Initial Environmental Examination

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Bangladesh: Khulna Water Supply Project (Phase 2)

PART A: Main Report

Prepared by Khulna Water Supply and Sewerage Authority, Ministry of Local Government and Rural Development and Cooperatives, Government of Bangladesh for the Asian Development Bank (ADB).

CURRENCY EQUIVALENTS

(as of 31 December 2024)

Currency unit	–	Bangladeshi Taka (BDT)
BDT 1.00	=	$ 0.01
$1.00	=	BDT 119.05

ABBREVIATIONS

ADB	-	Asian Development Bank
BWDB	-	Bangladesh Water Development Board
BWTP	-	Bangabandhu Water Treatment Plant
CDIA	-	Cities Development Initiative for Asia
CWR	-	clear water reservoir
DI	-	ductile iron
DoE	-	Department of Environment
DMA	-	district metered area
ECC	-	Environmental Compliance/Clearance Certificate
ECR	-	Environmental Conservation Rules
EMP	-	Environmental Management Plan
ESF	-	Environmental and Social Framework
GRC	-	grievance redressal committee
GRM	-	grievance redress mechanism
GW	-	groundwater
HDD	-	horizontal directional drilling
IWM	-	Institute of Water Modeling
IPCC	-	Intergovernmental Panel on Climate Change
IPR	-	impounding reservoir
JICA	-	Japan International Cooperation Agency
KCC	-	Khulna City Corporation
KSSDP	-	Khulna Sewerage System Development Project
KWASA	-	Khulna Water Supply and Sewerage Authority
KWSP	-	Khulna Water Supply Project
O&M	-	operation and maintenance
PAA	-	project approving agency
PAM	-	project administration manual
PIU	-	project implementation unit
PMU	-	project management unit
REA	-	rapid environmental assessment
RoW	-	right-of-way
PMSC	-	project implementation support consultants
SPS	-	Safeguard Policy Statement

WEIGHTS AND MEASURES

ha	–	hectare
km	–	kilometer
m	–	meter
mg/l	–	milligram per liter
MLD	–	million liters per day
mm	–	millimeter
km/hr	–	kilometer per hour

NOTE

In this report, "$" refers to United States dollars.

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EXECUTIVE SUMMARY

Khulna, the third largest city in Bangladesh, faces significant water supply challenges due to rising salinity, population growth, and climate-induced vulnerabilities, including sea-level rise and saline water intrusion into rivers and aquifers. The current population of Khulna is approximately 1.26 million and this figure is expected to grow to 2.03 million by 2050. Although the Khulna Water Supply Project (KWSP) established a surface water-based system in 2019, increasing salinity levels and the unmet water supply needs of 400,000 residents highlight the urgency for further action.[1] The proposed Phase 2 of KWSP for the Asian Development Bank (ADB) funding seeks to enhance climate-resilient infrastructure, expand the piped water distribution network, and address critical water quality issues, particularly during the dry season in Khulna.

Khulna Water Supply Project Phase 2. The project is aligned with the following impact: Safe and sustainable water supply, sanitation, and hygiene services for all, leading to better health and well-being.[2] The project will have the following outcome: Resilience and sustainability of water supply services in Khulna City improved. The three outputs of the project are: Output 1: Climate-resilient and inclusive drinking water supply infrastructure developed and/or upgraded and Output 2: KWASA's capacity enhanced for sustainable DMA management, and Output 3; The institutional capacity of KWASA in delivering sustainable water supply and sewerage services strengthened. The proposed project prioritizes sustainable and innovative solutions, including the development of new impounding reservoirs, and smart monitoring mechanisms to manage salinity and optimize operations. This phase aims to provide reliable piped water for currently underserved populations, improve supervisory control and data acquisition (SCADA) systems to reduce non-revenue water. To augment the water supply, the project will use a composite water source combining multiple schemes including small impounding reservoirs at Bangabandhu water treatment plant (WTP), intake expansion at Afil Gate, sustainable groundwater abstraction, and adoption of smart monitoring systems. The project is also proposed to support, under the Water Financing Partnership Facility, a study on artificial recharge and groundwater management in Khulna City through technical assistance. Proposed project includes the following work components:

- additional pumps at Mollahat intake pumping (increase from 110 million liters per day (MLD) to 135 MLD, and install online water quality monitoring
- pre-settling tank and an additional impounding reservoir (IPR) of 385 million liters (ML) at Bangabandhu Water Treatment Plant (BWTP), and retrofit BWTP to enhance capacity from 110 MLD to 135 MLD, additional clear water pumps,
- additional pumping capacity at Bhairab River Afil Gate intake, 5 MLD to 15 MLD,
- new IPR of 44 ML at Mustafa Mor, raw water pumping station, raw water pipelines of 31.5 km
- increase existing IPR capacity (57 to 192 ML) at Afil Gate WTP, & retrofit WTP to enhance capacity from 5 MLD to 15 MLD,
- clear water transmission pipelines of 37.8 km long,
- four clear water reservoirs (CWR), pumping station and overhead tanks (OHTs),
- production wells 75 numbers (new + rehabilitation) and monitoring system
- distribution lines 243 km length in Khulna city corporation (KCC) area and 235 km outside KCC (extension) area,

[1] KWSP, co-financed by the ADB and Japan International Cooperation Agency (JICA), developed water supply system based on Madhumati River, 58 km from Khulna City. Works were completed in June 2019. (Bangladesh: Khulna Water Supply Project).

[2] Government of Bangladesh, Local Government Division. 2021. National Strategy for Water Supply and Sanitation.

- solar power 3,775 kilowatt (kW), necessary mechanical, electrical works and SCADA

Environmental Categorization. Based on the Rapid Environmental Assessment (REA) and ADB SPS (2009), the project is classified as **Category B**, indicating that significant adverse environmental impacts are unlikely. An initial environmental examination (IEE) is deemed sufficient to determine and mitigate potential impacts. Therefore, this IEE report is prepared. According to Government of Bangladesh's Environment Conservation Rules (ECR, 2023), the project falls under Red Category and will require an environmental impact assessment (EIA) study (based on terms of reference approved by Department of Environment (DOE)) and Environmental Clearance Certificate (ECC) from the DOE. This shall be obtained prior to invitation of bids or award of contract.

Description of Environment and need for the sub-project. Khulna is in the southwestern coastal region of Bangladesh. The city lies along Bhairab and Rupsha rivers and is part of a low-lying deltaic landscape shaped by tidal influenced rivers and monsoon rainfall. This region is highly vulnerable to climate-induced challenges such as sea-level rise, saline water intrusion, and frequent hydro-meteorological hazards such as cyclones and storm surges, river and tidal flooding, seasonal salinity intrusion, droughts and urban flooding caused by heavy rainfall. The tropical monsoon climate results in distinct wet and dry seasons, with heavy rainfall during the monsoon and prolonged dry spells that exacerbate water scarcity. The city's geology is dominated by alluvial deposits, while the hydrology is marked by slow-moving rivers and canals that are increasingly affected by salinity.

Ecologically, Khulna region is close to the Sundarbans, the largest mangrove forest in the world and a World Heritage site. This proximity provides a rich but delicate ecosystem that supports diverse aquatic and terrestrial species. The wetlands and rivers surrounding the larger Khulna region host numerous fish species, amphibians, and bird species. Salinity intrusion into rivers and aquifers further threatens both biodiversity and the sustainability of water resources. Most of the project components are located in and around Khulna urban area where there are no notable environmentally sensitive features. From the nearest project component, Sundarbans is about 50 km away. Except for the Mollahat intake, all other project locations are situated mostly in and around Khulna urban area. Khulna region is one of the important areas for Gangetic River dolphins, an endangered (EN) species. These are found widely in Bhairab and Rupsha rivers. No impacts on these species are anticipated as no works are proposed in the rivers, as the existing intake in Bhairab will be utilized, and water abstraction is insignificant compared to the available river flow.

Socially, Khulna urban area is home to approximately 1.26 million people, with a mix of urban and semi-urban settlements. The city serves as a key economic hub, housing industries such as jute processing, shipbuilding, and shrimp farming. However, rapid urbanization and population growth have created disparities in access to basic services, particularly safe drinking water. Approximately 74% of the population has access to piped water, leaving 400,000 residents dependent on alternative, often unreliable, sources. This inequity underscores the urgent need for improved infrastructure and sustainable water management solutions to support public health and economic development while preserving the region's ecological integrity.

Environmental Impacts and Mitigation. The proposed Khulna Water Supply Project (KWSP) Phase 2 has been carefully designed to minimize adverse environmental impacts while maximizing the region's benefits. The project's environmental impacts have been assessed across pre-construction, construction, and operational phases, and targeted mitigation measures have been proposed to address these impacts effectively.

Source sustainability. The feasibility study 2024[3] assessment indicate that the proposed abstraction volume of 1.56 m³/s (equivalent to 135 MLD) from Madhumati River constitute just about 0.53% of the dry-season flow (292 m³/s). This minimal abstraction volume means that the withdrawal does not significantly alter the river's flow dynamics or its capacity to push back saline water intrusion from the Bay of Bengal. Similarly, In Bhairab River, where the dependable flow during the dry season is 80 m³/s, the proposed abstraction of 0.17 m³/s (15 MLD) constitutes 0.21% of the flow, a seemingly negligible amount. Salinity levels were assessed duly considering climate change risks i.e., sea level rise. Groundwater sustainability is assessed using the principle of safe yield, ensuring that annual withdrawals do not exceed annual recharge rates. Using a groundwater-surface water (GW-SW) model, a study conducted by Institute of Water Modelling (IWM) as part of the project feasibility study (2024) estimated a total annual groundwater resources: 48764 ML (133 MLD), of which 36,500 ML (100 MLD) (75% of the available resource) can be sustainably abstracted. Of the 100 MLD, KWASA will utilize 55 MLD and 45 is allocated for private use. KWASA will utilize groundwater to meet the gap in supply from surface water and therefore it is mostly used during dry season as follows: 25 MLD (July to February), 37 MLD (March & June) and 118 MLD (April-May). The annual abstraction will be within the safe limits. Private groundwater abstraction will be regulated.

Pre-Construction Phase: Key environmental concerns include site preparation impacts, vegetation clearance, and disposal of excavated soil. Careful site selection, made in compliance with Schedule-9 of ECR, 2023, aim to minimize the ecological footprint of new infrastructure. Measures such as avoidance of sensitive habitats, preservation of mature trees, and phased clearing are incorporated to reduce environmental disturbances. Soil erosion control measures and environmentally compliant disposal of excavated materials are planned to prevent sedimentation in nearby water bodies. Additionally, baseline environmental monitoring, including groundwater levels, air quality, and noise levels, will be conducted to establish reference conditions and guide impact mitigation during construction.

Construction Phase: The construction phase of the Khulna Water Supply Project poses several significant environmental and community impacts. Land clearing, excavation, and heavy equipment usage for activities such as the construction of impounding reservoirs (IPR), pumping houses, clear water reservoirs (CWR), pipeline laying, and retrofitting of water treatment plants (WTP) can lead to soil erosion, compaction, and sedimentation in nearby water bodies. Noise and dust pollution from machinery and transport vehicles may disrupt local communities and affect air quality. Improper management of construction waste and hazardous materials such as fuel, lubricants, and chemicals pose risks of soil and water contamination. The disturbance to biodiversity, particularly in areas with wetland vegetation or aquatic ecosystems, could lead to habitat degradation. Additionally, construction activities could temporarily disrupt traffic and access to community facilities while posing safety risks to workers and nearby residents. Mitigation measures include:

- Implement sediment control measures, such as silt fences and sediment traps, and suppress dust through regular water spraying at construction sites and along transportation routes.
- Use noise-dampening equipment and schedule noisy activities during daytime hours to minimize disruption to local communities and sensitive areas.
- Develop and enforce comprehensive waste management plans, ensuring proper segregation, secure storage, and environmentally safe disposal of construction and hazardous waste.
- Preserve native vegetation wherever feasible and restore cleared areas with suitable species post-construction to mitigate habitat loss and erosion risks.

[3] Cities Development Initiative for Asia. 2024. Preparation of the Feasibility Study for the Khulna Water Supply Project (Phase 2).

- Provide adequate personal protective equipment (PPE) for workers, conduct mandatory safety training, and establish stringent monitoring to ensure adherence to health and safety standards.
- Implement a traffic management plan, including designated detour routes, signage, and coordination with local authorities to minimize traffic disruptions and ensure safe access for both public and construction vehicles.

Operational Phase: Anticipated impacts include potential water contamination from chemical handling at water treatment plants (WTPs), wastewater generation from staff facilities, and increased solid waste from maintenance activities. To address these issues:

- Handling hazardous chemicals like chlorine and coagulants may pose safety risks. Robust chemical management plans, staff training, and spill containment systems will mitigate this. Maintenance of treatment plants, pumping stations, and pipelines will produce construction debris, lubricants, and municipal solid waste. Proper segregation, storage, and disposal will ensure compliance with local waste management regulations.
- Increased water withdrawal from rivers and aquifers may exacerbate salinity and reduce freshwater availability. Mitigation includes (i) Storing freshwater in impounding reservoirs for dry season dilution, (ii) Limiting groundwater abstraction to sustainable levels and monitoring aquifer recharge, and (iii) Online real-time monitoring of salinity to optimize water intake.

Cumulative Impacts: Increased salinity, over-reliance on groundwater, and ecosystem degradation are significant concerns. Mitigation strategies include:

- Construction of a 385 ML impounding reservoir at Bangabandhu WTP and augmentation of Afil Gate reservoirs to store freshwater, which will be blended with saline surface water during dry seasons to maintain treatable water quality.
- Reduction of non-revenue water through the expansion of SCADA systems and district metering areas (DMAs).
- Plan and implement initiatives such rainwater harvesting, managed aquifer recharge (MAR)to enhance groundwater replenishment over long-term and mitigate over-extraction risks during dry seasons. However, MAR shall be implemented only after appropriate studies of its feasibility and associated risks on groundwater quality. Attached technical assistance will support KWASA in these initiatives.
- Installation of smart monitoring and warning systems to manage salinity and optimize operations.
- Installing smart monitoring systems to track water quality and optimize salinity management.
- Encouraging moderate control of private groundwater abstraction and piloting groundwater recharge initiatives.

Increased river water abstraction during periods of high flow, as planned, is unlikely to cause significant impacts since it aligns with the river's natural replenishment capacity. However, over-reliance on river water during dry seasons can marginally contribute to localized salinity intrusion and may reduce water availability for downstream ecosystems. Groundwater abstraction, limited to sustainable annual yields, is expected to have a minimal impact on aquifer health. The abstraction plan adheres to safe extraction limits, mitigating risks of aquifer depletion or salinity ingress. With effective monitoring and management, the environmental and community impacts of these activities are expected to be negligible.

Climate Resilience: To address long-term climate vulnerabilities such as sea-level rise and salinity ingress, the project will adopt climate-resilient design features, including robust

infrastructure planning, nature-based solutions (NBS), and disaster-resilient engineering integrated across all components.

Environmental Management Plan (EMP). The Environmental Management Plan (EMP) ensures that all proposed mitigation measures are systematically implemented, monitored, and evaluated. This integrated approach will help minimize environmental risks, protect local biodiversity, and enhance the overall sustainability of the project while ensuring a reliable water supply for Khulna's growing population.

The EMP will guide the environmentally sound construction of the project and ensure efficient communication among (i) KWASA, (ii) the project management unit (PMU), (iii) the project management and supervision consultant (PMSC), (iv) the institutional development, awareness creation, and design consultants (IADC), and the contractors. The EMP will (i) ensure activities are conducted responsibly and without causing harm, (ii) provide a proactive, feasible, and practical tool for measuring and monitoring on-site environmental performance, (iii) guide the implementation of environmental assessment findings and recommendations, (iv) detail necessary actions to mitigate the project's environmental impact, and (v) ensure compliance with safety recommendations. A copy of the EMP will be kept on-site at all times during the construction and operation phases. The appointed contractor(s) will be responsible for organizing, directing, and executing environmental management activities during construction, adhering to all relevant environmental requirements, including consent documentation and other regulatory, statutory, and contractual obligations.

Public Consultation and Information Disclosure: Extensive public consultations were conducted to engage local communities, stakeholders, and relevant authorities. Feedback from these consultations has been incorporated into the project design and mitigation strategies to address community concerns and ensure transparency. The consultation process adhered to good practices, ensuring inclusivity and active participation of all affected parties, with a focus on sustainable development goals.

Grievance Redress Mechanism. A robust Grievance Redress Mechanism (GRM) will be established for the project's implementation. This GRM will provide an accessible, inclusive, and transparent platform for addressing grievances from stakeholders, including local communities, contractors, and other relevant parties. It will outline clear procedures for lodging complaints, timelines for resolution, and mechanisms for escalation, ensuring prompt and fair responses. Regular monitoring and reporting of the GRM will help maintain accountability and build trust among stakeholders.

Institutional Arrangements: The Khulna Water Supply and Sewerage Authority (KWASA) will be responsible for implementing the project. A Project Management Unit (PMU), headed by a Project Director, will be established within KWASA to oversee the day-to-day activities of the project. The PMU will be supported by a Project Management and Supervision Consultant (PMSC). PMU will include an environmental officer and a safety engineer, and supported by specialist consultants of PMSC, will monitor the implementation and ensure compliance with environmental safeguards requirements. Contractor personnel will include environmental, health and safety supervisors.

Monitoring and Reporting. An Environmental Management Plan (EMP) has been developed to guide the implementation of mitigation measures and ensure compliance with environmental standards. Regular monitoring and reporting mechanisms will be established to track the project's environmental performance. The KWASA / PMU, with support from PMSC, will be responsible for monitoring and reporting. Contractors will also be responsible for their own monitoring based on the site specific EMP (SEMP) and work plan activities, and reporting of status and progress of implementation. Contractors will submit monthly reports to PMU. PMU, with support from PMSC, will monitor the implementation of the EMP and SEMPs

by all contractors. PMSC will support PMU in consolidating all monthly reports from contractors. Based on results of its own monitoring activities and consolidated monthly reports from contractors, PMU, with support from PMSC, will prepare and submit semi-annual environmental monitoring reports (SEMRs) to ADB. KWASA/PMU and ADB will post the cleared SEMRs on project/KWASA and ADB websites, respectively. Any deviations or non-compliance issues will be promptly addressed to mitigate environmental risks and ensure sustainable project outcomes. ADB will monitor the project on an ongoing basis until a project completion report is issued.

Conclusions and Recommendations. The Khulna Water Supply Project (KWSP) Phase 2 addresses the critical challenges of water scarcity, increasing salinity, and climate vulnerabilities in Khulna City, including the expanded area. By implementing measures such as new impounding reservoirs, enhanced water treatment and distribution systems, and smart monitoring technologies, the project aims to ensure a reliable, sustainable, and climate-resilient water supply for the city's growing population. It also emphasizes sustainable water resource management to meet the immediate and long-term needs of unserved populations while fostering public health improvements, environmental protection, and economic growth. Strict groundwater monitoring and enforcement will be essential to ensure water abstraction remains within the safe limits. The proposed interventions are aligned with national environmental regulations and the ADB's Safeguard Policy Statement (2009).

For successful implementation, the project emphasizes the need for strict adherence to the Environmental Management Plan (EMP) to mitigate potential impacts during construction and operation, such as sedimentation, noise, traffic disruptions, and waste generation. Regular monitoring and adaptive management are vital to evaluate and address the impacts of river and groundwater abstraction on water quality and ecosystems. Continuous engagement with stakeholders, including local communities and authorities, will enhance project acceptance and transparency. Strengthening KWASA's institutional capacity through advanced technologies, staff training, and modernized management practices will be essential to ensure the long-term sustainability and resilience of the water supply system. With these strategies, KWSP Phase 2 is poised to significantly improve the quality of life for Khulna residents while promoting sustainable urban development.

This IEE will be updated during the detailed design and / or implementation phase to reflect any changes. The updated IEE shall be submitted by the PMU to ADB for review, clearance and disclosure. No work can commence until IEE updated to reflect the changes in components and the SEMP, including other work plans, prepared by the Contractor, is approved by the PMU. In the event of unanticipated impact and/or any design change and/or non-compliance during subproject implementation period, the IEE shall be updated to include (i) assessment of the unanticipated impact and corresponding mitigation measures; and/or (ii) information on the design change and assessment of associated environmental impacts, if any; and/or (iii) corrective actions, associated cost and schedule; respectively. Further, the PMU shall:

- Include this IEE in the bidding and contract documents.
- Obtain all statutory clearances and ensure relevant conditions or requirements, if any, are incorporated in the project
- Update/revise this IEE based on detailed design and/or if there are unanticipated impacts or significant change in scope
- Conduct safeguards induction to the Contractors after award of contract.
- Ensure Contractors appoint qualified environment, health and safety (EHS) officers prior to start of works.
- Disclose information and establishment of GRM in a timely manner.
- Strictly supervise EMP implementation.

- Continue consultations with stakeholders; and
- Monitor and report status of implementation of the EMP on a regular basis as indicated in the IEE.

This IEE report has been prepared in accordance with ADB SPS requirements for projects classified as Category B for environment. With the above premises considered, the classification of Category B for environment is confirmed. Separately, per Government of Bangladesh's ECR, 2023, the project falls under "Red" category and will require Location Clearance Certificate (LCC) and Environmental Clearance Certificate (ECC) from the Department of Environment (DOE). This shall be obtained prior to invitation of bids or award of contract.

I. INTRODUCTION

A. Background and Rational

1. Bangladesh is highly vulnerable to natural hydro-meteorological hazards. Sea level rise is leading to the submergence of low-lying coastal areas and saline water intrusion into coastal rivers and groundwater aquifers, reducing freshwater availability.[4] Khulna is the 3rd largest city and the 2nd largest port entry, situated along the Rupsha and Bhairab rivers in the southwestern part of Bangladesh (**Figure 1**). The city covers an area of 46 km^2 with an estimated population of 1.26 million people in the Khulna City Corporation (KCC) area with approximately 70,221 residential, commercial, and institutional buildings, and it forms an important urban centre. As per projections, the projected population of the KCC area is expected to increase to 1.588 million by 2035 and 2.033 million by 2050 (Final Report, Preparation of the Feasibility Study for the Khulna Water Supply Project Phase 2 (PFS-KWSP 2), 2024).[5]

2. The Khulna Water Supply and Sewerage Authority (KWASA), established in 2008, is responsible for the implementation and operation of the water supply and sewerage system in Khulna City (WASA Act, 1996). The KWSP, co-financed by the Asian Development Bank (ADB) and JICA, switched the water source from ground to surface water (Madhumoti River, 58 kilometres [km] from Khulna City) for which works were completed in June 2019. However, since then, increased water salinity has emerged as a critical issue. As against an estimated 16 days of high salinity, actual monitoring recorded over 50 days. This needs to be addressed urgently.[6] There are also uncovered areas that need to be provided with service both within KCC area and the extension area. Apart from the presently unserved population, long-term planning for the piped water supply is needed to cope with the future demand and ensure sustainable water service for all. KWSP Phase II is therefore proposed.

B. Khulna Water Supply Project – Phase 2

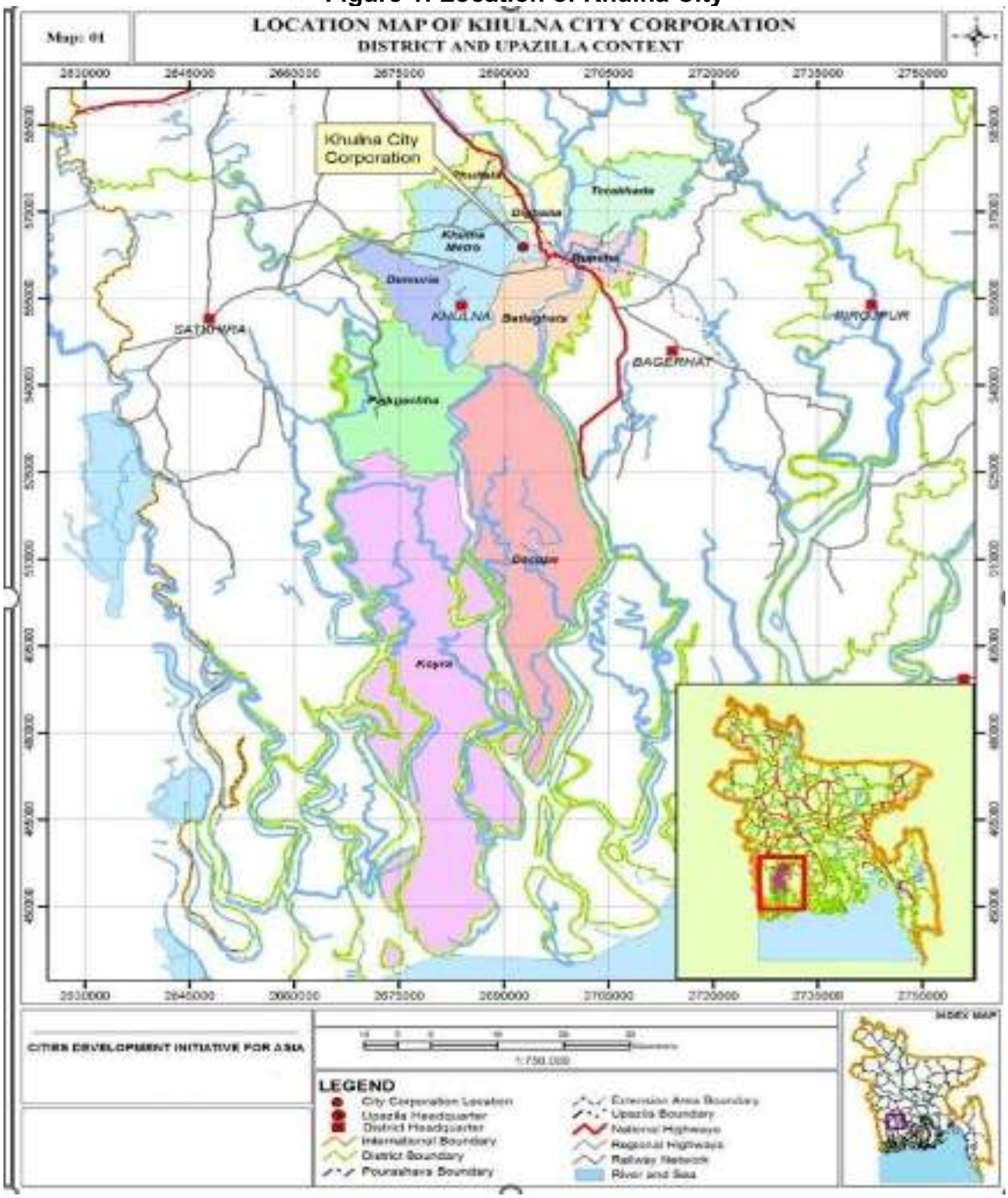
3. The proposed KWSP Phase 2 will (i) provide piped water supply for the currently unserved population, with provisions for system expansion until 2050; (ii) implement climate resilient and sustainable solutions to address source water salinity ingress during the dry season; (iii) improve the smart water management capacity of KWASA by expanding the existing supervisory control and data acquisition (SCADA) and district metering areas (DMAs) to manage non-revenue water (NRW), improving the billing system and establishing smart monitoring and warning systems to manage source water salinity and abstraction; and (iv) enhance institutional capacity for sustainable management of the water supply and sewerage systems.

[4] Government of Bangladesh, Ministry of Environment, Forest and Climate Change. 2022. National Adaptation Plan of Bangladesh (2023–2050). Dhaka.

[5] Supported by ADB TA-6559 REG: Implementing the Cities Development Initiative for Asia (funded by the City Development Initiative for Asia (CDIA) and managed by ADB)

[6] ADB-financed Khulna Sewerage System Development Project is developing sewerage system covering the core areas of the city. Khulna Wastewater Masterplan, developed in 2016 (under TA 7820-BAN), has been updated under TA 9897-REG to include both onsite sanitation and sewerage system to give 100% sanitation coverage to the city. Accordingly, a sanitation project for the city is included in the indicative pipeline for 2025. The KWSP Phase 2 was requested by KWASA ahead of the sanitation project primarily to identify and develop sustainable and resilient solution(s) to address the source water salinity.

Figure 1: Location of Khulna City



C. KWSP Phase 2 Outcome and Outputs

4. The project is aligned with the following impact(s): Safe and sustainable water supply, sanitation, and hygiene services for all, leading to better health and well-being.[7] The project will have the following outcome: Resilience and sustainability of water supply services in Khulna City improved. Following are the three outputs of the project:

(i) **Output 1: Climate-resilient and inclusive drinking water supply infrastructure developed and/or upgraded.** The project will support (a) the construction of climate- and disaster-resilient, and sustainable infrastructure (raw water reservoirs, production wells, upgradation of surface water treatment plants, and on-grid solar power-based energy system) to offset the source water salinity and produce around 175 million liters per day (MLD) for 60 days during the high salinity period; (b) the construction of around 40 kilometers (km) of new transmission line and 500 km of additional water distribution network with climate- and disaster-resilient measures; (c) installing 25,000 new metered house (holding) connections to ensure full coverage in the city including 100% vulnerable households and all female headed households (FHH); (d) establishing and managing 79 DMAs with upgraded SCADA and smart water supply management system (based on real-time data) to manage NRW, monitor source water salinity and water abstraction and ensure continuous water supply[8]; and (e) saving at least one hour for women and girls to collect water in the low-income community (LIC) of the extended areas.

(ii) **Output 2. KWASA's capacity enhanced for sustainable DMA management.** KWASA's managerial and technical capacity will be strengthened to maintain NRW at a low level (below 20%). The project will assist KWASA in (a) preparing and implementing a DMA management and NRW reduction plan; (b) strengthening monitoring capacity at the zone level with standard operating procedures, and training on DMA management, integrating SCADA and smart water supply management; and (iii) enhancing in-house design capacity for DMA management

(iii) **Output 3. The institutional capacity of KWASA in delivering sustainable water supply and sewerage services strengthened.** KWASA will achieve this through (a) benchmarking of service quality and developing a service standard improvement plan following international best practices, a 10-year tariff improvement plan and a capital investment plan which will be incorporated in the KWASA's updated business plan and implemented under the project after LGD's endorsement; (b) maintaining the operating ratio below 100% from 2028 (2024 baseline: 105%); (c) increasing collection efficiency at least 3% from 2028 and reaching 95% by 2032 (2024 baseline: 68.7%); (d) developing appropriate PPP modality for sustainable, inclusive, and climate-resilient water supply service delivery; (e) improving menstrual hygiene practices in LIC areas; (f) training of eligible KWASA staff (including all relevant female staff) on safely managed, sustainable, inclusive, and climate-resilient water supply and sewerage service delivery; (g) increasing awareness of the residents (including 60% women) of safe water, sanitation, and hygiene; and (Jashore) development and implementation of KWASA's Gender Strategy and Action Plan.

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[7] Government of Bangladesh, Local Government Division. 2021. *National Strategy for water Supply and Sanitation*.

[8] Cities Development Initiative for Asia. 2024. TA-6559 REG: Implementing the Cities Development Initiative for Asia. Preparation of the Feasibility Study for the Khulna Water Supply Project Phase 2. Final Report.

5. Project is also proposed to support, under the Water Financing Partnership Facility, a study on artificial recharge and groundwater management in Khulna City through technical assistance (TA).

6. **Proposed project components.** The project includes the following components: (i) additional pumps at Mollahat intake pumping to increase capacity from 110 million liters per day (MLD) to 135 MLD, and install online water quality monitoring (ii) pre-settling tank and an additional impounding reservoir (IPR) of 385 million liters (ML) at Bangabandhu water treatment plant (WTP), (iii) retrofit Bangabandhu WTP to enhance capacity from 110 MLD to 135 MLD, (iv) additional 25 MLD clear water pumps, (v) additional pumping capacity at Bhairab River Afil Gate intake pumping station, increase from 5 MLD to 15 MLD, (vi) new IPR of 44 ML at Mustafa Mor, raw water pumping station, (vii) increase existing IPR capacity (57 to 192 ML) at Afil Gate WTP, (viii) raw water pipelines of 31.5 km long from Afil gate intake to IPR, and to WTP, (ix) retrofit Afil Gate WTP to enhance capacity from 5 MLD to 15 MLD, (x) CWR and a pump house at Afil Gate WTP, (xi) clear water transmission pipelines of 37.8 km long, (xii) four clear water reservoirs (CWR), pumping station and overhead tanks (OHTs), (xiii) 75 production wells (new and rehabilitated) and monitoring system (xiv) distribution lines 243 km length in Khulna city corporation (KCC) area and 235 km outside KCC (extension) area, (xv) on-grid solar power, install solar panels at IPRs at two WTPs, CWRs to generate 3,775 kilowatt (kW) and (xvi) necessary mechanical, electrical works and SCADA systems.

D. Purpose and Structure of this Initial Environmental Examination (IEE) Report

7. Based on the outcome of the rapid environmental assessment, in compliance with the provisions of the ADB safeguards policy statement (SPS) 2009, the project is classified as environmentally Category B, i.e., the subproject is adjudged to be unlikely to have significant adverse environmental impacts. Through the ADB REA checklist for water supply (**Appendix 1**), the potential negative impacts were identified in relation to design, pre-construction, construction and operation of the subproject. Thus, this initial environmental examination (IEE) has been prepared in accordance with ADB Safeguard Policy Statement (SPS) requirements for environment Category B projects.

8. This IEE report has been prepared based on technical design of components (mostly preliminary designs, and in some cases detailed designs), baseline information of the project area, and results of field investigations and consultations. Environmental screening, setting of environmental baseline, stakeholder consultations, and assessment of potential impacts were carried out per the requirements of ADB SPS. Subsequently, the corresponding mitigation measures designed to minimize, reduce and mitigate the potential impacts were formulated as part of the assessment. Based on these elements, an Environmental Management Plan (EMP) was developed to serve as a direct reference plan to address each potential impact and risk with the corresponding mitigation measures during implementation, including the institutional arrangement and associated costs for implementing and monitoring the plan.

9. The IEE report generally follows the ADB Safeguard Policy Statement (2009) and Environmental Safeguards - Good Practice Sourcebook. The IEE report is organized as follows:

(i) **Introduction**: This section provides identification of the project components and an explanation of the proposed project's objectives and Components. It also presents the Approach and Methodology adopted by the IEE.

(ii) **Policy, Legal, and Administrative Framework**: This section summarizes the national and local legal and institutional framework for environmental assessment and identifies project-relevant international environmental agreements to which the country is a party. This chapter includes Applicable

Laws, Regulations, Standards, and Requirements and ADB Policy on Environmental Safeguards.

(iii) **Description of Project Components**: This section provides a detailed description of the components, their need, Their locations, the magnitude of the operations, the environmental Category of the overall project, and the implementation schedule of Components.

(iv) **Description of the Environment**: This section describes the baseline environment of the project area. The summaries are based on available documentation, statistical data, meetings with government authorities and stakeholders, field surveys, and investigations.

(v) **Screening of Potential Environmental Impacts and Mitigation Measures**: *This provides* an assessment of potential impacts of the proposed Component and its components, considering the existing conditions together with recommended actions to prevent and/or otherwise mitigate unavoidable impacts.

(vi) **Information Disclosure, Consultation, and Participation**: This section presents information on public participatory workshops and consultations with experts and local administrative officers.

(vii) **Grievance Redress Mechanism (GRM):** This section describes the grievance redress framework (both informal and formal channels), setting out the time frame and mechanisms for resolving complaints about environmental performance.

(viii) **Environmental Management Plan and Environmental Monitoring Plan, Implementation, and Institutional Requirements**: This section deals with the set of mitigation and management measures to be taken during Component implementation to avoid, reduce, mitigate, or compensate for adverse environmental impacts. It also includes management plans and actions. Describes the parties responsible for implementing, administering, and supervising each Component and the procedure to address concerns, complaints, and grievances of the affected population.

(ix) **Conclusion and Recommendations**: Findings of the IEE study and recommendations, which are finalized by the consultant, are stated here with the analysis of currently available data. The conclusions section outlines the outcome of the IEE and justifies the implementation of Components.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. ADB Safeguards Policy Statement 2009

10. ADB requires environmental issues be considered in all aspects of the Bank's operations. The detailed requirements are defined in the Safeguard Policy Statement (2009). The SPS affirms that ADB considers environmental and social sustainability as a cornerstone of economic growth and poverty reduction in Asia and the Pacific and is committed to ensuring the social and environmental sustainability of the projects it supports. The objectives of ADB's safeguards are to: (i) avoid adverse impacts of projects on the environment and affected people, where possible, (ii) minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people where avoidance is not possible; and (iii) help borrowers/clients strengthen their safeguard systems and develop the capacity to manage environmental and social risks. The Safeguard Policy Statement applies to all ADB projects.

11. **Screening and Categorization:** ADB screens a project in the preparation stage to (i) reflect the significance of potential impacts or risks that the project might present, (ii) identify the level of assessment and institutional resources required for the safeguarding process, and (iii) determine the requirements for public disclosure. Screening reviews necessary information on project design and operation, the proposed project site/s, and the general environmental/social features and is aided by ADB's Rapid Environmental Assessment (REA) checklists. By the significance of the potential environmental impacts and risks, projects are assigned to one of the following four categories:

(i) **Category A:** projects likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented and which may affect an area larger than the location subject to physical works. An Environmental Impact Assessment (EIA) is required.
(ii) **Category B:** projects with potential adverse impacts that are less significant than those of Category A. Impacts are site-specific, and few are irreversible. In most cases, impacts can be mitigated more readily than those for Category A projects. An Initial Environmental Examination (IEE) is required.
(iii) **Category C:** projects likely to have minimal or no adverse environmental impacts. No environmental assessment is required, although environmental implications are reviewed.
(iv) **Category FI:** projects where ADB funds are invested in or through a Financial Intermediary (FI). ADB conducts safeguard due diligence of the FI's portfolio and requires an appropriate environmental and social management system (ESMS) in place to address environmental or social risks.

