌজায় বাংলাদেশ পানি উন্নয়ণ বোর্ড কর্তৃক অধিগ্রহনকৃত জায়গা প্রচলিত নিয়মানুযায়ী ঢাকা ওয়াসা কর্তৃক ব্যবহারের জন্য উহা হস্তান্তর প্রক্রিয়া সম্পাদনের জন্য ঢাকা ওয়াসা'র প্রস্তাবটি ভূমি মন্ত্রণালয়ে প্রেরণ করার জন্য অনুরোধ করা হল।

সংযুক্ত : বর্ণনানুযায়ী।

প্রকৌশলী তাকসিম এ খান
ব্যবস্থাপনা পরিচালক
ঢাকা ওয়াসা।
ফোন: ৮১৮৯৬২৬

অনুলিপি
১। প্রকল্প পরিচালক, Dhaka Environmentally Sustainable Water Supply Project, Dhaka WASA.
২। জেলা প্রশাসক, নারায়ণগঞ্জ জেলা, নারায়ণগঞ্জ।

বিষয়ঃ ঢাকা ওয়াসা'র Dhaka Environmentally Sustainable Water Supply Project (DESWSP) শীর্ষক প্রকল্পের অধীনে রূপগঞ্জের গন্ধর্বপুর এলাকায় ৫০০ MLD ক্ষমতা সম্পন্ন পানি শোধনাগার নির্মাণের লক্ষ্যে মেঘনা নদী বিশনন্দী এলাকা হতে অপরিশোধিত পানি গন্ধর্বপুর পানি শোধনাগার সাইটে আনার জন্য পাইপ লাইন এ্যালাইনমেন্ট হিসেবে বাংলাদেশ পানি উন্নয়ন বোর্ডের কমবেশী ২৪ একর জমি ঢাকা ওয়াসা বরাবরে হস্তান্তরের জন্য বাংলাদেশ পানি উন্নয়ন বোর্ড ও ঢাকা ওয়াসা'র প্রতিনিধি কর্তৃক সরেজমিনে পরিদর্শন প্রতিবেদন।

সূত্র ঃ স্থানীয় সরকার বিভাগের স্মারক নং- ৪৬.০৮৫.০১৪.০১.০০.০১৫.২০১৬-৭৫৮, তারিখ-১৬/১০/২০১৬খ্রিঃ।

ঢাকা মহানগরবাসীর সুপেয় পানি সরবরাহ ব্যবস্থা নিশ্চিতকরণের লক্ষ্যে ঢাকা ওয়াসা'র "Dhaka Environmentally Sustainable Water Supply Project (DESWSP)" শীর্ষক প্রকল্পটি সরকার কর্তৃক অনুমোদিত হয়েছে। এ প্রকল্পের আওতায় নারায়ণগঞ্জ জেলার রূপগঞ্জ উপজেলার আওতাধীন গন্ধর্বপুরে ঢাকা ওয়াসা'র নিজস্ব জায়গায় পানি শোধনাগার (WTP) নির্মাণ করে পানি পরিশোধন করে ঢাকা শহরে সরবরাহ করা হবে। এ জন্য মেঘনা নদী হতে পানি উত্তোলন করে ট্রান্সমিশন লাইনের মাধ্যমে রূপগঞ্জের গন্ধর্বপুরে এনে প্রস্তাবিত পানি শোধনাগারে পানি পরিশোধন করে প্রকল্পের ১ম ও ২য় ফেইজে দৈনিক ৫০ কোটি লিটার করে সর্বমোট দৈনিক ১০০ কোটি লিটার সুপেয় পানি ঢাকা মহানগরীতে সরবরাহ করা হবে। উক্ত পানি শোধনাগারের জন্য আড়াই হাজারের বিশনন্দী হতে গন্ধর্বপুর পর্যন্ত ২৭ কিঃ মিঃ Raw Water Transmission Line স্থাপনের জন্য প্রস্তাবিত এলাইনমেন্ট বরাবর বাংলাদেশ পানি উন্নয়ন বোর্ড কর্তৃক অধিগ্রহণকৃত জমিতে তৈরীকৃত ঢাকা-সিলেট রোড হতে গন্ধর্বপুর পর্যন্ত ৮.৫০ কিঃ মিঃ দৈর্ঘ্যের (ভূলতা ফর্ণগোপ, নাসিংগল, দেবে, নোয়াগাঁও, গন্ধর্বপুর, ব্রাহ্মণগাঁও, শিবগঞ্জ, শরিয়তপুর মৌজাধীন) সেচ ও ড্রেনেজ ক্যানল হতে কমবেশী ২৪ একর জমি ব্যবহারের প্রয়োজন হবে।

প্রকল্প বাস্তবায়নের লক্ষ্যে উক্ত জমি ঢাকা ওয়াসা কর্তৃক ব্যবহারের বিষয়ে প্রয়োজনীয় ব্যবস্থা গ্রহণকল্পে ঢাকা ওয়াসা হতে স্থানীয় সরকার বিভাগে প্রস্তাব প্রেরণ করা হয়। উক্ত প্রস্তাবের আলোকে অধিগ্রহণকৃত জমির বর্তমান অবস্থা এবং প্রস্তাবিত সংস্থা ঢাকা ওয়াসা'র চাহিদা আলোকপাত করা হয়। ঢাকা ওয়াসা'র প্রস্তাবের আলোকে স্থানীয় সরকার বিভাগের সম্মেলন কক্ষে এতদসংক্রান্ত এক আন্তঃমন্ত্রণালয় সমন্বয় সভা ০৩/১০/২০১৬ তারিখে অনুষ্ঠিত হয়। উক্ত সভায় এক সংস্থার অধিগ্রহণকৃত জমি অন্য সংস্থায় হস্তান্তরের প্রক্রিয়া/ নীতিমালার উপর বিস্তারিত আলোচনা হয়। ঢাকা ওয়াসা'র ঢাকা এনভায়রনমেন্টালী সাসটেইনেবল ওয়াটার সাপ্লাই (DESWSP) প্রকল্পের পানি শোধনাগারের ট্রান্সমিশন লাইন স্থাপনের স্বার্থে অধিগ্রহণকৃত জায়গার প্রয়োজনীয়তা এবং প্রকল্প বাস্তবায়নের গুরুত্ব সকলে অনুধাবন করে এবং সংশ্লিষ্ট বিভাগ ও মন্ত্রণালয় হতে আগত প্রতিনিধিগণ এ বিষয়ে নিজ নিজ অবস্থান থেকে প্রকল্প বাস্তবায়নে সহযোগিতার আশ্বাস দেয়। বাংলাদেশ পানি উন্নয়ন বোর্ডের প্রতিনিধি তত্ত্বাবধায়ক প্রকৌশলী, ঢাকা পওর সার্কেল, বাপাউবো, ঢাকা সভাকে অবহিত করেণ যে, তিনি নিজেই সংশ্লিষ্ট প্রকল্প এলাকা ঘুরে এসেছেন। সভায় বিস্তারিত আলোচনান্তে ঢাকা ওয়াসা'র আলোচ্য প্রকল্প বাস্তবায়নের স্বার্থে ঢাকা ওয়াসা ও বাংলাদেশ পানি উন্নয়ন বোর্ডের প্রতিনিধি প্রস্তাবিত জমি/এ্যালাইনমেন্ট যৌথভাবে সরেজমিনে দেখে উহার বর্তমান অবস্থা বিশ্লেষণ করে রিপোর্ট প্রদান করবে এই মর্মে সিদ্ধান্ত গৃহীত হয়। অনুষ্ঠিত সভার কার্য বিবরণীতে ১নং অনুচ্ছেদে সিদ্ধান্ত হয় যে, ঢাকা ওয়াসা'র DESWS প্রকল্পের প্রকল্প পরিচালক এবং বাংলাদেশ পানি উন্নয়ন বোর্ডের অত্র এলাকার সংশ্লিষ্ট নির্বাহী প্রকৌশলী সরেজমিনে এলাকা পরিদর্শণ করে অধিগ্রহণকৃত জমি ঢাকা ওয়াসা কর্তৃক ব্যবহারের ব্যাপারে একটি প্রতিবেদন ৭ (সাত) দিনের মধ্যে দাখিল করবে।

চলমান পাতা-২

পাতা-২

উপরোক্ত সিদ্ধান্তের প্রেক্ষিতে ঢাকা ওয়াসা এবং বাংলাদেশ পানি উন্নয়ন বোর্ডের প্রতিনিধিবর্গ ০৫/১০/২০১৬ তারিখে ঢাকা ওয়াসা'র প্রকল্পের প্রস্তাবিত এ্যালাইনমেন্ট বরাবর বাংলাদেশ পানি উন্নয়ন বোর্ডের অধিগ্রহণকৃত জায়গা/এলাকাসমূহ যৌথভাবে পরিদর্শন পূর্বক পরিদর্শন প্রতিবেদন নিম্নে উপস্থাপন করা হলো ঃ

ক) ঢাকা-সিলেট রোড হতে গন্ধর্বপুর পর্যন্ত অংশের বর্তমান অবস্থা ঃ EXISTING CONDITION. FROM DHK-SYLHET ROAD TO GANDHARBPUR

১। DESWS প্রকল্পের প্রস্তাবিত এ্যালাইনমেন্ট অর্থাৎ বাংলাদেশ পানি উন্নয়ন বোর্ড আওতাধীন এনএনআইডি সেচ প্রকল্প এবং এনএনআইপি (ব্লক-এ/১) সেচ প্রকল্পের জন্য অধিগ্রহণকৃত বাঁধ ও ক্যানেল/ক্যানেলের পার্শ্ববর্তী অংশবিশেষ এলাকায় অনেক আবাদী জমির উপর শিল্প/কল-কারখানা, আবাসিক বাড়ী-ঘর নির্মিত হয়েছে। ফলে সেচযোগ্য এলাকায় আবাদী জমির পরিমান কমে এসেছে।

২। উক্ত প্রকল্প ২টির আওতায় সেচ প্রদানের নিমিত্ত সেচ খাল নির্মানের জন্য বাংলাদেশ পানি উন্নয়ন বোর্ড কর্তৃক ৮০ ফুট হতে ১৪০ ফুট প্রশস্থ জায়গা/জমি অধিগ্রহণ করা হয়। বর্নিত অধিগ্রহনকৃত জমির মধ্যে ঢাকা ওয়াসা কর্তৃক ২৫ মিটার (৮২ ফুট) প্রশস্থ জায়গা/জমি ব্যবহারের প্রস্তাব করা হয়েছে (সংযুক্ত নকশা)। ঢাকা ওয়াসা কর্তৃক প্রস্তাবিত এ্যালাইমেন্ট অনুযায়ী বাপাউবো'র অধিগ্রহনকৃত জমির মধ্যে প্রায় ২.৭২৮ কিঃমিঃ ক্যানাল কর্ণগোপ মৌজায় ১.১৮৯ কিঃমিঃ, নার্সিংগল মৌজায় ০.৭১৬ কিঃমিঃ এবং দেবৈ মৌজায় ০.৮২৩কিঃমিঃ) বর্তমানে সেচ কাজে ব্যবহার না হওয়ায় ক্যানেলটি ঢাকা ওয়াসা কর্তৃক ব্যবহার করা হলে সেচ কার্যক্রম বিঘ্নিত হবে না। এছাড়া ঢাকা ওয়াসা কর্তৃক প্রস্তাবিত এ্যালাইমেন্ট মোতাবেক প্রায় ০.৫৫৭ কিঃমিঃ ক্যানেলটি (ভুলতা মৌজায় ০.২৮৯ কিঃমিঃ এবং গন্ধর্বপুর মৌজায় ০.২৬৮কিঃমিঃ) সেচ কাজে ব্যবহৃত হচ্ছে। তাই উক্ত অংশে জানুয়ারী হতে এপ্রিল পর্যন্ত সেচ কার্যক্রম চলাকালীন সময়ে ঢাকা ওয়াসা কর্তৃক উন্নয়ন কার্যক্রম বন্ধ রাখার প্রয়োজন হবে; তাই উক্ত সময়ে সেচ কার্যক্রম নিরবচ্ছিন্নভাবে চালু রাখার স্বার্থে ঢাকা ওয়াসা'র সংশ্লিষ্ট প্রকল্প পরামর্শক প্রতিষ্ঠান কর্তৃক যথাযথ কর্মপরিকল্পনা গ্রহণ করতে হবে। (LAND DESCRIPTION)