12. **IEE.** KWSP Phase II is categorised as Category B for environmental safeguards. Thus, this IEE report has been prepared in accordance with ADB SPS requirements for environment category B projects. ADB SPS. Annex to Appendix 1 outlines an EIA/IEE report. Guidance on the practical approach to conducting the environmental assessment is provided in the Environment Safeguards Good Practice Sourcebook (ADB, 2012). EIA and IEE studies follow the same general approach and that the level of detail and comprehensiveness of the study should be commensurate with the significance of environmental impacts and risks so that an IEE may have a narrower scope.

13. **Public Consultation:** The ADB SPS, 2009 requires the borrower/client to conduct meaningful consultations with affected people and other stakeholders to facilitate informed participation. These should: (i) begin early during project preparation and continue throughout the project cycle; (ii) provide timely disclosure of adequate, relevant, and understandable information; (iii) be free of intimidation and coercion; (iv) be gender-inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enable

incorporation of all relevant views into decision-making, including project design, impact mitigation, and sharing of project benefits and opportunities. The results of the consultation process are documented in the IEE / EIA report.

14. **Environmental Audit of Existing Facilities**. ADB SPS requires that relevant external experts perform an environmental audit if a subproject involves facilities and/or business activities that already exist or are under construction. It is to determine the existence of any area where such a project may cause or is causing environmental risks or impacts and identify and plan appropriate measures to address outstanding environmental issues. If the project does not foresee any new major expansion, the audit constitutes the environmental assessment for the project.

15. **Grievance Redress Mechanism**. ADB SPS requires borrowers to establish a mechanism to receive and facilitate the resolution of affected people's concerns, complaints, and grievances about the subproject's performance. The grievance mechanism shall be scaled for the risks and adverse impacts of the subproject.

16. **Environmental Management Plan.** An EMP which addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project's impact and risks. The EMP shall include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.

17. **Monitoring and Reporting**. The borrower shall monitor, measure and document the implementation progress of the EMP. If necessary, the borrower shall identify the necessary corrective actions and reflect them in a corrective action plan. The borrower shall prepare and submit to ADB semi-annual environmental monitoring reports that describe progress with the implementation of the EMP, compliance issues, and corrective actions, if any. Reporting will continue at the minimum on an annual basis during operation until project completion.

18. **Unanticipated Environmental Impacts**. Where unanticipated environmental impacts become apparent during subproject implementation, ADB SPS, 2009 requires the borrower to update the environmental assessment and EMP or prepare a new environmental assessment and EMP to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts.

19. **Occupational Health and Safety**. ADB SPS requires the borrower[9] to ensure that workers[10] are provided with a safe and healthy working environment, considering risks inherent to the sector and specific classes of hazards in the subproject work areas, including physical, chemical, biological, and radiological hazards. Borrower shall take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work, including (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment;(v) enforcing appropriate protocols necessary to prevent the spread of communicable diseases, including emerging infectious diseases such

[9] In case where responsibility is delegated to subproject contractors during construction phase, borrower shall ensure that the responsibilities on occupational health and safety are included in the contract documents

[10] Including non-employee workers engaged by the borrower/client through contractors or other intermediaries to work on project sites or perform work directly related to the project's core functions.

as the 2019 Coronavirus Disease (COVID-19); (vi) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place. PMU shall ensure the application of preventive and protective measures consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health, and Safety Guidelines.

20. **Community Health and Safety**. ADB SPS requires the borrower to identify and assess risks to, and potential impacts on, the safety of affected communities during the design, construction, operation, and decommissioning of the subproject and establish preventive measures and plans to address them in a manner commensurate with the identified risks and impacts. The borrower shall ensure the application of preventive and protective measures for both occupational and community health and safety consistent with good international practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health, and Safety Guidelines. PMU shall also adhere to necessary protocols in response to emerging infectious diseases such as the coronavirus disease (COVID-19), which is consistent with the guidelines of relevant government healthcare agencies and the World Health Organization.

21. **Physical Cultural Resources**. The borrower is responsible for siting and designing the subproject to avoid significant damage to physical and cultural resources. ADB SPS requires that such resources likely to be affected by the subproject are identified and qualified and experienced experts assess the subproject's potential impacts on these resources using field-based surveys as an integral part of the environmental assessment process. When the proposed location of a subproject component is in areas where physical and cultural resources are expected to be found as determined during the environmental assessment process, chance finds procedures shall be included in the EMP.

22. **Pollution Prevention and Control Technologies**. During the design, construction, and operation of the project, PMU shall apply pollution prevention and control technologies and practices consistent with good international practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health, and Safety Guidelines.[11] These standards contain performance levels and measures that are normally acceptable and applicable to the project infrastructures. When the government's regulations differ from these levels and measures, the project shall achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, PMU will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS, 2009.

23. **Information Disclosure:** The SPS requires the borrower to make relevant environmental information available to affected people and other stakeholders promptly, in an accessible place, and in an understandable form and language(s). This normally involves providing draft and final IEE reports in public buildings in the study area. ADB also requires the borrower to provide the following for dissemination to a broader audience via the ADB website:

(i) The draft and final IEE
(ii) New or updated IEE, supplementary reports, and/or corrective action plans, if prepared during project implementation
(iii) Environmental monitoring reports prepared during project implementation

24. **Bidding and Contract Documents.** EMP shall be included in bidding and contract documents. The PMU shall also ensure that bidding and contract documents include specific

[11] World Bank Group. 2007. Environmental, Health, and Safety General Guidelines. Washington DC; https://Jashore.ifc.org-ehs-guidelines

provisions requiring contractors to (i) comply with all other conditions required by ADB and (ii) to submit to PMU, for review and approval, a site-specific environmental management plan (SEMP), including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; (iii) monitoring program as per EMP; and (iv) budget for SEMP implementation, among others as may be required. No work shall commence prior to the approval of the SEMP. A copy of the EMP and/or approved SEMP will be kept on-site at all times during the construction period. Non-compliance with, or any deviation from, the conditions set out in the EMP and/or SEMP constitute a failure in compliance and shall require corrective actions.

25. **Conditions for the Award of Contract and Commencement of Work**. PMU shall not award any works contract under the subproject until (i) relevant provisions from the EMP are incorporated into the works contract; (ii) this IEE report is updated to reflect the subproject's final detailed design and PMU has obtained ADB's clearance of such updated IEE report and disclosed; and (iii) other necessary permits from relevant government agencies have been obtained. For "design, build, and operate" type contracts, PMU shall ensure no works for a subproject that involves environmental impacts shall commence until (i) relevant provisions from the EMP are incorporated into the works contract and (ii) this IEE report is updated to reflect subproject's detailed design, and PMU has obtained ADB's clearance for such updated IEE.

B. National Environmental Laws

1. Environmental Assessment and Clearance Requirements

26. Key legislation governing the environmental approvals process for the proposed overall project (and hence the subproject) is the Bangladesh Environmental Conservation Act, 1995 (ECA, 1995) and the Environmental Conservation Rules (ECR, 2023). According to Rule 5 of ECR, 2023 proposed developments within Bangladesh are classified as one of four categories, as follows: (i) Green, (ii) Yellow, (iii) Orange, and (iv) Red. The category of a project determines the procedure for issuance of an Environmental Clearance Certificate (ECC). All proposed industrial units and projects that are low polluting are classified under "Green" and should be granted Environmental Clearance. For proposed industrial units and projects classified under the Yellow, Orange, or Red Categories, a Location Clearance Certificate (LCC) and a subsequent ECC are required from the Department of Environment (DOE). A detailed description of the approval process for the four categories of industry/projects is documented in Rules 9 – 19 of ECR, 2023. Key milestones in the approvals process comprise:

(i) Location Clearance Certificate: An LCC will be issued by DOE upon approval of all requirements, including compliance with the site selection requirements as the minimum for Yellow category projects. In addition to this compliance with site selection requirements, an IEE study is required for Orange category projects and an EIA study for Red category projects, and
(ii) Environmental Clearance Certificate: DOE will issue the ECC upon approval of the requirements. The ECC is issued to Green category projects upon approval of the General Description and to Yellow, Orange, and Red category projects after the issuance of the LCC.

27. **Process of obtaining LCC and ECC.** The environmental assessment process consists of: screening, IEE, and detailed EIA per ECR, 2023. The ECR also contains the procedures for obtaining the LCC and ECC from the DOE for different categories of proposed industrial units or projects. Any person or organization wishing to establish an industrial unit or project must obtain an LCC and ECC from the Director General of DOE. The application for

such a certificate must be in the prescribed forms provided together with the prescribed fees laid down in Schedule 6 and Schedule 7 through the deposit of a Treasury Chalan in favor of the Director General of DOE. The procedure of getting the LCC and ECC of four categories of project are briefly described as follows, and the process flow is outlined in **Figure 2**:

(i) **Green**

(a) The proponent has to submit an application in a prescribed format Form 3: Location Clearance / Environmental Clearance Certificate Application, Rule 9 Sub-Rule (1), Rule 10 Sub-Rule (1), Rule 11 Sub-Rule (1), Rule 12 Sub-Rule (1), Rule 14 Sub-Rule (1), and Rule 23 Sub-Rule (4) along with specified documents.
(b) In addition, as per Schedule 9: Industry or Project Site Selection Guideline, Rule 8 Sub-Rule (kha), Rule 9 Sub-Rule (2), Rule 10 Sub-Rule (2), Rule 12 Sub-Rule (2), and Rule 14 Sub-Rule (2) must be followed by the proponent; and,
(c) The Client must Deposit/Pay the mentioned amount of fees to DOE per Schedule 7: Location Clearance or Environmental Clearance Certificate Received and its Renewal Fee; Rule 9 Sub-Rule (3), Rule 10 Sub-Rule (3), Rule 12 Sub-Rule (6), Rule 84 Sub-Rule (3), Rule 21 Sub-Rule (14), Rule 22 Sub-Rule (1), and Rule 23 Sub-Rule (4).
(d) DOE will provide the ECC with the applicant within seven (7) days of the application, subject to their site investigation and satisfaction with the submitted documents. The ECC needs to be renewed every five years.

(ii) **Yellow**

(a) The proponent has to submit an application in a prescribed format Form 3: Location Clearance / Environmental Clearance Certificate Application, Rule 9 Sub-Rule (1), Rule 10 Sub-Rule (1), Rule 11 Sub-Rule (1), Rule 12 Sub-Rule (1), Rule 14 Sub-Rule (1), and Rule 23 Sub-Rule (4) along with specified documents.
(b) Deposit/pay the mentioned amount of application processing fee to DOE per Schedule 6: Location Clearance or Environmental Clearance Certificate Application Process Fee, Rule 10 Sub-Rule (2), Rule 12 Sub-Rule (2), Rule 14 Sub-Rule (2), and related documents and detail information per Schedule 9: Industry or Project Site Selection Guideline, which shall be followed.
(c) The relevant DOE office will conduct a site visit to the project and prepare a report with justification and opinion. Within 8 working days of receiving the application, the DOE office concerned will notify the applicant to pay the fee specified in Schedule 7, provided the information in the application is satisfactory and the on-site inspection is completed.
(d) The Client must Deposit/Pay the mentioned amount of location clearance fee to DOE per Schedule 7: Location Clearance or Environmental Clearance Certificate Received and its Renewal Fee; Rule 9 Sub-Rule (3), Rule 10 Sub-Rule (3), Rule 12 Sub-Rule (6), Rule 84 Sub-Rule (3), Rule 21 Sub-Rule (14), Rule 22 Sub-Rule (1), and Rule 23 Sub-Rule (4); and
(e) After issuance of LCC, the Client submits its application for issuance of ECC to DOE. DOE will provide the ECC to the applicant within seven (7) days of application subject to their site investigation and satisfaction with the submitted documents. The ECC needs to be renewed every 2

years.

(iii) **Orange**

(a) Projects categorized as Orange require proponents to submit an application in a prescribed format. Form 3: Location Clearance / Environmental Clearance Certificate Application for Location Clearance, along with Deposit /Payment of the mentioned amount of fees for the project to DOE per Schedule 6, submission of related documents and detailed information, an Initial Environmental Examination (IEE) Study report, and compliance with Schedule 9: Industry or Project Site Selection Guideline. After approval from the Authority, the Client must Deposit/Pay the mentioned amount of fees for the project to DOE per Schedule 7 to obtain Location Clearance for the project.

(b) The relevant DOE office will visit the project site and prepare a report. This report, along with the application, will be sent to the appropriate ECC committee based on the project's serial number listed in Schedule 1. The ECC committee will review the application and the report and make a decision. The applicant will then be notified to pay the fee listed in Schedule 7 for the LCC issuance. Within 21 days from payment of fees per Schedule 7, DOE issues the LCC. Upon obtaining the LCC, the Proponent/Client will apply for an ECC from the DOE. The DOE office will then perform a site visit to ensure LCC compliance and review relevant issues. A report justifying the issuance or rejection of the ECC will be prepared and forwarded, along with the application, to the appropriate ECC committee. The committee will make a decision within 20 working days of the application date and issue the ECC. If an initial environmental examination of an Orange Category project reveals significant pollution impacts, the ECC Committee may recommend an Environmental Impact Assessment (EIA). With approval from the Director General, the proponent must conduct the EIA. The ECC needs to be renewed every year.

(iv) **Red**

(a) Projects categorized as Red Projects require proponents to submit an application in a prescribed format Form 3: Location Clearance / Environmental Clearance Certificate Application for Location Clearance, along with Deposit /Payment of the mentioned amount of fees for the project to DOE per Schedule 6, related documents, detail information, draft Terms of Reference (ToR) of Environmental Impact Assessment (EIA) and compliance with Schedule 9: Industry or Project Site Selection Guideline;

(b) Per Schedule 10: Environmental Impact Assessment Scope of Works Guidelines, Rule 14 Sub-Rule (3), a draft Terms of Reference (TOR) will be prepared for the conduct of an Environmental Impact Assessment and submitted to the DOE for approval.

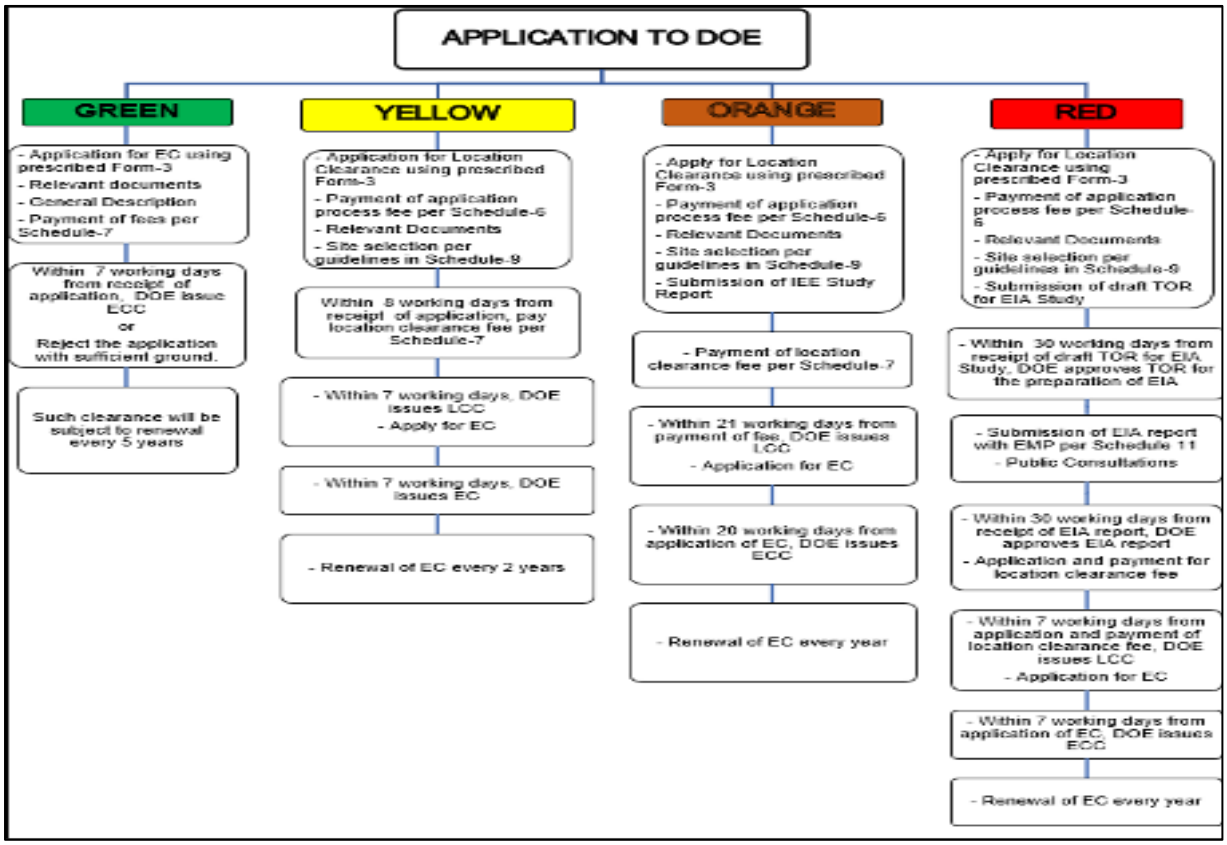
(c) The relevant DOE office will visit the project site to review the documents and all pertinent issues. A report with justifications and findings on the rationale for issuing the location clearance certificate and draft ToR for the EIA will be forwarded to the ECC Committee. Upon receiving the documents, the ECC Committee will review and evaluate them and then submit a report to the Director General (DG) for approval. With the DG's approval, the concerned office will approve the ToR for the EIA within

30 working days.

(d) An EIA study shall be prepared based on DOE's approved TOR. An Environmental Management Plan should be prepared as an integral part of the EIA study according to Schedule 11: Industry or Project Environmental Impact Assessment Study Preparation Guidelines and Rule 15 Sub-Rule (3). Public consultations for the EIA study shall be carried out.

(e) The proponent must submit the EIA report to the ECC Committee as per Schedule 11. If the EIA is approved by the DG, the proponent must pay the fee specified in Schedule 7 within a maximum of 7 working days, and the LCC will be issued within 7 working days of submission of the fee to the concerned DOE office. After the issuance of the LCC, the proponent/client will submit the application for issuance of the ECC. The relevant DOE office will conduct a site visit to verify the conditions of the LCC and the recommendations of the EIA etc. A report will be prepared and forwarded to the ECC committee. Upon reviewing the reports and documents, the ECC Committee will make recommendations to the Director General regarding the issuance of the ECC. Once the approves these recommendations, the concerned office will issue the ECC within 30 working days. The ECC needs to be renewed every year.

Figure 2: Government Environmental Clearance Process



DOE = Department of Environment, EC = Environmental Clearance, ECC = Environmental Compliance Certificate, EIA = environmental impact assessment, EMP = environmental management plan, IEE = initial environmental examination, LCC = Location Clearance Certificate, TOR = terms of reference.

28. **KWSP Phase 2 Environmental Categorization per ECR, 2023.** Project category is presented in the following table. KWSP Phase 2 includes components falling under Red and Orange categories, and as per procedures and the highest category among those is set for the overall project. Thus, the overall project needs to comply with the requirements of the Red

Category. KWASA will obtain one ECC for the entire project (covering all subprojects). KWASA has submitted a screening application to the DOE to formally initiate the environmental clearance process. Based on the screening and review of the project scope, DOE has confirmed that the project falls within the Red Category. KWASA is currently in the process of finalizing the EIA report. Once the EIA is reviewed and accepted by DOE, KWASA will apply for the Location Clearance Certificate (LCC). Following issuance of the LCC, the application for the Environmental Clearance Certificate (ECC) will be submitted.

Table 1: Categorization of the Project per ECR, 2023

Subproject/ Component	Interventions	ECR Category
Construction and Rehabilitation of the Drinking Water Supply System	Rehabilitation of Water Treatment Plant, construction of IPR, CWR, Deep Tube Wells, Pump houses, Overhead Tanks, laying of water pipelines (clear water transmission and distribution) along the existing road network, including crossing water bodies, roads, and railway lines.	Red
	Installation of solar panels, and solar power	Orange

2. Other Legislations Relevant to Project Activities

29. The following Table 3 provides a summary of legislations and policies that deal with the drinking water supply sector, including climate change in Bangladesh. Table 4 provides summary of relevant labour regulations.

Table 2: Relevant National Environmental Acts and Laws

Laws, Regulations, and Standards	Details	Relevance to the Subproject
The Constitution of the People's Republic of Bangladesh	The constitution of the country was adopted in 1972, but the 15th amendment to this constitution made in 2011 included the concept of the protection and improvement of the environment and biodiversity under fundamental principles of state policy (part II). To this end, Article 18A clearly states that the state shall endeavor to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests, and wildlife for the present and future citizens.	Overall applicability to the project
Environmental Conservation Act (ECA), 1995 (and as amended till date)	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 Environmental Conservation Rules have been framed with various amendments. The main strategies of the Act can be summarized as: • Declaration of ecologically critical areas (ECAs), and restriction on the operation and process, which can be carried out or cannot be initiated in the ecologically critical areas. • Regulation with respect to vehicles emitting smoke is harmful to the environment.	According to this law, 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.

Laws, Regulations, and Standards	Details	Relevance to the Subproject
	• Environmental clearance. • Regulation of the industries and other development activities – discharge permit. • Promulgation of standards for quality of air, water, noise, and soil for different areas for different purposes • Promulgation of standard limit for discharging and emitting waste. • Formulation and declaration of environmental guidelines. Amendment of 2000 of the Bangladesh Environmental Conservation Act focuses on (i) ascertaining responsibility for Compensation in cases of damage to ecosystems, (ii) increased provision of punitive measures both for fines and imprisonment, and (iii) fixing authority on cognizance of offences. The next amendment in 2002 emphasizes (i) restriction on polluting automobiles, (ii) restriction on the sale and production of environmentally harmful items like polythene bags, (iii) assistance from law enforcement agencies for environmental actions, (iv) break up of punitive measures, and (v) authority to try environmental cases. The latest amendment in 2010 declares demarcation of wetlands and water bodies and imposes restrictions on hazardous waste import, transportation, storage, etc., and activities on cutting of hills and/or mountains along with Ecologically Critical Areas.	
Environmental Conservation Rules, 2023	These provide, amongst other items, standards and guidelines for: • Categorization of industries and development projects. • Procedure for obtaining environmental clearance; and • Environmental quality standards in relation to inland surface water, coastal water, drinking water, sewage water, and industrial wastewater quality parameters are mentioned under schedules 2, 3, 4, and 5. Whereas standards for air pollution and noise are referenced to the Air Pollution Control Rules, 2022 and Noise Pollution Control Rules, 2006, respectively. ECR, 2023, classifies industrial units and development projects into four categories for the purpose of issuance of an Environmental Clearance Certificate (ECC).	In accordance with the ECR, 2023, the overall project is classified under the Red Category, requiring an EIA for the issuance of ECC from DOE. This ECC must be obtained prior to the commencement of the project.
Bangladesh Climate	The Government of Bangladesh prepared	Project is required to

Laws, Regulations, and Standards	Details	Relevance to the Subproject
Change Strategy and Action Plan, 2009	the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008 and revised it in 2009. This is a comprehensive strategy to address climate change challenges in Bangladesh. It is built around the following six themes: 1. Food security, social protection and health to ensure that the poorest and most vulnerable in society, including women and children, are protected from climate change. 2. Comprehensive disaster management. 3. Infrastructure to ensure that existing assets (e.g., coastal and river embankments) are well maintained and fit for purpose and that urgently needed infrastructures (cyclone shelters and urban drainage) are put in place to deal with the likely impacts of climate change. 4. Research and knowledge management 5. Mitigation and low carbon development 6. Capacity building and Institutional strengthening	consider in its design mitigation measures that will ensure the infrastructures (e.g. quality of pipes, depth of DTWs) can withstand the impact of climate change in the future.
National Water Policy, 1999	The National Water Policy was promulgated in 1999 with the intention of guiding both public and private actions to ensure optimal development and management of water to benefit both individuals and society at large. The policy aims to ensure progress towards fulfilling national goals of economic development, poverty alleviation, food security, public health and safety, a decent standard of living for the people, and protection of the natural environment. According to the policy, all agencies and departments entrusted with water resource management responsibilities (regulation, planning, construction, operation, and maintenance) will have to enhance environmental amenities and ensure that environmental resources are protected and restored while executing their activities. Environmental needs and objectives will be treated equally with the resources management needs. The policy has several clauses related to the protection and conservation of the natural environment to ensure sustainable development. Clause 4.6b of this policy states that natural depressions and water bodies in major urban areas must be preserved to recharge underground aquifers and rainwater management. Moreover, measures must be taken to minimize disruption to the natural aquatic	Project design, construction and operation shall take into consideration relevant policy provisions

Laws, Regulations, and Standards	Details	Relevance to the Subproject
	environment in streams and water channels (Clause 4.9b). In addition, this policy requires each water resources development project or rehabilitation program to give full consideration to environmental protection, restoration, and enhancement measures consistent with the National Environmental Management Plan and the National Water Management Plan and adhere to a formal environment impact assessment process, if required by the Government (Clause 4.12a and clause 4.12b). All these elements are directly associated with the nature of the subproject. The policy also applies to the subproject due to the subproject's potential to pollute surface water bodies and groundwater during the construction and operation phases. Therefore, the project is bound to comply with the requirements under this policy in its design.	
National Safe Drinking Water Supply and Sanitation Policy, 1998	The National Safe Drinking Water Supply and Sanitation Policy was adopted in 1998 and sets out the basic framework for the improvement of public health quality and to ensure an improved environment, together with a set of broad sectoral action guidelines. The policy has the following objectives: • To manage water supply and sanitation-related basic needs for all. • To bring about a positive change in people's attitude towards water and sanitation. • To reduce the outbreak of water-borne diseases. • To increase the efficiency of the Local Government and associated communities in handling the problems related to water supply and sanitation. • To improve sustainable water supply and sanitation system. • To promote proper conservation, management, and use of surface water and to control water pollution considering the scarcity of groundwater; and, • (vii) To take the necessary steps to capture and use rainwater.	This policy covers the project as far as managing water supply is concerned. The subproject is one of the means to realize the many objectives, in particular the ones related to improving the water supply system and reducing problems related to water scarcity, etc.
The Forest Act (1927) and the Forest (Amendment) Act (2000)	The Forest Act (1927) was enacted to control trespass and illegal resource extraction from forests and to provide a framework for the forestry revenue collection system. It is the main legislative context for forestry protection and management in Bangladesh. The Act allows for the notification of forest reserves	Although there are no forests around the project areas and alignments, the relevance of this Act is only to the potential cutting of trees in some project sites or alignments. The project

Laws, Regulations, and Standards	Details	Relevance to the Subproject
	in which the government, through the Forest Department, regulates the felling, extraction, and transport of forestry produce in Bangladesh. The Act grants the government several basic powers, largely for the conservation and protection of government forests, and limited powers for private forests.	will be required to obtain permits for cutting any trees prior to the start of civil works.
Bangladesh Public Procurement Rule (PPR), 2008	This rule applies to the Procurement of Goods, Works, or Services by any government, semi-government, or any statutory body established under any law. The rule includes adequate measures regarding the "Safety, Security and Protection of the Environment' in the construction works. This clause includes the contractor's responsibility to take all reasonable steps to (i) safeguard the health and safety of all workers working on the site and other persons entitled to be on it, and to keep the site in an orderly state and (ii) protect the environment on and off the site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.	KWASA is a government entity that needs to comply with the environment-related requirements under this Rule, as explicitly specified herein.
National Environmental Policy, 2018	The central theme of the policy is to ensure protection and improvement in the environment. The policy gives a thrust to sustainable development and long-term use of natural resources. The National Environment Policy contains policy statements and strategic options about population and land-use management, management and utilization of natural resources and other socio-economic sectors, as well as the necessary arrangements for the implementation of the policy.	The project will have site-specific impacts and will require the implementation of mitigation measures to ensure the protection and improvement of the environment.
Environment Court Act, 2000, and subsequent amendments in 2003	The Environment Court Act of 2000 has been enacted to establish environmental courts in each administrative division of Bangladesh. This Act sets out a policy for the effective pursuance and completion of legal proceedings related to environmental crimes. Under this Act the Director General of the DOE has the power to impose heavy penalties on industrial polluters who are dumping untreated wastewater into the environment or not operating their legally mandated effluent treatment plants.	This provides an avenue for stakeholders to resolution of environmental related grievances
The Bangladesh Wildlife (Conservation and Security) Act, 2012	Conservation and security of biodiversity, forests, and wildlife in Bangladesh. Act deals with prohibition of hunting of wild animals without permission, vulnerable, endangered and critically endangered species, removal and transfer of wild	There are no protected areas in the project area. Act provisions shall be complied with dealing with any wildlife

Laws, Regulations, and Standards	Details	Relevance to the Subproject
	animals, protected areas, etc.,	
The Antiquities Act, 1968	Law provides for preservation and protection of antiquities, which are defined in the act as "(i) any ancient product of human activity, movable or immovable, illustrative of art, architecture, craft, custom, literature, morals, politics, religion, warfare, science or of any aspect of civilization or culture, (ii) any ancient object or site of historical, ethnographical, anthropological, military or scientific interest, and (iii) any other ancient object or class of such objects declared by the Government, by notification. Act, among others, prohibits distribution, damage etc., of antiquities and regulates mining and quarrying in notified areas	There are no protected monuments in the project area. Project to comply with provisions of the act in case of any other antiquities found near the project sites.
National Water Act, 2013 National Water Rules, 2018	Ensures Bangladesh water sources are free from any type of pollution. Pollution from water in urban outfalls and reservoirs, e.g., lakes, canals, ponds and ditches, may result in amenity losses, fisheries depletion, health problems and fish and aquatic species contamination.	The project is required to implement measures to ensure that water source pollution is avoided
National Land Use Policy, 2001	Sets out guidelines for improved land use and zoning regulations. The main objective of this policy is to ensure criteria-based uses of land and to provide guidelines for the usage of land for the purpose of agriculture, housing, afforestation, commercial and industrial establishments, rail and highway, and tea and rubber gardens.	Siting of project components need to comply with land use and zoning regulations.
Natural Reservoir Conservation Act, 2000	This Act restricts the use of parks, playfield, natural water bodies etc., which are marked in Master Plan for any other purposes without the approval of competent authority.	Not applicable; project does not include use of natural water bodies for any other purpose
The Pourashava Act, 2009 / Ordinance issued for the amendment of local government (municipality) Ordinance, 2009 and 2010; The Pourashava Ordinance, 1977; Municipal Administration Ordinance, 1960	Provides guidance for subproject integrated community and workers health and hygiene at the construction and operation and maintenance stages of the project.	Mandated coordination with Pourashava committees on disaster management measures, water and sanitation, and waste management.
Building Construction (Amendment) Act and Building Construction Rules, Bangladesh National Building Code, 2020	Regulates technical details of building construction and maintains standards of building construction	Project designs for any building structure need to comply with the Act and Rules.
Air Pollution Control Rules, 2022	APCR, 2022, contains air quality standards based on WHO Guidelines (Interim Goals), emissions limits, and technical	Project construction activities will potentially generate air pollution

Laws, Regulations, and Standards	Details	Relevance to the Subproject
	specifications for key sectors, mandates, and coordination mechanisms among relevant line ministries to control both household and outdoor air pollution. The rules elevated the air quality management dialogue and leadership beyond the environment sector by establishing the National Committee on Air Pollution Control, a multi-sector decision-making body presided by the Cabinet Secretary to coordinate the APCR implementation and instruct relevant agencies on specific interventions to comply with the new rules.	(dust and smoke emissions) and thus need to comply with the emission standards specified in the Rules.
Noise Pollution (Control) Rules, 2006	The Noise Pollution Rules, 2006 addresses the sound levels to be no more than 50 dB in Silent Zones[a] during daytime (6 am to 9 pm) and 40 dB at night-time (9 pm to 6 am). In residential areas, these levels are 55 dB and 45 dB; in mixed areas, 60 dB and 50 dB; in commercial and industrial areas, 70 dB and 60 dB and in industrial areas, 75 dB and 70 dB for daytime and night-time, respectively.	Project activities, particularly the linear works, will be in various locations of Khulna City and extended area with different land uses. Thus, the project needs to comply with the corresponding noise level standards at all sites.
Solid Waste Management Rules, 2021	The Rules provide a comprehensive set of rules based on the national 3R strategy and other national and international policies and guidelines pertaining to solid waste management. It defines the roles and responsibilities of relevant government ministries and agencies, including local government authorities and other stakeholders, in implementing solid waste management undertakings. It also includes the environmental requirements necessary for these undertakings, the provision of incentives for the promotion of sustainable waste management practices, etc.	The project will generate solid waste and will be required to implement measures to comply with the integrated waste management rules.
Hazardous Waste (e-waste) Management Rules, 2021	Rules cover the various products that generate e-waste (home appliances, monitoring and control equipment, medical equipment, automatic machines, information technology and communication equipment). It establishes obligations for manufacturers, assemblers, collectors, sellers, and consumers of the products in storing, recycling and managing e-waste. The rule also sets provisions to limit the use of 10 notified substances.	E-waste generated in the project shall be managed as per the provisions of the rules

a. The area within 100 m of hospitals, academic institutions, or places identified/identifiable by the government
b. An area which is primarily a residential area with either or both commercial and industrial parts in it.

Table 3: Occupational Health and Safety Legislations

Title of Laws and Rules	Relevance
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.
Bangladesh Labor Act 2006 (amended in 2018)	Compliance with the provisions on employment standards, occupational safety and health, welfare and social protection, labor relations and social dialogue, and enforcement Prohibition of employment of children and adolescents.
Bangladesh Labor Rules, 2015	Contractor to implement occupational health and safety measures. The contractor will be liable for compensation for work-related injuries.
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 if an emergency arises, it is necessary to make special provisions for preventing the spread of human disease, safeguarding public health, and providing them with adequate medical services and other services essential to the health of the respective communities and workers, in particular during the construction-related work.
The Employees State Insurance Act, 1948	It has to be noted that health, injury, and sickness benefits should be paid to people, particularly respective workers at the 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 public health and environmental conservation.

3. Relevant International Conventions, Treaties and Protocols

30. Relevant International Conventions, Treaties, and Protocols (ICTPs) ratified by Bangladesh are given in the following table.

Table 4: Relevant International Environmental Conventions

	International Treaties	Ratified/ Accessed (AC)/ Accepted (AT)/ Adaptation (AD)	Relevance
1	International Plant Protection Convention (Rome, 1951) & Plant Protection Agreement for SE Asia and Pacific (1999 Revision)	01.09.1978 04.12.1974 (AC)	Ensures that component work or construction materials do not introduce plant pests.
2	Convention Concerning the Protection of World Cultural and Natural Heritage (Paris,	03.11.1983 (ratified)	No world heritage sites in or near project area. Nearest world heritage site is at about 50 km (60 dome

	International Treaties	Ratified/ Accessed (AC)/ Accepted (AT)/ Adaptation (AD)	Relevance
	1972)		mosque in Bagerhat)
3	Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1987)	02.08.90 31.10.90 (AC) (entry into force)	Use of equipment or facilities (e.g., refrigeration and air-conditioning units) that utilize ozone-friendly chemicals or substances.
5	Kyoto protocol		
6	Convention on Biological Diversity, 1992 (Rio de Janeiro)	03.05.1994	Protection of biodiversity during construction and operation.
7	Convention on Persistent Organic Pollutants, 2001	In process	Restriction of use of pesticides and herbicides.
8	United Nations Framework Convention on Climate Change, 1997	22.10.2001 13.11.2003 (amended)	Reduce greenhouse gas concentrations in the atmosphere to a level that would prevent dangerous anthropogenic interference with the climate system.
9	International Labour Organization (ILO) fundamental labour conventions (core labour standards) - Forced Labour Convention, 1930 - Freedom of Association and Protection of the Right to Organise Convention, 1948 - Right to Organise and Collective Bargaining Convention, 1949 - Equal Remuneration Convention, 1951 - Abolition of Forced Labour Convention, 1957 - Discrimination (Employment and Occupation) Convention, 1958 - Minimum Age Convention, 1973 - Worst Forms of Child Labour Convention, 1999	Ratified between 1972-2022	Core labour standards ratified by Bangladesh applicable to both project implementation and operation phase

4. Permits and Clearances

31. Table below shows the list of clearances/permissions required for the project. The project and construction related clearances shall be obtained prior to bidding or award of contract or start of construction, as the case may be. The contractor should ascertain the requirements prior to start of the construction and obtain all necessary clearances/permission prior to start of construction. It is the responsibility of PMU to ensure that all necessary regulatory clearances and permits timely and ensure compliance with the conditions, if any, stipulated in the respective clearances and permits. PMU, with the support of PMSC, will oversee and ensure contractors and sub-contractors' compliance with regulatory requirements.

Table 5: Project related Clearances and Permissions

No	Project component	Clearance / Permission	Project stage	Responsibility
1.	All project components	Environmental clearance certificate (ECC) from Department of Environment	Prior to bidding/ contract award	PMU, KWASA
2.	Increase in water abstraction (tube wells and surface water – Madhumati and Bhairab rivers)	Permission from Bangladesh Water Development Board (BWDB) and Permission from Water Resource Planning Organization (WARPO)	Prior to bidding/ contract award	PMU, KWASA
3.	Road cutting and laying of pipelines in public roads or crossing water bodies	Permission from concerned jurisdictional government agency: Khulna City Corporation (KCC), Local Government Engineer Department (LGED), Roads and Highways Department (RHD), Bangladesh Inland Water Transport Authority (BIWTA) etc., as the case may be	Prior to commencement of works in respective sections	Contractor and PMU
4.	Construction related permits (labour license, insurances, workman compensation policy, vehicle fitness, vehicle pollution under control certificates etc.)	Department of labour Bangladesh Road Transport Authority	Prior to commencement of works and throughout implementation	Contractor, PMU
5.	Tree cutting permission	No forest land involved in the project; tree cutting permission will be required from the tree owner (KWASA in project sites / road owning agencies for pipelines)	Prior to cutting of trees	Contractor, PMU

5. GOB Environmental Standards

32. **GOB Environmental Standards**. ECR, 2023 stipulates standards, including for drinking water, inland surface water, and effluent discharge standards for disposal into inland waters, coastal waters and public sewers. Ambient air quality and noise standards are prescribed in Air Pollution Control Rules, 2022 and Noise Pollution Control Rules, 2006 respectively. These are given in **Appendix 2**.

C. Comparative Analysis of ADB and GOB Requirements

33. A comparative analysis of ADB SPS policy principles and GOB requirements is presented in the below table. There are no major gaps, except requirements related to public consultation and disclosure, which is not mandatory as per the GOB regulations. There are some gaps in environmental standards for some parameters.

Table 6: Comparative Analysis of Environmental Safeguard Policy

.	ADB SPS, 2009		GOB Policy	Gaps (if any)
	Principles	Delivery Process		
1	Use of screening process to determine the appropriate environmental assessment	Uses sector-specific rapid environmental assessment checklist for screening and assigns categories based on potential impacts: A - EIA required (irreversible, diverse, or unprecedented adverse environmental impacts). B - IEE required. C - No environmental assessment is required, but a review of environmental implications is. FI - ESMS required.	ECA, 1995 and ECR, 2023 set screening criteria to classify industries/ projects based on potential environmental impacts as follows: Green, Yellow, Orange and Red (cause significant environmental impacts). The screening criteria is based on the project or industry type and do not consider the scale and location. The category determines the level of environmental assessment.	No major gaps
2	Conduct an environmental assessment.	EIA and IEE - Identify potential impacts on physical, biological, and socioeconomic aspects in the context of the project's area of influence (i.e., primary project site and associated facilities) ESMS for FIs	Industry/project category Green- no environmental assessment required. Yellow – compliance with site selection criteria. Orange – compliance with site selection criteria and conduct of IEE required. Red – compliance with site selection criteria and both IEE and EIA required.	No major gaps
3	Examine alternatives	Analyze alternatives to the project's location, design, and technology Document rationale for selecting the project location, design, and technology Consider a "no project" alternative	Regulations (i.e., ECA, 1995 and ECR, 2023) do not require specifically the identification and analysis of alternatives.	Not required by law but the ToR for EIA to be approved by the DOE now includes a discussion on analysis of alternatives.
4	Prepare an environmental management plan (EMP)	EMP to include monitoring, budget and implementation arrangements.	EMP and procedures for monitoring included in the IEE and EIA (i.e., Yellow, Orange, and Red category projects)	No major gaps
5	Carry out meaningful Consultation	Starts early and continues during implementation. Undertaken in an atmosphere of free intimidation Gender inclusive and responsive and tailored to the needs of vulnerable groups Allows for the incorporation of all relevant views of stakeholders Establish a grievance	For projects classified under the Red Category, public consultation is required based on ECR, 2023 The grievance redress mechanism is not mentioned in ECA, 1995 and ECR, 2023. The EIA format required by DOE includes stakeholders' consultation.	Approval of the ToR of EIA by DOE includes mandatory consultation with stakeholders.

.	ADB SPS, 2009		GOB Policy	Gaps (if any)
	Principles	**Delivery Process**		
		redress mechanism		
6	Timely disclosure of draft environmental assessment (including the EMP)	Draft EIA report posted on the ADB website at least 120 days prior to Board consideration. Draft EA/EARF prior to appraisal Final or updated EIA/IEE upon receipt Environmental monitoring report submitted by borrowers upon receipt.	There is no requirement for public disclosure of environmental reports, but DOE posts the minutes of the meeting on the application for an environmental clearance certificate on its website: http://Jashore.doebd.org/minutes.php	No requirement for public disclosure of environmental assessment
7	Implement EMP and monitor the effectiveness	Prepare monitoring reports on the progress of EMP Retain qualified and experienced external experts or NGOs to verify monitoring information for Category A projects. Prepare and implement a corrective action plan if noncompliance is identified. Requires submission of quarterly, semi-annual, and annual reports to ADB for review	For project classified under Orange and Red Categories, ECC is subject to annual renewal based on compliance of the conditions set by DOE.	No major gaps
8	Avoid areas of critical habitats (use of precautionary approach to the use, development, and management of renewable natural resources)	Provides guidance on critical habitats.	ECA, 1995 and ECR, 2023 identify ecologically critical areas and the rules to protect them.	No major gaps
9	Use pollution prevention and control technologies and practices consistent with international good practices.	Refers to World Bank's Environmental Health and Safety (EHS) General Guidelines 2007 (or any update) If national regulations differ, more stringent will be followed. If less stringent levels are appropriate in view of specific project circumstances, provide a full and detailed justification.	Effluent standards, ambient, and emission standards are included in ECA, 1995 and ECR, 2023. Ambient noise levels are included in Noise Pollution Control Rules, 2006.	No major gaps
10	Provide workers with safe and healthy working conditions	Refers to WB EHS General Guidelines 2007 (or any update).	Occupational health and safety standards are included in the Factories Act 1965, the Bangladesh Labour Act 2006, and its	No major gaps

.	ADB SPS, 2009		GOB Policy	Gaps (if any)
	Principles	**Delivery Process**		
			2013 amendment.	
11	Conserve physical cultural resources (PCR) and avoid destroying or damaging them.	Use of field-based surveys and experts in the assessment. Consult affected communities on PCR findings Use chance find procedures for Guidance.	Preservation and protection of cultural resources are within the Antiquities Act 1968.	No major gaps

III. PROJECT DESCRIPTION

A. Existing Water Supply System in Khulna

34. Khulna is the 3rd largest city and the 2nd largest port entry, situated along the Rupsha and Bhairab rivers in the southwestern part of Bangladesh. The city covers an area of 46 km^2 with an estimated population of 1.26 million people in the Khulna City Corporation (KCC) area with approximately 70,221 residential, commercial, and institutional buildings and forms an important urban center. As per projections, the projected population of the KCC area is expected to increase to 1.588 million by 2035 and 2.033 million by 2050.

35. The Khulna Water Supply and Sewerage Authority (KWASA) is responsible for provision of city's water supply and sewerage system. The Khulna Water Supply Project - KWSP (co-financed by ADB and JICA) was completed in June 2019, which was aimed at providing a sustainable water supply system for Khulna through the development of a surface water treatment plant to meet the growing demand of the city while preventing excessive abstraction of groundwater. Presently, about 1.1 million (74%) of the Khulna's population has access to piped water supply. However, 400,000 residents remain unserved, necessitating additional investments to meet their needs and those of the future population. The main components of the system are detailed below:

36. **Water supply sources.** The KWSP draws water primarily from the Madhumati River. At present, of 110 MLD capacity, it supplies about 45-50 MLD from this system. About 5 MLD is supplied from Bhairab river. This is supplemented by about 30 MLD supply from tube wells located in various places in the city. As per the feasibility study estimate, about 30 MLD of water is abstracted by individual households through their own sources (tube wells /hand pumps), which is about 27% of the total demand. Thus, the total water supply in the KCC area currently amounts to 110 MLD. [12]

37. **Mollahat Intake Point***:* The Intake is located at Mollahat Bazar, about 200 m downstream of Dhaka-Khulna Highway, on the right bank of the Madhumati River. The raw water is introduced to the pump well through the intake gate,inflow screen with an opening of 100 mm, and grit chamber. Water flows by gravity from the intake offtake to the Pump House. In Pump House, 4 vertical double suction volute pumps with dry sumps are installed, which lift the raw water from the intake sump and push it to the raw water pipeline. The present capacity of the pumping system is 110 MLD (1.27 m^3/s) but the ultimate capacity of Intake is 220 MLD (2.54 m^3/s). This represents approximately 1% of the river discharge. As per KWASA officials, pumps frequently choked giving lower efficiency of work due to silts in the intake water. At present there is no silt trap or desilting basin. The Intake premises also has an Electrical room (Switchgear and Transformer), Generator room, Surge Vessel and an administrative building.

38. **Raw Water Transmission Pipeline.** Raw water transmission pipeline consists of a 1,400 mm diameter Ductile Iron (DI) pipe of 32.6 km length up to the Water Treatment Plant (WTP). The alignment traverses along the Dhaka-Khulna highway along the right bank. From Fakirhat, the pipeline leaves the highway and goes along the Bahirdia-Baghmara road up to the WTP at Patherghat. There are 19 underwater crossings. As per KWASA officials, one river/canal near Fakirhat has been dredged after the laying of pipes, due to which the pipes got exposed above the ground level. At present, KWASA has made temporarysupport (girders) to hold the pipes in position. There is a need to construct a new underwater crossing at this point.

[12] PFS for KWSP Phase 2, 2024, included a detailed surface and groundwater resource assessment in Khulna conducted by Institute of Water Modelling (IWM), Bangladesh. The Hydrological Study Report of IWM is appended to PFS Report as Appendix 15. This report is referred in IEE as "IWM Report or IWM Study"

Figure 3: Khulna Water Supply System Components

39. Impounding reservoir. An impounding reservoir (IPR) is located just before the WTP in the same premises. It is a rectangular pond of 207 m x 337 m and a depth of 12 m. The reservoir has a capacity of 770,000 m^3. During the rainy season, surface water with lower chloride concentration is stored in the impounding reservoir, and used to blend with raw water during high salinity periods before supply. This is intended to store the water for 7 days design capacity of WTP. Due to the high silt concentration in the intake water, KWASA also uses the impounding reservoir as a de-silting basin. This would reduce the effective volume of the Reservoir gradually.

40. **Bangabandhu Water Treatment Plant (BWTP).** A conventional water treatment plant of 110 MLD capacity (called Bangabandhu WTP) is located at Patharghat, on the outskirts of Khulna City. At present, the BWTP operates at less than half of design capacity (43-45 MLD). WTP is performing well. There are no issues in the performance of the Plant. The main Units of BWTP are shown in the images below.

Figure 4: Main operational units of WTP

41. **Clear Water Transmission and Distribution System.** The transmission network comprises ductile iron (DI) pipes and internal cement mortar lining a length of about 27 km. Pipe sizes range from 1,200 mm to 350 mm in diameter. Clear water is pumped from WTP to 7 Nos. zonal clear water reservoir cum pumping stations. From these pumping stations water is fed to the distribution system. The pipeline crosses the Rupsha River at Rupsha Ghat. The pipe used forcrossing is 1,100 mm diameter steel pipe. Khulna city area has a boundary area of 45.64 sq.km within its current corporation limits. The existing system serves all 31 wards of KCC. The total length of the distribution network is approximately 663 km consisting of mostly High-Density Polyethylene (HDPE) pipes. There are also about 42 km of DI pipes in the system. The existing city area is divided into 10 water zones. The zonal demand is fed from 7 nos. Distribution reservoir cum pumping stations at strategic locations throughout the city area. Each water zone contains a small-capacity Overhead Tank (OHT) with 20 m staging height. The distribution system was designed based on the District Meter Area (DMA) approach, comprising 67 DMAs in the entire distribution system.

Table 7: Distribution Pipeline Details

DR Name	Zone	Zone Name	HDPE Pipes (in km)						DI	TOTAL
			75 NB	110 NB	160 NB	200 NB	250 NB	355-450	300-600	(in km)
Labonchora	Zone 1	Labonchora	21	36	11	7	4	-	1	80
Chhota Boyra	Zone 2	Baniakhamar	31	12	12	17	11	-	4	87
Chhota Boyra	Zone 3	Choto Boyra	30	9	17	16	-	-	4	76
Natun Bazar	Zone 4	Natun Bazar	11	30	16	5	5	5	6	78
Rayer Mahal	Zone 5	Rayer Mahal	26	16	17	11	2	-	7	79
Boyra	Zone 6	Boyra	21	20	17	6	5	-	2	71
Charerhat	Zone 7	Charerhat	6	18	3	5	2	-	5	39
Rayer Mahal	Zone 8	Natun Rasta	8	13	10	4	-	-	4	39

DR Name	Zone	Zone Name	HDPE Pipes (in km)						DI	TOTAL
			75 NB	110 NB	160 NB	200 NB	250 NB	355-450	300-600	(in km)
Deana	Zone 9	Deana west	15	6	13	12	-	-	2	48
Deana	Zone10	Meer-e-Danga	24	-	15	16	5		7	67
	Total		**193**	**160**	**131**	**99**	**34**	**5**	**42**	**663**

42. **Supply from Production Tube wells.** Prior to commissioning of Khulna Water Supply Project (KWSP) funded by ADB in July 2019, groundwater resources served as the primary water source for all households in Khulna City. This included deep tube wells owned by KWASA, as well as privately owned deep tube wells and hand pumps. At present, in addition to supply from Bangabandhu WTP, KWASA also supplements the demand by ground water supply from 40 nos. tube wells (production wells). These tube wells inject water into the network directly from their location. These are the main source of supply during the high salinity periods of river. Groundwater level data is given in the following table.

Table 8: Water Level at Khulna City Corporation Area

	Year	Static Water Level (SWL) (m)	Pumping Water Level (PWL) (m)	Remarks
1	April, 2015	8.34	18.404	Average of 61 Locations
2	April, 2016	7.781	18.635	Average of 65 Locations
3	March, 2017	8.118	20.534	Average of 66 Locations
4	April, 2021	10.23	23.784	Average of 20 Locations
5	April, 2022	9.5	22.11	Average of 26 Locations

Source: KWASA

43. **System Operation and Control: SCADA System**. The SCADA system is comprehensive, encompassing all key components of the water supply infrastructure. From the intake to the various parts of the BWTP, it also includes the clear water transmission system, service reservoirs, and pumping stations across different zones, as well as district-metered areas within the distribution network.

44. **Afil gate intake on Bhairab River, transmission and treatment**. About 5 MLD of water is drawn from Afil Gate intake on Bhairab River at Gilatala in Khulna Water flows into the intake by gravity through an underground conduit from river into intake well in pump house. Water is conveyed to the IPR at the Afil gate WTP campus, about 1.5 km away. The WTP has a capacity of 5 MLD. Treated water is supplied to the system

45. **Water supply system in extended area (outside KCC).** The extended area is predominantly low-density and has a rural setting. Roads are under development in the vacant areas. Khulna by-pass Road runs along the north-south direction of the extended area. At present, this area is dependent on individual water sources, mainly groundwater, and as per the feasibility study, the estimated water abstraction is 40 MLD.

46. **Issues / Gaps in the Existing System.** The 2010 JICA study, based on which the river source was identified, projected that increased salinity (i.e., exceeding 1,000 milligrams per liter [mg/l]) may last for about 16 days during April. Accordingly, a reservoir was built to dilute the river water during the dry season mixing with freshwater stored in the reservoir to reduce salinity to a level suitable for treatment.[13] However, KWASA water quality monitoring data for 2020, 2021, and 2023 showed that the intake water salinity ranged from 1,100 to

[13] JICA. 2011. Feasibility Study for Khulna Water Supply Improvement Project in People's Republic of Bangladesh.

2,300 mg/l from April to June and stayed at 20 to 50 mg/l for the remaining nine months.[14] Since the completion of the KWSP in 2019, increased water salinity has emerged as a critical concern that needs to be addressed urgently. The KWSP serves 1.1 million people (40,000 houses [holdings]) with 113 liters per capita per day.[15] The Khulna City Corporation (KCC) has extended its area since the design of KWSP. Based on the population projection, an additional 16,000 houses in the existing area and 9,000 houses in the extended area will need to be connected by 2035, which accounts for 0.76 million population.[16] Long-term planning for the piped water supply is needed to cope with the future demand and ensure sustainable water service to the city. Therefore, KWSP Phase 2 is proposed with ADB funding.

Figure 5: Mollahat Intake on Madhumati River

[14] The maximum acceptable level of salinity is 600 mg/l as per Bangladesh Drinking Water Standard (Environment Conservation Rules, 1997).
[15] ADB. 2021. *Completion Report: Khulna Water Supply Project in Bangladesh*.
[16] Cities Development Initiative for Asia. 2024. TA-6559 REG: Implementing the Cities Development Initiative for Asia. Preparation of the Feasibility Study for the Khulna Water Supply Project (Phase 2). Final Report. As per Khulna City Corporation holding data (2019), on an average, each holding has 4.5 households (families) and each household has six members. Therefore, each house connection supplies water to 27 persons.

Figure 6: Bangabandhu Water Treatment Plant and IPR

Figure 7: Bhairab Intake at Afil Gate

Figure 8: Water Treatment Plant and IPR at Afil Gate

B. Proposed Khulna Water Supply Project - Phase 2

47. Since the completion of the KWSP in 2019, rising water salinity has become a critical issue requiring immediate attention. The KWSP currently serves a population of 1.1 million (40,000 households) with 113 liters of water per capita per day. Approximately 6,000 households could not be connected to piped water services during the initial project because road alignments in those areas were not available at the time. Now, the road networks in those areas have been developed. Additionally, the city corporation area has expanded since the KWSP design, with around 9,000 new households built in both the city's core and extended areas. As a result, an additional 400,000 people (15,000 households) now require a piped water supply. Beyond serving the current unconnected population, long-term planning for the piped water supply is essential to meet future demand and ensure sustainable water services for all.

48. **Design period of the project.** Although the design period for the Project is set as 2050, immediate investment for implementation of the KWSP Phase 2 shall be made for the requirement up to 2035.

1. Water demand and supply

49. **Projected water demand of the project area**. Based on the Population forecast, and per capita water consumption assessment made in the feasibility study, water demand is projected as 220 MLD (2035) and 340 MLD (2050).

Table 9: Assessment of water demand

Particulars	Water Demand Estimate (for this project)			
	2023	2023	2035	2050
Population of Project Area (KCC + Extension)	1,080,000 (in KCC)	1,474,868	1,858,319	2,383,632
Per capita domestic demand, LPCD	73	73	85	100
Domestic water demand, MLD	78.84	108	157.95	238.36
Non-domestic demand as % of domestic demand	5	5	8	10
Non-domestic Demand, MLD	3.94	5	12.64	23.84
Total of Domestic and Non-domestic demand, MLD	82.78	113	170.59	262.20
Leakage after WTP, %	12	12	12	12
Avg. day water demand, MLD	92.71	127	191.06	293.66
Seasonal Peak factor	1.15	1.15	1.15	1.15
Max. day water demand, MLD	106.61 (Say 110)	146 (Say 150)	219.72 (Say 220)	337.71 (Say 340)

50. **Water Supply Sources.** The feasibility study investigated and analysed the following three (3) possible options (or Alternatives) for securing the required quantity and quality of drinking water in the dry season when salinity is high at Mollahat Intake. Salinity levels were assessed duly considering climate change risks i.e. sea level rise. Options include: (i) change the source of water, (ii) reduce salinity by dilution with stored freshwater in impounding reservoirs (IPR), and (iii) composite solution - use multiple sources of surface and ground water. Details of these options are provided in **Appendix 3.** Analysis concluded that option 1 and option 2 both have some technical, financial, administrative, social, and environmental issues and challenges that requires detailed studies and assessments prior to implement the project, which can best be considered for a long-term solution. Option 3 has been selected as the preferred option for implementation to address the immediate issue of salinity during the dry season with the design period of 2035. Consideration is given to the consumptive use of water. Input from hydro-geological studies conducted by IWM, Bangladesh (June 2024) has been considered. This option includes the following measures, and proposed source-wise monthly water abstraction is given the table below.

(i) Adapt consumptive use, optimize groundwater usage and ensure annual abstraction within estimated safe yield limits; reduce groundwater abstraction in normal season and increase in dry periods
(ii) **Madhumati River system.** Increase water abstraction from Madhumati River (110 MLD to 135 MLD) in non-lean season;
(iii) construct a new IPR at Bangabandhu WTP (450 million liter (ML) capacity) to store additional water during non-lean season; together with existing IPR the total capacity will increase to (1,155 ML), which can supply water at the rate of 18.9 MLD for 2 months (Apr-May) of dry season.
(iv) **Bhairab River system.** Increase water abstraction from Bhairav River (5 MLD to 15 MLD) in non-lean season
(v) Augment existing IPR capacity at Afil gate WTP from 57 ML to 192 ML by deepening and construct a new IPR at Mostafa Mor (44 ML capacity). This system can supply water at 2.7 MLD for 4 months during the high salinity period from March to June.
(vi) **Groundwater.** Increase average groundwater abstraction from 30 MLD to 43 MLD; abstraction to vary seasonally with maximum water utilization in lean summer season
(vii) The groundwater abstraction by private parties in the total project area is

estimated as 70 MLD at present (30 MLD KCC area + 40 MLD outside area). This is planned to be reduced to 45 MLD in 2035 by strict control and surveillance.

(viii) Groundwater abstraction by private individuals: 30 to 45 MLD

(ix) Ensure overall abstraction within the annual safe yield limits

Table 10: Water supply sources & proposed monthly abstraction (2035)

Facility	Water Source	Quantity of Raw Water Abstraction, MLD											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BWTP	Mollahat	135	135	135	35	35	135	135	135	135	135	135	135
	IPR				18.9	18.9							
Afil Gate WTP	Bhairab River	15	15					15	15	15	15	15	15
	IPR			2.7	2.7	2.7	2.7						
KWASA	Production Well	25	25	37	118.4	118.4	37	25	25	25	25	25	25
Private	Tube well	45	45	45	45	45	45	45	45	45	45	45	45
Total, MLD		**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**

Table 11: Water Sources Potential, Existing and Proposed Abstraction

Components	Potential	Existing utilization	Proposed
Groundwater	Estimated safe yield: Annual = 36,500 ML Average daily = 100 ML	KWASA = 30 MLD Private supplies = 45 MLD (KCC area) + 25 MLD (outside KCC area) Total abstraction daily: 100 ML Annual: 36,500 MLD % of usage = 100% of safe yield	KWASA: Daily average: 43 MLD (actual daily abstraction will vary seasonally from 25 – 118.4 MLD) Private: Daily: 45 ML Total abstraction daily: 88 ML (average) Annual: 31,961 ML % of usage = 88% of safe yield
Madhumati River	Lean period flow = 292 m3/sec	Design: 110 MLD (1.16 m3/sec) Actual abstraction 45-50 MLD (0.58 m3/sec) Utilization: 0.4% of lean season flow	Average: 118 MLD (actual daily abstraction will vary seasonally from 35 – 135 MLD) Utilization considering maximum abstraction of 135 MLD: 0.53% of lean season flow
Bhairav river	Lean period flow = 80 m3/sec	Design: 5 MLD (0.058 m3/sec) Utilization: 0.07% of lean season flow	Daily: 15 MLD (for 8 months, July-Feb) Utilization: 0.21% of lean season flow

2. Proposed Project Components

51. Details of the components proposed under the project are discussed below, and details are given in **Table 12. Figure 9 to 7** shows the locations, alignment, layouts etc of the proposed components. Technical details of all components are presented in **Appendix 4**.

(i) **Optimization in pumping at Mollahat Intake**: Install online monitoring system

(Salinity and Electrical Conductivity) for Salinity and automatic adjustment of pumping rate and linked to the SCADA system. It is expected that this provision will allow a minimum pumping of 35 MLD in the dry season too.

(ii) **Impounding Reservoir (IPR) at BWTP**: 385 ML capacity is proposed adjacent to the existing IPR in the BWTP complex. The existing pumping capacity shall be enhanced by 25 MLD to cater for 135 MLD of pumping.

(iii) **Retrofitting of BWTP**: Increase the capacity of existing WTP from 110 to 135 MLD by retrofitting WTP. The retrofitting is possible by modifying the existing sedimentation and filtration system. The proposed modifications are:

- Coagulation- by Mechanical mixer and flocculators
- Sedimentation- by Lamella tube/plate settlers
- Filtration- introduce filter nozzles, modify filter deck system, and dual (air and water) backwash system.
- Additional clear water pumps of 25 MLD capacity

(iv) **Clear Water Transmission Mains**: New pipelines will be laid to strengthen the existing system for the 2050 requirement.

(v) **Clear Water Reservoirs (Distribution) and Pump Houses**: These are also planned for Phase 2 (2050) requirement. It is proposed to construct 4 Distribution Reservoirs cum Pump houses, namely CWR 1 to CWR 4, for supplying water to the proposed extension area of the Project. Each facility will have a distribution reservoir, a pump house, an OHT, and a administrative buildings. CWR-1 and CWR-2 are to be constructed on new private land proposed for acquisition. The land area proposed for acquisition is 2,700 m^2 and 7,500 m^2 for CWR-1 and CWR-2, respectively. CWR-3 and CWR-4 would be constructed on KWASA's own land at Afil Gate, one inside the 5 MLD WTP premises and another at the place of abandoned CWR from the KCC area.

(vi) **Distribution System Pipelines**: This component is also planned for Phase 2 development for 2050. The distribution system pipeline in the existing area (KCC area) would be 243 km in length and 235 km in the extension area, thus totaling 478 km in length. The pipelines would be DI and HDPE pipes.

(vii) **Afil Gate Intake and Pump station**: Water flows into existing intake at Gilatala on the bank of the Bhairab River by gravity through an underground conduit from river into intake well in pump house, and this arrangement is adequate to draw 15 MLD, and therefore no works will be required in the river. Pumphouse will be retrofitted and capacity augmented from 5 to 15 MLD.

(viii) **Raw Water Pipeline from Intake to Afil Gate IPR**: 1,500 m long 600 mm diameter DI pipeline.

(ix) **Afil Gate IPR**: The size of the IPR is 120 m x 160 m and depth are about 3 m. It is proposed to deepen to 10 m to augment the capacity.

(x) **Raw Water Pipeline, Reservoir, and Pump house at Mostafa Mor**: IPR of capacity 44 MLD at Mostafa Mor, a raw water pumping station, raw water pipeline from Afil Gate Intake to IPR, and from IPR to Afil Gate WTP (12 km long).

(xi) **Retrofitting of Afil Gate WTP**: Increase the capacity from 5 to 15 MLD by modifying the existing Coagulation and sedimentation system. The proposed modifications are:

- Coagulation Tank Portion- To be converted into Coagulation, Flocculation, and Lamella Tube/Plate Settlers.
- Sedimentation Tank Portion- To be converted into a Filtration Tank.
- Rehabilitation of the Chlorination system and Clear water reservoir
- Additional clear water pumps of 10 MLD capacity shall also be installed.

(xii) **Clear Water Transmission Pipeline for Afil Gate WTP system**

(xiii) **KWASA's Production Wells**: At present, KWASA's production wells are yielding a total of about 30 MLD only. It is planned to increase daily average

abstraction of 45 MLD to meet 2035 demand. Groundwater usage will be synchronized to meet the gap in surface water supply, therefore maximum abstraction will be during the dry season. Tube well locations will be finalized as per the zones shown in the IWM study (June 2024). These will be mostly constructed in old and defunct productions well sites of Khulna City Corporation (KCC) and outer areas.

(xiv) **Privately Managed Wells**: The groundwater abstraction by private parties in the total project area is estimated as 70 MLD at present. Once the KWASA water supply is provided this will come down. A provision of 45 MLD is kept to meet 2035 demand. Strict control and monitoring mechanisms will be implemented to limit abstraction to 45 MLD.

(xv) **Solar Power Generation**: On-grid solar power by installing solar panels at the IPRs (2 existing IPRs at BWTP & Afil Gate and 1 new proposed IPR at BWTP) and rooftop of CWRs (7 nos. existing and 4 new proposed). Estimated power generation is 3,775 kilowatt (KW). Floating type solar panels are proposed over the IPRs. This will also reduce the evaporation loss of IPRs, and water beneath the panels would have a cooling effect on the panels.

Table 12: Proposed Project Components

Component	Description of Work	Unit	No.	Quantity/ Capacity
Pre-settling Tank	Civil works- Pre-settling tank, inlet/outlet channel, and peripheral works	LS	1	1
	Mech. Works- Sluice gate, Pipes, Valves, Scrapper mechanism, Sludge pump, dewatering pump	LS	1	1
Pumping System	Mech Works - Pumps, Dismantling Joint, NRV, suction and discharge pipes, sludge and dewatering pumps, etc.	No.	1	Main Pump, Q = 1,800 m^3/hr, JASHORE = 34 m, Rating = 250 kW
Electrical Works	Electrical Switchgear (HT and LT Panels), VFD Panels, Cables, etc.	LS	1	1
Smart Online Monitoring System	EC meter, Salinity/Chloride meter, and Automation Works	LS	1	1
Existing Raw Water Pipeline from Mollahat to BWTP				
Khal Crossing for existing pipeline	1,400 mm DI (restraint joint) pipe laying under-drain works	m	1	60
New Impounding Reservoir at BWTP				
Impounding Reservoir	Construction of IPR, including connecting channel between old and new IPR	ML	1	385
	Inlet Pipeline, Valves, & Chambers from the incoming raw water pipeline	m	1	300
	Steel Arch Bridge for the crossing of the connecting channel	m	1	30
Pumps and Mechanical Works	Additional Pumps for existing Pumping Station at IPR, including Dismantling Joint, NRV, Pipes & Common Header	No.	1	Q = 1.800 m^3/hr, JASHORE = 30 m, Rating = 250 kW
Electrical Works	Electrical Switchgear (HT and LT Panels), VFD Panels, Cables, etc.	LS	1	1
Retrofitting of BWTP				
Retrofitting of WTP	Retrofitting of BWTP, including Civil and	MLD	1	25

Component	Description of Work	Unit	No.	Quantity/ Capacity
	E/M Works			
Pumps for Clear Water Transmission System	Additional Pumps	No.	2	Q = 1.800 m^3/hr, JASHORE = 30 m, Rating = 250 kW
	Dismantling Joint, NRV, Pipes & Common Header	LS	1	1
	Electrical Switchgear (HT and LT Panels), VFD Panels, Cables, etc.	LS	1	1
New Intake at Afil Gate in Bhairab River				
Intake	Inlet chamber, Sluice Gate, Grit Chamber, Bar Screens, etc.	LS	1	1
Pump House and Pumping System	Civil Works for Bldg. (Sump and Superstructure)	LS	1	1
	Additional Pumps and associated mechanical Works- Dismantling Joint, NRV, Pipes & Common Header	No.	3	Q = 417 m^3/hr, JASHORE = 20 m, Rating = 75 kW
Electrical and Allied Works	Civil work for Electrical Building	LS	1	1
	Civil works for Admin. Building	LS	1	1
	Electrical Switchgear (HT&LT), VFD, Transformer, Surge Tanks, Generator, Fuel Tank, etc.	LS	1	1
New Raw Water Pipeline from Afil Gate Intake to WTP				
Raw Water Pipeline	600 mm HDPE (PN 10) Pipeline including Valves	m		1,500
	250 mm HDPE pipeline from Intake to Mostafa Mor and Mostafa Mor to Afil Gate WTP	m		12,000
Impounding Reservoir at Afil Gate				
Impounding Reservoir	Construction work for the expansion of IPR, including Inlet Pipeline, Valves & Chambers.	ML	1	192
Pumps for Raw Water pumping from IPR	Additional VT Pumps, including Suction and Delivery Pipelines, Dismantling Joint, NRV, etc.	No.	2	Q = 417 m^3/hr, JASHORE = 20 m, Rating = 75 kW
Impounding Reservoir at Mostafa Mor				
Impounding Reservoir	Raw Water Reservoir, including Inlet Pipeline, Valves & Chambers.	ML	1	44
Pumping System	Pumps and associated pipelines, NRV, Joints, etc.	LS	1	1
Retrofitting of Afil Gate WTP				
Retrofitting of WTP	Retrofitting of Afil Gate WTP, including Civil and E/M Works	MLD	1	5 to 15
Pumps for Clear Water Transmission Main	Additional Centrifugal Pumps, including Dismantling Joint, NRV, and Piping to Common Header	No.	2	Q = 417 m^3/hr, JASHORE = 20 m, Rating = 75 kW

Component	Description of Work	Unit	No.	Quantity/ Capacity
Electrical and Allied Works	Electrical Switchgear (HT&LT), VFD, Transformer, Surge Tanks, Generator, Fuel Tank, etc.	LS	1	1
Clear Water Transmission Pipeline from Afil Gate WTP				
Pipeline Works	600 mm diameter DI Pipeline	m		300
	Inter-connecting pipelines, Valves, and Appurtenances	LS	1	1
Clear Water Transmission Mains from BWTP				
DI Pipeline	900 mm	m		16,637
	800 mm	m		4,781
	700 mm	m		12,549
	600 mm	m		77
	500 mm	m		2,181
	400 mm	m		1,585
Mayur River Crossing	River Crossing by HDD Method	m	3	200
Other Drain Crossings	Canal/Drain Crossing by HDD Method	m	25	10
Butterfly Valve	900 mm	No.		8
	800 mm	No.		5
	700 mm	No.		9
	600 mm	No.		5
	500 mm	No.		5
	400 mm	No.		5
Wash Out Valve	250 mm	No.		25
Air Valve (Double Orifice)	150 mm	No.		20
Clear Water Distribution Reservoir and Pump House				
Zone 11				
Civil Works	CWR	ML	1	2
	Pump House	LS	1	1
	Overhead Tank (OHT)	ML	1	0.3
	Other Buildings (Administrative, Electrical, Guard room)	LS	1	1
	Pipelines and Valves within the complex joining various units	m		100
	Miscellaneous Works (Road, Drainage, Lighting, etc.)	LS	1	1
Mechanical Works	Pumps	No.	3	Q = 58 m^3/hr, JASHORE = 30 m, Rating = 75 kW
	Dismantling Joints, NRVs, Pipes, and Common Header in the Pump House	LS	1	1
	Electro-magnetic Flow meter after Header Pipe	No.	1	1
Electrical and Allied Works	Electrical Panels (Switchgear, VFD panels), Transformer, Generator	LS	1	4
Zone 12, 13 & 14				
Civil Works	CWR	ML	1	7
	Pump House	LS	1	1
	Overhead Tank (OHT)	ML	1	0.9
	Other Buildings (Administrative, Electrical, Guard room)	LS	1	1
	Pipelines and Valves within the complex joining various units	m		150
	Miscellaneous Works (Road, Drainage, Lighting, etc.)	LS	1	1
Mechanical Works	Pumps	No.	9	Q = 89

Component	Description of Work	Unit	No.	Quantity/ Capacity
				m^3/hr, JASHORE = 30 m, Rating = 75 kW
	Dismantling Joints, NRVs, Pipes, and Common Header in the Pump House	LS	1	1
	Electro-magnetic Flow meter after Header Pipe	No.	1	1
Electrical Works	Electrical Panels (Switchgear, VFD panels), Transformer, Generator	LS	1	4
Zone 15				
Civil Works	CWR	ML	1	5
	Pump House	LS	1	1
	Overhead Tank (OHT)	ML	1	0.5
	Other Buildings (Administrative, Electrical, Guard room)	LS	1	1
	Pipelines and Valves within the complex joining various units	m		100
	Miscellaneous Works (Road, Drainage, Lighting, etc.)	LS	1	1
Mechanical Works	Pumps	No.	3	Q = 304 m^3/hr, JASHORE = 31 m, Rating = 75 kW
	Dismantling Joints, NRVs, Pipes, and Common Header in the Pump House	LS	1	1
	Electro-magnetic Flow meter after Header Pipe	No.	1	1
Electrical Works	Electrical Panels (Switchgear, VFD panels), Transformer, Generator	LS	1	4
Zone 16				
Civil Works	CWR	ML	1	7
	Pump House	LS	1	1
	Overhead Tank (OHT)	ML	1	0.5
	Other Buildings (Administrative, Electrical, Guard room)	LS	1	1
	Pipelines and Valves within the complex joining various units	m		100
	Miscellaneous Works (Road, Drainage, Lighting, etc.)	LS	1	1
Mechanical Works	Pumps	No.	3	Q = 417 m^3/hr, JASHORE = 20 m, Rating = 75 kW
	Dismantling Joints, NRVs, Pipes, and Common Header in the Pump House	LS	1	1
	Electro-magnetic Flow meter after Header Pipe	No.	1	1
Electrical Works	Electrical Panels (Switchgear, VFD panels), Transformer, Generator	LS	1	4
Demolition Works	Existing Structure at Zone 16 site	LS	1	1

Component	Description of Work	Unit	No.	Quantity/ Capacity
Distribution System Pipeline – Existing Area				
DI Pipe	400 mm	m		1,000
HDPE Pipeline works by HDD Method	400 mm	m		35,000
	315 mm	m		4,000
	250 mm	m		8,000
	200 mm	m		24,000
	160 mm	m		27,000
	110 mm	m		68,000
HDPE Pipeline works by Open cut/trench method	315 mm	m		1000
	250 mm	m		4,000
	200 mm	m		8,000
	160 mm	m		15,000
	110 mm	m		48,000
Pipeline for Production Wells	From 75 Production wells to the nearest Service Reservoirs, 250mm HDPE	m		30,000
Pipe Disconnections		No.		253
Distribution System Pipeline – Extension Area				
DI Pipe	600 mm	m		200
HDPE Pipeline Works by HDD method	560 mm	m		6,800
	400 mm	m		7,200
	315 mm	m		1,000
	200 mm	m		15,000
	160 mm	m		35,000
	110 mm	m		70,000
HDPE Pipeline Works by open cut method	250 mm	m		20,000
	200 mm	m		10,000
	160 mm	m		24,000
	110 mm	m		46,000
Valves – Existing and Extension Area				
Isolation Sluice Valve	250 mm	No.		18
	200 mm	No.		182
	150 mm	No.		236
	100 mm	No.		464
Butterfly Valves	500 mm	No.		14
	300 mm	No.		16
Washout Sluice Valve	150 mm	No.		16
	110 mm	No.		220
Air Valve	80 mm	No.		12
PRV	250 mm	No.		18
Road Restoration Works				
Clear water Trans. Pipeline	2 m stretch, 36 km length	m^2		72,000
Dist. DI Pipeline	2 m width stretch, 51 km length	m^2		102,000
Dist. HDPE-HDD Pits	9 m^2 pit size, 50% of 250 km length, 200m	m^2		5,625
Dist. HDPE- Open trench	1.5 m width stretch, 176 km length	m^2		264,000
Afil Gate Scheme and Production Well Pipeline	2 m width stretch, 33.5 km length	m^2		67,000
DMA Formation works				
Flowmeter		No.		22
PRV		No.		20
Pressure Meter		No.		101
House Service Connection		No.		25,800
Customer Meter for HSC				
Ordinary Mechanical		No.		20,000
Smart (AMR)	With all facilities	No.		4,300
Pre-paid & Smart	With all facilities	No.		1,500
SCADA Works				