খ) গন্ধর্বপুর হতে মুড়াপাড়া পর্যন্ত অংশের বর্তমান অবস্থা ঃ EXISTING CONDITION GANDHARPUR – MURAPARA

১। বাংলাদেশ পানি উন্নয়ন বোর্ড কর্তৃক বিগত ১৯৯০-৯১ সনে গন্ধর্বপুর, ব্রাহ্মণগাঁও, শিবগঞ্জ ও শরিয়তগঞ্জ মৌজায় প্রায় ৪.০০ কিঃমিঃ দৈর্ঘ্যে (গন্ধর্বপুর হতে মুড়াপাড়া পর্যন্ত) ১৮০ ফুট প্রশস্থ জায়গা/জমি অধিগ্রহণ করে বাঁধ নির্মাণ করা হয়। পরবর্তীতে এলজিইডি কর্তৃক উক্ত বাঁধের উপর ৫০ ফুট প্রশস্থ রাস্তা নির্মাণ করা হয় এবং অবশিষ্ট অংশ বরোপিট হিসেবে ব্যবহৃত হচ্ছে। উক্ত বরোপিটের নীচ দিয়ে ঢাকা ওয়াসা কর্তৃক Transmission Line স্থাপন করলে প্রকল্পের সেচ কার্যক্রম ব্যহত হবে না।

এমতাবস্থায়, ঢাকা ওয়াসা'র ঢাকা এনভায়রনমেন্টালী সাসটেইনেবল ওয়াটার সাপ্লাই প্রকল্প (DESWSP) সুষ্ঠু বাস্তবায়নকল্পে বাংলাদেশ পানি উন্নয়ন বোর্ডের অধিগ্রহণকৃত কম/বেশী ২৪ একর জায়গা ঢাকা ওয়াসা কর্তৃক ব্যবহারের জন্য প্রচলিত বিধি মোতাবেক ব্যবস্থা গ্রহন করা যেতে পারে। 24 ACRE TO BE USED FROM BWDB.

(মোঃ আঃ অহিয়াল মিয়া)
নির্বাহী প্রকৌশলী
ঢাকা পওর বিভাগ-১
বাপাউবো, ঢাকা।

(মোঃ মাহমুদুল ইসলাম)
তত্ত্বাবধায়ক প্রকৌশলী
ও
প্রকল্প পরিচালক
ডিইএসডব্লিউএসপি
ঢাকা ওয়াসা।

P1 & P2

LETTER FROM RHD, XEN NARAYANGONJ

SUB: PERMISSION FOR ROAD CROSSING AT DHAKA-SYLHET ROAD 08/02/17 AT BHULTA, GOLAKANDAIL

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
নির্বাহী প্রকৌশলীর কার্যালয় (সওজ)
নারায়ণগঞ্জ সড়ক বিভাগ
দশিমরাইল, নারায়ণগঞ্জ।

স্মারক নং- ২১৬ তারিখ- ৮/২/১৭

বিষয়ঃ- ঢাকা মহানগরী এলাকায় সুপেয় পানি সরবরাহের লক্ষ্যে "ঢাকা এনভায়রনমেন্টাল সাসটেইনেবল ওয়াটার সাপ্লাই প্রজেক্ট" রূপগঞ্জ এর গন্ধর্বপুর এলাকার প্রস্তাবিত পানি শোধনাগার নির্মাণ প্রকল্পে মেঘনা নদীর বিশনন্দী পয়েন্ট হতে পানি আনার জন্য ঢাকা-সিলেট রোডের গোলাকান্দাইল, ভুলতা, নারায়ণগঞ্জ রোডে ক্রসিং করার অনুমতি প্রদান প্রসঙ্গে।

উপরোক্ত বিষয়ের পরিপ্রেক্ষিতে সম্মানের সাথে জানানো যাচ্ছে যে, ঢাকা-সিলেট মহাসড়কের চেঃ ২৪+৭০০, জয়দেবপুর-দেবগ্রাম-ভুলতা-মদনপুর-মদনপুর সড়ক চেঃ ৩৭+১০০, নরসিংদী-মদনগঞ্জ সড়ক চেঃ ২৪+৭০০ "ঢাকা এনভায়রনমেন্টাল ওয়াটার সাপ্লাই প্রজেক্ট" রূপগঞ্জ এর গন্ধর্বপুর এলাকার প্রস্তাবিত পানি শোধনাগার নির্মাণ প্রকল্পে মেঘনা নদীর বিশনন্দী পয়েন্ট হতে পানি আনার জন্য সওজ সড়কের কাঁচা অংশে পিট খনন ও কাঁচা অংশে H.D.D পদ্ধতিতে ১৬০০মিঃমিঃ ডায়া ৪টি পাইপ লাইন স্থাপন করিবার করার জন্য প্রকৌশলী তাকসিম এ খান, ব্যবস্থাপনা পরিচালক ঢাকা ওয়াসা, ঢাকা। প্রধান প্রকৌশলী, সড়ক ও জনপথ অধিদপ্তর সড়ক ভবন, ঢাকা বরাবরে আবেদন করেন। উক্ত আবেদনের প্রেক্ষিতে সংশ্লিষ্ট উপ-সহকারী প্রকৌশলী ও উপ-বিভাগীয় প্রকৌশলী নারায়ণগঞ্জ উপ-বিভাগ নিম্নোক্ত তথ্য ও মতামত সহ ১(এক)টি প্রতিবেদন স্মারক নং-৭১(৩) তারিখ-২৬-০১-২০১৭ খ্রিঃ এর মাধ্যমে অত্র দপ্তরে দাখিল করেছেন।

নিম্নে প্রদত্ত শর্তের ভিত্তিতে আবেদনকারীকে সড়কের পাইপ লাইন স্থাপনের জন্য রাস্তার কাঁচা অংশে পিট খনন ও এইচ.ডি.ডি পদ্ধতিতে বোরিং করিবার অনুমতি প্রদান করা যেতে পারে উক্ত শর্ত সমূহ নিম্নরূপঃ-

শর্তসমূহ CONDITIONS

১. কাঁচা অংশে পিট খননের সময় প্রয়োজনীয় সর্তকতামূলক সাইন সিগনাল স্থাপন করতে হবে, যাতে কোন প্রকার দুর্ঘটনা না ঘটতে পারে। 1. SIGN BOARD IN SAFETY
২. পাইপ লাইন স্থাপনের সময় যানবাহন চলাচলে যাহাতে কোন বাধার সৃষ্টি না সেদিকে খেয়াল রাখতে হবে। 2. NO DISTURBANCE FOR VEHICLE MOVEMENT
৩. ভবিষ্যতে সড়ক উন্নয়ন কাজের চাহিদা মোতাবেক বর্ণিত লাইন স্থানান্তরে ঢাকা পানি সরবরাহ ও পয়ঃ নিষ্কাশন কর্তৃপক্ষ এর নিজস্ব উদ্যোগে পাইপ লাইন স্থানান্তর করতে হবে। 3. EXISTING UTILITIES TO BE SHIFTED BY DWASA.
৪. পাইপ লাইন স্থাপনের সময় সড়কের যাহাতে কোনরূপ ক্ষতি সাধিত না হয় সেদিকে লক্ষ্য রাখতে হবে। কোন প্রকার ক্ষতি হলে ঢাকা পানি সরবরাহ ও পয়ঃ নিষ্কাশন কর্তৃপক্ষ এর নিজস্ব উদ্যোগে মেরামত করতে বাধ্য থাকবে। 4. NO DAMAGE TO ROAD, IF ANY REPAIR BY DWASA.
৫. সংযোগ লাইন বসানোর পর খননকৃত পিটের মধ্যে নিজস্ব খরচে গর্ত ৬ ইঞ্চি স্তরে বালু ভরাট করন এবং চাপানো সহ এক স্তর ইটা বিছানো হইবে। কোন অবস্থাতেই বালি এফ.এম ০.৮০ এর নীচে হবে না। 5. 6 INCH SAND OF FM 0.8 AND A LAYER OF BRICKS ON ROAD.
৬. উক্ত কাজটি করার সময় অত্র অফিসের প্রতিনিধির উপস্থিতিতে কার্যক্রম সম্পাদন করতে হবে। 6. REPRESENTATIVE TO BE PRESENT
৭. কোন অবস্থাতেই সড়কের পেভমেন্টের কোন অংশ খনন করা যাবে না। 7. PAVEMENT CANNOT BE DAMAGED.
৮. কোন অবস্থাতেই অনুমোদিত নক্সার বাহিরে কাজ করা যাবে না। 8. ONLY APPROVED DRAWING WILL BE CONSIDERED
৯. বর্ষার সময় সড়ক বাঁধের কোন ক্ষতি করা যাবেনা। পাইপ লাইন স্থাপনের পর তার উপর মাটির Compaction এর গ্রহণযোগ্য মান নিশ্চিত করতে হবে।
১০. পানির পাইপ লাইন স্থাপনের সময় মাটির উপর এবং নীচের সকল Utilities এর বিষয়ে অত্র দপ্তরের সাথে যোগাযোগ করে উহা অপসারণের প্রয়োজন হলে ঢাকা ওয়াসা প্রয়োজনীয় ব্যবস্থা নিবে। 10. EXISTING UTILITIES SHIFTING WITH CONCERNED AUTHORITIES
১১. সড়ক পার্শ্ববর্তী ভূমি হতে ১.৫ মিটার নীচ দিয়ে পাইপ লাইন স্থাপন করতে হবে। 11. 1.5 BELOW IN THE SHOULDER TO BE INSTALLED
১২. যথা সম্ভব কাজটি এইচ.ডি.ডি পদ্ধতিতে সম্পাদন করতে হবে। উন্মুক্ত পদ্ধতিতে রাস্তা খননের প্রয়োজন হলে যথাযথ Shoring/Boxing সহ Bypass রাস্তা নির্মাণ করতে হবে। কাজ শুরু করার পূর্বে সংশ্লিষ্ট সড়ক শাখার সহিত যোগাযোগ করতে হবে। HDD METHOD TO BE USED, OPEN CUT WITH SHORING
এতদসঙ্গে প্রাক্কলনে ক্ষতিপূরনের টাকা যথাযথ কর্তৃপক্ষের কর্তৃক অনুমোদনের পর বিভাগীয় অফিসে জমা দেওয়া স্বাপেক্ষে বিভাগীয় অন্যান্য সর্বশেষ প্রচলিত নীতিমালা অনুযায়ী আবেদনকারীকে সড়কের কাঁচা অংশে পিট খনন ও পাকা অংশে এইচ.ডি.ডি পদ্ধতিতে বোরিং এর অনুমতি দেওয়া যেতে পারে। COMPENSATION TO BE DEPOSITED. EARTHEN PART OPEN PIT, PAVEMENT PART HDD METHOD