Component	Description of Work	Unit	No.	Quantity/ Capacity
Upgradation for SCADA for WTP	Hardware & Software	LS	1	1
Upgradation of SCADA for Dist. System	Hardware & Software	LS	1	1
DMA	PLC and power system	No.	1	10
SR&PS sites	PLC and power system	No.	1	14
Distribution network WQ and pressure	WQ and pressure sensor and telemetry	No.	2	18
New/Rehabilitation of Tubewells				
KWASA Production wells	Construction of Tube wells, 60 m3/hr capacity, incl. E/M	No.		75
Water Quality Monitoring	Water Quality Monitoring of Surface and Groundwaters	LS	1	1
Solar Power Generation				
Solar Power Generation, 1.5 MW	Floating Panels in IPR at BWTP and Afil Gate	KW	1	1,500
Solar Power Generation, 2.275 MW	At the rooftop of all 11 Distribution Reservoirs	KW	1	2,275
Building				
Admin. Building	Vertical Expansion of KWASA HQ Building by one floor, 6,000 sq. ft.	LS	1	1

Figure 9: Proposed Project Components in Khulna

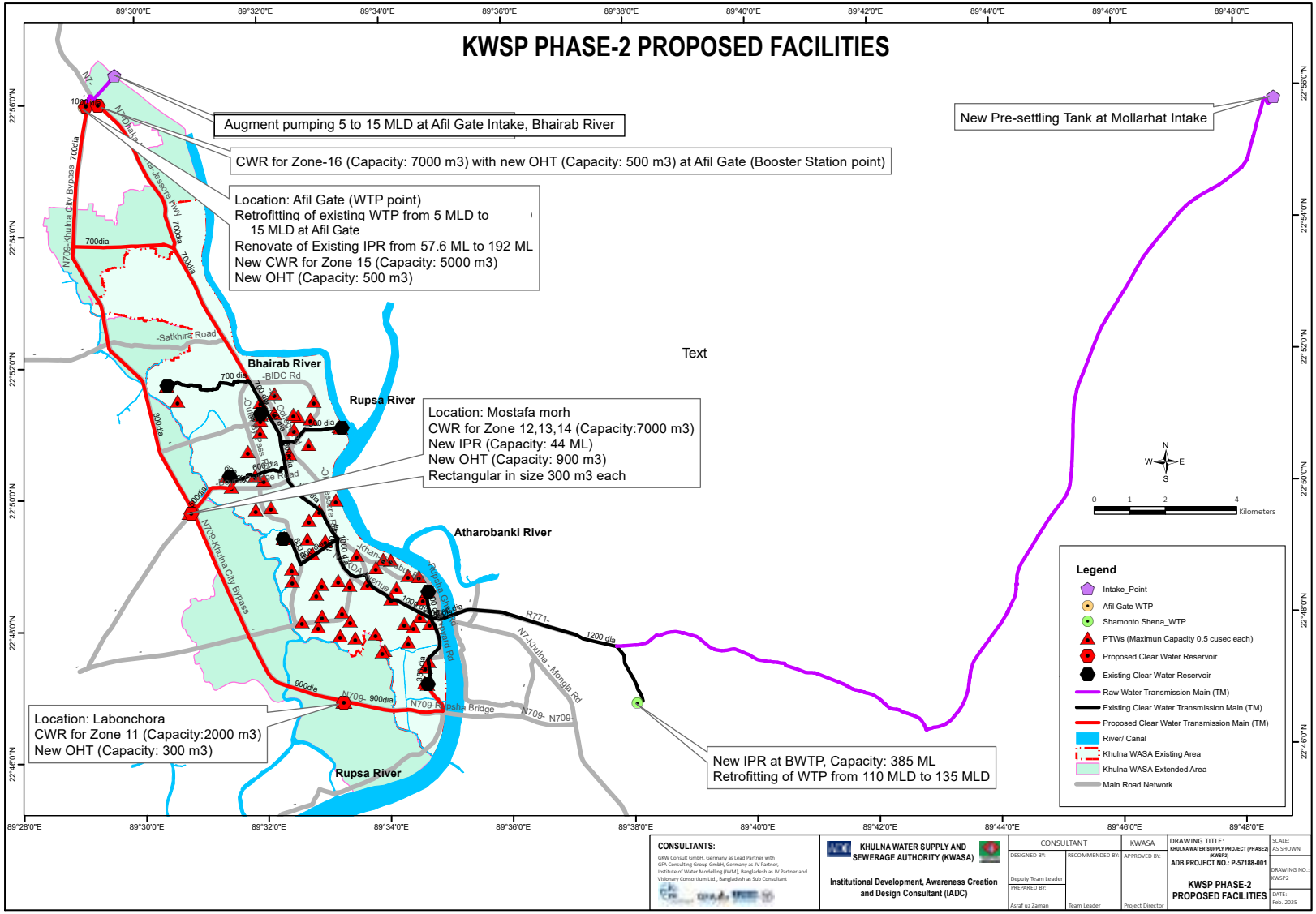


Figure 10: Facility Plan for Pre-settling Tank at Mollahat

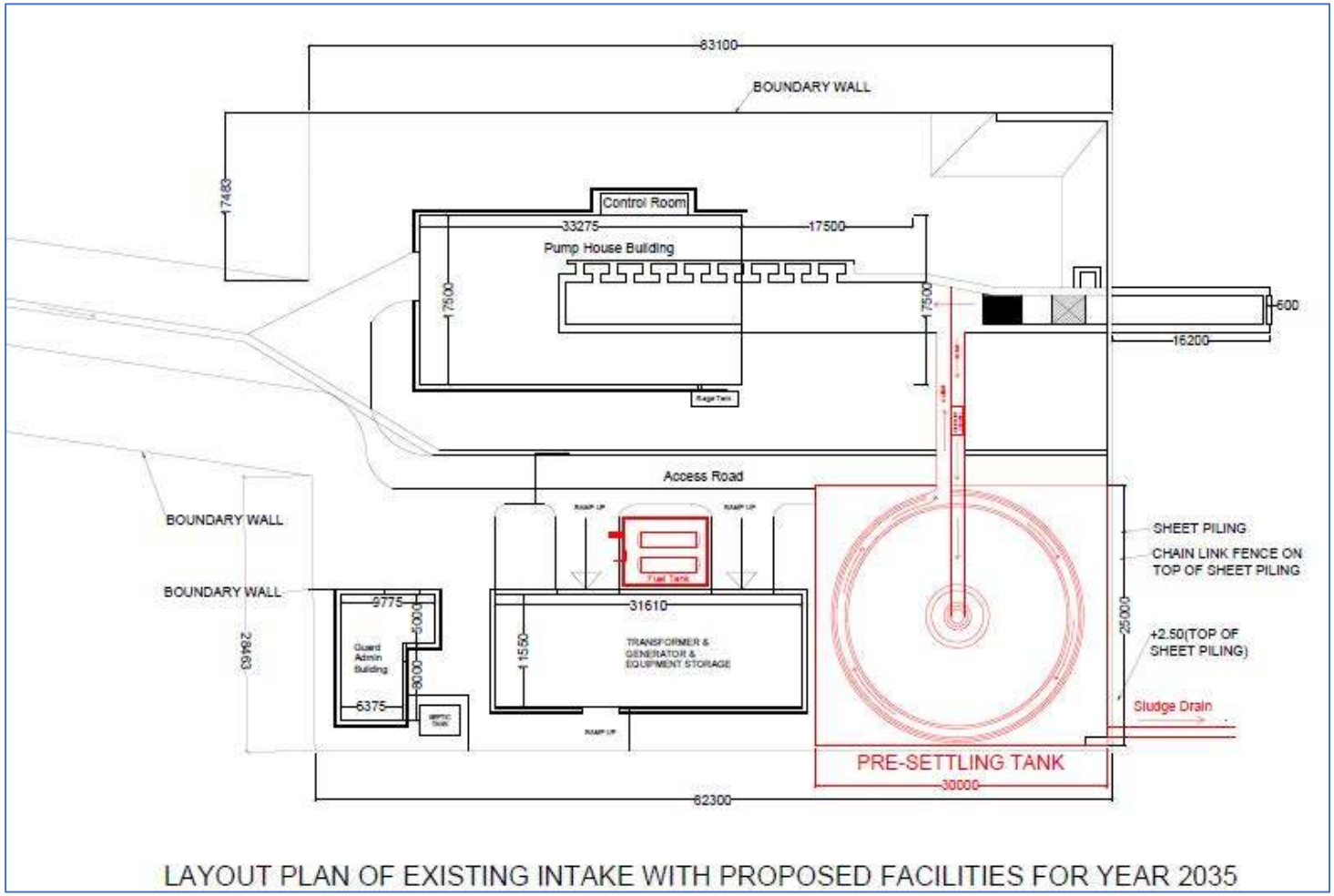


Figure 11: Facility Plan for Impounding Reservoir at BWTP

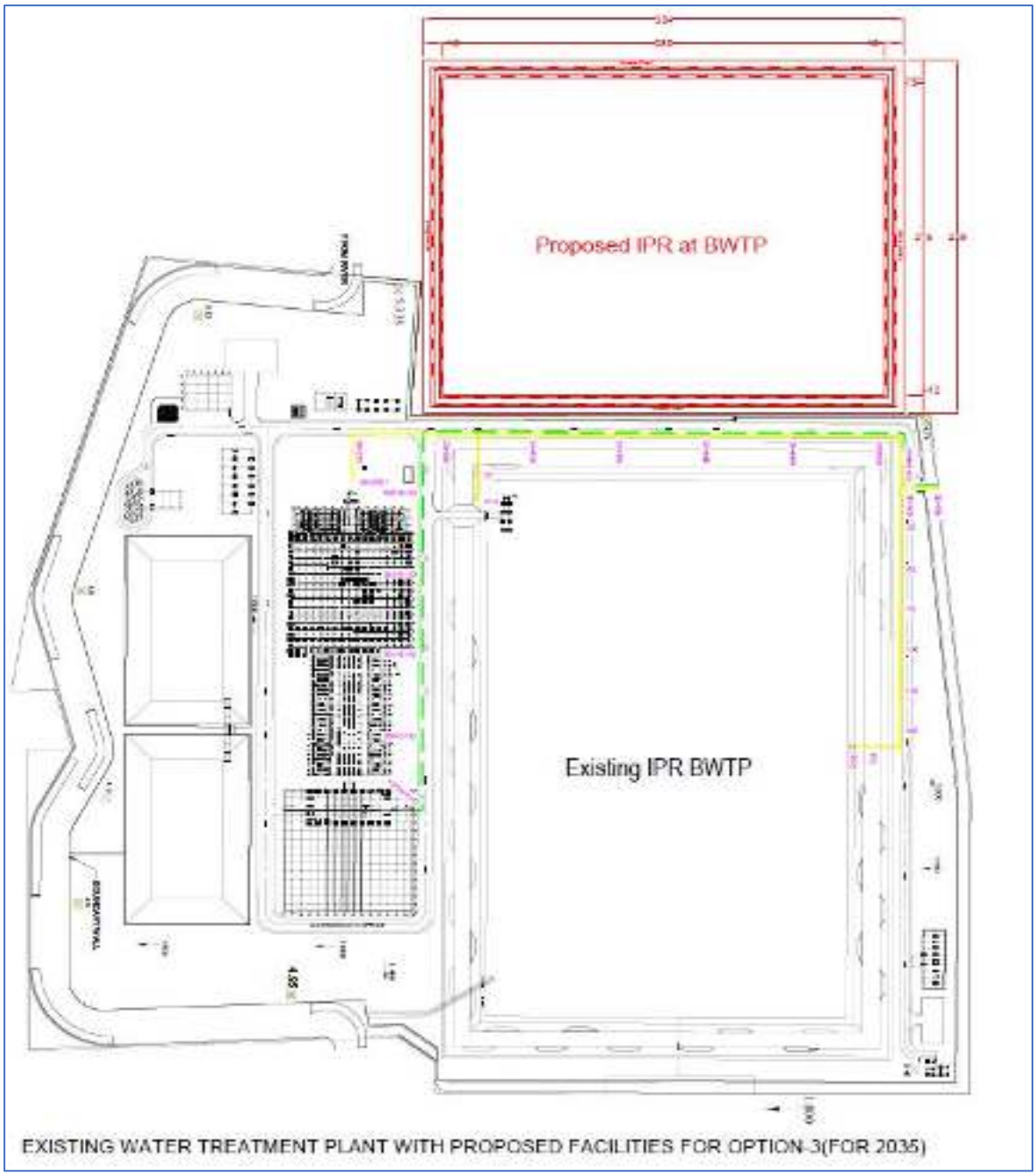


Figure 12: Modifications proposed and Retrofitting of Bangabandhu WTP

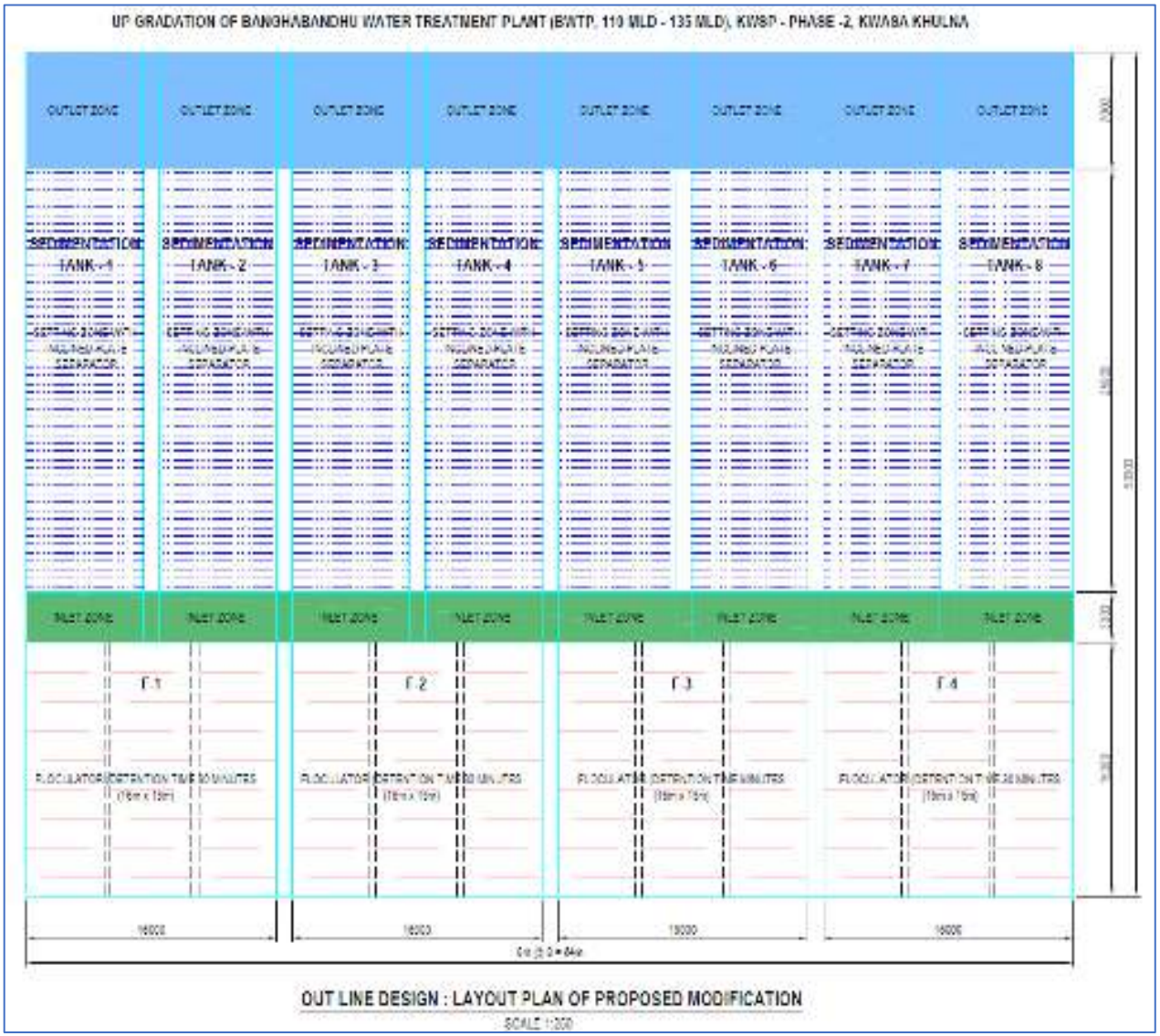


Figure 13: Proposed upgrading of Afil Gate Intake from 5 MLD to 15 MLD: Layout of the proposed Intake

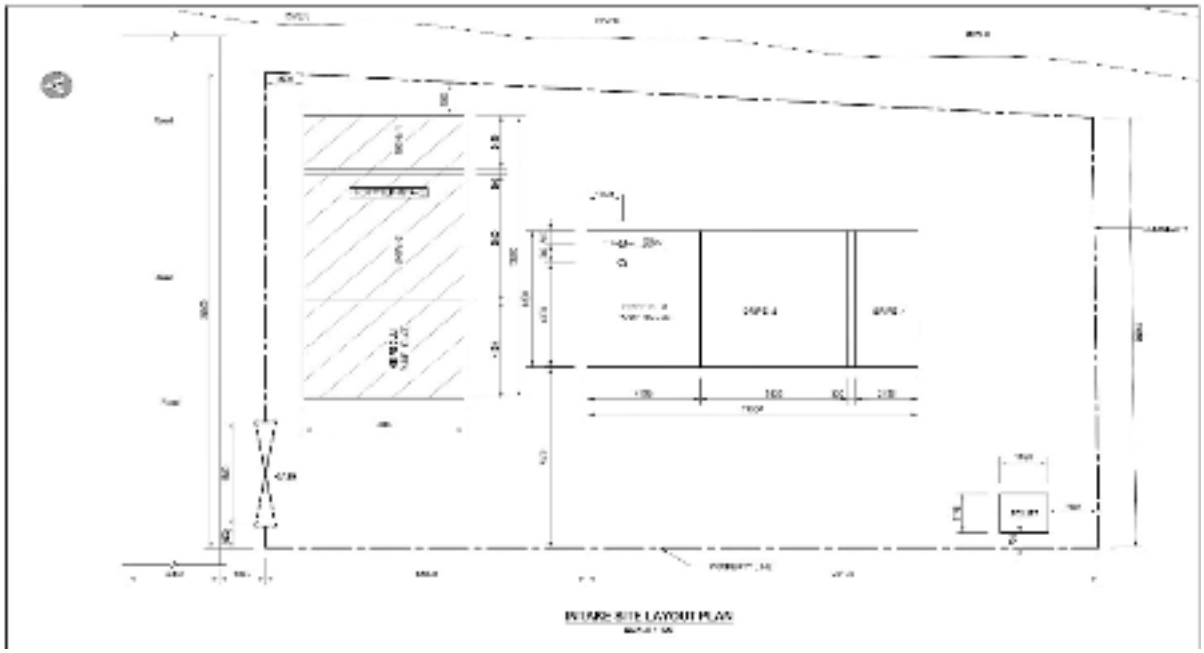


Figure 14: Layout plan of the proposed 8 MLD WTP at Afil Gate

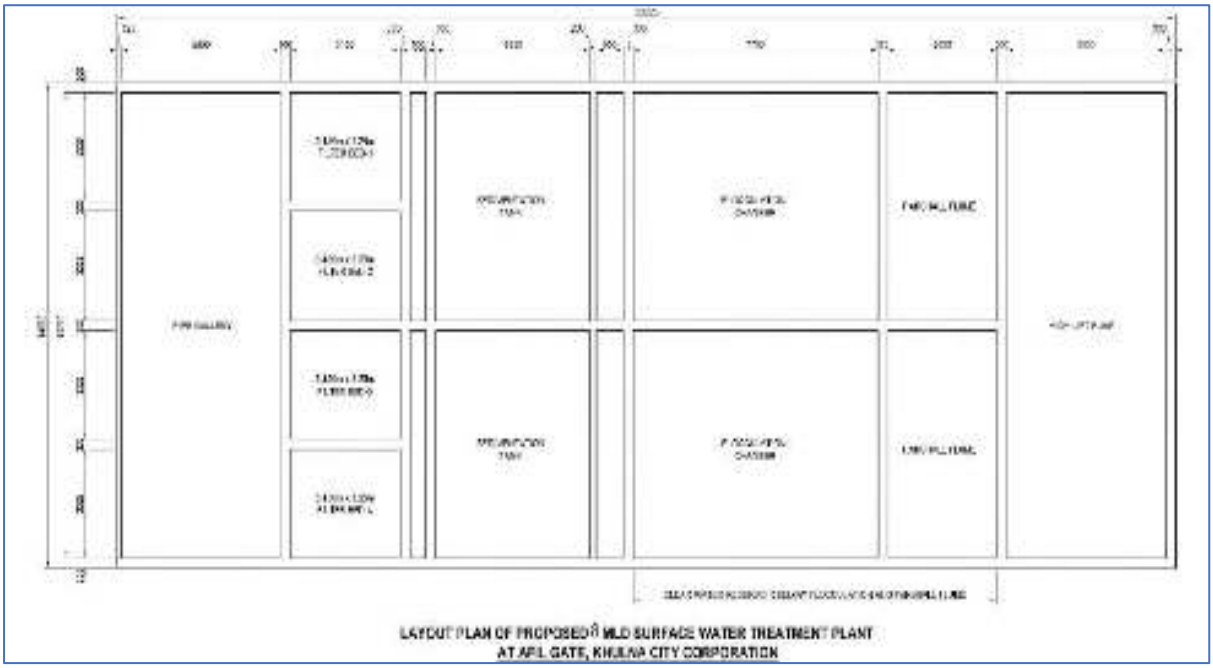
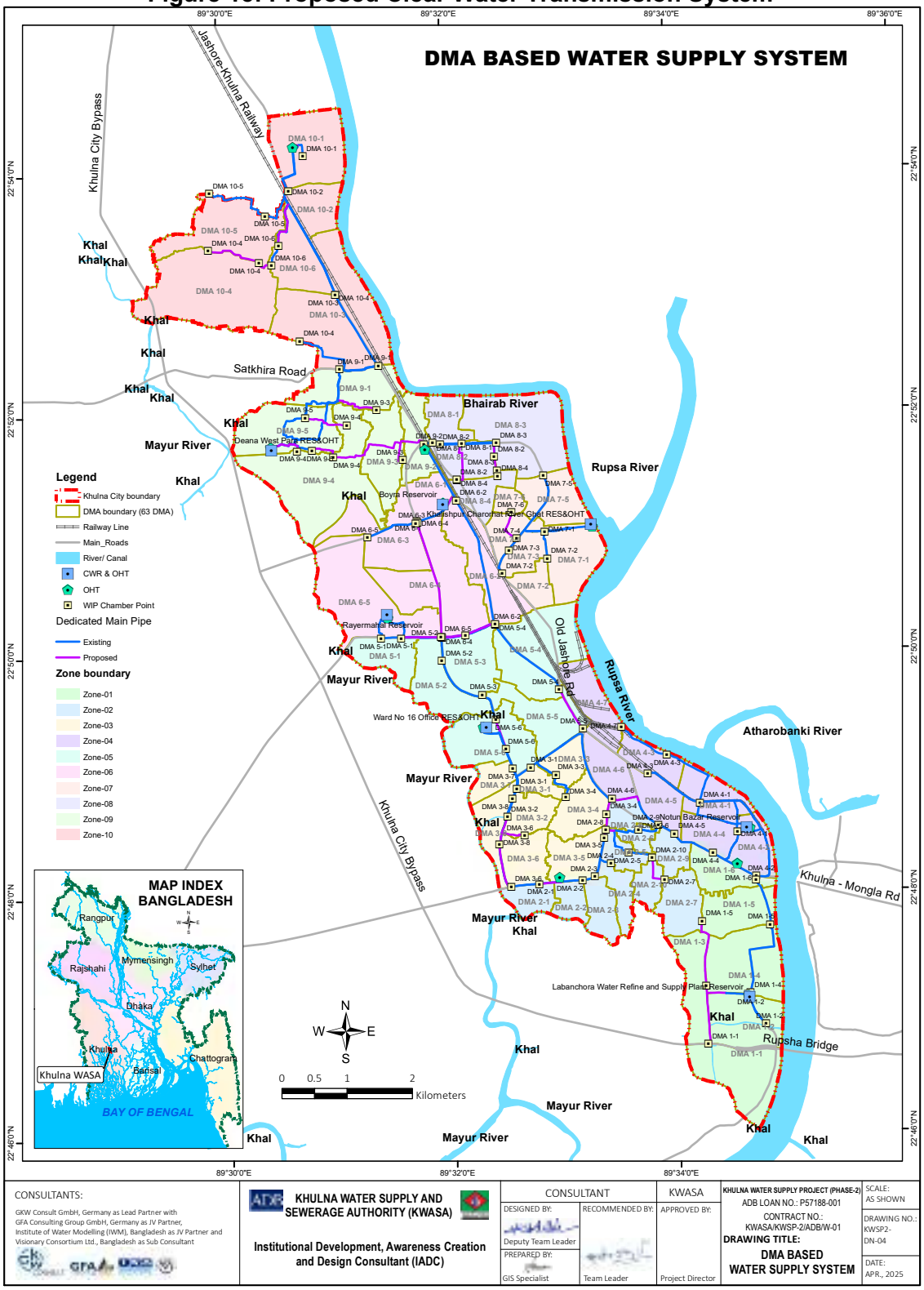


Figure 15: Proposed Clear Water Transmission System



CONSULTANTS:

GKW Consult GmbH, Germany as Lead Partner with GFA Consulting Group GmbH, Germany as JV Partner, Institute of Water Modelling (IWM), Bangladesh as JV Partner and Visionary Consortium Ltd., Bangladesh as Sub Consultant

KHULNA WATER SUPPLY AND SEWERAGE AUTHORITY (KWASA)

Institutional Development, Awareness Creation and Design Consultant (IADC)

CONSULTANT		KWASA	
DESIGNED BY: Deputy Team Leader	RECOMMENDED BY: Team Leader	APPROVED BY: Project Director	KHULNA WATER SUPPLY PROJECT (PHASE-2)
PREPARED BY: GIS Specialist			ADB LOAN NO.: P57188-001 CONTRACT NO.: KWASA/KWSP-2/ADB/W-01 DRAWING TITLE: DMA BASED WATER SUPPLY SYSTEM

SCALE: AS SHOWN
DRAWING NO.: KWSP2-DN-04
DATE: APR., 2025

Figure 16: Project area (KWASA & Extension Area), Location of CWRs, OHTs, & Transmission Lines

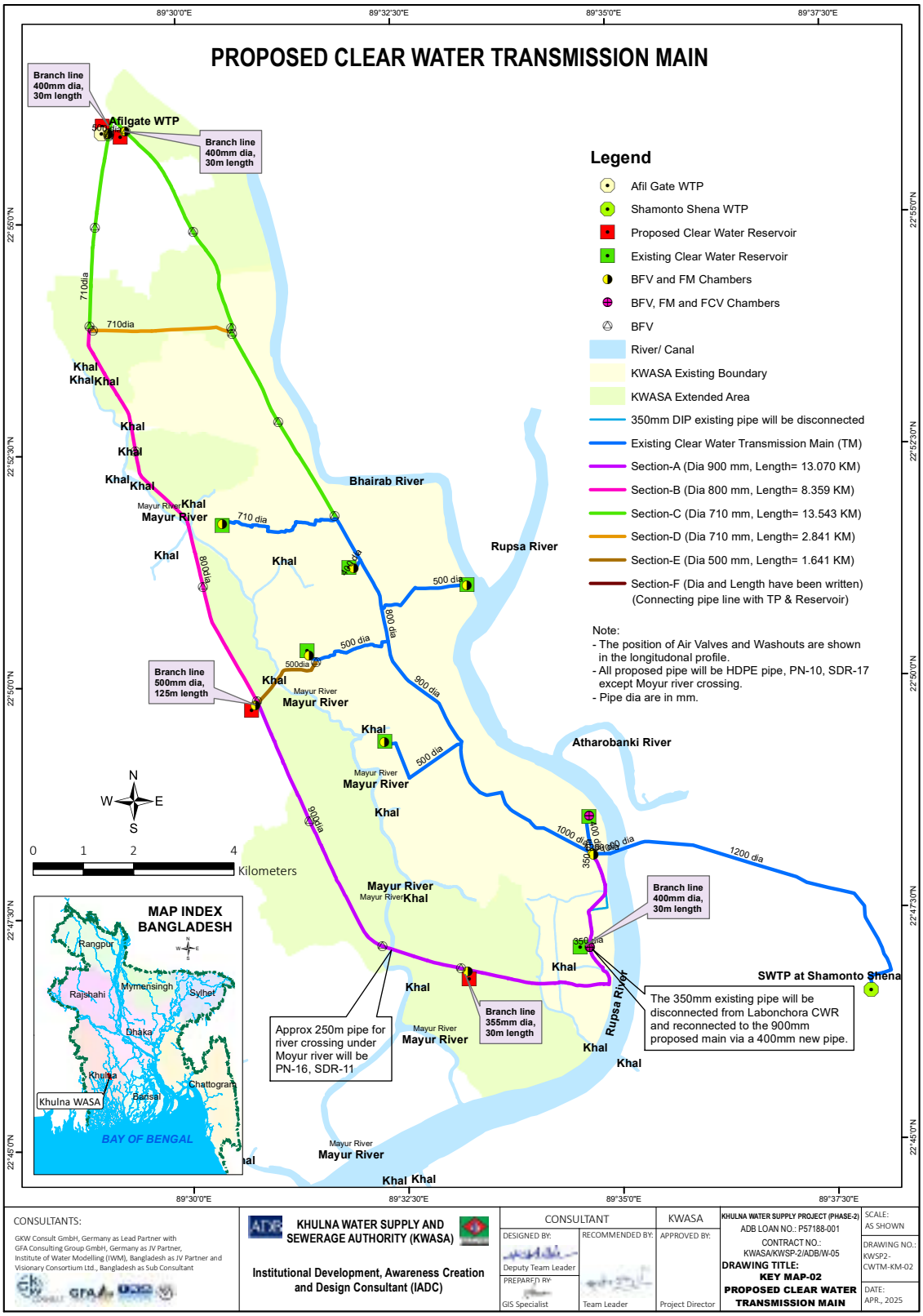


Figure 17: Layout plans of the four CWR-1

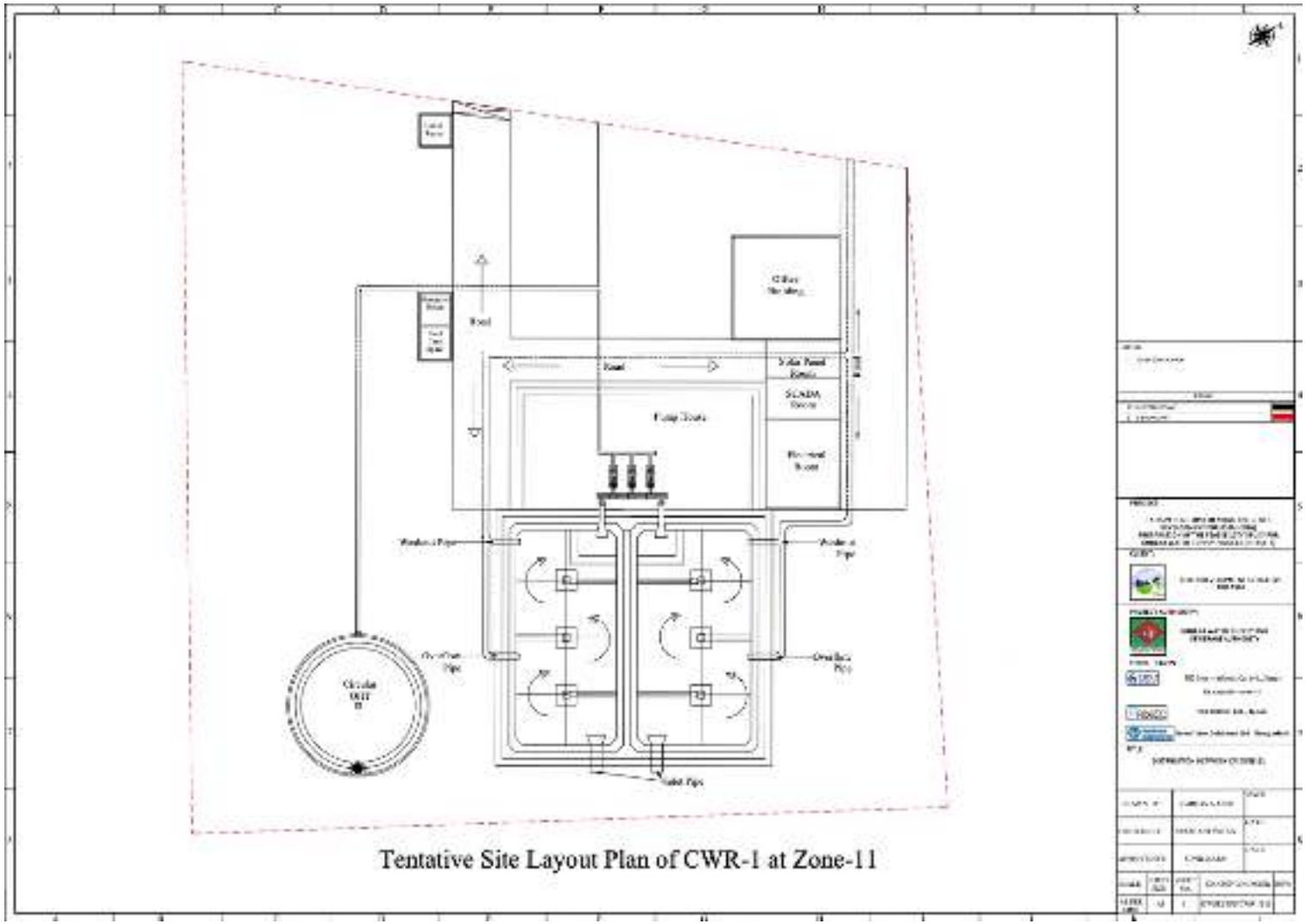


Figure 18: Layout plans of the four CWR-2

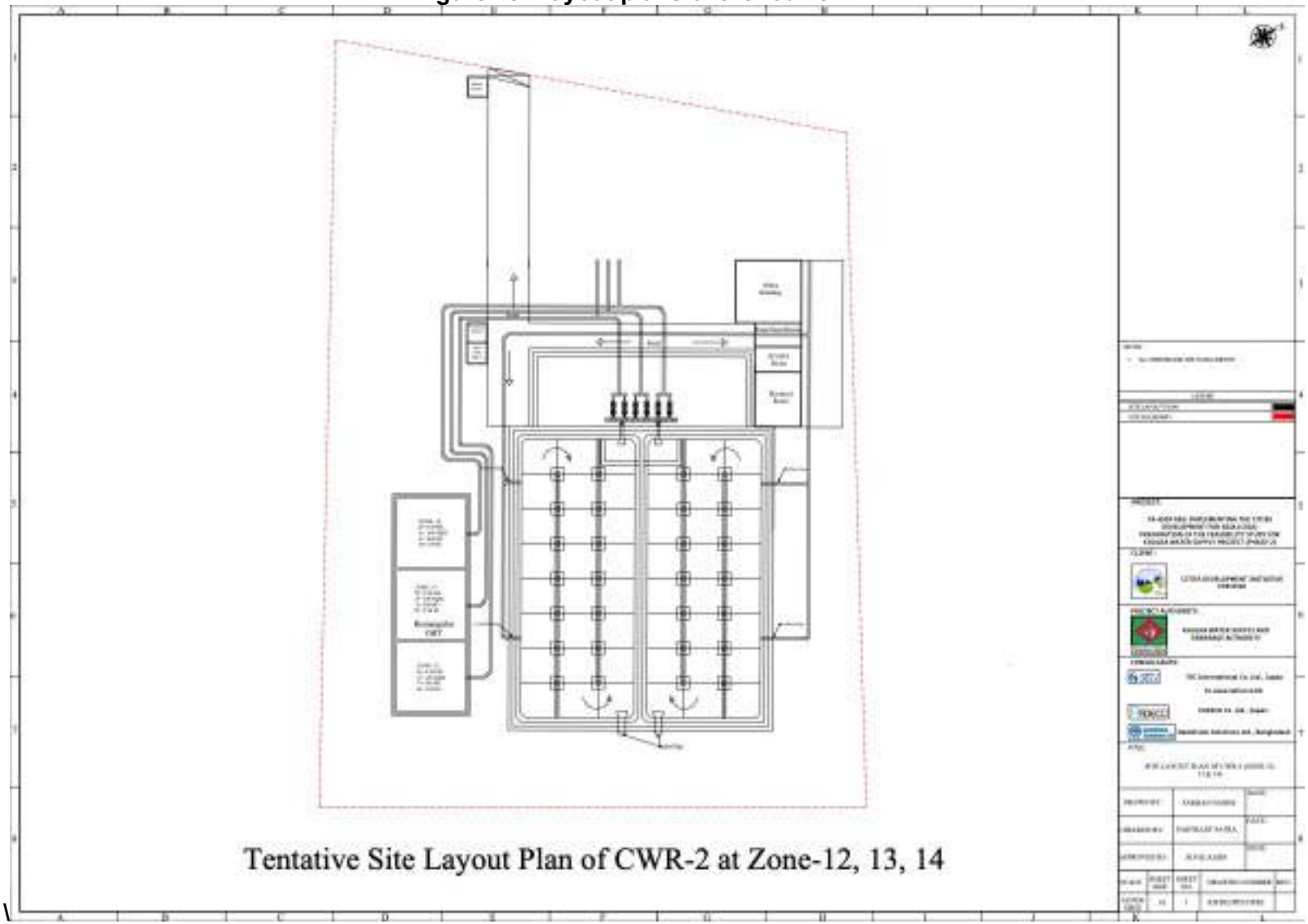


Figure 19: Layout plans of the four CWR-3

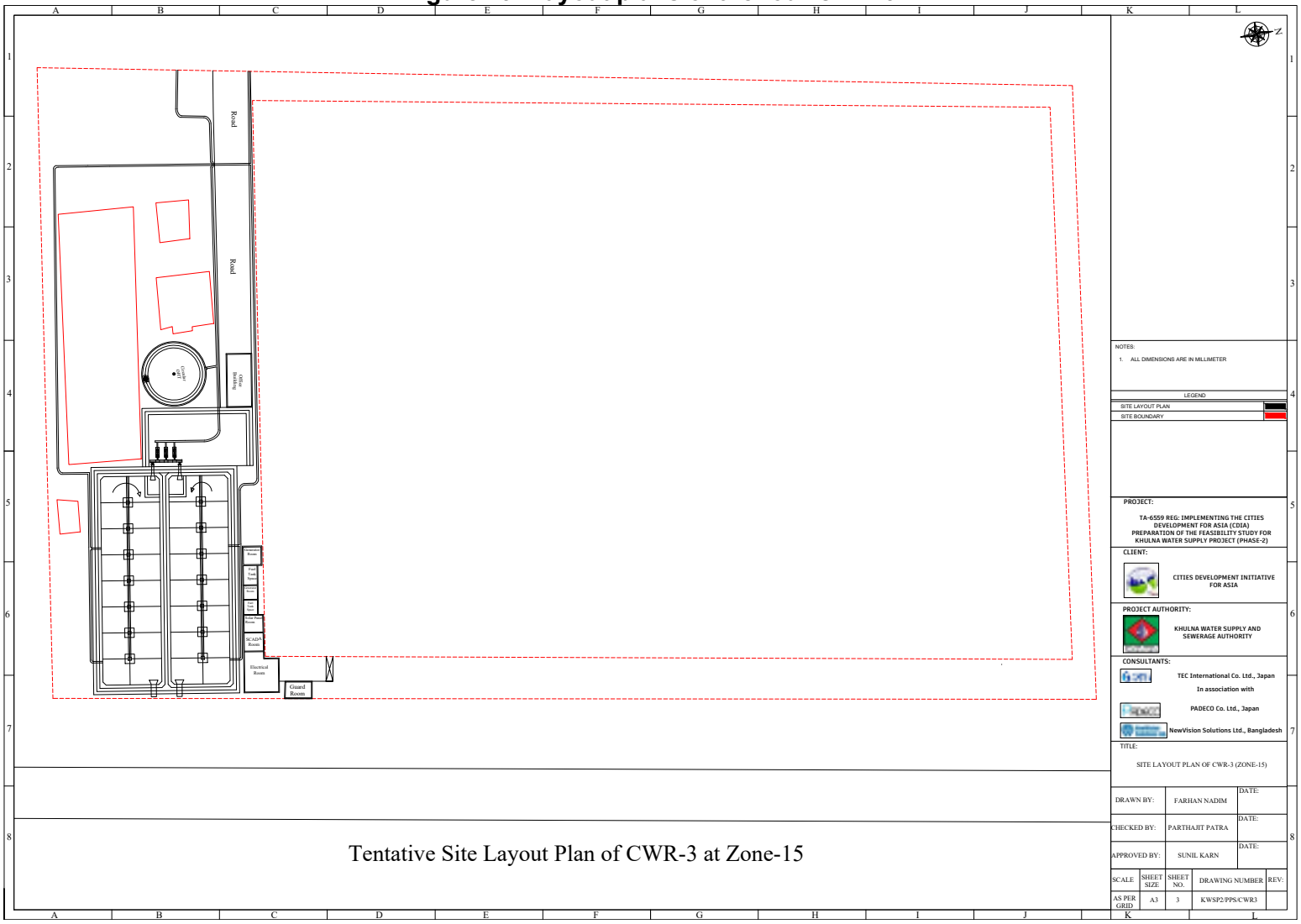


Figure 20: Layout plans of the four CWR-4

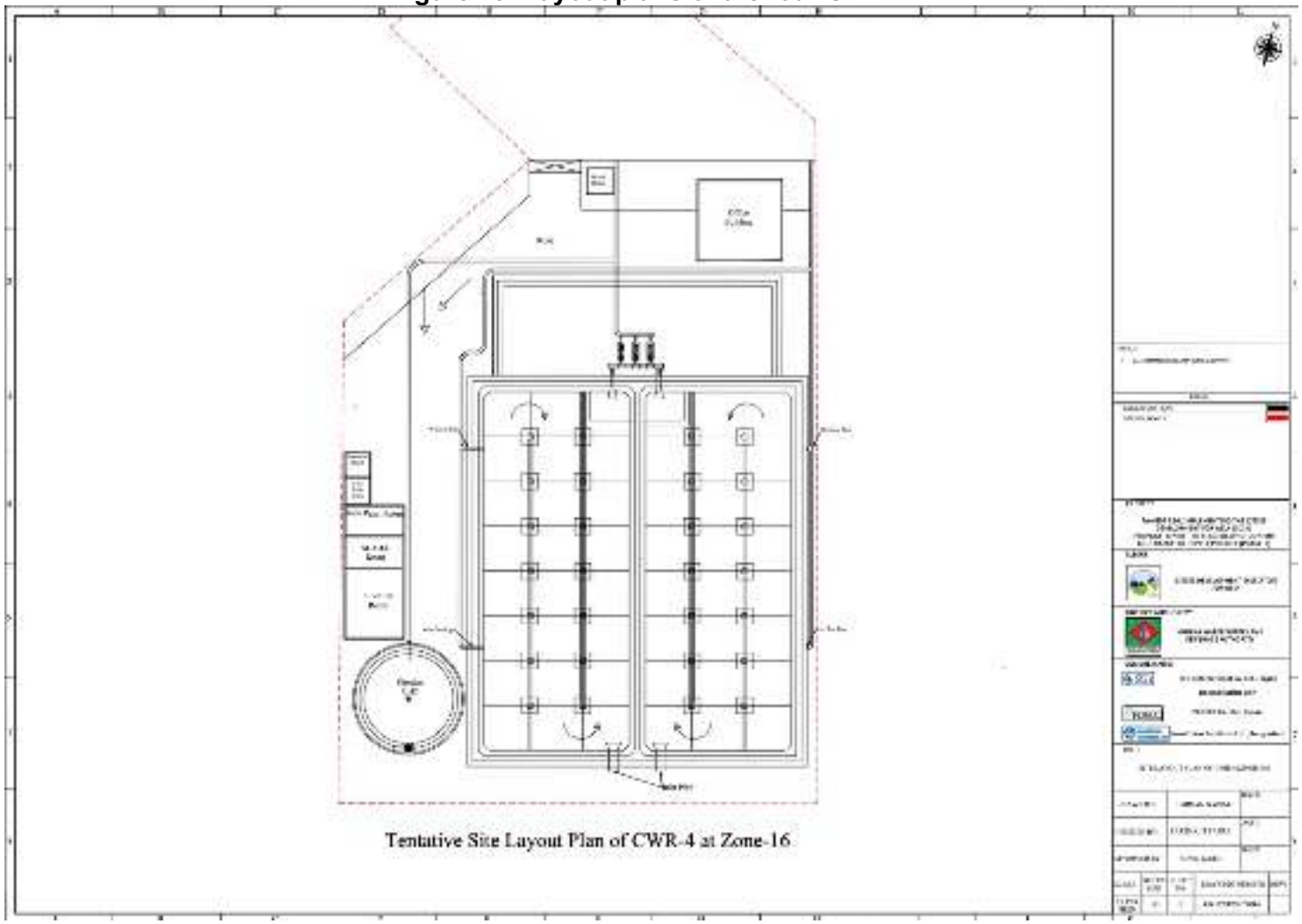


Figure 21: Distribution zones

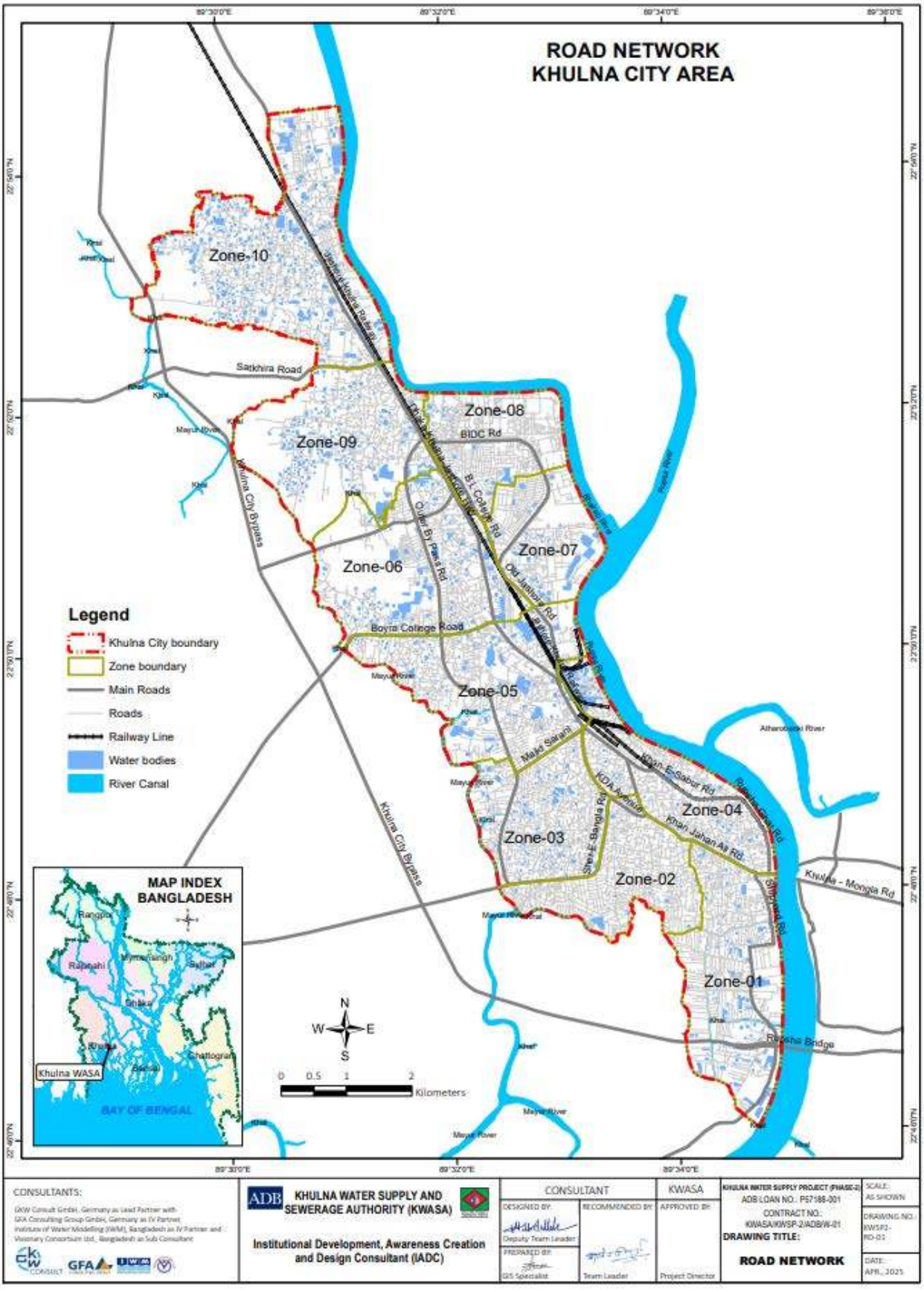


Figure 22: Proposed District Metering Areas

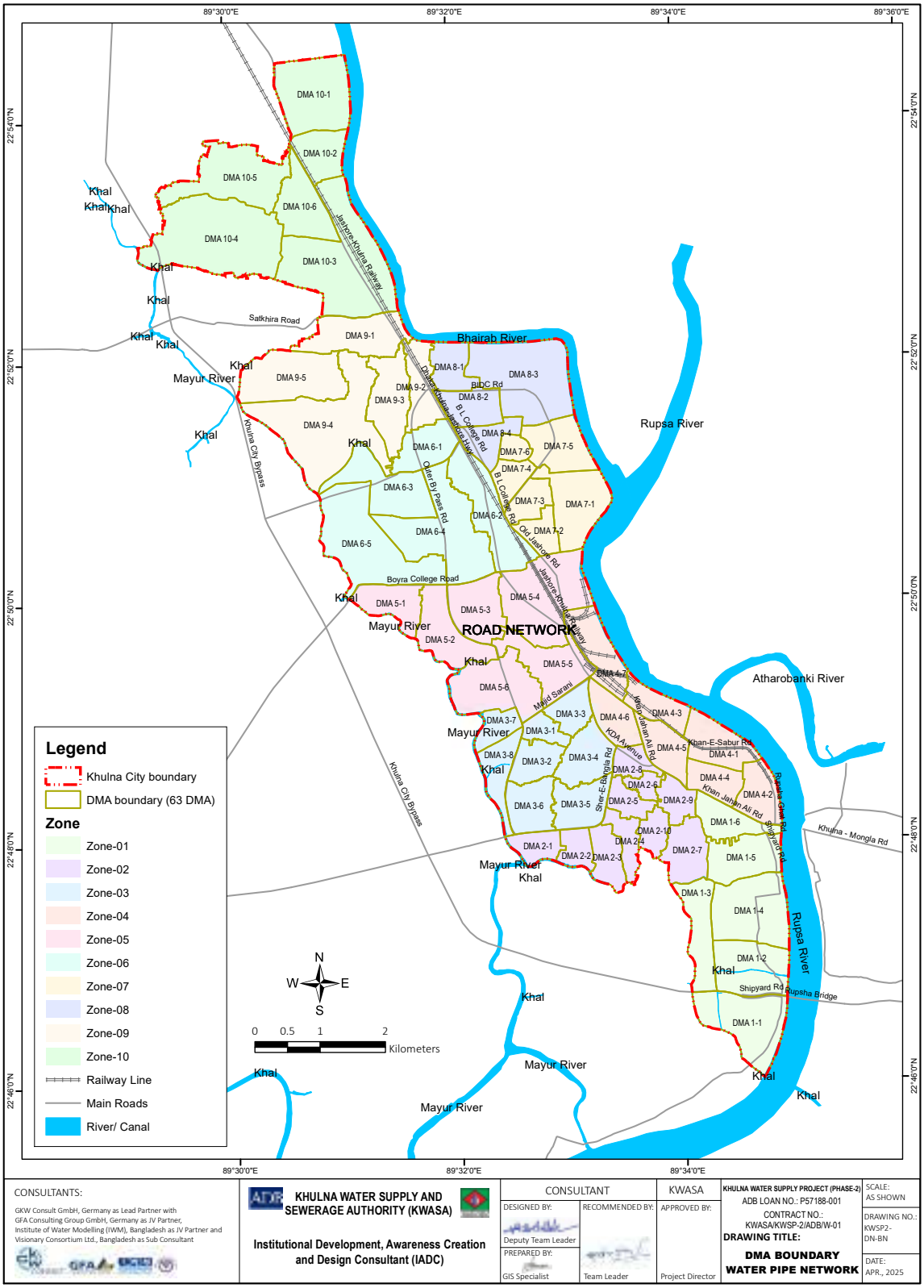


Figure 23: Existing and Proposed Distribution Network

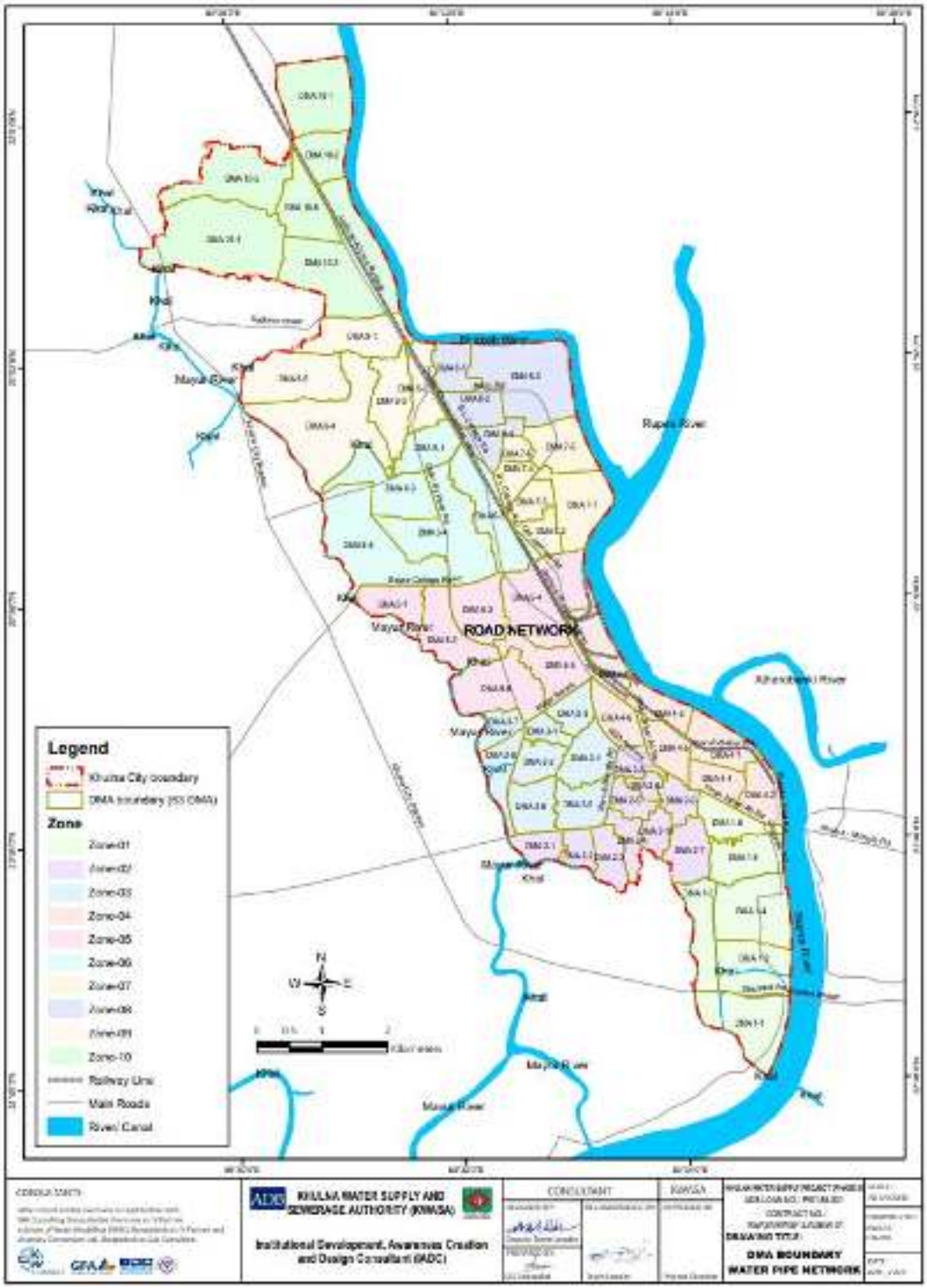


Figure 24: Extended Area for Distribution Network Expansion

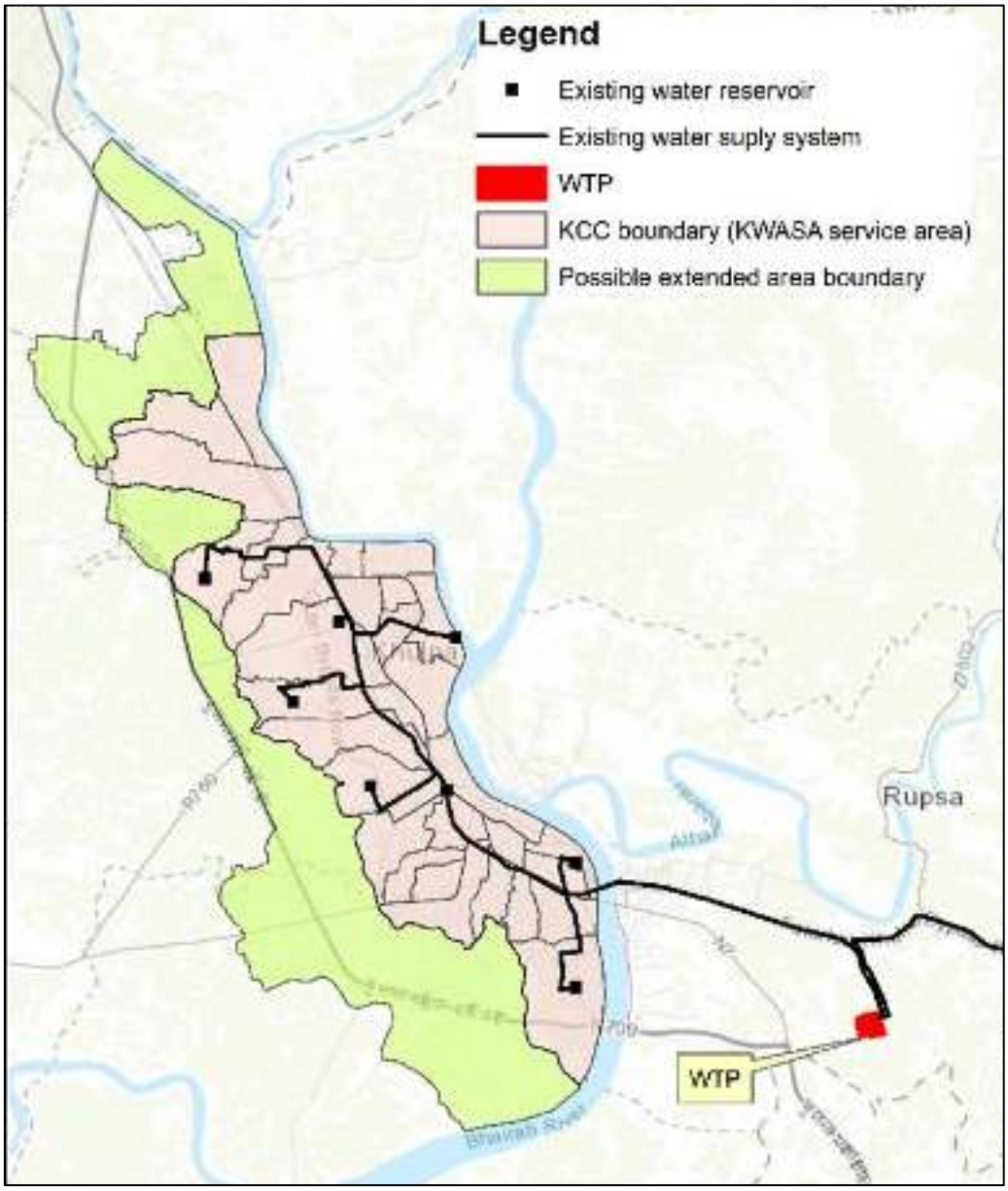
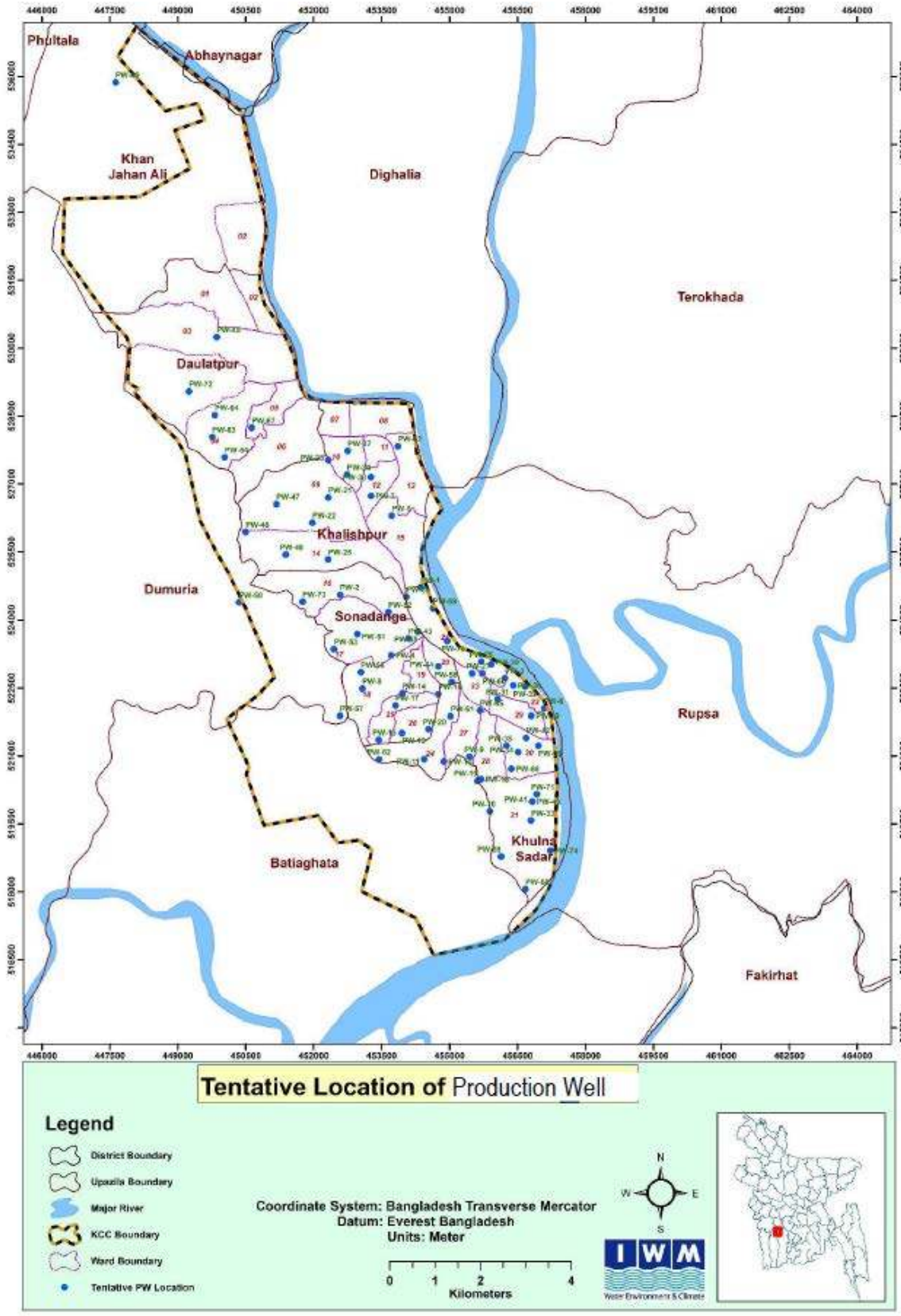


Figure 25: Tentative Location of proposed production wells



Note: Exact locations will be finalized based on the availability of space, distance and groundwater potential as per IWM study

Figure 26: Typical Designs of a Proposed Production Well

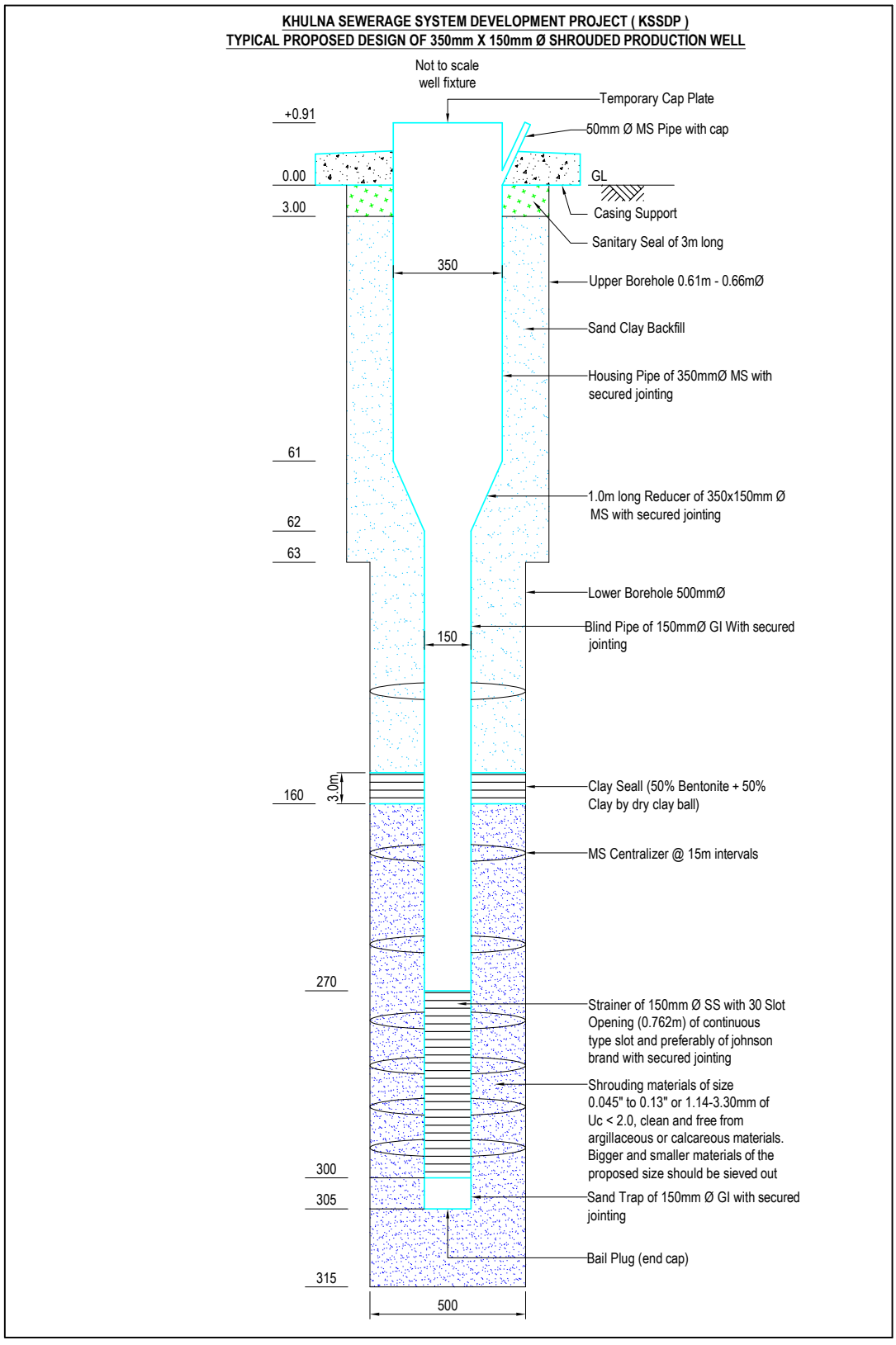


Figure 27: Proposed locations for Real-time Bulk Water Monitoring

C. Implementation Schedule

Table 13: Proposed packages under KSWP Phase II

Package No.	Description of Procurement as per PP WORKS	Unit	QTY	Duration	StartDate
Package-1	Construction of Distribution pipe Network with DMA establishment in Existing areas, including O&M	km	258	3 years	Sept 25
	Construction works for modification of 61 DMA in the Existing Distribution Network, including O&M	No	61		
Package-2	Construction of Production well, including pump motor. VFD pump house and electrical work	No	75	3 years	Nov 25
Package-3	Construction of Impounding Reservoir (385,000 m^3) at BWTP including pumping station	No	1	3 years	Oct 25
	Upgrading the capacity of existing BWTP from the capacity of 110 – 135 MLD	No	1		
	Upgrading the capacity of existing intake facilities at Mollahat (110 – 135 MLD) and Construction of pre-setting tank	No	1		
Package-4	Construction of distribution network with DMA establishment in the extension area and interconnection pipeline for 75 production wells	km	272	3 years	Dec 25
	Construction of service connection, including meter installation	No	25,800		
Package-5	Construction of Clear Water transmission Main including Maun River and canal crossing	km	38	3 years	Nov 25
Package-6	Construction for SWTP and Upgradation of existing SWTP	MLD	10	3 years	Feb 26

Package No.	Description of Procurement as per PP WORKS	Unit	QTY	Duration	StartDate
	at Afil Gate (5.5 MLD to 15.5 MLD)				
	Construction for Upgradation of Afil Gate Intake facilities (5-20MLD)	No	1		
	Construction of Raw water transmission line (630 mm) from river intake to Afil Gate SWTP	km	2		
	Construction of Raw water transmission line (250 mm die) from Afil Gate to Mustofa Mor, including pumping station	km	13		
	Construction of Impounding reservoir at Afil Gate (upgrading) and Mustofa Mor	cum	236,000		
Package-7	Construction of Distribution reservoirs, Overhead tank, and Pumping station, including O&M	No	4	3 years	Dec 25
	Vertical extension of KWASA headquarters building (from 6th to 7th floor)	sqm	600		
Package-8	Supply & Installation of on-grid Solar power generation system (green energy) with all accessories, including O&M	MW	4	3 years	Nov 25
Package-9	Development of a Smart Water Supply Monitoring System through SCADA, including O&M	No	1	2 years	Jul 25
	Establishment of a Smart system for monitoring and controlling ground & surface water sources, including O&M	No	1		

D. Other important aspects considered in the project design

52. **Energy and climate considerations.** The Khulna Water Supply Phase II project incorporates renewable energy as a strategic response to climate change and energy sustainability. A 4 MW on-grid solar photovoltaic (PV) system will be installed as part of the project, with distributed generation planned across rooftops of water treatment plants (WTPs), pumping stations, and service reservoirs, including at BWTP and Afil Gate facilities. This integration aims to reduce operational reliance on grid-based electricity, which is largely fossil fuel-dependent, thereby lowering greenhouse gas (GHG) emissions from the water supply infrastructure.

53. The design of the solar installations takes into account local climatic risks such as high winds, cyclones, and monsoonal rainfall. Structural assessments have guided the selection of wind-resistant mounting systems, and waterproof electrical enclosures will be installed to ensure system resilience. Inverters and panels will comply with IEC 61730 and 61215 standards for safety and durability under tropical conditions. Lightning protection and surge arrestors will also be included.

54. To optimize energy generation, solar panel layouts have been aligned with load patterns at major consumption points (WTPs and pumping stations). During peak solar hours,

the energy generated will directly offset the operational demand of water treatment and pumping. Provisions for net metering will be explored to export excess electricity to the grid, further improving the project's financial sustainability

55. In addition to solar integration, energy-efficient technologies such as variable frequency drives (VFDs), energy-efficient motors (IE3 class or better), and automated pumping schedules through SCADA will be used across the water network. These measures are expected to reduce operational energy consumption by up to 25%.

56. **Drainage and flood management.** Khulna is a low-lying, flood-prone city frequently affected by tidal surges, river overflows, and heavy monsoonal rainfall. Given this context, robust flood resilience and drainage management strategies have been integrated into the design of all infrastructure under the Khulna Water Supply Phase II project. All critical water supply infrastructure—including intake structures at the Madhumati and Bhairab rivers, pumping stations, WTPs, impounding reservoirs, and transmission mains—are being designed based on the highest flood level (HFL) data recorded over the past 25 years. For example, structures such as intake chambers, pump houses, and reservoir control rooms will be constructed with plinth levels elevated at least 0.5 m above the historical HFL to prevent inundation.

57. The intake pipelines are designed with anti-buoyancy and anchoring systems to prevent displacement or structural damage during peak floods or tidal surges. Electrical and mechanical systems, including motors and control panels, will be elevated and enclosed within flood-resistant housings, and sealed against water ingress. The design of impounding reservoirs and treatment plants also includes flood control features such as embankments or sheet pile retaining walls to prevent overflow during intense rainfall. Perimeter drainage systems with silt traps and dedicated stormwater diversion channels will be constructed around all key sites to ensure quick runoff and minimize local waterlogging. These systems are designed to remain operational during flood events.

58. To ensure operational continuity during adverse weather, provision has been made for safe access roads to major sites and the installation of SCADA-based remote monitoring and control systems, allowing KWASA staff to manage operations even during restricted access. Drainage at production well sites will be ensured through raised platforms and rapid dewatering pumps. Historically flooding in Khulna has disrupted services in the past. However, lessons learned—such as the successful implementation of elevated pumping stations under earlier phases—have informed current engineering practices. The same principle of elevating structures and providing all-weather access and drainage is now applied comprehensively across Phase II assets.

59. These measures collectively ensure that water supply assets are protected from flood damage, continue to operate during flood events, and remain accessible for emergency maintenance, thus supporting climate resilience and service reliability in a challenging hydrological setting.