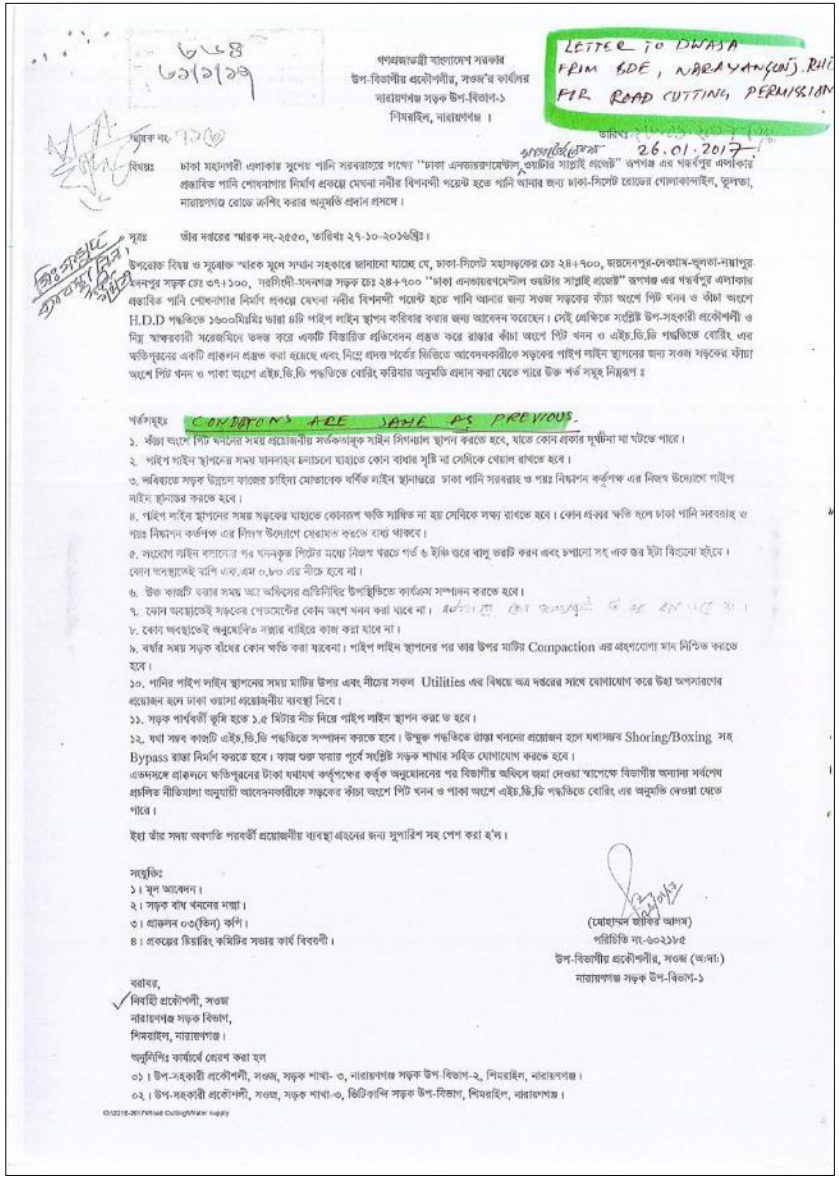
প্রস্তাবিত বিষয়ে সংশ্লিষ্ট উপ-বিভাগীয় প্রকৌশলী, সওজ, নারায়নগঞ্জ সড়ক উপ-বিভাগ-১ এর ১(এক)টি প্রতিবেদন এতদসংগে সংযুক্ত করত বিষয়টি তাঁর সদয় অবগতি এবং পরবর্তী প্রয়োজনীয় ব্যবস্থা গ্রহনের জন্য সুপারিশ সহ প্রেরন করা হল।

সংযুক্তিঃ
১। মূল আবেদন।
২। সড়ক বাঁধ খননের নক্সা।
৩। প্রাক্কলন ০২(দুই) কপি।
৪। প্রকল্পের স্টিয়ারিং কমিটির সভার কার্য বিবরণী।

(মুহাঃ আলিমুল হোসেন)
পরিচিতি নং-৬০১৯৭৭
নির্বাহী প্রকৌশলী, সওজ
সড়ক বিভাগ, নারায়ণগঞ্জ।

বরাবর,
তত্ত্বাবধায়ক প্রকৌশলী (সওজ),
ঢাকা সড়ক সার্কেল,
এলেনবাড়ী, ঢাকা।

অনুলিপি জ্ঞাতার্থেঃ
১। উপ-বিভাগীয় প্রকৌশলী (সওজ), নারায়নগঞ্জ সড়ক-বিভাগ-১, শিমরাইল, নারায়নগঞ্জ। ইহা তার কার্যালয়ের স্মারক নং-৭১(৩) তারিখঃ-২৬-০১-



LETTER TO DWASA FRIM SDE, NARAYANGONJ. RHI FOR ROAD CUTTING PERMISSION

৬১৫৪
৬১/১/১৭

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
উপ-বিভাগীয় প্রকৌশলীর, সওজ'র কার্যালয়
নারায়ণগঞ্জ সড়ক উপ-বিভাগ-১
শিমরাইল, নারায়ণগঞ্জ ।

স্মারক নং- ৭২৩

তারিখ: ২৬.০১.২০১৭

বিষয়ঃ ঢাকা মহানগরী এলাকায় সুপেয় পানি সরবরাহের লক্ষ্যে "ঢাকা এনভায়রনমেন্টাল ওয়াটার সাপ্লাই প্রজেক্ট" রূপগঞ্জ এর গন্ধর্বপুর এলাকায় প্রস্তাবিত পানি শোধনাগার নির্মাণ প্রকল্পে মেঘনা নদীর বিপনদী পয়েন্ট হতে পানি আনার জন্য সওজ সড়কের কাঁচা অংশে পিট খনন ও কাঁচা অংশে H.D.D পদ্ধতিতে নারায়ণগঞ্জ রোডে ক্রসিং করার অনুমতি প্রদান প্রসঙ্গে।

সূত্রঃ তাঁর দপ্তরের স্মারক নং-২৫৫০, তারিখঃ ২৭-১০-২০১৬খ্রিঃ।

উপরোক্ত বিষয় ও সূত্রোক্ত স্মারক মূলে সংশ্লিষ্ট সহকারে জানানো যাচ্ছে যে, ঢাকা-সিলেট মহাসড়কের চেঃ ২৪+৭০০, জয়দেবপুর-দেকাশ-ভুলতা-নয়াপুর বন্দরপুর সড়ক চেঃ ৩৭+১০০, নরসিংদী-মদনগঞ্জ সড়ক চেঃ ২৪+৭০০ "ঢাকা এনভায়রণমেন্টাল ওয়াটার সাপ্লাই প্রজেক্ট" রূপগঞ্জ এর গন্ধর্বপুর এলাকায় প্রস্তাবিত পানি শোধনাগার নির্মাণ প্রকল্পে মেঘনা নদীর বিপনদী পয়েন্ট হতে পানি আনার জন্য সওজ সড়কের কাঁচা অংশে পিট খনন ও কাঁচা অংশে H.D.D পদ্ধতিতে ১৬০০মিমিঃ ডায়া ৪টি পাইপ লাইন স্থাপন করিবার করার জন্য আবেদন করেছেন। সেই প্রেক্ষিতে সংশ্লিষ্ট উপ-সহকারী প্রকৌশলী ও নিম্ন স্বাক্ষরকারী সরেজমিনে তদন্ত করে একটি বিস্তারিত প্রতিবেদন প্রস্তুত করে রাস্তার কাঁচা অংশে পিট খনন ও এইচ.ডি.ডি পদ্ধতিতে বোরিং এর ক্ষতিপূরনের একটি প্রাক্কলন প্রস্তুত করা হয়েছে এবং নিম্নে প্রদত্ত শর্তের ভিত্তিতে আবেদনকারীকে সড়কের পাইপ লাইন স্থাপনের জন্য সওজ সড়কের কাঁচা অংশে পিট খনন ও পাকা অংশে এইচ.ডি.ডি পদ্ধতিতে বোরিং করিবার অনুমতি প্রদান করা যেতে পারে উক্ত শর্ত সমূহ নিম্নরূপ ঃ

শর্তসমূহঃ CONDITIONS ARE SAME AS PREVIOUS.

১. কাঁচা অংশে পিট খননের সময় প্রয়োজনীয় সর্তকতামূলক সাইন সিগন্যাল স্থাপন করতে হবে, যাতে কোন প্রকার দুর্ঘটনা না ঘটতে পারে।
২. পাইপ লাইন স্থাপনের সময় যানবাহন চলাচলে যাহাতে কোন বাধার সৃষ্টি না সেদিকে খেয়াল রাখতে হবে।
৩. ভবিষ্যতে সড়ক উন্নয়ন স্কীমের চাহিদা মোতাবেক বর্ণিত লাইন স্থানান্তরে ঢাকা পানি সরবরাহ ও পয়ঃ নিষ্কাশন কর্তৃপক্ষ এর নিজস্ব উদ্যোগে পাইপ লাইন স্থানান্তর করতে হবে।
৪. পাইপ লাইন স্থাপনের সময় সড়কের যাহাতে কোনরূপ ক্ষতি সাধিত না হয় সেদিকে লক্ষ্য রাখতে হবে। কোন প্রকার ক্ষতি হলে ঢাকা পানি সরবরাহ ও পয়ঃ নিষ্কাশন কর্তৃপক্ষ এর নিজস্ব উদ্যোগে মেরামত করতে বাধ্য থাকবে।
৫. সংযোগ লাইন বসানোর পর খননকৃত পিটের মধ্যে নিজস্ব খরচে পর্ত ৬ ইঞ্চি স্তরে বালু ভরাট করন এবং চাপানো সহ পাকা স্তর ইটা বিছানো হইবে। কোন অবস্থাতেই বালি এবং এম ০.৮০ এর নীচে হবে না।
৬. উক্ত কাজটি করার সময় ডাং অফিসের প্রতিনিধির উপস্থিতিতে কার্যক্রম সম্পাদন করতে হবে।
৭. কোন অবস্থাতেই সড়কের পেভমেন্টের কোন অংশ খনন করা যাবে না। [illegible]
৮. কোন অবস্থাতেই অনুমোদিত নক্সার বাহিরে কাজ করা যাবে না।
৯. বর্ষার সময় সড়ক বাঁধের কোন ক্ষতি করা যাবেনা। পাইপ লাইন স্থাপনের পর তার উপর মাটির Compaction এর গ্রহণযোগ্য মান নিশ্চিত করতে হবে।
১০. পানির পাইপ লাইন স্থাপনের সময় মাটির উপর এবং নীচের সকল Utilities এর বিষয়ে অত্র দপ্তরের সাথে যোগাযোগ করে উহা অপসারণের প্রয়োজন হলে ঢাকা ওয়াসা প্রয়োজনীয় ব্যবস্থা নিবে।
১১. সড়ক পার্শ্ববর্তী ভূমি হতে ১.৫ মিটার নীচ দিয়ে পাইপ লাইন স্থাপন করতে হবে।
১২. যথা সম্ভব কাজটি এইচ.ডি.ডি পদ্ধতিতে সম্পাদন করতে হবে। উন্মুক্ত পদ্ধতিতে রাস্তা খননের প্রয়োজন হলে যথাসম্ভব Shoring/Boxing সহ Bypass রাস্তা নির্মাণ করতে হবে। কাজ শুরু করার পূর্বে সংশ্লিষ্ট সড়ক শাখার সহিত যোগাযোগ করতে হবে।

এতদসঙ্গে প্রাক্কলনে ক্ষতিপূরনের টাকা যথাযথ কর্তৃপক্ষের কর্তৃক অনুমোদনের পর বিভাগীয় অফিসে জমা দেওয়া স্বাপেক্ষে বিভাগীয় অন্যান্য সর্বশেষ প্রচলিত নীতিমালা অনুযায়ী আবেদনকারীকে সড়কের কাঁচা অংশে পিট খনন ও পাকা অংশে এইচ.ডি.ডি পদ্ধতিতে বোরিং এর অনুমতি দেওয়া যেতে পারে।

ইহা তাঁর সদয় অবগতি পরবর্তী প্রয়োজনীয় ব্যবস্থা গ্রহনের জন্য সুপারিশ সহ পেশ করা হ'ল।

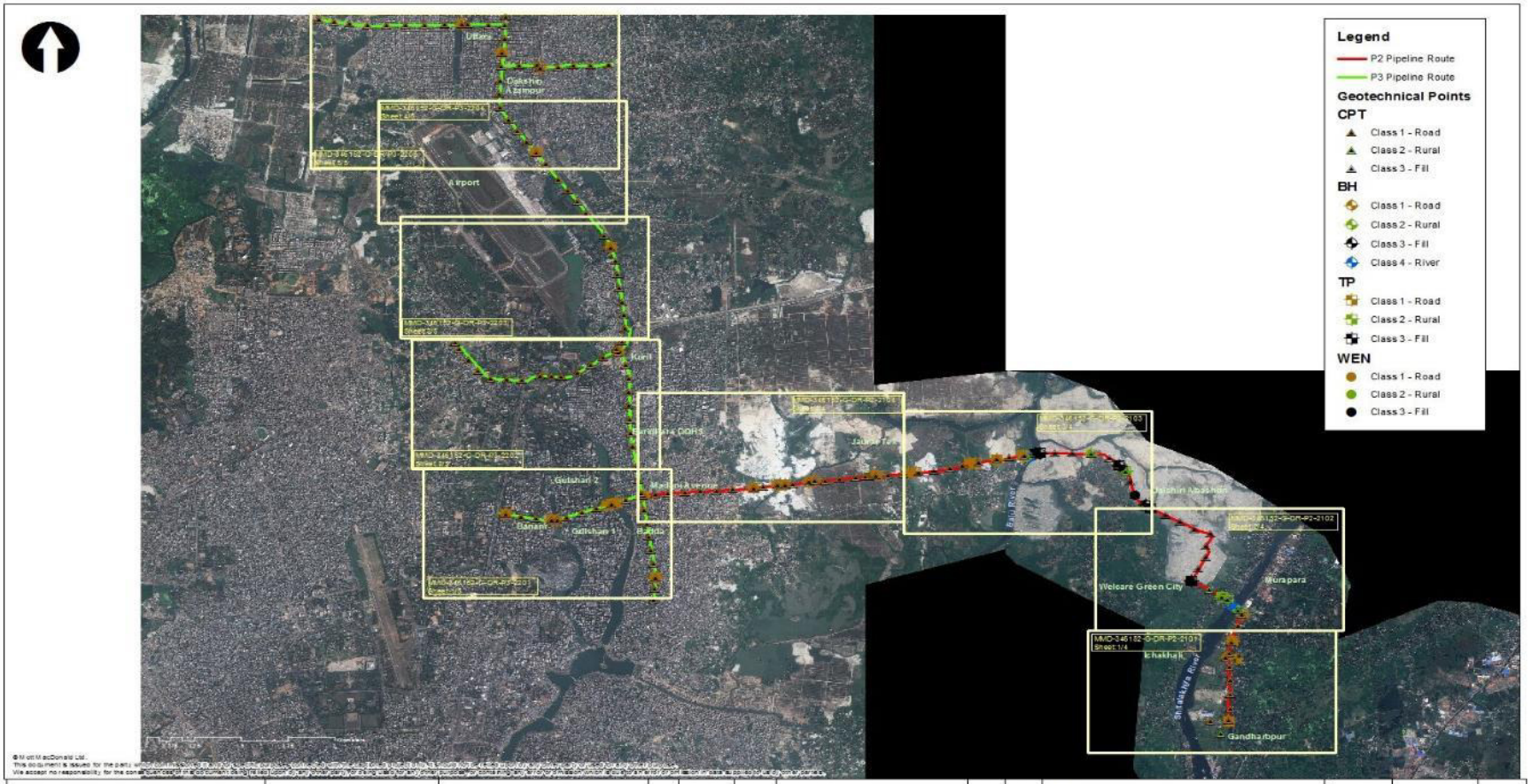
সংযুক্তিঃ
১। মূল আবেদন।
২। সড়ক বাধ খননের নক্সা।
৩। প্রাক্কলন ০৩(তিন) কপি।
৪। প্রকল্পের ডিজাইন কমিটির সভার কার্য বিবরণী।

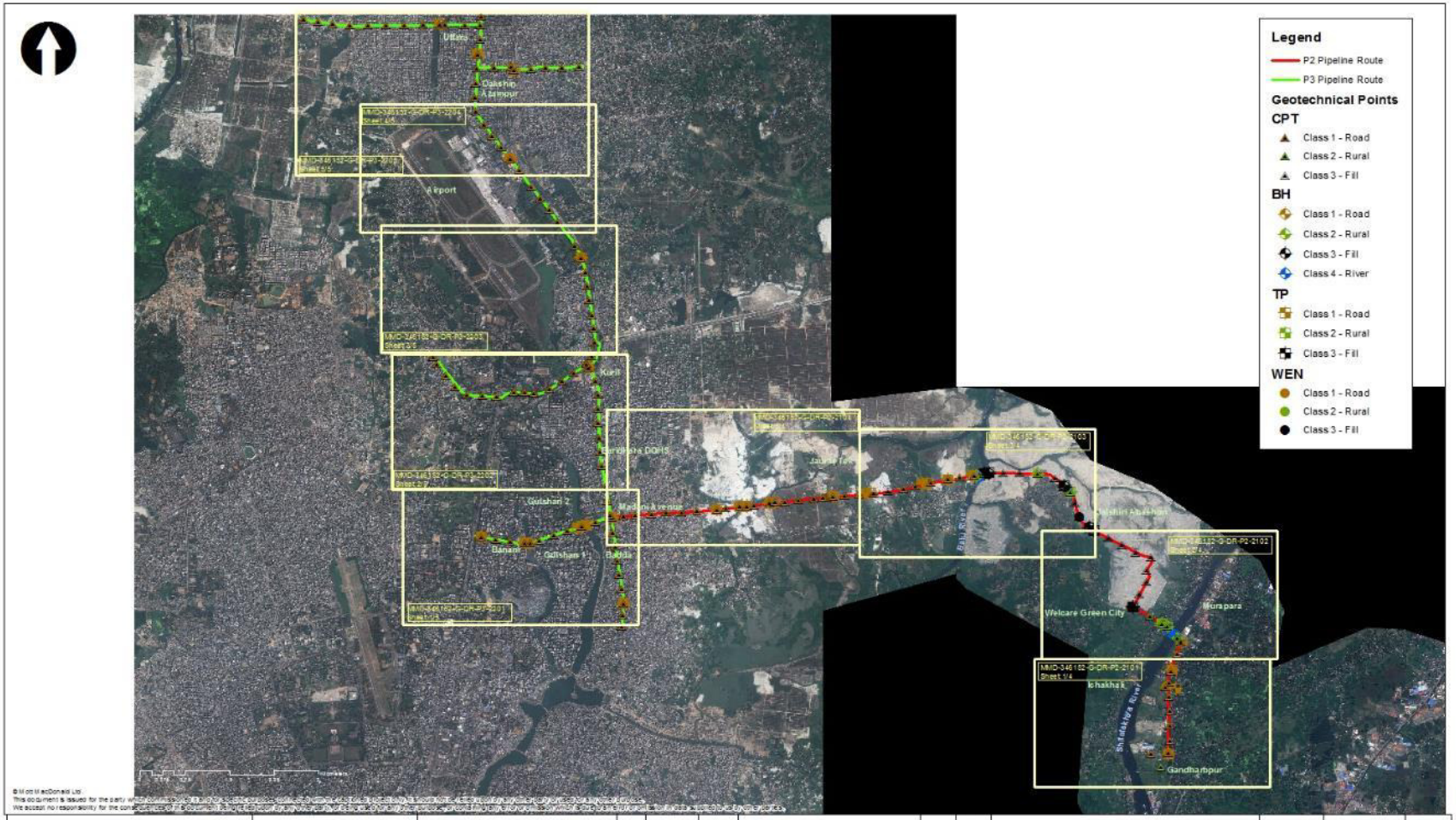
(মোহাম্মদ আকির আলম)
পরিচিতি নং-৬০২১৮৫
উপ-বিভাগীয় প্রকৌশলীর, সওজ (অঃদাঃ)
নারায়ণগঞ্জ সড়ক উপ-বিভাগ-১

বরাবর,
নির্বাহী প্রকৌশলী, সওজ
নারায়ণগঞ্জ সড়ক বিভাগ,
শিমরাইল, নারায়ণগঞ্জ।

অনুলিপিঃ কার্যার্থে প্রেরণ করা হল
০১। উপ-সহকারী প্রকৌশলী, সওজ, সড়ক শাখা- ৩, নারায়ণগঞ্জ সড়ক উপ-বিভাগ-২, শিমরাইল, নারায়ণগঞ্জ।
০২। উপ-সহকারী প্রকৌশলী, সওজ, সড়ক শাখা-৩, ডিটিকালি সড়ক উপ-বিভাগ, শিমরাইল, নারায়ণগঞ্জ।

Appendix-6: Geotechnical Investigation Maps





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Dhaka Environmentally Sustainable Water Supply Project (DESWSP) - Subsoil Investigation
ICB-05/B&D/DESWSP/2016

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	28/9/16	A.K.A	Issued with first revision	M.M.	N.O.
P2	23/4/17	A.K.A	Issued with second revision	M.M.	N.O.