60. **Disaster risk mitigation.** If any disasters such as cyclones, earthquake were to occur, this would affect the intakes, impending reservoirs, WTPs and pumping stations, and distribution systems, indirectly creating a hazard to human health in the instance of contamination of raw water or treated water. DRM is integrated into the design of the project. The intakes, treatment plants, elevated tanks and pumping stations are designed within Zone 3: BNBC Building Code based on expected seismic activity. These structures are also designed for a basic wind speed considering BNBC Codes, which, according to historical storm tracks, is not expected. The collection system is also designed with a similar approach. Flooding of the treatment plants and pumping station sites will be prevented by incorporating mitigation measures during detailed design phase of the subproject elements. Historical

maximum river levels of the two rivers were obtained from BWDB data. All the sub-project elements of Phase I have been designed, which is above the highest flood level (HFL) information of the last 25 years, and the water network will be laid at 3- to 5-m depth below the ground level. All the additional sub-project components of Phase are also designed according to the above-mentioned design Codes. The WTPs (in Phase I and the components that will be retrofitted) will be designed such that the treatment process continues even throughout the high-water levels of a flood.

IV. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. Methodology used for the baseline study

61. **Data collection.** The baseline study was conducted using both primary and secondary data sources, including reconnaissance field surveys, stakeholder consultations, and literature reviews. The Khulna Water Supply Project (KWSP) Phase II primarily involves the construction and rehabilitation of production wells, impounding reservoirs, transmission and distribution networks, water treatment plant upgrades, and solar power installations. Given the nature and scale of these interventions, environmental impacts are expected to vary across project components. Some impacts will be localized and temporary, occurring primarily during the construction phase. Others may be long-term, particularly those associated with groundwater extraction and water source sustainability.

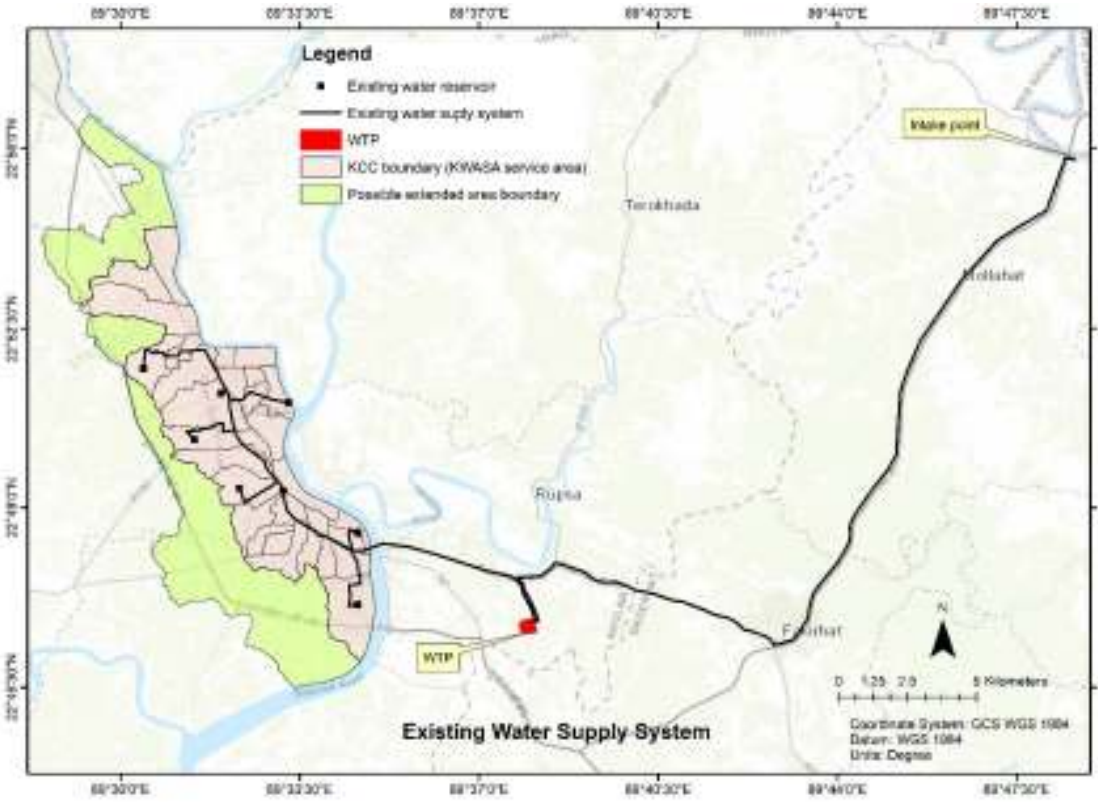
62. **Data sources.** The data collection process was conducted through various sources, including project reports, maps, and technical documents obtained from KWASA, consultants, and government agencies, and previous studies and published data, and hydrological, geological, and socio-economic studies from past water supply and urban development projects in Khulna.

63. **Field surveys and site visits.** To establish a baseline, environmental parameters such as surface and groundwater quality, noise and dust levels, biodiversity, hydrology, and socio-economic conditions were assessed. Limited baseline monitoring of key environmental parameters was conducted. Contractor will establish baseline through field sampling surveys before the commencement of civil works. Stakeholder consultations were carried out. Several visits were conducted between May and December 2024 to assess existing environmental conditions and potential project impacts. These visits included project facilities, proposed sites and overall project areas, during which the team also interacted with local people to understand local context and safeguards related aspects.

64. **Project influence area.** The project involves water intake expansion, impounding reservoir construction, production well installation, pipeline networks, water treatment plant upgrades, and solar energy installations, each having a distinct spatial impact zone. For the construction of distribution networks and transmission pipelines, particularly along existing road alignments, the influence area extends a stretch of land on each side of the pipeline corridor. This space is necessary for excavation, material staging, and temporary construction activities. Impacts in these areas are mostly related to dust, noise, traffic disruption, and temporary access restrictions for local communities and businesses. The construction of new impounding reservoirs at BWTP and Afil Gate, as well as the expansion of water treatment facilities, will have a wider influence due to the excavation of large soil volumes, movement of heavy machinery, and changes in land use. Since these sites have sufficient designated land, most impacts will remain confined within project boundaries. However, material transport, labor camp setup, and soil disposal activities could extend the influence area up to 500 m, especially where trucking routes, water bodies, or ecologically sensitive areas are involved.

65. The installation of 75 production wells across multiple locations is expected to have localized impacts primarily within 50 m of each well site. These impacts include drilling noise and vibration, temporary road disruptions, slurry disposal, and construction-related traffic. However, since wells will be strategically placed to minimize interference with existing infrastructure and land uses, their overall impact radius is smaller compared to other components. The on-grid solar power system at BWTP and other sites will have minimal off-site environmental impacts, as construction will largely occur within facility premises. However, during installation, transportation of solar panels and equipment may contribute to localized impacts such as road congestion and dust emissions along transport routes.

Figure 28: Project Influence Area



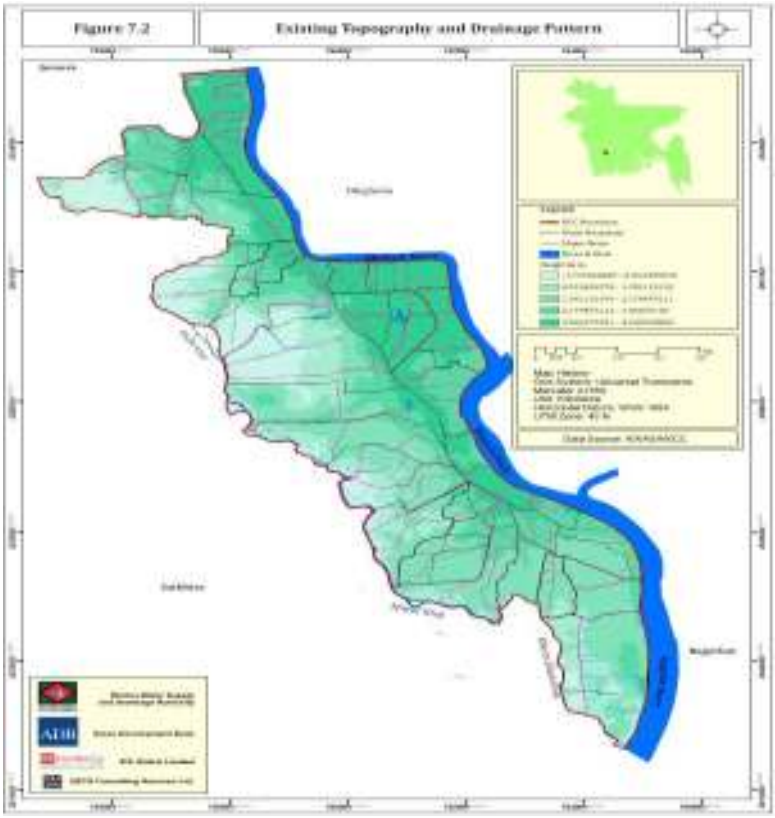
B. Physical Environment

1. Topography and Drainage

66. Geographically, Bangladesh lies within the extensive delta formed by major Himalayan rivers such as the Brahmaputra, Ganges (Padma), and Meghna, along with numerous tributaries and distributaries including the Gorai, Kopotakkho, and Madhumati Rivers, which ultimately discharge into the Bay of Bengal. The country's topography is predominantly flat deltaic plains, with the highest elevations rarely exceeding 150 m above sea level. Khulna district, located in the southwest of Bangladesh, follows this pattern with predominantly flat terrain, gently sloping towards the Bay of Bengal and interwoven by an intricate network of rivers and canals influenced significantly by tides, storm surges, and salinity intrusion from the sea.

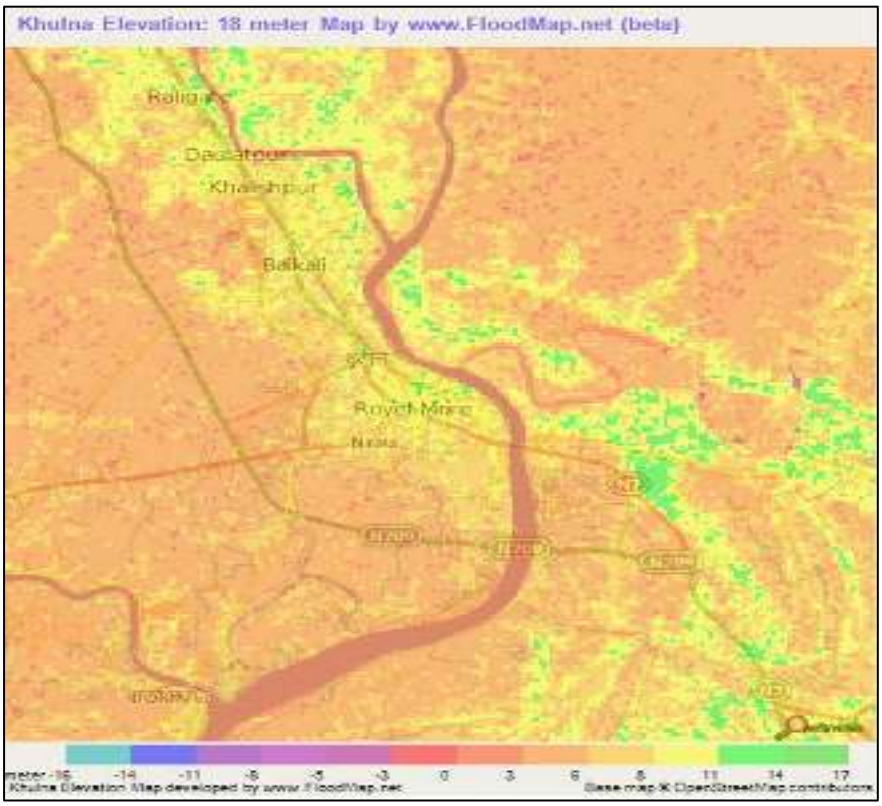
67. Historically, the city emerged as an important commercial and trading hub, benefiting from proximity to the Rupsha and Bhairab Rivers. Extending about 15 km along the Bhairab River, the city encompasses approximately 46 km². Khulna city is characterized by generally flat terrain, with elevations ranging approximately from +1.7 m to +4.2 m above mean sea level (MSL). The region gently slopes from north to south and is traversed by several major rivers, notably the Rupsha and Bhairab Rivers, which are tidally influenced and significantly affect local drainage. The city's topography is notably divided by the Khulna-Jashore Road, which acts as a ridgeline running north to south, effectively partitioning the city into two drainage basins: the eastern part primarily drains towards the Rupsha/Bhairab River system, while the western section slopes towards the Mayur River. Apart from these main river systems, the city's drainage network includes multiple natural and man-made channels that culminate into these rivers. Certain low-lying areas adjacent to these drainage pathways or water bodies are particularly prone to flooding during heavy rainfall events.

Figure 29: Topography of Khulna City



Source: KWASA

Figure 30: Flood Map of Khulna



Source: https://Jashore.floodmap.net/Elevation/ElevationMap/?gi=1336135

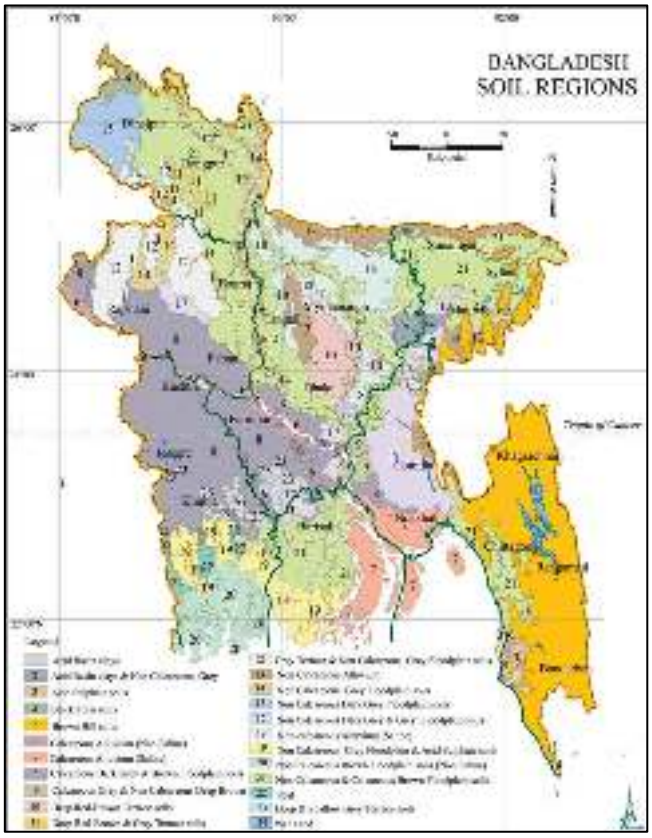
2. Geology and Soil Conditions

68. Bangladesh consists predominantly of sediments ranging from Tertiary to Quaternary age, with recent floodplain and piedmont alluvium covering approximately seventy percent of the land area. The geological setting is characterized by sedimentary deposits divided into two major tectonic units: the Precambrian platform and the Bengal Foredeep, separated by the Kolkata-Mymensingh hinge line. Khulna, located in southwestern Bangladesh, primarily consists of Holocene alluvial deposits from deltaic processes involving major rivers such as the Ganges, Brahmaputra, and Meghna. These recent deposits include unconsolidated to normally consolidated silts, clays, sands, and organic-rich soils, notably found in tidal plains, floodplains, and depression areas.

69. According to Roy et al. (2005),[17] the Khulna City Corporation (KCC) area is composed of late Holocene to recent alluvium deposits of the Ganges deltaic plain in the north and tidal plain in the south. These deposits consist mainly of sand, silt, and clay in varying proportions. Small quantities of coarse sand and are classified into seven distinct litho-stratigraphic units from base to top. The soils in Khulna region are predominantly saline due to their location within the Ganges tidal floodplain, young meghna estuarine floodplain, and tidal areas of the Chattogram Coastal Plain. Salinity issues, coupled with low fertility—particularly deficiencies in organic matter, nitrogen, zinc, and copper—pose significant agricultural challenges. Other issues include scarcity of quality irrigation water during winter, variability in annual rainfall, heavy soil texture (ranging from silty clay to clay), and perennial waterlogging caused by inadequate drainage systems. Geotechnically, the area's soil primarily includes soft alluvial floodplain deposits featuring fine-textured silts and clays, enriched with organic content particularly in marshy areas. At greater depths, fine sands interlayered with mica are commonly encountered. Underground soil investigations at key project sites, such as Labonchora near Rupsha River, indicate clayey silt up to 6 m depth followed by loose silty fine sands up to 3 m depth. These soil profiles are highly susceptible to settlement, requiring careful consideration in design and construction phases to ensure structural stability and reduce subsidence risks.

[17] Roy, M.K., Datta, D.K., Adhikari, D.K., Chowdhury, B.K., & Roy, P.J. (2005). Geology of the Khulna City Corporation. *Journal of Life and Earth Science*, 1(1), 57–63.

Figure 31: Bangladesh soil regions



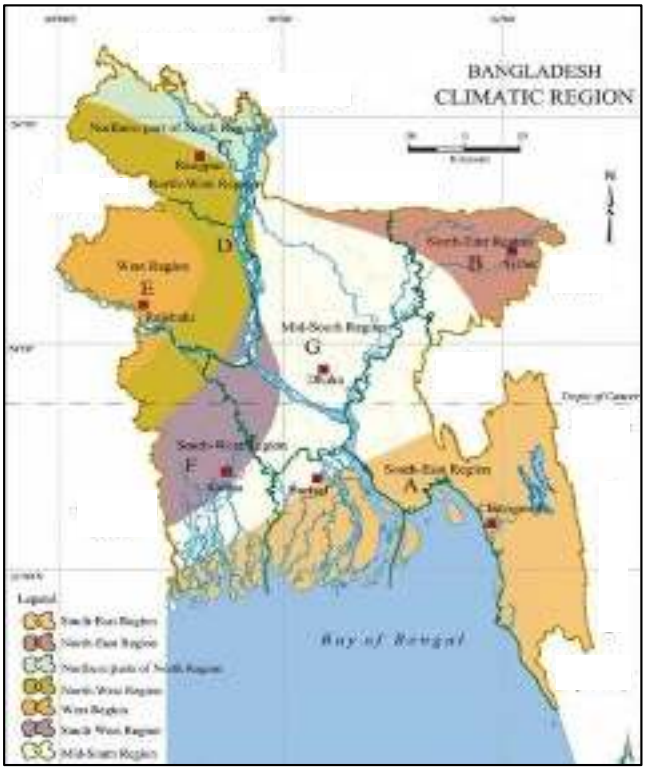
Source: https://en.banglapedia.org/index.php/Bangladesh_Soil

3. Climatic Conditions

70. According to the Köppen climate classification, the project area falls under the Aw category, characterized by a tropical wet and dry climate with hot, humid summers and dry winters. Based on climatic features, Bangladesh is divided into seven distinct sub-regions. Khulna City experiences hot and humid summers, while winters are pleasantly warm. There are three distinct seasons: Cool dry season- November through February; Pre-monsoon hot season- March through May; Rainy monsoon- June through October.

71. The city is significantly influenced by the South Asian Monsoon but receives comparatively less rainfall than other regions of Bangladesh, partly due to its geographical position and the moderating effects of the Sundarbans to the south. Situated at an elevation of 8.17 meters (26.8 feet) above sea level, Khulna has an average annual temperature of 28.66 °C, which is slightly higher than the national average. The city receives approximately 1,808 millimetres (mm) of annual precipitation spread across 111 rainy days (30.41% of the year). Most of the rainfall, about 87%, occurs between May and October, with an annual average of 1,878.4 mm (73.95 inches). Additionally, Khulna also experiences heavy rainfall associated with cyclones originating in the Bay of Bengal.

Figure 32: Climate sub-regions of Bangladesh



Source: Rahman, 2018.

72. **Temperature.** The temperatures in Khulna typically range from warm to hot throughout the year, with distinct seasonal variations. During the winter months (December to February), the temperatures are relatively cooler, averaging between 12 °C and 25 °C. In Khulna, summers are hot and humid, with temperatures often ranging from 25 °C to 35 °C. Overall, Khulna has a warm climate year-round, with significant humidity during the monsoon season.

Table 14: Temperature and Annual Rainfall Data of Khulna City

Year	Temp (ºC)	T. max Ave. (ºC)	T. min Ave. (ºC)	Rainfall (mm)	Days (1 mm)	Days (0.1 mm)
2011	27.3	30.2	25.6	1357.2	69	75
2012	26.8	31.6	22.5	1240.8	87	107
2013	26.3	31.5	21.6	1811.0	110	124
2014	27.0	31.8	22.3	1270.2	92	104
2015	27.1	31.7	22.5	2259.8	100	115
2016	27.4	32.0	22.9	1806.9	91	106
2017	27.0	31.5	22.4	2105.1	105	115
2018	26.7	31.5	22.0	1055.1	94	109
2019	27.2	31.4	22.2	1435.5	86	93
2020	26.7	31.2	22.2	1530.8	100	125
2021	27.1	31.7	22.5	1875.5	97	106
2022	27.1	31.7	22.5	1042.1	83	90
2023	27.8	32.6	23.0	1940.8	72	79

Source: Feasibility report, 2024

73. **Rainfall.** Overall, Khulna's climate features a pronounced rainy season with heavy rainfall, particularly from June to September, while the rest of the year experiences varying but generally lower levels of precipitation.

(i) Monsoon Season (June to Sept) accounts for the majority of Khulna's annual rainfall. Heavy rains are frequent, with the city receiving the highest precipitation during these months. The average monthly rainfall can exceed 300 mm (11.8 inches).

(ii) Rainfall during pre-monsoon season (March to May) begins to increase in the pre-monsoon season, with occasional thunderstorms. Rainfall during these months varies but generally remains lower compared to the peak monsoon period.

(iii) Rainfall during post-monsoon season (October to November) starts to decrease as the monsoon season ends, but occasional showers still occur. The precipitation during this period is significantly less than during the monsoon season.

(iv) Winter Season (Dec to February): The winter months are the driest, with minimal rainfall. This period has the least amount of precipitation, with several dry days.

Table 15: Average Monthly Rainfall of Khulna City

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec
Average precipitation mm	1.62	8.24	13.23	44.77	46.2	88.76	144.1	156.21	110.35	76.37	39.01	3.27
Avg precipitation days	0.27	1.45	3.27	6.55	8.45	16.82	21.36	21.64	18.45	10.45	1.82	0.45
Avg. relative humidity (%	44.85	42.16	47.77	57.74	63.28	69.6	78.03	80.67	81.66	75.92	60.77	50.17

Source: https://weatherandclimate.com/bangladesh/khulna#t2

Table 16: Frequency of rainy days over Khulna for different rainfall ranges during the period 1981-2010

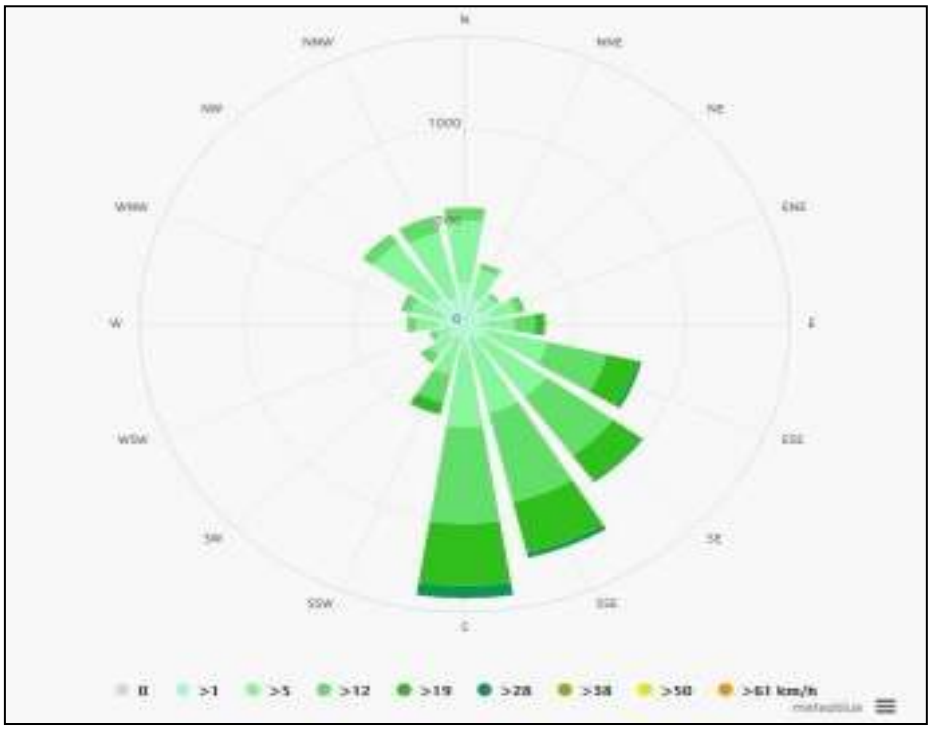
Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Total Missing Days
Dry days	888	766	831	725	601	384	223	279	376	672	841	905	7491	
%	8.1	6.9	7.6	6.6	5.48	3.5	2.03	2.6	3.43	6.13	7.7	8.3	68.34	
Light rain 1-10	31	53	52	106	166	277	374	385	303	136	36	23	1942	30
%	0.3	0.48	.47	0.97	1.5	2.53	3.4	3.5	2.76	1.24	0.33	0.21	17.72	
Moderate rain 11-22	6	13	25	38	87	102	171	133	111	54	10		750	
%	0.05	0.12	0.23	0.35	0.79	0.93	1.56	1.2	1.0	0.5	0.09		**6.84**	
Moderate heavy 23-43	4	11	14	26	40	79	91	92	68	40	6	1	472	
%	0.04	0.1	0.13	0.24	0.36	0.72	0.83	0.84	0.62	0.36	0.05	0.01	4.31	
Heavy 44-88	1	4	6	2	33	42	35	36	33	21	2	1	216	
%	0.01	0.04	0.05	0.02	0.3	0.38	0.32	0.33	0.30	0.19	0.02	0.01	1.97	
Very heavy			2	3	3	16	5	5	9	7	5		55	

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Total Missing Days
Dry days	888	766	831	725	601	384	223	279	376	672	841	905	7491	
>89														
%	0	0	0.02	0.03	0.03	0.15	0.05	0.05	0.08	0.06	0.05	0	0.5	
Very heavy 100-299				2		12	4	3	5	6	3		32	
%	0	0	0	0.02	0	0.12	0.04	0.03	0.05	0.05	0.03	0	0.31	

Source: https://weatherandclimate.com/bangladesh/khulna#t2

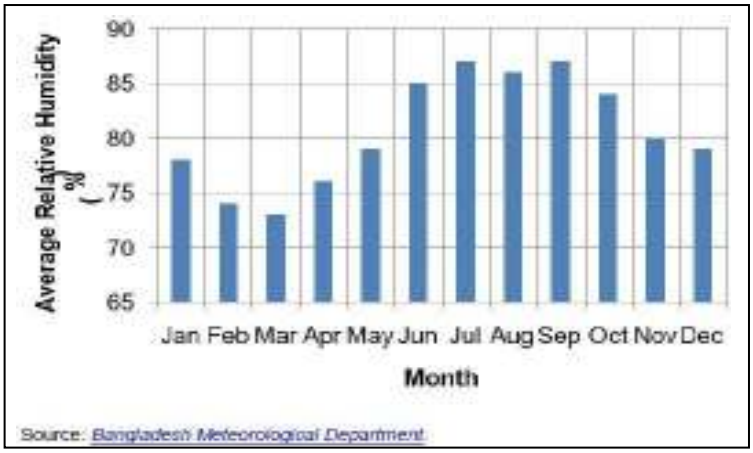
74. **Wind.** The following wind rose for Khulna shows the number of hours per year the wind blows from the indicated direction and the predominant direction is confined within a zone stretching from South and East-South-East direction. Average wind speed ranges from 5 to 19 km/Jashore during the maximum period of the year.

Figure 33: Wind Rose Diagram for Khulna City



75. **Relative humidity.** Being situated in the Southern coastal region of Bangladesh, another strong parameter ofdaily weather of Khulna is average relative humidity, which is relatively high all the year round. 85% is the average relative humidity from June through October (monsoon period) month.

Figure 34: Average Relative Humidity (%)



4. Hydrology and Surface Water

76. The topography in the Khulna District in the southwest Bangladesh, which is in the deltaic area of Padma River, one of the world's largest rivers, is flat and slopes gently towards the Bay of Bengal and is crisscrossed by a network of rivers and canals influenced by tides, storm surges from the sea and intrusion of seawater.[18] Two main subsidiary rivers, the Gorai and the Arial Khan, respectively have their offtake from the Southern bank of Padma River. Both river systems contribute with vital freshwater flow during the dry season into the southwest region, and together with local rainfall they help to recharge groundwater and push back the salinity ingress propagating upstream via coastal aquifers and tidal coastal rivers and threatening the water supply intakes (surface water) and tube wells (groundwater

77. Khulna project area is traversed by several rivers, notably the Bhairab, Rupsha, and Madhumati rivers, all of which significantly influence the area's hydrology and drainage. The Bhairab River enters Khulna from the northwest, runs southeast through the district, subsequently joining the Rupsha River at Charer Hat. The Rupsha continues further southward, merging eventually with the Pasur River. The river system receives surplus water from various local channels and canals, which become essential during monsoon floods and tidal surges. Madhumati River, part of the Gorai-Madhumati distributary system branching from the Padma River, experiences considerable seasonal flow variations. Its upstream connection with the Gorai River and downstream confluence with smaller channels like the Kumar, Nabaganga, and Chitra rivers play a vital role in the regional hydrology and sustainability of water resources.

[18] Padma River is formed by joining of Brahmaputra River, known locally as the Jamuna, with Ganges River.

Figure 35: River System in the Project Area

Source: Google Maps.

78. Rainfall and transboundary river inflows constitute the primary sources of surface water in Bangladesh, significantly influencing the hydrology of the Khulna region. Bangladesh is characterized by an extensive network of inland water bodies with approximately 700 rivers, inclusive of their tributaries and distributaries, which traverse the landscape and create an extensive network of inland water bodies covering around 98,000 hectares, supplemented by more than 24,000 km of flowing streams. Additionally, approximately 1.3 million ponds (covering about 147,000 hectares) and numerous haors, baors, and beels—seasonally inundated depressions—contribute to the country's extensive surface water resources, although many of these water bodies typically dry up during the winter months. Despite the abundance of these surface water resources, their effective utilization for development purposes in Bangladesh—and particularly in urban settings like Khulna—remains limited.

79. In Khulna city, conditions are similar. The absence of an adequately functional centralized sewerage and sanitation infrastructure results in untreated or inadequately treated domestic wastewater—along with septage—being discharged directly into existing drainage channels or nearby rivers such as the Bhairab and Rupsha. Consequently, these receiving water bodies face significant contamination, with adverse impacts on aquatic biodiversity, public health, and the reliability of urban water supplies. Addressing these challenges through improved wastewater management infrastructure, strict enforcement of environmental regulations, and enhanced community awareness is crucial for safeguarding Khulna's surface water resources and ensuring sustainable urban water management. KWASA is currently implementing Khulna sewerage system development project funded by ADB, which includes collection, conveyance and sewage treatment system. KWASA also has plans to expand the system to uncovered and extended areas in the future.

80. The surface water quality monitoring within the project influence area was conducted to establish baseline conditions. Sampling and analysis of surface water quality parameters

were undertaken in January 2025 during the IEE study. Sampling involved the collection of surface water samples from strategic locations within the project area, notably near key intake points proposed under this project, including the Madhumati River intake at Mollahat and the Bhairab River intake at Afil Gate. In comparison with inland surface water standards of Bangladesh, Bhairab and Madhumati water is suitable for source of drinking water after conventional treatment, except for dissolved oxygen which is slight less than the standard.

Table 17: Surface Water Quality - Bhairab and Madhumati Rivers

Sl. No.	Sample ID	Location	Surface Water Quality											
			pH	Total Alkalinity	DO (mg/l)	TOC (mg/l)	TDS (mg/l)	Oil & grease (mg/l)	BOD (mg/l)	EC (µs/cm)	Hardness (mg/l)	TSS (mg/l)	COD (mg/l)	Turbidity (NTU)
1	SW 1	Bhairab Intake Upstream	7.24	103	4.7	6.34	655	2.13	3.5	617	246	112	1.09	75
2	SW 2	Bhairab Intake downstream	7.25	101	4.3	6.42	641	2.11	3.3	641	238	112	1.09	75
3	SW 3	Madhumati Intake Upstream	6.33	107	4.8	6.34	446	1.08	3.12	688	241	67	0.95	56
4	SW 4	Madhumati Intake downstream	6.73	101	4.9	6.42	471	1.12	3.04	742	238	65	0.95	58
	SW 5	Rupsha River (06 Ghat, 31 no ward, Labonchara)	-	-	2.8	-	-	-	-	-	-	-	8	-
	SW 6	Rupsha River (Putimari, Labonchara)	-	-	2.4	-	-	-	-	-	-	-	8	-
	GOB Standards (surface water quality)	Source of drinking water for supply after conventional treatment	6-9		≥5	-	1000	-	≤3	-	-	-	25	-

Source: Field sampling survey, January 2025.

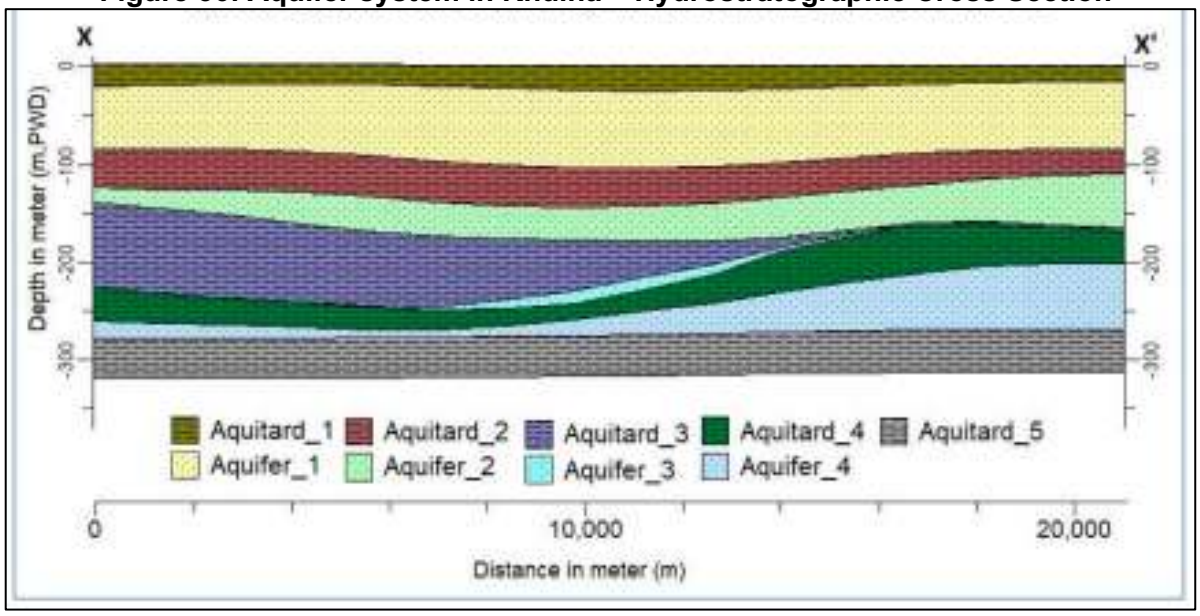
5. Groundwater

81. In Bangladesh, groundwater is found at a very shallow depth, with the primary aquifers located in recent alluvial sediments within the floodplains. These aquifers are primarily recharged by the percolation of rainwater and floodwater. Rivers and other standing water bodies also contribute to recharging nearby aquifers. The main component of groundwater discharge is the withdrawal of water through various types of tube wells for different purposes, while a minor component discharges towards lower gradients, sometimes as base flow. During the monsoon season, the recharge rate is so high that the groundwater level rises very close to the surface. Conversely, in April and May, the groundwater level reaches its maximum depth. Irrigation accounts for the largest portion of groundwater usage nationwide. Groundwater is also widely used for industrial and domestic purposes, including drinking, in both rural and urban areas. Consequently, high concentrations of natural elements like arsenic, iron, manganese, and fluoride in groundwater pose significant public health risks. In coastal regions, high salinity and the presence of fecal coliform in shallow groundwater further exacerbate public health concerns.

82. **Findings of Hydrogeological Study on Groundwater Resources.** As part of the feasibility study for KWSP Phase 2, Institute of Water Modelling (IWM) carried out this study in 2024. The hydrogeological study reveals that the topsoil thickness of the KWASA area varies from 1 to 30 m in most of the areas except some parts of the area, where it varies from 31 m to 55 m. Also, there is no significant thickness of the production aquifer (3rd aquifer) in parts of the Daulatpur area. The maximum thickness of 3rd aquifer exists in Sonadanga and Khalispur area (thickness varies from 67 to 166 m). Approximately 15,270 private tubewells are active within the KWASA area, abstracting 45.6 MLD. These tubewells, primarily 180–1,200 ft deep, contribute to the stress on groundwater resources. According to groundwater level trends observed in 2015, 2022 and 2024, the depth of groundwater tables varies from 9 to 13.6 m and the maximum depth is found at Sonadanga area. The declining trend of groundwater in Sonadanga area may be due to increased number of private tubewells compared to other areas of the city. The depth of groundwater table goes down around 1m to 3 m compared to that of 2003 in most of the areas except Khalishpur. Surface water use was started after 2019. The data of 2022 and 2024 indicates the stabilization of water table except few places.

83. A water balance was prepared from model simulation for different geological layers represents that an amount of recharge occurs in the deeper aquifer. The recharges for the year 2004 and 2023 are 97 mm and 188 mm respectively as per the abstractions. Considering the 3rd aquifer and the availability of the upper aquitard, groundwater resources have been assessed using groundwater flow (mathematical) modelling. Total annual groundwater availability is estimated as 48,900 ML (133.6 MLD), and safe yield is estimated as 36,500 ML (100 MLD).