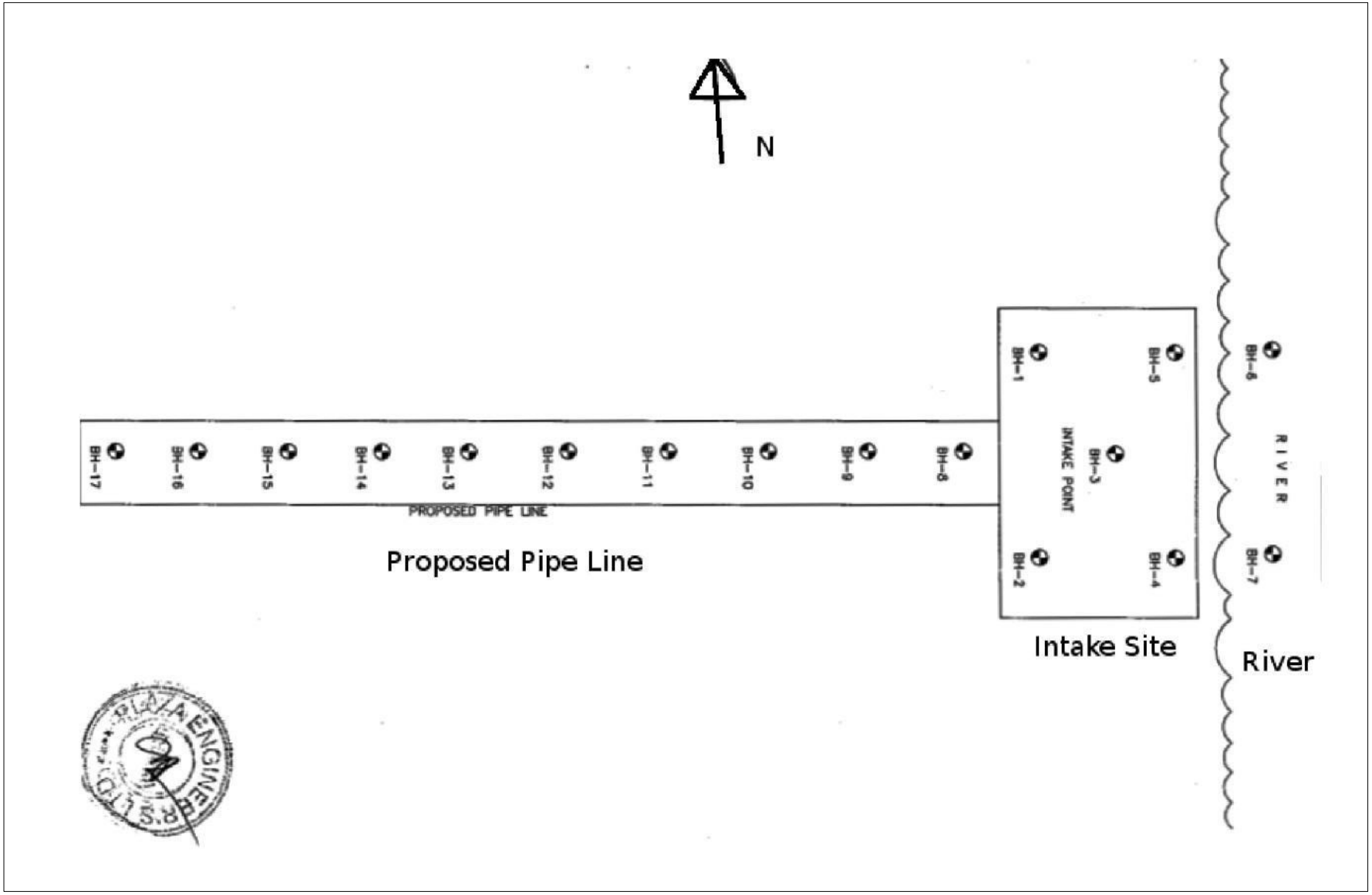
Title: Overall Pipe Route Layout and Geotechnical Test Locations

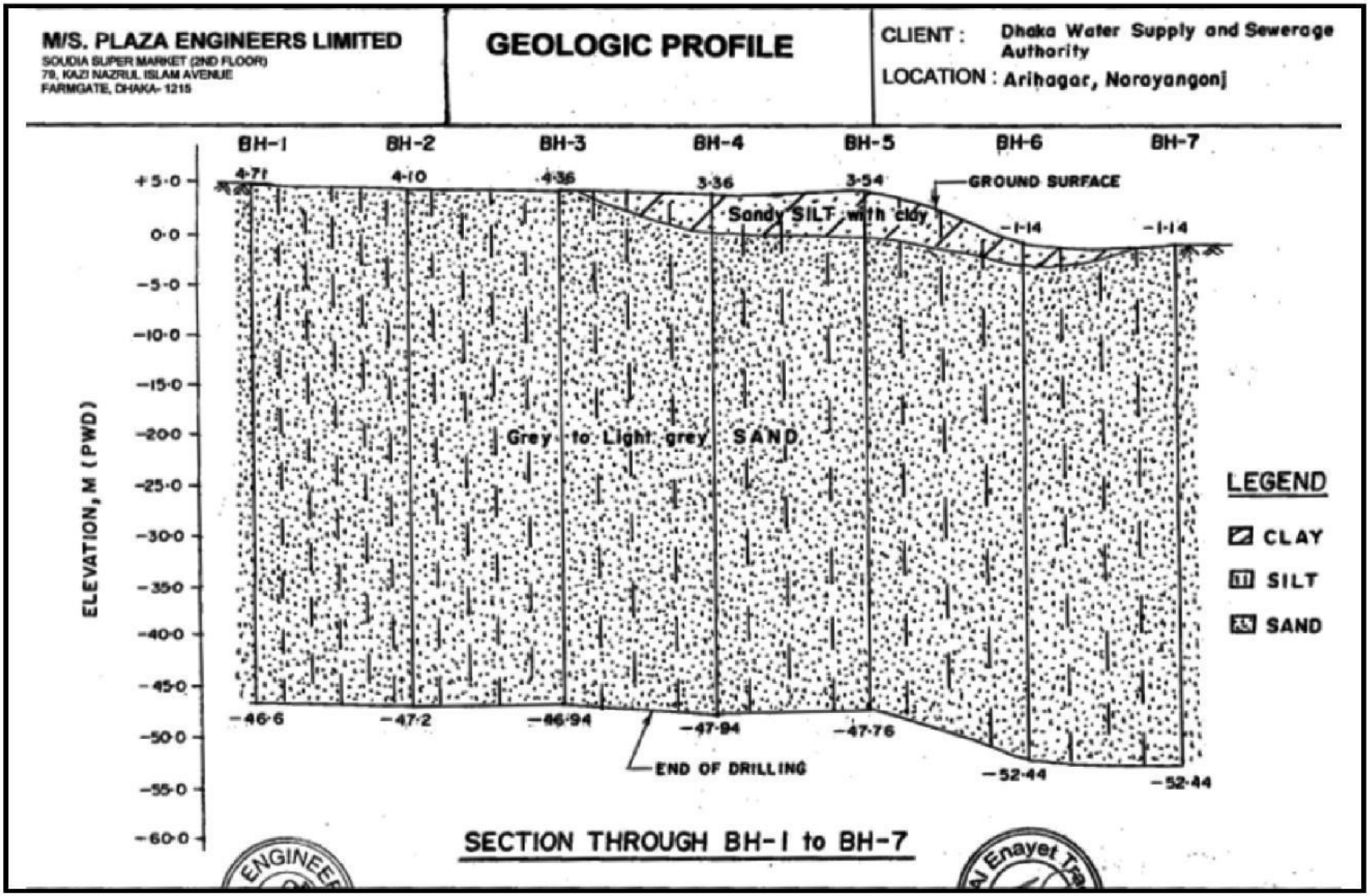
Drawn	A K Ankur
Checked	M Mackenbach
Approved	N A Osmaston
Scale at A3	1:60,000

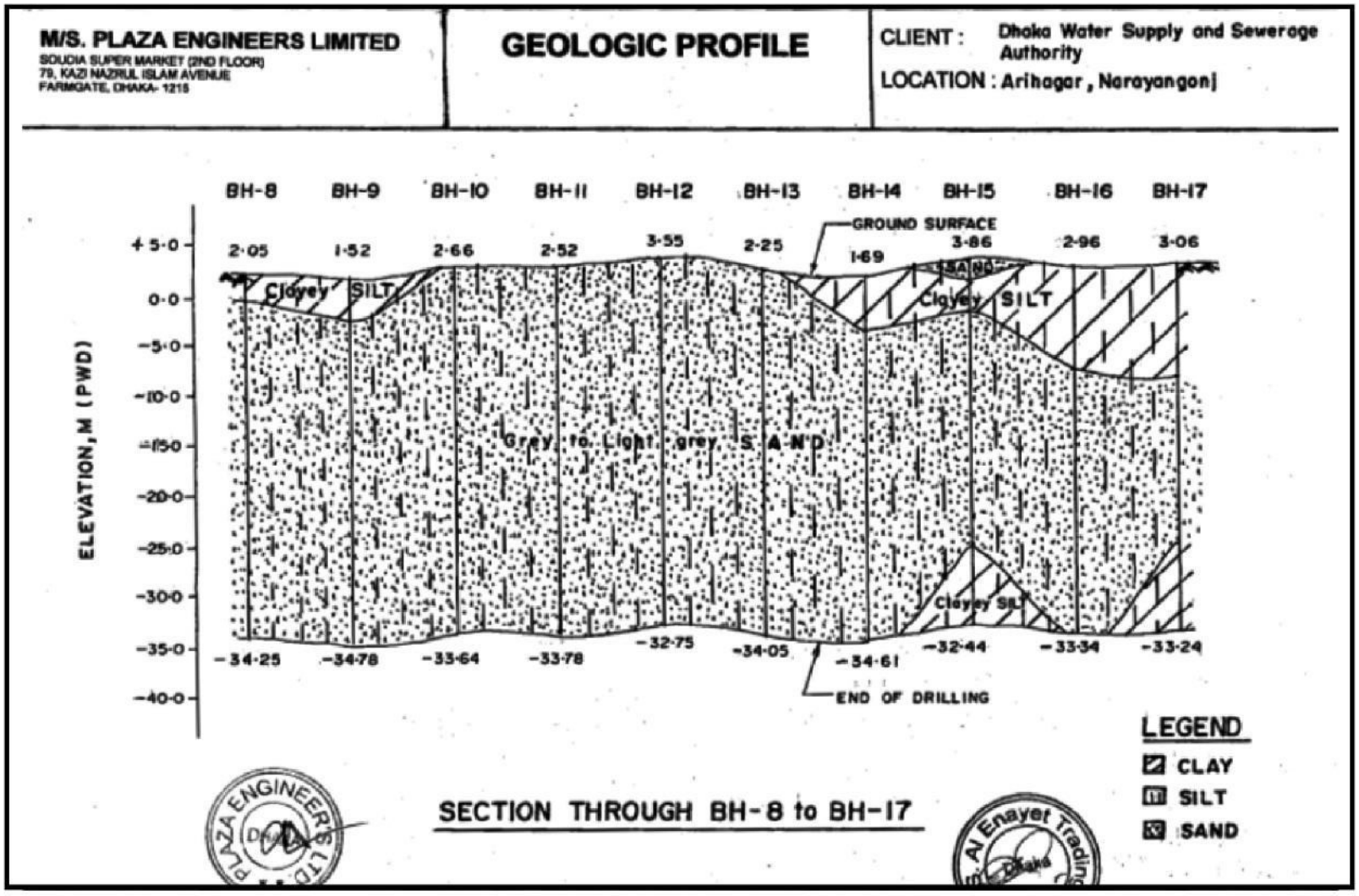
Drawing Number	Sheet	Security	Status	Rev
MMD-346152-G-DR-PX-2300	1/1	STD	PRE	P2

E:\DESWSP\Geotechnical Investigation\Geotech Bid Doc DESWSP\old GIS files\draft shp_\A3- PX Whole.mxd

Appendix-7: Geologic Profile




M/S. PLAZA ENGINEERS LIMITED
SOUDIA SUPER MARKET (2ND FLOOR)
79, KAZI NAZRUL ISLAM AVENUE
FARMGATE, DHAKA- 1215
GEOLOGIC PROFILE
CLIENT : Dhaka Water Supply and Sewerage Authority
LOCATION : Arihagar, Narayangonj
BH-1
BH-2
BH-3
BH-4
BH-5
BH-6
BH-7
4·71
4·10
4·36
3·36
3·54
GROUND SURFACE
Sandy SILT with clay
-1·14
-1·14
+5·0
0·0
-5·0
-10·0
-15·0
-20·0
-25·0
-30·0
-35·0
-40·0
-45·0
-50·0
-55·0
-60·0
ELEVATION, M (PWD)
Grey to Light grey SAND
-46·6
-47·2
-46·94
-47·94
-47·76
-52·44
-52·44
END OF DRILLING
LEGEND
CLAY
SILT
SAND
SECTION THROUGH BH-1 to BH-7


M/S. PLAZA ENGINEERS LIMITED
SOUDIA SUPER MARKET (2ND FLOOR)
79, KAZI NAZRUL ISLAM AVENUE
FARMGATE, DHAKA- 1215
GEOLOGIC PROFILE
CLIENT : Dhaka Water Supply and Sewerage Authority
LOCATION : Arihagar, Narayangonj
BH-8 BH-9 BH-10 BH-11 BH-12 BH-13 BH-14 BH-15 BH-16 BH-17
GROUND SURFACE
2·05 1·52 2·66 2·52 3·55 2·25 1·69 3·86 2·96 3·06
ELEVATION, M (PWD)
+5·0
0·0
-5·0
-10·0
-15·0
-20·0
-25·0
-30·0
-35·0
-40·0
Clayey SILT
Grey to Light grey SAND
Clayey SILT
Clayey SILT
-34·25 -34·78 -33·64 -33·78 -32·75 -34·05 -34·61 -32·44 -33·34 -33·24
END OF DRILLING
LEGEND
CLAY
SILT
SAND
SECTION THROUGH BH-8 to BH-17

Appendix-8 Environmental Quality Test Parameters

Ambient Air quality testing report

Enviro Consultants Ltd.
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EQRL/Ambient Air/1680/2017

Enviro Quality Laboratory

Test Results of Ambient Air Quality Analysis

Name of the Project	:	Dhaka Environmentally Sustainable Water Supply Project (DESWSP)
Address of the Office	:	Dhaka WASA Bhaban, Kawran Bazar, Tejgaon, Dhaka-1215
Location of Project Sites	:	Chaitankanda, Shejan Point, Gandhabpur, Murapara, Gulshan & Uttara.
Description of Sample	:	Samples were collected from selected locations.
Sample Collector	:	Collected by ECL Personnel
Sampling Date	:	27th – 31st August, 2017
Date of Analysis	:	28th August – 5th September 2017
Reporting Date	:	7th September, 2017

Description of Analysis:

S.N	Locations	Concentration						
		SPM µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	SO_2 µg/m³	NO_X µg/m³	O_3 µg/m³	CO ppm
01	Chaitankanda	111.17	22.21	56.81	< LOD	9.22	34.93	Nil
02	Shejan Point	567.50	56.32	168.18	6.92	89.64	7.46	Nil
03	Gandhabpur	109.46	19.85	43.40	< LOD	32.92	< LOD	Nil
04	Murapara,	156.40	23.87	51.37	< LOD	17.25	< LOD	Nil
05	Gulshan	272.98	27.63	61.37	< LOD	29.66	5.05	Nil
06	Uttara	272.93	32.11	77.55	< LOD	64.55	5.28	Nil
Duration (hrs)		8	24	24	24	24	8	1
DoE Standard		200	65	150	365	100	157	40
Method of Analysis		Gravimetric	Gravi-metric	Gravime-tric	West Geake	Jacob & Hochheiser	Photomet-ric	Digital Meter

Note:

- *There is no rain during monitoring but before 24hr. there was rain*
- *Regular checkup and calibration of the equipment are done by the manufacturers and ECL personnel to avoid any error*
- *The LOD of SO_2 & O_3 is 5 µg/m³*

7/09/2017

Gabriel Ripon Peris
Senoir Chemist

Ambient Noise level testing report

Enviro Consultants Ltd.

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EQRL/Noise Level/1683/2017

Enviro Quality Laboratory

Results of Ambient Noise Level Measurement and Analysis

Name of the Project	:	Dhaka Environmentally Sustainable Water Supply Project (DESWSP)
Address of the Office	:	Dhaka WASA Bhaban, Kawran Bazar, Tejgaon, Dhaka-1215
Location of Project Sites	:	Chaitankanda, Shejan Point, Gandhabpur, Murapara, Gulshan & Uttara
Description of Noise Data	:	Data were collected from the Selected Locations of the Project Area
Data Collector	:	Collected by ECL Personnel
Data Collection Date	:	28th August – 5th September, 2017
Date of Analysis	:	9th September, 2017
Reporting Date	:	16th September, 2017

Description of Analysis

SN	Location	Result in dB - A		DoE (Bangladesh) Noise Standard for Mixed Area (Schedule-1), Leq	
		Leq		Day Time (6 AM-9 PM)	Night Time (9 PM- 6 AM)
		Day	Night		
01	Chaitankanda	68.76	65.52	60	50
02	Shejan Point	72.00	68.84	60	50
03	Gandhabpur	73.41	68.91	60	50
04	Murapara	71.72	66.61	60	50
05	Gulshan	79.66	75.18	60	50
06	Uttara	87.22	75.89	60	50
Method/Instrument				Sound Level Meter Model: SL – 4033SD	

16/09/2017

Gabriel Ripon Peris
Senior Chemist

Surface water quality testing report

Enviro Consultants Ltd.

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EQRL/Surface Water/1682/2017

Enviro Quality Laboratory

Test Results of Surface Water Quality Analysis

Name of the Project : Dhaka Environmentally Sustainable Water Supply Project (DESWSP)
Address of the Office : Dhaka WASA Bhaban, Kawran Bazar, Tejgaon, Dhaka-1215
Location of Project Sites : Chaitankanda, Shejan Point, Gandhabpur, Murapara, Gulshan & Uttara.
Description of Sample : Sample was collected from Rivers and Ponds of the Project Area.
Sample Collector : Collected by ECL's Personnel
Sampling Date : 27th – 31st August, 2017
Date of Analysis : 27th August – 5th September , 2017
Reporting Date : 10th September, 2017

Description of Analysis

S.N	Locations	Concentration						
		pH	DO mg/l	BOD_5 mg/l	COD mg/l	TDS mg/l	EC µS/cm	TSS mg/l
01	Chaitankanda (Meghna River)	7.5	6.5	3.7	16	36	72	49
02	Shejan Point (Canal)	7.5	0.6	33	112	342	669	120
03	Gandhabpur (Shitalakshya River)	7.7	6.4	7.6	32	130	261	68
04	Murapara (Shitalakshya River)	7.7	6.0	7.8	48	135	264	50
05	Gulshan (Pond)	8.1	5.8	14.1	73.5	87	170	31
06	Uttara (Turag River)	7.5	4.7	11.7	48	77	152	62
Bangladesh (DoE) Standard for Surface Water (Schedule- 3-A)		6.5 – 8.5	≥5	≤10	NYS	NYS	2250	NYS

Note:
NYS - Not Yet Set

10/09/2017
Gabriel Ripon Peris
(Senior Chemist)

Ground water quality testing report

Enviro Consultants Ltd.

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EQRL/Ground Water/1681/2017

Enviro Quality Laboratory

Test Results of Ground Water Quality Analysis

Name of the Project : Dhaka Environmentally Sustainable Water Supply Project (DESWSP)
Address of the Office : Dhaka WASA Bhaban, Kawran Bazar, Tejgaon, Dhaka-1215

Location of Project Sites : Chaitankanda, Shejan Point, Gandhabpur, Murapara, Gulshan & Uttara.
Description of Sample : Sample was collected from a Handheld Tube Wells and Taps
Sample Collector : Collected by ECL's Personnel
Sampling Date : 27th – 31st August, 2017
Date of Analysis : 28th August– 5th September, 2017
Reporting Date : 6th September, 2017

Description of Analysis

S.N	Locations	Concentration						
		pH	DO mg/l	COD mg/l	TDS mg/l	EC µS/cm	Fe mg/l	As mg/l
01	Chaitankanda (HHTW)	7.9	5.5	< LOD	550	1104	1.42	< LOD
02	Shejan Point (HHTW)	7.7	5.8	< LOD	403	791	< LOD	< LOD
03	Gandhabpur (HHTW)	7.6	6.1	< LOD	528	1004	0.015	< LOD
04	Murapara (HHTW)	7.4	6.3	< LOD	588	1133	< LOD	< LOD
05	Gulshan (TW)	7.8	6.0	< LOD	155	292	< LOD	< LOD
06	Uttara (TW)	7.5	6.7	< LOD	167	329	< LOD	< LOD
Bangladesh (DoE) Standard for Ground Water (Schedule-3-B)		6.5 – 8.5	6	4	1000	NYS	0.3-1	0.05

Note:
NYS - Not Yet Set
LOD - 0.01 mg/L for Iron, 0.001 mg/L for Arsenic, 10 mg/L for COD
HHTW - Hand Held Tube Well
TW - Tap Water

6/09/2017
Gabriel Ripon Peris
(Senior Chemist)

Appendix-9 Weekly, Monthly and Quarterly Water Quality Reports

Monthly Water Quality Parameters at Chaitankanda Intake points (Bisnandi)