Figure 36: Aquifer system in Khulna – Hydrostratographic Cross Section



Note: x-x is a north-south cross section through middle of the city.
Source: IWM study (2024).

Table 18: Status of the aquifer in Khulna and recharge rate

Ward No.	3rd aquifer thickness (m)	Aquitard thickness on Third Aquifer (m)	Chloride Concentration (mg/l)	Conduct. (m/d)	Recharge (mm)	GW Resources (MLD)
Ward-03	28-48	101-136	200-400	9	1,280	4.0
Ward-04	28-48	101-136	200-600	10	1,344	6.4

Ward No.	3rd aquifer thickness (m)	Aquitard thickness on Third Aquifer (m)	Chloride Concentration (mg/l)	Conduct. (m/d)	Recharge (mm)	GW Resources (MLD)
Ward-06	28-66	137-174	400-600	10	1,280	1.5
Ward-09	67-96	59-174	400-600	13	1,707	11.0
Ward-12	67-96	9-59	400-600	13	1,387	1.1
Ward-14	67-96	101-136	300-600	17	1,830	13.2
Ward-15	67-96	9-100	200-600	20	2,045	2.6
Ward-16	67-96	101-136	200-600	21	2,163	13.8
Ward-17	67-96	101-136	200-400	20	2,234	14.1
Ward-18	49-66	101-136	300-400	17	1,958	9.1
Ward-19	3-96	101-136	300-400	23	2,158	3.0
Ward-20	3-166	59-100	300-400	24	2,176	2.9
Ward-21	67-166	9-100	300-400	25	2,285	8.4
Ward-23	28-166	9-59	300-400	17	1,908	2.6
Ward-24	49-96	59-174	200-400	28	2,204	9.0
Ward-25	3-66	101-174	200-400	18	1,504	3.0
Ward-26	28-66	101-136	200-300	29	1,911	3.5
Ward-27	49-66	59-100	200-400	34	2,168	4.9
Ward-28	49-96	9-59	200-600	20	2,232	4.3
Ward-30	67-96	9-59	200-600	15	1,475	3.7
Ward-31	49-66	9-59	200-300	16	1,229	11.5
					Total	**133.6**

Source: Feasibility Study Report, KWSP-2, 2024.

84. In Khulna city, groundwater quality is a major concern due to its high salinity concentration. To assess groundwater quality, surveys of existing production wells and monitoring wells have been conducted as part of this project. During these surveys, five physical parameters—pH, electrical conductivity (EC), total dissolved solids (TDS), salinity, and temperature—were measured in the field for both production and monitoring wells. The recommended TDS is 1,000 mg/L. Water with TDS levels above 1,200 mg/L is generally considered unacceptable for drinking. The standard limit for chloride in drinking water is 250 mg/L. This limit is based on taste considerations rather than health concerns. As per Bangladesh standard, the limit is 1,000 mg/L in coastal areas. As per the IWM study, an increasing trend of chloride concentration has been observed in the deeper aquifers of Daulatpur, Khalishpur, and Sonadanga areas. However, under the proposed Phase II of the project, no additional groundwater abstraction is planned from these areas. This decision was made to prevent further degradation of water quality, as chloride concentrations are projected to rise with continued extraction. Instead, groundwater abstraction will be optimized through seasonal redistribution from other less-affected zones, and monitoring of salinity trends in these high-risk areas will continue to guide future resource planning and allocation.

Table 19: Measured groundwater quality data at existing production well

	Well ID	GW Quality					Depth of Well
		pH	EC (µs/cm)	TDS (mg/l)	Chloride Salinity (ppm)	Temp (°C)	
1	Head Office Pump	7.83	972	460	256	26.9	Deep
2	16no Ward Office Pump	7.60	2,182	918	510	34.4	Shallow
3	Khulna Islmia College Pump	8.13	1,006	448	249	29.9	Deep

	Well ID	GW Quality					Depth of Well
		pH	EC (µs/cm)	TDS (mg/l)	Chloride Salinity (ppm)	Temp (°C)	
4	Sonadanga Puraton Thana Pump	7.88	1,894	786	437	34.8	Deep
5	Khulna Polytechnic College	7.56	2,410	1097	609	30.4	Deep
6	Khalishpur Road No 12	7.40	2,910	1234	686	32.9	Deep
7	KCC Office Khalishpur (New)	7.39	1,619	689	383	33.2	Deep
8	Shonadanga Truck Terminal	7.86	931	394	219	32.4	Deep
9	East Baniakhamar Madrasa	8.18	759	330	183	30.7	Deep
10	Bagmara Banckers Colony	8.10	800	345	192	31.3	Deep
11	Nirala KCC Park	8.09	1,734	768	427	31.1	Deep
12	Club er More Pump	7.71	854	360	200	32.7	Deep
13	Siddikia Madrasa Pump	7.92	1,843	794	441	32.8	Deep
14	Lions School Pump	8.20	892	384	213	31.5	Deep
15	Sher-E-Bangla Road new Pump	7.80	1,271	549	305	31.9	Deep
16	Shahid Shorohwardi College	7.62	1,566	655	364	34	Deep
17	Tutpara High School New	8.18	776	338	188	30.7	Deep
18	Tootpara High School Old	8.22	789	341	189	31.2	Deep
19	Habelibag Pump	8.09	811	355	197	30.5	Deep
20	Muggunni Bottola New Pump	7.72	1,405	667	371	27.3	Deep
21	Bastuhara Baytur Rohmot Pump	7.67	1,578	698	388	31.1	Deep
22	BGB Camp Pump	7.5	2,370	1043	579	32.1	Deep
23	Goalkhali Graveyard Pump	7.61	2,360	1041	578	32	Deep
24	Boyra Public College	7.71	1,939	859	477	31.4	Deep
25	Zilla Schooler Picher Pump	7.10	3,190	1403	779	32.8	Deep
26	Golokmoni Shishupark	8.19	1,188	534	297	29.7	Deep
27	Shadar Thana Staff Quarter Pump	7.29	1,282	567	315	30.4	Deep
28	Soburronnesa School Pump	7.10	3,050	1350	750	32.5	Deep
29	Sadar Hospital Pump	7.22	1,394	617	343	30.8	Deep
30	KCC Rest House	7.72	2,500	1109	616	31.7	Deep
31	Zila School Quarter Pump	7.71	2,200	968	538	32.1	Deep
32	31 No Ward Office	7.56	931	412	229	30.4	Deep
33	Taltala Hospital Pump	7.79	1,896	849	472	30.8	Deep

	Well ID	GW Quality					Depth of Well
		pH	EC (µs/cm)	TDS (mg/l)	Chloride Salinity (ppm)	Temp (°C)	
34	Ghosher Vita Pump	7.28	1,836	806	448	31.9	Deep
35	Dhaka Match School	7.39	811	353	196	31.1	Deep
	GOB drinking water standards	6.5-8.5		1000	250 / 1,000 (in coastal areas)	-	-

Source: Feasibility Study Report, KWSP-2, 2024.

Table 20: Measured groundwater quality data at completed monitoring wells

Sl. No.	Monitoring Well ID	Location	Depth of Well	Groundwater Quality				
				pH	EC (µs/cm)	TDS (mg/l)	Chloride Salinity (ppm)	Temp (°C)
1	MW- 1_CBR	Choto Boyra Reservoir, Sonadanga	278.96	8.1	1,281	547	304	32.7
2	MW-2_BWTP	Bangabandhu WTP, Rupsha	294.2	7.65	6,850	3180	1767	31.9
3	MW-3_HP	Hadis Park KWASA Office Compound	264.32	8.26	905	402	223	30.4
4	MW-4_DR	Deana Reservoir KWASA, Daulatpur	327.74	8.7	987	436	242	31.4
		GOB drinking water standards		6.5-8.5	-	1000	250 / 1,000 (in coastal areas)	-

Source: Feasibility Study Report, 2024.

6. Air Quality

85. Ambient air quality data of Khulna obtained from DOE reports, pertaining to 2017-19 is presented in the following table. The monthly average values show in comparison with GOB ambient air quality standards yearly average show that PM 10 and PM 2.5 are exceeding in 2 out of six months. All other parameters are well within the limits. In comparison with the World Health Organization (WHO) ambient air quality guideline values, both PM 10 and PM 2.5 concentration is exceeding the standards, while oxides of nitrogen and sulphur are within the standards. The ambient air quality data pertaining to 2024 and 2025, random one day sampling shows that in comparison with GOB standards (24-hour average), all tested parameters are well within the limits. Values are exceeding WHO's PM 10 and PM 2.5 guideline values.

Table 21: Ambient air quality in Khulna (2017-2019)

Sl. No	Month	Monthly average Concentration (µg/m^3)				
		PM 10	PM 2.5	SO2	NO2	CO mg/m^3
1	October 2017	-	51.8	-	71.5	0.54
2	April 2018	63.88	25.25	21.30	46.21	DNA
3	June 2018	39.7	18.5	12.0	20.0	1.24
4	August 2018	28.52	13.57	1.54	4.58	0.37
5	March 2019	93.7	56.5	1.97	22.6	0.74
6	April 2019	48.9	28.3	-	21.1	0.70
	GoB Standard (24 hours)	150	65	80	80	5

Sl. No	Month	Monthly average Concentration (µg/m³)				
		PM 10	PM 2.5	SO2	NO2	CO mg/m³
	GoB Standard (1-year)	50	35	-	-	
	WHO Standard (24 hours)	50	25	20		-

Source: Monthly Air Quality Monitoring Reports, Clean Air and Sustainable Environment Project, Department of Environment, Government of Bangladesh.

Table 22: Ambient air quality in Khulna (2024)

Sl. No	Location	GPS coordinates	Sampling Date	SPM	PM 10	PM 2.5	SO2	No2	CO (µg/m³)
				Ambient Air Pollutants Concentration (µg/m³)					
1	Labonchara	22°46'43.72"N 89°33'19.48"E	14 May 2024	95.6	50.2	29.7	10.5	0.043	0.043
2	Labonchara	22°46'43.72"N 89°33'19.48"E	26 May 2024	93.2	49.6	22.5	8.3	11.1	0.024
	GoB standard (24 hours average)			-	150	65	80	80	5
	WHO standard (24 hours average)			-	50	25	20	-	-

Source: Environmental monitoring report, May 2024. Khulna Sewerage System Development Project (ADB Loan 3978/3979-BAN)

Table 23: Ambient air quality in Khulna (2025)

No	Location	GPS coordinates	Date	Ambient Air Pollutants Concentration (µg/m³)				
				PM 2.5	PM 10	NO2	SO2	CO mg/m³
1	AAQ 1 - Mostofa More	22.828829° N 89.512964° E	23 Jan 2025	44.4	77.9	8.3	15.4	448
2	AAQ 2 -Sonadanga Moyur Bridge,	22.812854°N 89.535667°E	24 Jan 2025	47.4	77.3	8.0	14.1	433
3	AAQ 3 - Mayur Bridge, Khulna City Bypass.	22.862111 N 89.501124 E	24 Jan 2025	40.43	69.95	7.88	11.38	398
	AAQ 4 - Mollahat, Bagerhat.	22.929875 N, 89.811045 E	25 Jan 2025	28.00	56.1	8.4	11.9	385
	GoB standard (24 hours average)			65	150	80	80	-
	WHO standard (24 hours average)			25	50	20	-	-

Source: Field sampling survey, January 2025.

Figure 37: Ambient air quality monitoring locations

7. Noise level

86. Excessive noise poses a potential threat to both humans and wildlife, leading to various negative effects, including mild annoyance, increased aggression, and significant disruptions in behavioural patterns. As presented below, the baseline noise levels measured during the survey are within the standards, except in silent zones where values are exceeding the standards.

Table 24: Baseline data of noise level[19]

Sl no	location	GPS Cords	date	Leq day	Leq night	L max	Lmin
				dB(A)			
1	Labonchora, Khulna	22°46'43.72"N 89°33'19.48"E	14 Mar 2024	55.8	33.5	69.8	31.2
2	Labonchora, Khulna	22°46'43.72"N 89°33'19.48"E	26 May 2024	53.7	34.5	62.6	30.8
	GOB Standards	Mixed Zone		60	50	-	-

Source: Environmental monitoring report, May 2024. Khulna Sewerage System Development Project (ADB Loan 3978/3979-BAN)

Table 25: Baseline data of noise level

S no	location	GPS Cords	Date	Day L max	Day Min L	Night L max	Night Lmin	GOB standards	
								day	night
				dB(A)					
1	Mostofa More, Khulna (Commercial zone)	22°82'88.29" N, 89°51'29.64" E	23 Jan 2025	66.23	54.77	69.29	52.04	70	60
2	Sonadanga Moyur Bridge. (Silent zone)	22°81'28.54" N, 89°53'56.67" E	23 & 24 Jan 2025	70.61	49.74	69.13	44.15	50	40
3	Mayur Bridge, Khulna City Bypass. (Silent zone)	22°86'21.11" N, 89°50'11.24" E	24 Jan 2025	69.55	50.95	70.2	49.95	50	40
4	KWASA, Mollahat, (Industrial zone)	22°92'98.75" N, 89°81'10.45" E	25 Jan 2025	64.55	48.2	64.5	49.55	75	70

Source: Field sampling survey, January 2025

8. Disaster and Climate Risk

87. Khulna district is situated in a natural disaster-prone area. Waterlogging, salinity intrusion, cyclones, storm surges, and river erosion are the main natural disasters in the district area. Such disasters occur nearly every year in this area. However, the city area is less affected by these sorts of disasters, except for some cyclonic events lambasting periodically. The climate risk and vulnerability assessment (CRVA) tool by the Programming Division (2018) of the Planning Commission, Bangladesh has categorized different parts of the country into five levels of likelihood of 10 hazards and scored as Very Unlikely = 0, Unlikely = 1, Possibly

[19] **Sampling done by EQMS in KSSDP, data taken from monthly progress report.

= 2, Likely = 3 and Almost Certain = 4. Risk calculation of Khulan is presented in the table below. Khulna faces moderate risk in terms of salinity, cyclone, sea-level rise and extreme rainfall events.

Table 26: Risk Score Calculation for Khulna

Hazards	Likelihood of Hazard (L)	Exposure (E)	Vulnerability (V)	Consequences (E*0.7) +(V*0.3)	Generalized Consequence Score (C)	Risk Score (L*C)	Risk Category
Salinity	4	3	4	3.3	3	12	Moderate
Cyclone	4	3	3	3	3	12	Moderate
Sea-level rise	3	3	3	3	3	9	Moderate
Extreme rainfall episodes (leading to floods)	3	3	3	3	3	9	Moderate
Drought	3	2	3	2.3	2	6	Low
Earthquake	1	2	3	2.3	2	2	Very Low
Erosion	2	2	3	2.3	2	4	Very Low

88. **Cyclones. K**hulna city frequently faces the cyclones due to its proximity to the Bay of Bengal. These cyclones bring destructive winds, heavy rainfall, and storm surges that can cause extensive damage to urban infrastructure, residential areas, and public services. The city's drainage systems often become overwhelmed, leading to severe waterlogging and prolonged flooding in many neighbourhoods. The recurring cyclonic activity also disrupts daily life, causing power outages, damage to buildings, and posing significant health risks due to contaminated water and poor sanitation conditions. Despite efforts to improve disaster preparedness and resilience, the increasing intensity of cyclones continues to challenge Khulna City's ability to safeguard its population and maintain essential services.

Figure 38: Cyclone hits map of Bangladesh and causality records in Khulna

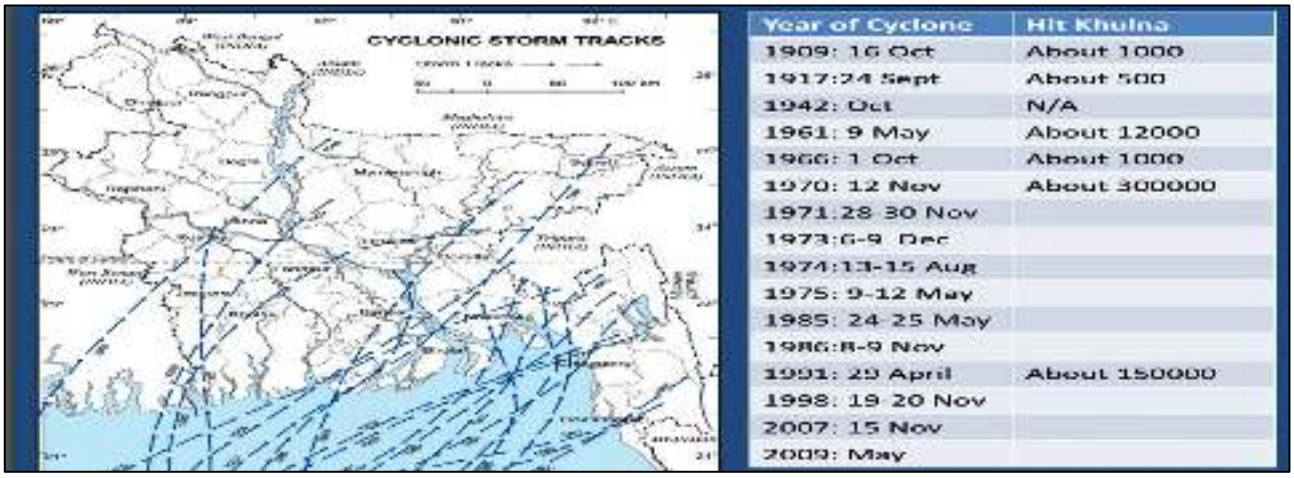
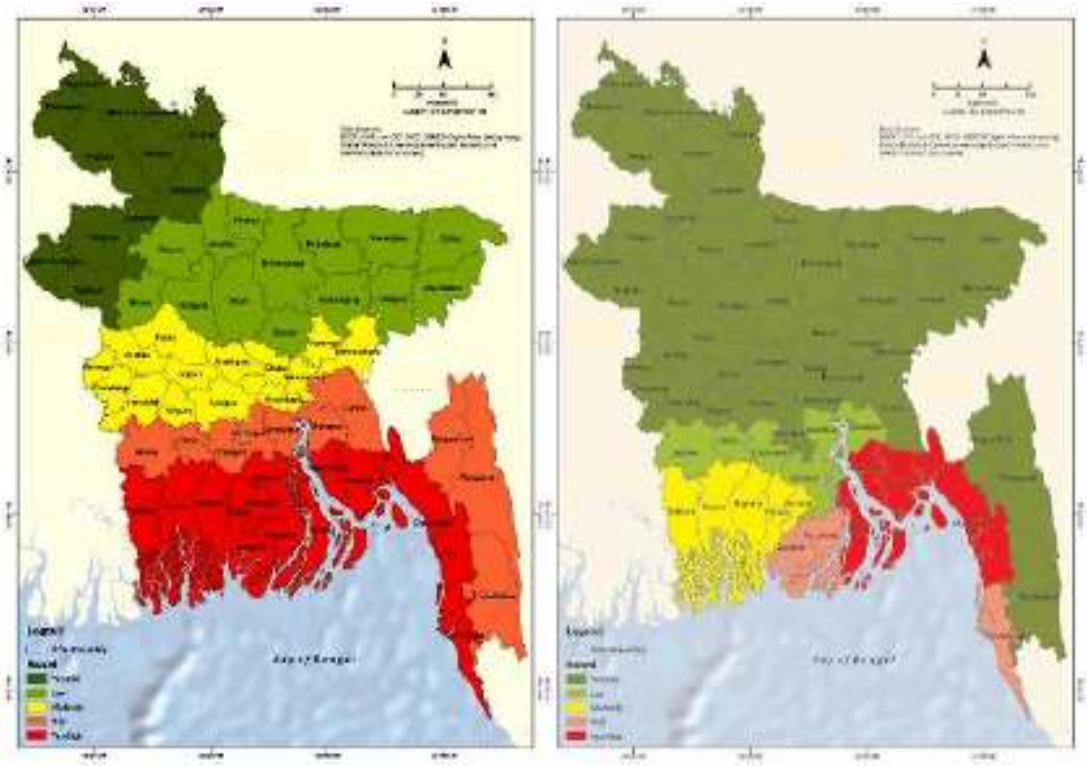


Figure 39: Cyclone Risk Index map of Bangladesh (Left); Storm surge Index of Bangladesh (Right) Source: PC and ADB 2021)



89. **Floods.** Khulna City in Bangladesh experiences frequent flooding due to its geographic location, and low-lying terrain. The city's flood frequency is exacerbated by monsoon rains, tidal surges, and the overflow of the adjacent Rupsha and Bhairab rivers. Climate change has intensified these events, leading to more severe and unpredictable flooding. Poor drainage infrastructure and rapid urbanization further contribute to the problem, often resulting in prolonged waterlogging in various parts of the city. These frequent floods have significant socio-economic impacts, disrupting daily life, damaging property, and posing health risks to the residents of Khulna.

Figure 40: Flood frequency map (2016-2024) (Source: Geoinformatics Center of AIT)

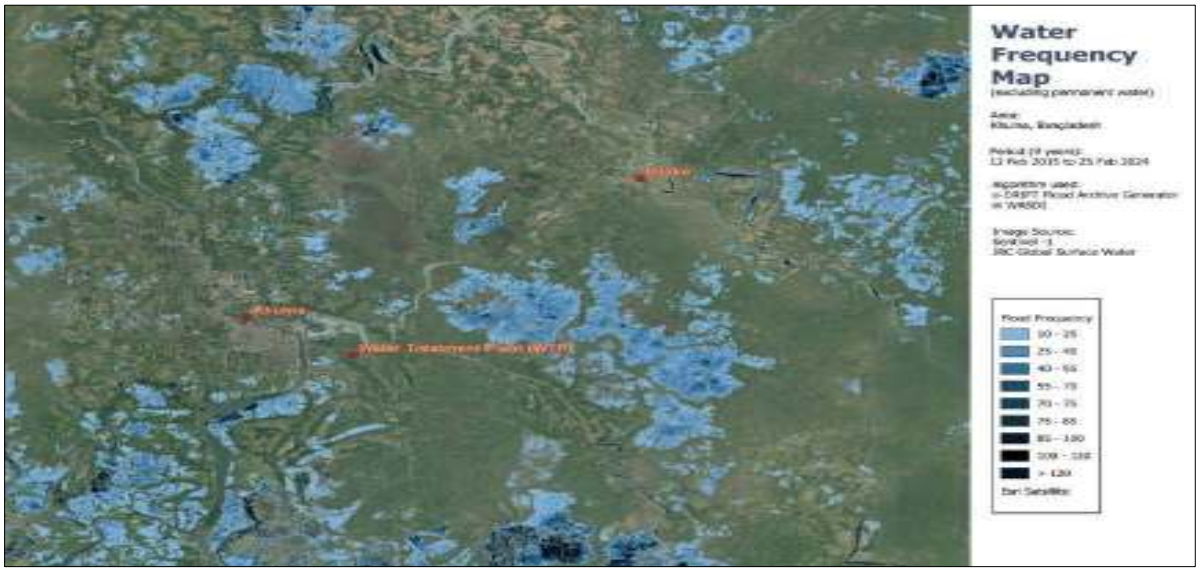
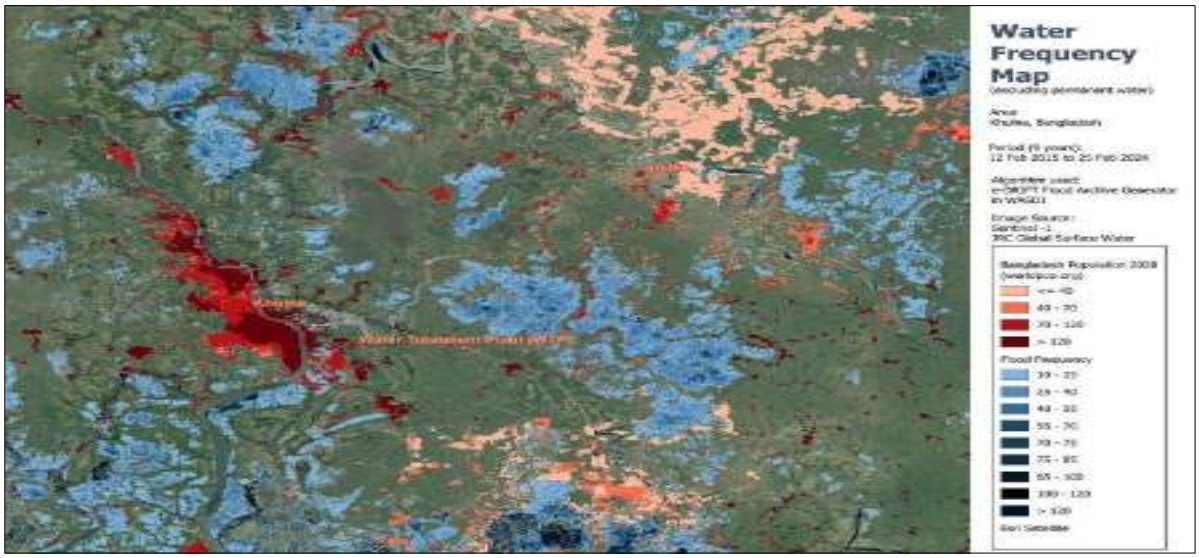


Figure 41: Flood frequency map (2015-2024) with Bangladesh Population 2020



Source: Geoinformatics Center of AIT.

90. **Sea Level Rise.** By 2050, sea levels in the region are expected to rise by approximately 0.3 to 0.5 meters (30 to 50 cm) under moderate emission scenarios. This increase poses substantial risks to coastal communities, infrastructure, and freshwater resources. Of importance to KWASA is the projected increase in salinity in Khulna. Studies indicate that by 2050, salinity levels in coastal areas, including Khulna, could increase by a median of 26%.[20,21] This scenario necessitates the need for continuous development of freshwater sources to continuously dilute saline water for future domestic consumption.

91. **Salinity intrusion**. Salinity is a major problem in the coastal region of the world, and Bangladesh is not an exception. It is situated near the coast of the Bay of Bengal. The Khulna district is in the southwestern zone of Bangladesh and is prone to salinity (Molla Rahman Shaibur et al., 2021), which affects the rivers in the district and source of water, the Madhumati River at Mollahat, for the Khulna City Corporation (KCC). The Khulna Water Supply and Sewerage Authority (KWASA) is facing increased salinity in water sources due to several factors that includes the: i) rising sea levels and changing weather patterns contribute to higher salinity levels in rivers dure to climate change[22], ii) reduced freshwater flow from upstream rivers allows more saltwater intrusion, iii) industrial activities and land use changes affect water quality,[23] iv) natural tidal movements bring saltwater into freshwater sources; and over-extraction of groundwater reduces its quality and increases salinity. High salinity levels in drinking water adversely effects the health with issues like hypertension, kidney diseases, skin diseases, gastrointestinal issues, and reproductive health issues.

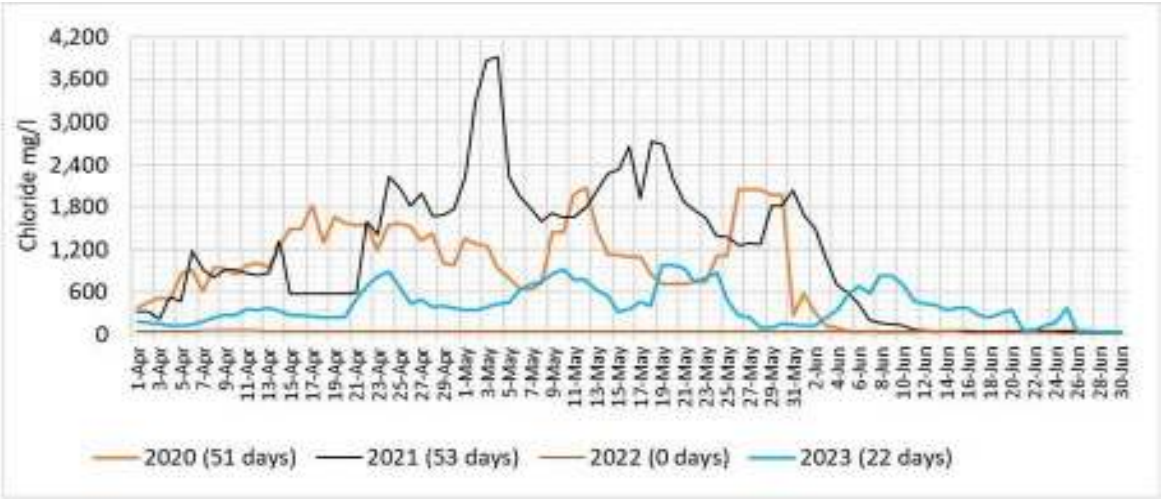
92. KWASA is addressing the increasing salinity of water sources, including this project, and long term-proposals like development of new intake sources to source less saline water in Madaripur Beel Route Canal and Bhairab River in the upstream. Interim measures include: i) construction of small capacity impounding reservoirs at the Bangabandhu Water Treatment Plant to store and treat water; ii) utilizing groundwater with strict limits to ensure sustainability;

[20] Climate Change and Salinity Intrusion: Research conducted by SpringerLink explores the relationship between temperature, rainfall, and salinity gradients in various water sources in Khulna.
[21] Peri-Urban Water Security Project that assessed the role of regional anthropogenic interventions and climate change-induced sea level rise on salinity progression in Khulna.
[22] https://cdia.asia/2024/10/27/khulna-tackles-water-supply-issues-amid-rising-salinity-and-population-growth/
[23] https://Jashore.worldwateratlas.org/narratives/water-as-leverage/water-as-leverage-in-khulna/

smart water management, management of aquifer recharge, and developing climate-resilient and sustainable solutions to address salinity ingress during the dry season.

93. Khulna water supply is affected by the high salinity in the Madhumati River during the dry season (April to June). KWASA has been monitoring the daily water quality of the river at the intake on a random sampling basis. The salinity level begins to increase in April and gradually reaches its peak in May each year and reduces in June. The daily salinity level for the past five years from 2019 to 2023 in the months of April, May and June is presented in **Figure 42** below and marked the number of days it exceeded the limit. In 2020, 2021 and 2023, the maximum salinity level was 2,080 mg/l on May 12th, 2020, 3,920 mg/l on May 4th, 2021, and 980 mg/l on May 19th, 2023, respectively. The years 2020 and 2021 had a total of 51 days and 53 days with over 600 mg/l of salinity, respectively.

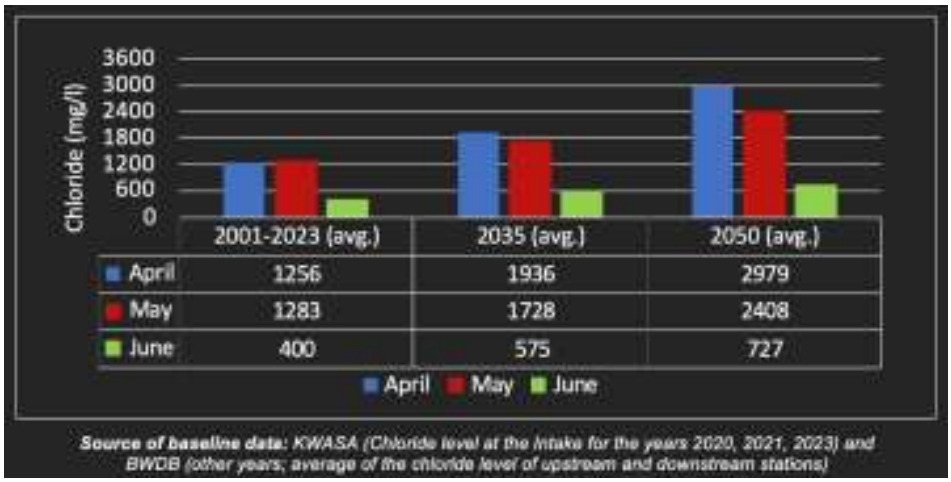
Figure 42: Daily Salinity (Chloride) Levels Madhumati River, Mollahat (April to June)



Source: Feasibility Study Report, KWSP-2, 2024.

94. **Salinity Projection for the Future.** To study the risk of future salinity increases, forecast of the salinity at the intake area was conducted using a linear trend relative to the historic average of the salinity (high and low tide) from 2001 to 2022. The forecast exhibits that the salinity may continue to worsen in the dry season months, especially in April and May, and may reach an average of close to 2000 mg/l and 3,000 mg/l in 2035 and 2050, respectively. These findings were considered in the design of water supply system.

Figure 43: Projected Average Monthly Salinity, 2035-2050 (baseline: 2001-2023)

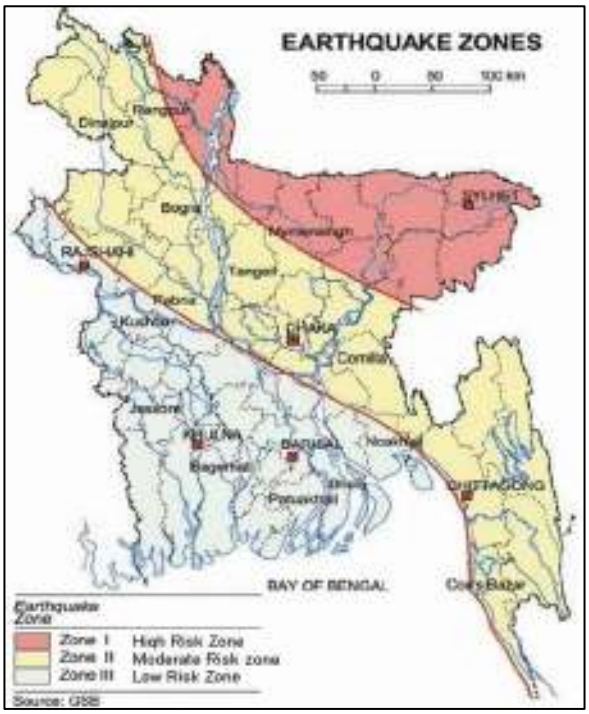


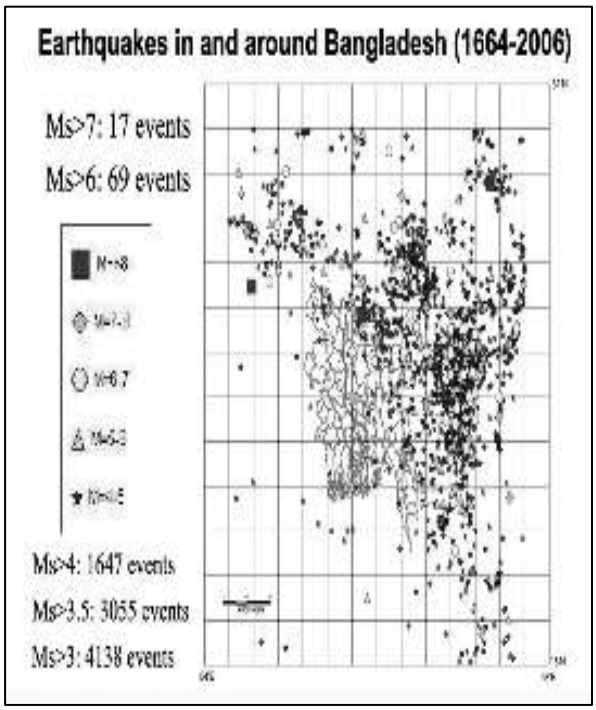
Source: Feasibility Report, 2024.

95. **Seismicity.** Seismicity denotes the proneness to earthquake occurrence. Higher seismicity of a region is more likely to experience more frequent and large earthquakes than a region of lower seismicity. This seismicity can be shown in seismic zoning map, that considers the soil type, foundation conditions, ground structure and its dynamic characteristics, intensity distribution during past earthquakes, ground motion attenuation characteristics, location of seismically active zone, etc. Likewise, Bangladesh is divided into threegeneralized seismic zones- Zone I (High Risk), Zone II (Moderate Risk) and Zone III (Low Risk).

96. The project site in Khulna district, lies within the Zone-III comprising the southwestern partof Bangladesh, is seismically quiet, with an estimated basic seismic co-efficient of 0.04. The project area is the least vulnerable in terms of seismicity compared to the other parts of Bangladesh like northern and eastern regions of Bangladesh with the presence of several faults and thrust counting the basic seismic co-efficient of 0.08 or the central part of Bangladesh representing the regions of recent uplifted Pleistocene blocks of the Barind and Madhupur Tracts,and the western extension of the folded belt. However, all building structures will be designed following the Bangladesh National Building Code (BNBC), 2006 and 2020, in order to avert the least impact causedby any potential tremor.

Figure 44: Earthquake zones in Bangladesh





C. Biological Environment

1. Flora

97. The project area exhibits a mix of semi-urbanized, semi-rural, totally rural, and riverine landscapes. The vegetation primarily includes species adapted to wetlands, riverbanks, and moderately saline soils, typical of the Khulna region.

(i) Riparian Vegetation: Bhairab and Madhumati riverbanks are lined with native species such as Mahogany, *Koroi*, *Shishu* and River Grass. These plants contribute to erosion control and provide habitat for aquatic fauna. Water hyacinths in large numbers were seen at the Madhumati River.

(ii) Urban Vegetation: At Labonchara and Mostofar Mor, the selected lands for the projects are low laying agricultural lands and usually those fields are used for paddy cultivation. Vegetation is limited to small patches of roadside trees such as *shishu, koroi babla*, Mahogony, moringa and lots of pointy shrubs adapted to urban environments.

(iii) The Mollahat intake facility has a nicely managed tree garden along with fruit trees are planted there; guava, papaya, tentul, coconut etc. same thing can be said for Afil gate WTP and SWTP areas.

(iv) Cultivated Crops: Agricultural fields near Mollahat intake and SWTP are also dominated by paddy and seasonal vegetables, which form an integral part of the local ecosystem.