Sampling Month	Sampling Week	Date & Time	Depth (m)	Arsenic (mg/L)	Aluminum (mg/L)	Iron (mg/L)	Manganese (mg/L)	TDS (mg/L)	Algae (µg/L)
Bangladesh Standard (SW, RCR 1997)				**0.2**	**-**	**2**	**5**	**2100**	**-**
Bangladesh Standard (DW, ECR 1997)				**0.05**	**0.2**	**0.3-1**	**0.1**	**1000**	**-**
1st	4th	08-03 14 & 1-30 pm	9	0.002	0.315	<0.09	<0.05	65	208
2nd	8th	05-04-14 & 9-00 am	9	0.003	0.291	<0.09	<0.05	74	590
3rd	9th	12-4-14 & 12.20 pm	9.1	_	_	_	_	_	1087
	10th	19-4-14 & 12.10 pm	9.2	_	_	_	_	_	973
	12th	26-4-14 & 12.10 pm	8.0	_	_	_	_	_	1181
	13th	10-05-14 &12-10 pm	7.5	0.002	0.28	<0.09	<0.05	81	_
4th	17th	07-06-14 & 3-45 pm	8	0.004	0.298	0.68	<0.05	41	_
5th	21st	5-07-14 & 1.20 pm	7	0.002	0.278	0.3	<0.05	26	-
6th	23rd	19-7-2014 & 9.01am	6.5	0.001	0.27	0.22	<0.05	25	_
7th	30th	05-09-14 &11.15 am	7.5	0.002	0.269	1	<0.05	24	_
8th	35th	11-10-14 & 11.48 am	7.5	0.001	0.24	0.53	<0.05	30	_
9th	38th	01-11-14 & 02.05 pm	7.5	0.002	0.269	1	<0.05	24	_
10th	41st	22-11-14 & 12.10 pm	7	_	_	_	_	_	389
	42nd	29-11-14 & 12.40 pm	6.5	0.001	0.15	0.5	0.2	46.6	_
	43rd	06-12-14 & 11.30 am	7.75	_	_	_	_	_	423
11th	45th	20-12-14 & 3.10 pm	7	_	_	_	_	_	396
	47th	03-01-15 & 2.15 pm	6.5	0.001	0.15	0.34	<LOQ	52.5	409
12th	49th	24-01-15 & 11.35 am	6.75	0.001	0.15	0.41	0.05	50.7	644
	51st	07-02-15 & 11.35 am	7.5	_	_	_	_	_	456
13th	54th	9-05-15 & 12.10 pm	7	0.001	0.23	0.54	0.08	40	_
14th	56th	23-05-15 & 12.30pm	7.5	_	_	_	_	_	416
	57th	13-06-15 & 12.30pm	8	0.002	0.27	0.32	<0.05	62	_

Quarterly Water Quality Monitoring at Chaitankanda

Parameter	Unit	Bangladesh Standard (DW, ECR 1997)	Bangladesh Standard (SW, ECR 1997)	1st Quarter test result	2nd Quarter test result	3rd Quarter test result	4th Quarter test result
Barium	mg/l	0.01	-	0.045	0.041	0.038	0.087
Cadmium	mg/l	0.005	0.50	0.0008	0.0005	<0.00015	<0.00015
Chloride	mg/l	150-600	600	16	70	6	7
Chromium	mg/l	0.05	0.50	0.009	0.007	0.001	0.001
Fecal Coliform	cfu	0 no. / 100mL	-	850	460	290	210
BOD	mg/l	0.2	50	10	8	4	3.19
COD	mg/l	4.0	200	28	24	20	22
Lead	mg/l	0.05	0.1	<0.002	<0.002	<0.002	<0.002
Mercury	mg/l	0.001	0.01	<0.002	<0.00015	<0.00015	<0.00015
Nitrite	mg/l	<1.0	-	0.04	0.06	0.06	0.04
Nitrate	mg/l	10	10	2.1	1.71	1.1	1
Phosphate	mg/l	6.0	-	0.38	<0.12	0.13	0.2
TOC	mg/l	-	-	2.1	1.93	1.81	1.15
Oil & Grease	mg/l	0.01	10	0.31	0.23	0.19	0.15
Fluride	mg/l	1.0	2.0	<0.10	<0.10	<0.10	<0.10
Selinium	mg/l	0.01	0.05	<0.002	<0.002	<0.002	<0.002
Zinc	mg/l	5.0	5.0	<0.08	<0.08	<0.08	<0.08
Sulphate	mg/l	400	-	5	3	3	5
Copper	mg/l	1.0	0.05	<0.26	<0.26	<0.26	<0.26
Ammonia	mg/l	0.50	5.0	<0.10	0.21	0.3	0.39
Boron	mg/l	1.0	2.0	<0.20	<0.20	<0.20	<0.20
Nickel	mg/l	0.10	1.0	0.013	0.015	0.11	0.1
Sodium	mg/l	200	-	21	18	20	25
α-BHC	mg/l	-	-	Not Detected	Not Detected	-	-
γ-BHC	mg/l	-	-	Not Detected	Not Detected	-	-

Parameter	Unit	Bangladesh Standard (DW, ECR 1997)	Bangladesh Standard (SW, ECR 1997)	1st Quarter test result	2nd Quarter test result	3rd Quarter test result	4th Quarter test result
β-BHC	mg/l	-	-	Not Detected	Not Detected	-	-
Heptachlor	mg/l	-	-	Not Detected	Not Detected	-	-
Aldrin	mg/l	-	-	Not Detected	Not Detected	-	-
Hepatachloro Epoxide Isomer	mg/l	-	-	Not Detected	Not Detected	-	-
Dieldrin	mg/l	-	-	Not Detected	Not Detected	-	-
4,4 -DDE	mg/l	-	-	Not Detected	Not Detected	-	-
Endrin	mg/l	-	-	Not Detected	Not Detected	-	-
2,4 -DDT	mg/l	-	-	Not Detected	Not Detected	-	-
4,4 DDT	mg/l	-	-	Not Detected	Not Detected	-	-
4,4 DDD	mg/l	-	-	Not Detected	Not Detected	-	-
2,4 DDT	mg/l	-	-	Not Detected	Not Detected	-	-

Appendix-10: UK River Abstraction Analysis Report

Table 1 River water reach types based on Holmes et al. (1998), who classified UK rivers on the basis of macrophytic plant communities found during site surveys at over 1500 sites, together with their trophic status, geology, sediment and flow type.

Type A (A1 to A4)		Type B (B1 and B2)		Type C (C1 and C2)		Type D (D1 and D2)	
Alluvium/clay and/or Chalk; low altitude; low slope; eutrophic; silt/clay-gravel bed; smooth flow; predominantly C and SE England		Hard limestone and sandstone low-medium altitude; low-medium slope; mesotrophic?; gravel-boulder (predominantly pebble-cobble), mostly smooth flow, small turbulent areas SW, NW, NE England, E Scotland, C and S Wales		Non-calcareous shales, hard limestone and sandstone; medium altitude; medium slope; oligo-meso-trophic; pebble, cobble, boulder bed, smooth flow with abundant riffles and rapids; SW, NE England, Lake District, W Wales, Southern Uplands, Grampians		Granites and other hard rocks; low and high altitudes; gentle and steep slopes; ultraoligo – oligotrophic; cobble, boulder, bedrock, pebble; smooth with turbulent areas – torrential; C, N and W Scotland, scattered in W Wales, SW, NW and S England	
Type A1 Lowest gradients (0.8 ± 0.4 m/km) and altitudes (36 ± 25 m); predominantly clay; SE England and East Anglia & Cheshire plain	Type A2 (hw and ds) Slightly steeper (1.7 ± 0.8 m/km); low altitude (55 ± 38 m); Chalk catchments; predominantly gravel beds base-rich	Type B1 Gradient: 4.1 ± 9.9 m/km; altitude: 93 ± 69 m; hard sandstone, calcareous shales; predominantly S. & SW England and SW Wales	Type B2 Shallower than B1 (2.7 ± 10.7 m/km); altitude: 71 ± 58 m; predominantly NW England, E Scotland	Type C1 Gradient: 5.4 ± 6.5 m/km; altitude: 101 ± 84 m; hard limestone; more silt and sand than C2; mesotrophic	Type C2 Steeper than C1 (7.3 ± 10.8 m/km); altitude: 130 ± 90 m; non-calcareous shales; pebble-bedrock; oligo-mesotrophic	Type D1 Medium gradient (11.3 ± 15.6 m/km); low altitude (93 ± 92 m), oligotrophic, substrate finer than D2 (incl. silt & sand); more slow flow areas than D2	Type D2 High gradient (25.5 ± 33 m/km); high altitude (178 ± 131 m); stream order 1 & 2 bed rock and boulder; ultra-oligo trophic torrential
Example rivers where water body types (river reaches) can be found:							
Wissey, Lark, Nar, Wensum, Bure, (lowland reaches only) Welland, Cherwell, Tame, Evenlode	Test, Piddle, Frome, Itchen, Mimram, Hull, headwaters of East Anglian rivers listed on left	Tamar, Torridge, Exe, Teifi, Monnow, Lugg, Dove	Ribble, Wharfe, Eden, Tweed, Lunan, Ythan	Scattered	Lower Findhorn, Spey, Dee, Esk, Ure, Derwent, Conwy, Dee, Cothi, Barle	English lowland acid heaths (New Forest), Scottish Flow Country, Western Isles	Dartmoor, Exmoor, Brecon Beacons, Snowdonia, Pennines, Cairngorms, NW Highlands

Table 3 Summary of thresholds defined by river scientists for UK river types for achieving GES. For macrophytes and macro-invertebrates, the thresholds are given as % allowable abstraction of natural flow (thresholds are for annual flow statistics); for fish the thresholds are given as % allowable abstraction of natural flow exceeding Q_{95} i.e. % of residual flow (natural flow minus Q_{95}).

	Macrophytes:		Macro-invertebrates:		Fish:	
	% flow	Period	% flow	Period	% (flow – Q_{95})	Period
A1	10	Mar.–May	30	All year	50	Jul.–Apr. HOF Q_{98}
	20	Jun.–Feb.			20	May–Jun. HOF Q_{98}
A2	10	Mar.–May	10	All year	20	All year 10% flow < Q_{95} 5% flow < Q_{99}
	20	Jun.–Feb.				
B1	10	Mar.–May	10	All year	50	Rheophilic cyprinids Jul.–Jan. 25% flow < Q_{90} 20% flow < Q_{99} HOF Q_{99}
	20	Jun.–Feb.				
B2	20	All year	20	All year		
C1	20	All year	20	All year	50	Feb.–Jun. HOF Q_{90}
C2	10	Mar.–May	10	All year	50	Adult salmonids All year HOF Q_{95}
	20	Jun.–Feb.				
D1	10	Mar.–May	20	All year		
	20	Jun.–Feb.				
D2	10	Mar.–May	10	All year		Salmonid spawning and nursery
	20	Jun.–Feb.			20	May–Sep. HOF Q_{95}
					20	Oct.–Apr. HOF Q_{80}
	HOF Q_{97} Mar.–May			HOF flow Q_{97} All year		

Appendix-11 Checklist of safety measures during construction

ANNEX 6: PRECAUTIONS FOR PROTECTION OF ENVIRONMENTAL RESOURCES

1. The Contractor shall ensure that construction activities do not result in any contamination of land or water by polluting substances.

2. Unless otherwise provided in the specifications, the Contractor shall ensure that no trees or shrubs or waterside vegetation are cut or harmed except those required to be cleared for execution of the works. The Contractor shall protect trees and vegetation from damage to the satisfaction of the Engineer.

3. The Contractor shall not use or permit the use of wood as a fuel for the execution of any part of the works and to the extent practicable, shall ensure that fuels other than wood are used for cooking and heating in all camps and living accommodations. Any wood so used must be harvested legally, and the Contractor shall provide the Engineer with copies of the relevant permits, if required.

4. The Contractor shall consult with local residents and local government before locating project offices, sheds, and construction plant. The work camps shall not be located near settlements, near drinking water supply intakes, protected areas, or wildlife habitats.

5. In the conduct of cleaning activities and operation of equipment, the Contractor will utilize such practicable methods and devices as are reasonably available to control, prevent and otherwise minimize air/noise pollution.

A. Noise and Air Pollution

1. All works will be carried out without unreasonable noise and air pollution. Subject and without prejudice to any other provision of the Contract and the law of the land and its obligation as applicable, the Contractor will take all precautions outlined in the EMP to avoid the air and noise pollution.

2. The Contractor shall monitor the environmental parameters periodically as specified in the monitoring plan and report to the Engineer.

3. The Contractor shall indemnify and keep indemnified the Employer from and against any liability for damages on account of noise or other disturbance created while carrying out the work, and from and against all claims, demands, proceedings, damages, costs, charges, and expenses, whatsoever, in regard or in relation to such liability.

B. Occupational Health and Safety During Construction

The Contractor shall, in accordance with the safety and health provisions specified in the EMP, provide workers with a safe and healthy working environment, in the work areas, through application of preventive and protective measures consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. The borrower/client will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by:

a) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances;
b) providing appropriate equipment to minimize risks and requiring and enforcing its use;
c) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment;
d) documenting and reporting occupational accidents, diseases, and incidents; and
e) having emergency prevention, preparedness, and response arrangements in place.

C. Post-Construction Clearance

1. On completion of work, wherever applicable, the Contractor shall clear away and remove from the sites all constructional plant, surplus materials, rubbish, scaffoldings, and temporary works of every kind and leave the whole of the sites and works in a clean condition. The handing over of the sites shall be done only after an inspection of the site and a written clearance by the Environmental specialist of the PMDSC.

2. Construction camp sites post construction shall be cleared as specified in the EMP and handed over to the Owner. It will be ensured by the contractor that the site handed over is in line with the conditions of temporary acquisition signed by both parties.

Appendix-12 Stakeholder and the participants list

Public Consultation Meeting at Different Locations

ATTENDANCE SHEET OF PUBLIC CONSULTATION MEETING
Initial Environmental Examination (IEE) Study of

Geotechnical Investigation Study of P2 Component of Dhaka Environmentally Sustainable Water Supply Project (DESWSP)

Venue : Gandharbpur, Rupgonj, Narayangonj

Date: 17.04.2017

SL No	Name	Address	Mobile no.	Profession/ Designation	Signature
1	Abdul Loff	Gondovpur		Farmer	[illegible]
2	Md. Mojammel Hoq	Gondovpur		Farmer	[illegible]
3	Md. Jasim uddin	DO		Busniss	[illegible]
4	Md. Alauddin	DO		Farmer	[illegible]
5	Md. Abul Hasem	DO		Farmer	[illegible]
6	Md. Abul Hasem	DO		Farmer	[illegible]
7	Md. Yeakub Ali	DO		Farmer.	[illegible]
8	Md. Kabir Hossain	DO		Farmer	[illegible]
9	Md. Anower Hossain	DO		Job	[illegible]
10	Md. Mahmudul Islam	PD, DESWSP.	DWASA	PD	[illegible]
11	Md. M.A Mannan	DO		(Rte)	[illegible]
12	Md. Abdul Hi	DO		Farmer	[illegible]
13	Md. Abdus Sattar	DO		Teacher	[illegible]
14	Md. Ebrahim	DO		Farmer	Ebrahim
15	Dr. J.C. Saha	Env. Expert MDSC		Env. Expt MDSC	[illegible]
16	Sujrot Ali	Gandorpur,		Farmer	[illegible]
17	Md. Ismail Hossain.	A.M. Rupgonj		JOB	[illegible]
18	Md. Rubel Alam	R.O Rupgonj		Job	Rubel
19	Md. Ramjan Hossain	Surveyor		Job	[illegible]
20	MD. SAIDUR RAHMAN	"		JOB	[illegible]
21	MD IBRAHIM	C.O Rupgo		JOB	[illegible]
22	Md. Monirul Is:	R.O		Job	[illegible]
23	Mahbuba Akter	CO		Job	[illegible]
24	Syeda Zahara	L.I.F		Job	[illegible]
25	Jisnu Sarker	S.R.V		Job	[illegible]

ATTENDANCE SHEET OF PUBLIC CONSULTATION MEETING
Initial Environmental Examination (IEE) Study of

Geotechnical Investigation Study of P3 Component of Dhaka Environmentally Sustainable Water Supply Project (DESWSP)

Venue : City Corporation Office Uttara, Sector 6

Date: 16.04.2017

SL No	Name	Address	Mobile no.	Profession	Signature
1	MD. AFSAR UDDIN KHAN	Uttara Commissiner	01715619261		[illegible]
2	MD. HEMAYET HOSSAIN	DNCC, Zone-1 CEO	01712-721475		[illegible]
3	MD. MIZANUR RAHMAN	XEN, DESWSP	[illegible]		[illegible]
4	Md. Enamul Kabir	XEN, Zone-1 DNCC	01711-341018		[illegible]
5	Md. Harunur Rashid	CE - MDSC	[illegible]		[illegible]
6	[illegible]	PD, DESWSP	01922198190		[illegible]
7	Md. [illegible]	S.A.E DESW	[illegible]		[illegible]
8	Md. Main Uddin	Work Assistant	01724-276777		[illegible]
9	Dr. J.C. Saha	Env. Expert MDSC	01713117822		[illegible]
10					
11					
12					
13					
14					
15					
16					
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25					

Venue: - [illegible], [illegible] ২৬/০৬/১৪.

(i) [illegible] - (01740925242) ([illegible])

(ii) [illegible] (01940708012)

(iii) মো: [illegible] (Agri)

(iv) মো: [illegible] "

(v) [illegible] "

(vi) [illegible] "

(vii) মো: [illegible] "

(viii) মো: [illegible] "

(x) মো: [illegible] "

(xi) মো: [illegible], ([illegible])

(xii) মো: [illegible] Agri

[illegible] - 01794126970

[illegible] - 01931194201

[illegible] - Agri

- মো: [illegible] "
- মো: [illegible] "
- [illegible] "
- মো: [illegible] "

নাম	পেশা	মোবাইল নম্বর	স্বাক্ষর
1. আব্দুল মজিদ	চেয়ারম্যান	01716127548	[signature]
2. [illegible] মিয়া	ওয়ার্ড সদস্য	01923000409	[signature]
3. তপন কুমার ঘোষ	"	01711-464882	[signature]
4. জামাল উদ্দিন মিয়া	"	01923302424	[signature]
5. ফাতেমা বেগম	"	01930518278	[signature]
6.			

Dhaka Environmentally Sustainable Water Supply Project (DESWSP)

Participant List for Focus Group Discussion/Public Consultation

Venue: Shamvupura, Bishnondi Date: 25-08-14

Sl. No.	Name	Resident Address	Sex	Occupation	Mobile Number	Signature
1	MD. Shaheen	Shamvupura	male	member	01728 160865	
2.	Kuddus	u	m	Business	01829215[illegible]	
3.	Miar Hosen	u	m	Agriculture	—	
4.	Omor Fawk	u	m	u	-	
5.	Abdul Bafor	u	m	u		
6.	JOJ Mia	u	m	u	0181812014[illegible]	
7.	Mohammad Ali	u	m	u	01836880362	MOHAMMAD
8.	Siddik	u	m	u		
9	Hosen Ali	u	m	u		HOSEN
10	Jalal Mia	u	m	u		
11	Nurul Amin	u	m	u	01835143852	
12	Md. Dilu	u	m	u		
13	Mahmud Ali	u	m	u		

SL.No	Name	Address	occupation	Mobile no.	signature
14.	saiful Islam	shamoupura	Business	01849955656	
15.	yasin Ali	u	Fisherman	01294031260	
16.	Ripon	u	Business	0	
17.	Amin Hosen	u	Agriculture		
18.	Johirul Islam	u	u	01814833124	
19.	shorif	u	Fisherman	01263660046	
20.	Sadu Mia	u	Driver		
21.	Anamul	u	Business	01850859938	

Venue: চরগান্ধর্বপুর, রূপগঞ্জ। ২৬/০৩/১৪

⇒ ১৯৮২ সালে এই চরের জমি DWASA অধিগ্রহণ করেছে নামমাত্র মূল্যে। এখানে প্রায় ৬৬০ একর জমির জন্য দিয়েছে মাত্র ২২ লক্ষ টাকা। বিঘা প্রতি জমির মূল্য নির্ধারণ করেছিল ২০০০/- টাকা। ঐ টাকা তুলতে আমাদের দালালদের টাকা দিতে হয়েছে। ঘুষ দিয়ে আবার টাকাও পায়নি। এখানে যে অঞ্চলের জন্য DWASA এবং WAPDA এর নিকট (৭ একর জমি) দিতে হয়েছে ৭ কোটি টাকা। আমরা কৃষক হতদরিদ্র, বাজারে নিঃস্ব হয়ে যাব যদি এখানে চাষাবাদ করতে না পারি, এখানকার কৃষকদের প্রাণের দাবি ক্ষতিপূরণ পাওয়া,

* এই চরের জমি এতটাই উর্বর যে এখানে সব ধরনের সবজি চাষ হয়, ধান হয়, পাট হয়। এখানকার অধিকাংশ লোক কৃষির উপর নির্ভরশীল। চাষাবাদ না করতে পারলে অনাহারে সর্বশান্ত হয়ে যাব,

* বর্তমানে এখানকার জমির বাজারমূল্য বিঘাপ্রতি ১ কোটি টাকা। যদি আমাদের ১/২ / ১/৩ ক্ষতিপূরণ দেয়া হয় তাহলে আমরা খুবই খুশি। অন্যথা সরকার যদি কোন কর্মসংস্থানের সুযোগ করে দেয় তাহলেও হয়। কিন্তু DWASA আমাদের সাথে কোন

আলোচনা না করেই এখানে wall তুলেছে। অবৈধ(?) দখল করেছে। আমরা কিছুই বলতে পারছি না। কিন্তু চুপ করে বসে থাকলে মনে হয় যে আমরা মেনে নিয়েছি। আমরা জনগণ সংগঠিত হয়ে নদী দখল(?) নিয়ে প্রতিবাদ করব, সময় হলেই দেখবেন।

* আমরা শুনেছি এরা(?) আমাদের সাথে সমঝোতা করে কাজ করবে। কিন্তু ওরা (DWASA) অন্য পথে যাচ্ছে, মানুষের দিকে কোন খেয়াল নেই। আমাদের প্রতিবাদে কোন ফল হবে? আমরা এই জমি থেকে এক বিন্দুও সরাতে(?) পারিনি(?)।

* এখানকার প্রায় 30% শিক্ষিত ছেলে, কিন্তু কর্মসংস্থানের সুযোগ করে এবং সমাধান(?) করতে(?)