Figure 45: Image of Flora taken from project locations

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>The presence of water hyacinth and river grass</td><td>Dragonfly at SWTP</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Red powderpuff Flower tree at Mollahat intake</td><td>Butterfly at SWTP campus</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Series of trees at Mollahat intake campus</td><td>Snail at Afil gate intake</td></tr>
</table>

Guava tree at Mollahat intake

2. Fauna

98. **Aquatic Fauna.** The Bhairab River supports a range of fish species, such as Hilsa ilisha (Hilsa), the national fish of Bangladesh. Freshwater invertebrates, including crabs and prawns, are also present. In the field survey, the most common species were water insects, small fish, snails, frogs, etc. Frogs and small fish are very common in SWTP, and they get into the sedimentation chamber from IPR. In the first visit of the national consultant, the local fish market at Mostofar Mor was surveyed. The Madhumati River is known for supporting larger populations of commercially valuable fish like *Labeo rohita* (Rohu) and *Catla catla* (Catla). Information taken from local people. The Bhairab-Rupsha confluence, located downstream of Afil Gate WTP, is a recognized habitat for the *Platanista gangetica* (Ganges River Dolphin), which is a globally endangered species.

99. **Terrestrial Fauna.** Urban and semi-rural areas near Labonchara and Mostofar Mor, Afil gate and BWTP host common species such as Benji (mongoose), earthworms, house cats and dogs, and rats' holes were identified. Suring the survey the avian species sparrow, house crow, house sparrow, drongo, kingfisher, magpie, kite and shalik were identified. Mostofar Mor, Mollahat is a kind of birds' hub due to the availability of paddy fields, small fish and insects, and the locations are far from the city area. At Labonchara and Afil gate, WTP crow and sparrow nests were seen. At SWTP, about five types of butterflies were seen in a great number, but specific species could not be identified; the availability of grass, shrubs and small flowers is a reason for butterflies blooming in that area. The agricultural landscapes around Mostofar mor and Mollahat intake support small mammals like Bandicota bengalensis (Bengal Bandicoot Rat) and amphibians such as *Hoplobatrachus tigerinus* (Indian Bullfrog) and mongoose.

100. In summary, the project areas are characterized by a diverse ecological setting, with aquatic and terrestrial biodiversity. The areas like Labonchara, Mollahat and Afil Gate are still considered as semi-rural, some development activity is ongoing at Mostafa Mor where Mollahat intake and Bangabandhu WTP sites have rural surroundings. As presented in the following table, almost all species are of least concern (LC), except one.

Table 27: List of flora and fauna species, primary and secondary included

SL No.	Local Name	Scientific Name	Location / source of information	IUCN Red List mark
Terrestrial Flora				
1.	Betel nut (P)	*Areca catechu*	N 709	Least concern
2.	Dates palm (P)	*Phoenix dactylifera*	Mostafa mor	Least concern
3.	Potato (P)	*Solanum tuberosum*	N 709	Least concern

SL No.	Local Name	Scientific Name	Location / source of information	IUCN Red List mark
4.	Ground Nut	*Arachis hypogea*	Secondary source	Least concern
5.	Ginger	*Zingiber officinale*	Secondary source	Least concern
6.	Wheat (P)	*Triticum aestivum*	Secondary source	Least concern
7.	Til	*Sesamum indicum*	Secondary source	Least concern
8.	Kumra	*Cucurbita maxima*	Secondary source	Least concern
9.	Shishu tree (P)	*Dalbergia sissoo*	Labonchara	Least concern
10.	Bot (P)	*Ficus benghalensis*	N 709	Least concern
11.	Pakur (P)	*Ficus macrocarpa*	Labonchara, Mollahat intake	Least concern
12.	Mahogany (P)	*Swietenia macrophylla*	Labonchara, Mollahat	Least concern
13.	Guava (P)	*Psidium guajava*	Mollahat intake	Least concern
14.	Powder puff (P)	*Calliandra haematocephala*	Mollahat intake	Least concern
15.	Tentul (P)	*Tamarindus indica*	Labonchara, Mostafa mor, Mollahat	Least concern
16.	Kathbadam (P)	*Terminalia catappa*	Molar hat	Least concern
17.	Daab (P)	*Cocos nucifera*	Mollahat, N 709	Least concern
18.	Papaya (P)	*carica papaya*	Mollahat, Afil gate	Least concern
19.	Moringa (P)	*Moringa oleifera*	Mostafa mor, Mollahat, Afil gate	Least concern
20.	Koroi (P)	*Albizia lebbeck*	Mostafa Mor, Mollahat, Labonchara	Least concern
21.	Bibul / Babla	*Acacia nilotica*)	Labonchara, Mollahat, Afil gate	Least concern
22	Banana	*Musa paradisiaca*	Labonchara	Least concern
23	Red powderpuff	*Calliandra haematocephala*	Mollahat	Least concern
Terrestrial Fauna (Reptiles)				
1.	Anjila	*Mabuya carinata*	Secondary source	Least concern
2.	Dhura Shap	*Fowlea PMSCator*	Secondary source	Least concern
3.	Matia Shap	*Atretium schistosum*	Secondary source	Least concern
4.	Tiktiki (P)	*Hemidactylus brookii*	Anywhere	Least concern
5.	Daraish Shap	*Ptyas mucosus*	Secondary source	Least concern
6.	Gui Shap	*Varanus sparnus*	Secondary source	Data deficient
Terrestrial Fauna (Mammals)				
1.	Badur	*Pteropus giganteus*	Secondary source	Near threatened
2.	Idur	*Mus musculus*	Secondary source	Least concern
3.	Shial	*Vulpes bengalensis*	Secondary source	Least concern
4.	Chika	*Suncus murinus*	Secondary source	Least concern
5.	Beji (P)	*Herpestes fuscus*	Mollahat	Least concern
Avifauna (Birds)				
1.	Choroi (P)	*Passer domesticus*	All over city	Least concern
2	Doyel (P)	*Copsychus saularis*	All over city	Least concern
3.	Kak (P)	*Carvus splendens*	All over city	Least concern
4.	Ghugho	*Streptapelia Orientalis*	Secondary source	Least concern
5.	Shalik (P)	*Stuma contra*	All over city	Least concern
6.	Tuntuni (P)	*Orthotomus sutorius*	Mostafa mor	Least concern
7.	Machranga (P)	*Helcyon smyrrensis*	Mostafa mor	Least concern
8.	Haludpakhi	*Oriolus xanthornus*	Secondary source	Least concern
9.	Katthokra	*Picus canus*	Secondary source	Least concern
10.	Pecha	*Tyto alba*	Secondary source	Least concern
11.	Bok (Heron) (P)	*Ardeidae*	Mostafa mor, Mollahat	Least concern
12.	Drongo / Finge (P)	*Dicrurus macrocercus*	Mostafa mor, Mollahat, Labonchara	Least concern
13.	Brahminy kite (P)	*Haliastur indus*		Least concern
Insects				

SL No.	Local Name	Scientific Name	Location / source of information	IUCN Red List mark
1.	Dragon fly nymph	Odonata	SWTP, Mollahat, Bhairab river	Least concern
2	Damsel fly nymph	Odonata	Secondary source	Least concern
3.	Water strider (P)	Hemiptera	Mostafa mor, Bhairab river	Least concern
4.	Midge	Diptera	Fairly Common	Least concern
5.	Flies (P)	Diptera	Mostafa mor fish market	Least concern
6.	Ant (P)	Hymenoptera	Everywhere	Least concern
7.	Caddisfly	Trichoptera	Secondary source	Least concern
8.	Mantis (P)	Mantodea	Labonchara	Least concern
9.	Earth Worm (P)	Lumbricina	SWTP, Afil gate	Least concern
10.	Snails (P)	*Cyclophorus auranticus*	SWTP, Afil gate, Mollahat, Mostafa mor, Bhairab river	Least concern
11.	Frogs (P)	*Polypedates leucomystax*		Least concern
Fish				
1.	Pabda (P)	*Ompoc pabda*	Mostafa mor, coming from Bhairab river	Least concern
2	Golsha (P)	*Mystus cavasius*	Mostafa mor, coming from Bhairab river	Least concern
3.	Bele	*Glossogobius giuris*	Secondary source	Least concern
4.	Tengra (P)	*Mystus vittatus*	Mostafa mor, Bhairab river	Least concern
5.	Puti	*Puntius conchonius*	Secondary source	Least concern
6.	Fali	*Notopterus notopterus*	Secondary source	Least concern
7.	Kachki	*Corica suborna*	Secondary source	Least concern
8.	Mola	*Amblypharyngodon mola*	Secondary source	Least concern
9.	Kakila	*Xenentodon cancila*	Secondary source	Least concern
10.	Chapila	*Gudusia chapra*	Secondary source	Least concern
11.	Kholisha	*Colisa fasciatus*	Secondary source	Least concern
12.	Chingri	*Macrobrachium eqidense*	Secondary source	Least concern
13.	Shol	*Channa striates*	Secondary source	Least concern
14.	Taki	*Channa punctatus*	Secondary source	Least concern
15.	Shing	*Heteropneustes fossilis*	Secondary source	Least concern
16.	Koi	*Anabas testudineus*	Secondary source	Least concern
17.	Gozar	*Channa marulius*	Secondary source	Least concern
18.	Chela	*Chela cachius*	Secondary source	Least concern
19.	Rui	*Labeo rohita*	Secondary source	Least concern
20.	Katla	*Catla catla*	Secondary source	Least concern
21.	Kalibaush	*Labeo calbasu*	Secondary source	Least concern
22.	Boal (P)	*Wallago attu*	Mostafa mor	Least concern
23.	Ayre (P)	*Sperata aor*	Mostafa mor,	Least concern
24.	Bain	*Mastacembelus armatus*	Secondary source	Least concern
25.	Chital	*Chitala chitala*	Secondary source	Least concern
26.	Fasha	*Setipinna phasa*	Secondary source	Least concern
27.	Bata	*Liza Persia*	Secondary source	Least concern
28.	Dari	*Scistura scaturigina*	Secondary source	Least concern

Reference: IUCN red list assessment categories

Not evaluated	Data deficient	Least concern	Near threatened	Vulnerable	Endangered	Critically endangered	Extinct in the wild	Extinct

101. **Gangetic River Dolphins.** The Gangetic River dolphin (*Platanista gangetica*) is an endemic aquatic mammal found in the Indian subcontinent including the vast waters of Bangladesh. International Union for Conservation of Nature (IUCN) Red List of Threatened Species, this is classified as Endangered (EN). In the region, the distribution of this species is in Bangladesh, India, Nepal, and possibly Bhutan, below an elevation of about 250 m (Rice, 1998). Currently the species survives in the Ganges-Brahmaputra-Meghna and Karnaphuli-Sangu river systems, while a few individuals may survive in the Karnali, and the Sapta Kosi Rivers in Nepal (Sinha et al., 2010). In Khulna region, it inhabits the Bhairab-Atai-Rupsha River system.

102. There is an existing water intake in Bhairab river at Afil gate to abstract water, which will be continued with increased abstraction in the proposed KWSP Phase 2. The Bhairab-Madhumati confluence, which is a known dolphin area, is about 3 km downstream of the intake location. The main stem of Madhumati River that flows north-south at about 25-30 km east of Khulna is the principal source of water for Khulna. There are no dolphins in this river. Secondary information available shows that, in 2017, a survey conducted by IUCN Bangladesh part of an environmental impact assessment (EIA) study for a power plant, identified six locations in and around Khulna as important dolphin locations: (i) confluence of Bhairab – Atai – Rupsha, (ii) Atai River, (iii) near Rupsha bridge, (iv) Bhairab-Madhumati confluence, (v) Gekhana Ghat confluence, (vi) near Daulatapur.[24] (**Figure 46**). These locations are downstream of existing water intake on Bhairab river; nearest is about 4 km (Bhairab-Madhumati confluence). As per this there are an estimated 34 number of individuals in about 30 km stretch of rivers comprising Bhairab, Atai and Rupsha, with most of the population found in confluences. Discussions with IUCN Bangladesh expert involved in the survey indicated that the follow-on seasonal monitoring surveys (pre-monsoon, monsoon, post monsoon and winter) for the power plant project between May 2021 and August 2024 resulted in lower number of Dolphins (12- 25 numbers).

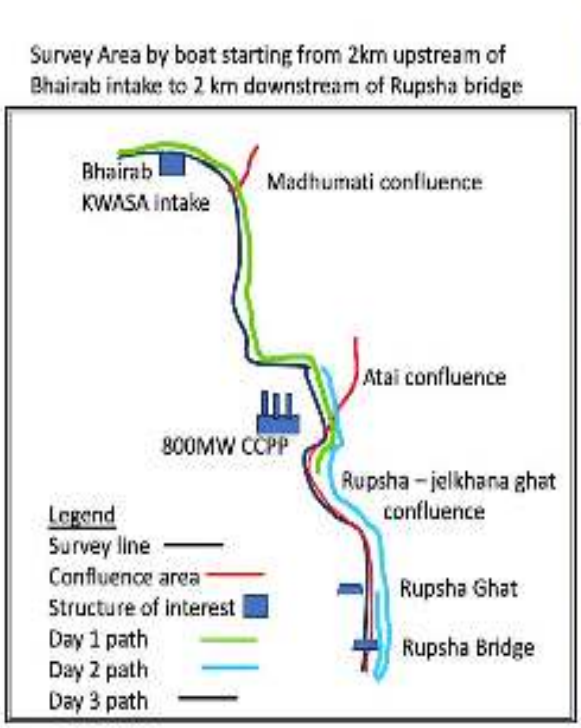
103. Consultation with experts indicate that although overall numbers in Bangladesh are increasing, the reduction in numbers in this area can be attributed to a number of factors. These include oil spills from boats, tankers and industrial waste discharges, increasing number of fishers, the use of illegal fishing nets with excessively small mesh sizes, the application of toxic substances to catch fish, riverbed depletion, and escalating noise pollution caused by extensive waterway transportation. It is also pointed out during consultations that the Pankhali Dolphin Sanctuary, officially designated as a gazetted dolphin sanctuary by the Government of Bangladesh in 2020, is located approximately 20 km downstream of the Bhairab-Rupsha River in Dacope Upazila, Khulna. It falls within the Pashur-Rupsha confluence. This sanctuary provides a significantly safer habitat for dolphins, as all water vessel traffic and fishing activities are strictly prohibited, ensuring better conservation measures. As a result, dolphins from the Bhairab-Rupsha region may be migrating toward the sanctuary in search of more favorable survival conditions. This migration could be a primary factor contributing to the declining dolphin numbers observed in recent surveys.

104. A rapid field survey was conducted as part of this IEE in January 2025 to study the baseline of these species. This survey was conducted for three days 23-25 January by experts with experience in dolphin surveys and following the standard methods. This survey covered about 30 km stretch of rivers in Khulna (Figure 36) and estimated presence of 14-15 dolphins. The biodiversity assessment and dolphin survey report are in **Appendix 5.**

[24] Environmental Impact Assessment Report (2018). Bangladesh: Rupsha 800 MW Combined Cycle Power Plant Project

Figure 46: Dolphin areas and KWASA water intakes

Figure 47: Dolphin survey coverage in Bhairav and Rupsha Rivers



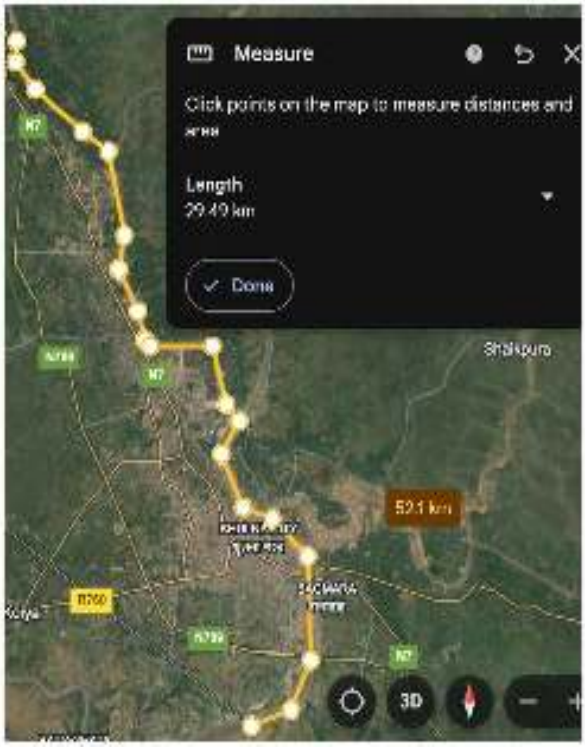


Figure 48: Dolphin images from the survey

Source: Field Survey, January 2025.

105. **Critical Habitat Screening.** As per IBAT screening, there are no protected areas or key biodiversity areas (KBAs) within or close to project area. Two protected areas (Char Muguria eco park and Pankhali wildlife sanctuary and dolphin reserve) are the nearest sensitive areas, located in 50 km buffer. Sundarbans protected area, an ecologically sensitive and biodiversity rich area, is located more than 50 km from the project area. Though the IBAT screening report identified 20+ species in the critically endangered (CR) and endangered (EN) categories within 50 km**,** except endangered Gangetic River dolphin none of the species are known to be found in the project area which is characterized by urban and semi-urban setting. These species are known to be found mostly in protected areas such as sanctuaries. As per International Finance Corporation (IFC) performance standard 6 (PS6) to establish critical habitat, species threatened with global extinction and listed as CR and EN on the IUCN Red List of Threatened Species shall be considered as part of Criterion 1, that stipulates the following thresholds for an area to qualify as a critical habitat: (a) areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species).

106. The global population estimates of Gangetic dolphins are about 5200 individuals with a range of 4700 to 5920 of all ages throughout its distribution range.[25] A recent study report published by Wildlife Institute of India titled “Population Status of River Dolphins in India (2024)” estimates the population of Ganges River dolphin as 6,324 individuals with a range of 5,977-6,688.[26] In Bangladesh, reports indicate 1352 dolphins in the country. Available secondary information and primary field survey in the Khulna project area estimated a dolphin population range between 15 and 25 individuals in the study area. This accounts for only 1–2% of national population and less than 0.5% of global population in the project area. Based on this criterion, the project area is not qualified as a critical habitat for dolphins as it holds less than 0.5% of global population.

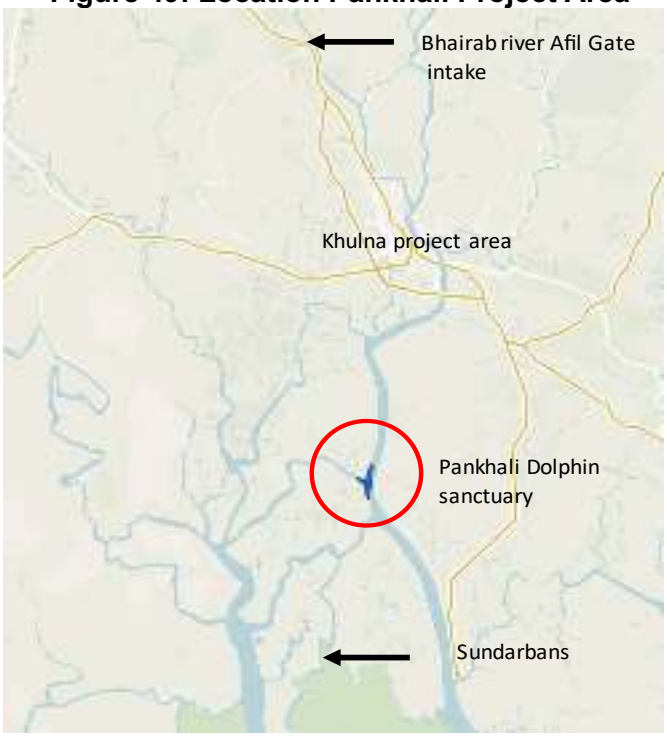
107. **Pankhali Dolphin sanctuary.** This dolphin hotspot and sanctuary is located upstream of Sundarbans Mangrove Forest, at the confluence of Passur and Jhapjhapia Rivers in Khulna District where the density of Ganges River dolphin is very high. It is consisting of an area of 1.41 sq km, which was considered for inclusion in the protected area network. Notably, the Passur River is used as a major shipping route, connecting Mongla Port and smaller river ports upstream. But the hotspot occupies a small area on the west side of the river. Passur river is the downstream part of Rupsha River and is about 40-45 km (water course length)

[25] https: Jashore.iucnredlist.org

[26] Population Status of River Dolphin in India. Qamar Qureshi, Vishnupriya Kolipakam, Abdul Wakid, Soumitra Dasgupta, Satya Prakash Yadav, Virendra R. Tiwari & Bivash Ranjan. Population Status of River Dolphins in India. 2021-23 (2024). Ministry of Environment, Forest and Climate Change, New Delhi and Wildlife Institute of India, Dehradun. https://wii.gov.in/staus_river_dophin

downstream of Afil Gate intake on River Bhairab and about 20 km from the project area boundary. [27]

Figure 49: Location Pankhali Project Area



D. Socio, Economic and Cultural Resources

108. **Demography.** Khulna is the 3rd largest city and the 2nd largest port entry, situated along the Rupsha and Bhairab rivers in the southwestern part of Bangladesh. As per 2022 census, Khulna City Corporation (KCC) had a population had a population of 719,557 and 188,579 households. 14.97% of the population was under 10 years of age. Khulna had a literacy rate of 88.07% for those 7 years and older. The city covers an area of 46 km^2 and is subdivided into 31 administrative units which are called wards. The population consists of 51% males and 49% females. The male-female ratio is 102.91 which is higher than the national average of 100.2 (Bangladesh Bureau of Statistics (BBS), 2020). Prime working age group (15-64 years old) dominates the population (71.54%) followed by children, 23.23% (with age group 0-14 years old). About 3% belongs to the age group of 65+ years old.[28] Most residents speak Bengali (the national language), its dialects, and regional languages.

109. **Literacy Rate and Employment.** As per the Census population and housing census 2022, literacy rate is 88.01% compared to the national rate of 74.66%. Main occupation is service (82.94%). This is followed by people engaged in industry 14.16% then in agriculture 2.9%.

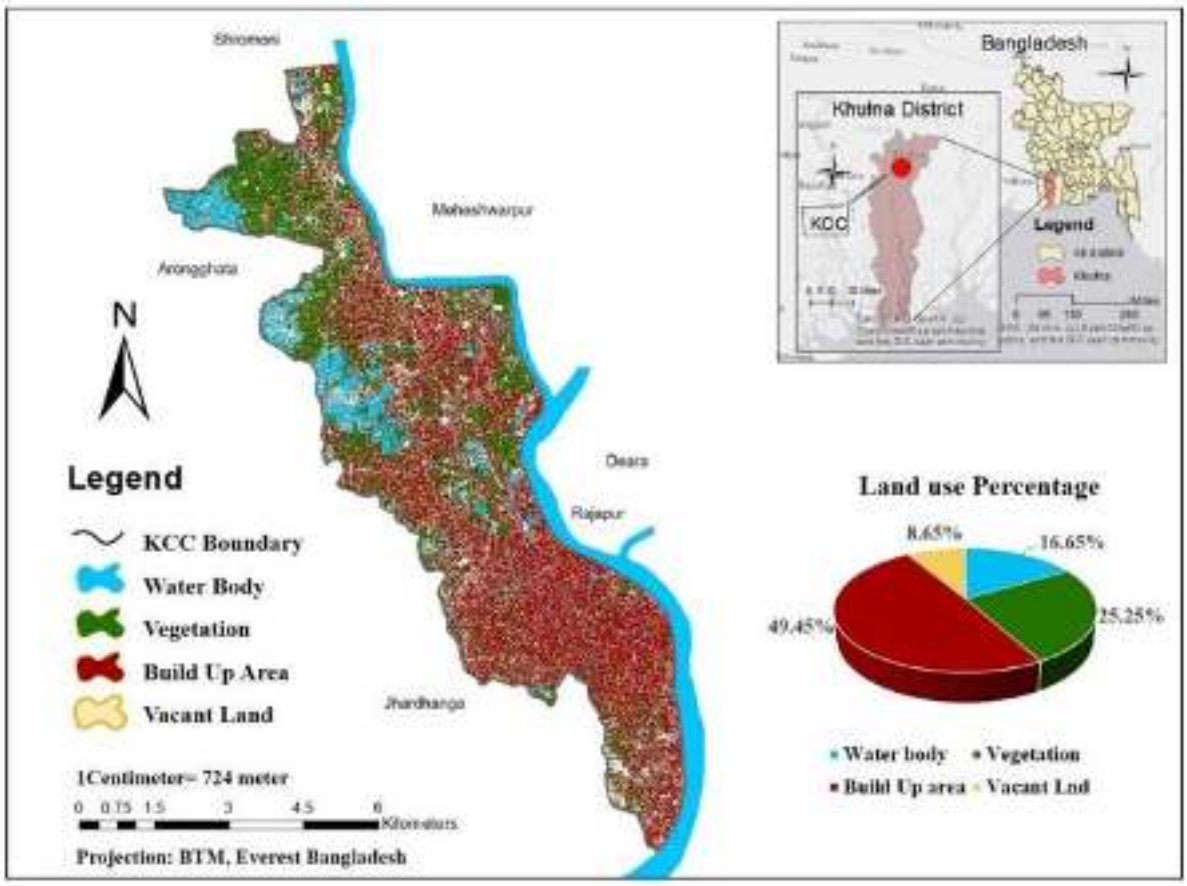
110. **Housing Condition.** 54.94% of the households have *pucca* houses, 29.78% have semi *pucca*, 14.64% are in *katcha* category while the rest of the households are in Jhupri house (0.65%) (Source: Report on National Survey on Persons with Disabilities, NSPD, 2021).

111. **Land Use**. The city of Khulna, situated in the northern part of Khulna district, historically evolved as a significant commercial and trade center, largely due to its strategic location along the Rupsha and Bhairab rivers. The city extends approximately 15 km along

[27] Dolphins Of Bangladesh
[28] Report on National Survey on Persons with Disabilities (NSPD) 2021.

the Bhairab River. Major topographic characteristics of Khulna include substantial areas of low-lying swamps and marshes, especially prominent in the northwestern parts of the city. Approximately 50% of the land within Khulna City Corporation (KCC) is developed, and water bodies occupy around 16.65%. The availability of vacant land in Khulna city is limited. Industrial zones within Khulna have traditionally benefited from proximity to rivers, major roads, and railway lines, facilitating efficient transportation and logistics. Historically, rivers such as the Bhairab and Rupsha have been integral for the transportation of industrial and commercial goods. The areas adjacent to these rivers are already extensively utilized for residential, commercial, and small-scale industrial activities.

Figure 50: Land use in Khulna



(Source: Haque, 2020)

112. **Business and Industry**. Khulna is the third largest economic center in Bangladesh. It is situated north of the Port of Mongla and has various heavy and light industries. However, industrial pattern has been changed in recent years in Khulna. The major sectors are jute, chemicals, fish and seafood packaging, food processing, sugar mills, power generation and shipbuilding. Currently, cement manufacturing and LNG gas terminal is also flourishing. The region has an Export Processing Zone which has attracted substantial foreign investment. The city is home to the corporate branch offices of numerous national companies, including among others, MM Ispahani Limited, Beximco, James Finlay Bangladesh, Summit Power and the Abul Khair Group. Some of the largest companies based in the city include Khulna Shipyards, Bangladesh Oxygen, Platinum Jubilee Mills, Star Jute Mills and the Khulna Oxygen Company.

113. **Drinking Water and Sanitation.** At present under the KCC area 26.11% of the population has access to piped water supply. The remaining 72% has the tube-well connection and about 3% has bottled water connection. Around 82.05% population has the toilet with septic tank and 9.95% has pit latrine. However, most of the cases, septic tanks are connected

with the surface drain.[29] In other areas, toilets with septic tanks are predominant in households which on an average almost 66% and the rest of 34% have access to pit latrine to manage their wastewater. Majority of the septic tanks are not provided with any soak pits. As the groundwater table of Khulna is high in Khulna, adequate dispersal of wastewater becomes a serious issue in addition to the overflowing of soak well at times. KWASA is currently implementing a Sewage system development project in Khulna funded by ADB.

114. **Health Facility.** Khulna City Corporation area is now housing three major government health facilities-150- bed Khulna Sadar Hospital, 250-bed Shaheed Sheikh Abu Naser Specialized Hospital and 250- bed Khulna Medical College Hospital. Patients from different districts receive better medical treatment from all these medical facilities. Apart from these, over 25 private clinics and hospitals are serving the city dwellers alongside the people of nearby districts.

115. **Electricity**. Latest data shows that about 99.76% of the households in KCC area have connection with grid electricity to meet their daily demand.

116. **Transportation**. Modes of transport available are roadway, railway and waterway. The main roadway is Jashore-Khulna highway road, Khulna-Bagerhat–Pirojpur Road which is connected to the southern part of Bangladesh. One of the major roads is Khulna to Dhaka via Gopalganj and Mawaghat. There is railway connection in Khulna and an airport in Jashore district. Further rail connection through Mongla sea port is now underway. Water transport is mainly through Bhairab, Rupsha and Passur River. However, 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.

117. **History and culture**. Khulna region has a rich cultural and historical significance. Its heritage sites reflect a blend of traditional Bengali culture and colonial influences, offering a unique glimpse into the city's past. Nearest protected area is the Sixty Dome Mosque (Shat Gombuj Masjid), a UNESCO World Heritage Site located in nearby Bagerhat about 30 km southeast of Khulna, and it holds exceptional significance. Built-in the 15th century by Khan Jahan Ali, it is an architectural marvel of the medieval Islamic Bengal Sultanate period. Dakkhindighi Rabindra complex, a place associated the great poet of Bengal, Rabindranath Tagore is located at Jugnipasha, about 6 km west of Afil gate. This is a protected site and is outside the project area.

118. Within the project area, there are no protected historical or cultural sites, however, has a number of places that have local cultural and historical significance. These include religious places like mosques, temples and churches etc., in the city. Khulna Divisional Museum in the city showcases artefacts, traditional crafts, and historical documents of region legacy. Rupsha River enhances the cultural identity of Khulna, playing a vital role in shaping the livelihoods and traditions of local communities. Khulna region known for vibrant folk traditions, such as Baul music, traditional pottery, and weaving. Following are some locally important cultural places: Darul Ulum mosques and madrasa, Zinnah mosque, Durga Shankar Mission Kali Mandir, Sri Raj Lakshmi Temple/ Jora Shivbari temple, Dhormoshova temple, Shitalbari Mandir, Khulna Baptist Church, Rupsha Ghat, Hadis Park, Khulna Railway Station, Khulna Circuit House, office of the Deputy commissioner of Khulna, Banabilash Zoo, Khulna Shilpakala Academy, Golokdham, Umesh Chandra Public Library. Khulna Divisional Museum, and 1971 museum. A list of physical cultural resources in and around project area is given in **Appendix 6.**

119. **Proposed project sites and baseline features. Appendix 7** provides the baseline features of proposed sites and facilities along with photographs.

[29] IEE report: IEE BAN: Khulna Sewerage System Development Project, 2020.

Figure 51: Historical and cultural places in Khulna

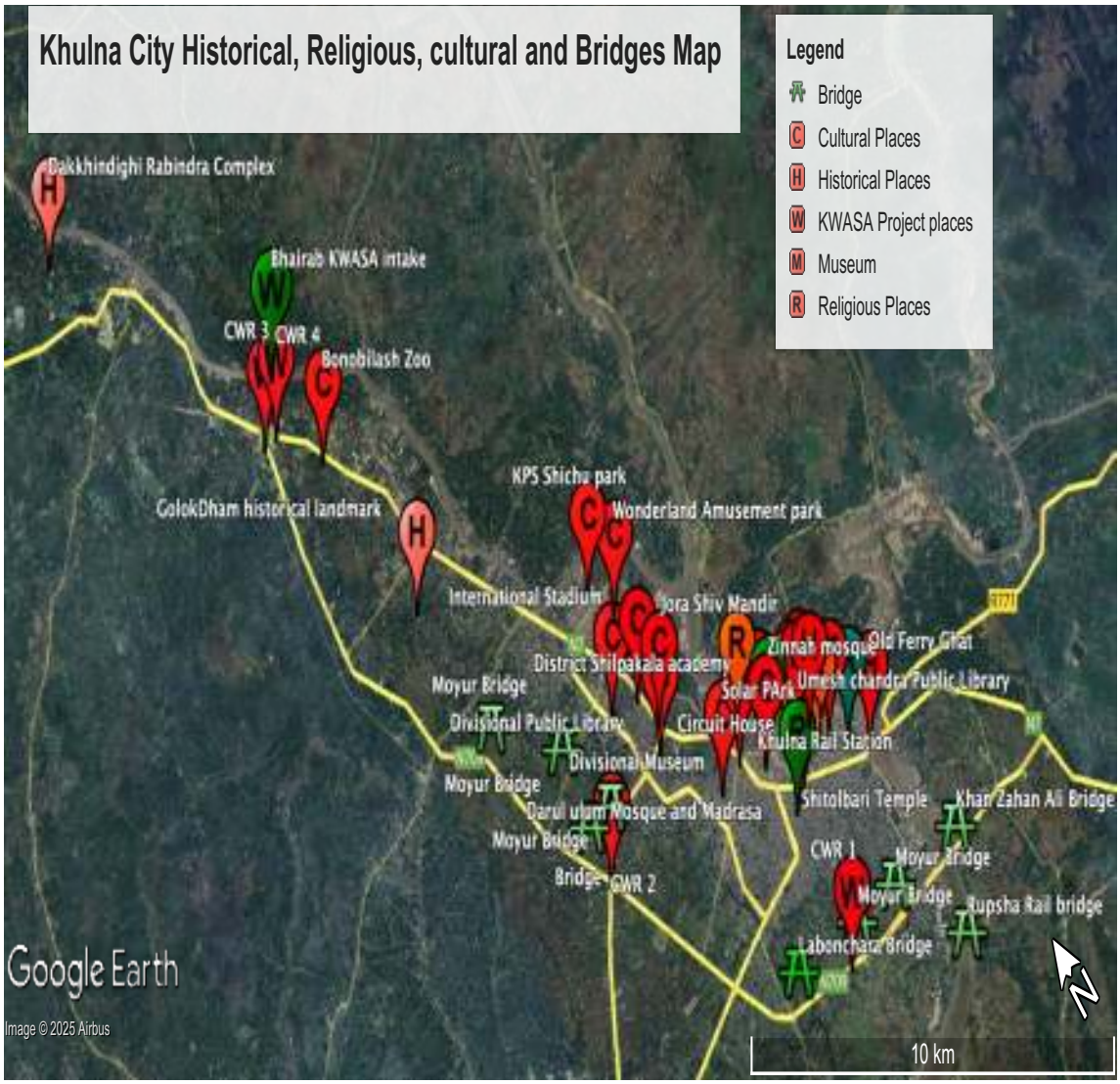
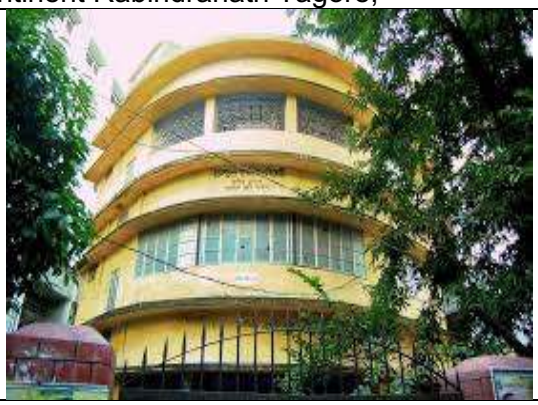


Figure 52: Historical and cultural places in and around Khulna

	
Sixty Dome Mosque of Bagerhaat	"Zinnah mosque" in Khulna city
	
Jora Shiv Mandir	This Baptist mission church
	
The in-laws house of the great poet of the sub-continent Rabindranath Tagore,	An old building within Khulna city
	
Umesh Chandra Public Library	Old Train station building of Khulna

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Introduction

120. This section presents a comprehensive assessment of the potential environmental impacts associated with the proposed project, alongside corresponding mitigation measures. The assessment adheres to ADB Safeguard Policy Statement (SPS), 2009, which mandates a systematic evaluation of environmental impacts across all phases of the project: location, design, construction, and operation. The analysis focuses on the project's area of influence, employing standardized methodologies to identify, assess, and mitigate adverse impacts, while also enhancing potential positive outcomes.

121. **Project area of influence .** The project's area of influence comprises: (i) Direct Impact Zone - Includes all sites directly affected by project interventions, such as construction areas, storage yards, and access roads; (ii) Indirect Impact Zone - Includes areas affected by secondary impacts such as dust, noise, and changes in hydrology, typically extending a several kilometers from the direct impact zone, and (iii) Cumulative Impact Zone – refers to broader environmental and social areas that may be potentially affected by long-term and combined effects of the project and other ongoing developments in the region.

122. This section outlines the potential environmental impacts of the proposed project components, including the construction of the intake structures, treatment plants, impounding reservoirs, pump stations, clear water reservoirs, construction of pipelines, construction of offices and other interventions. Mitigation measures to minimize/mitigate negative impacts, if any, are recommended, along with the party responsible for implementation. Monitoring activities to be conducted during the implementation phase are also recommended to ensure compliance and reduce the impacts. The screening of potential environmental impacts is categorized into three phases of project development: (i) planning and design (pre-construction), (ii) construction phase, and (iii) operational and maintenance phase

123. **Methodology.** The impact assessment adopts a systematic, stepwise process:

(i) *Baseline study:* Involves collection of primary and secondary data on existing environmental conditions (e.g., air, water, noise, soil, biodiversity, and social parameters).

(ii) *Impact prediction:* Evaluation of the magnitude, duration, and likelihood of potential impacts using predictive models and expert judgment.

(iii) *Impact evaluation:* Classification of impacts based on their significance (low, moderate, or high) and reversibility (temporary or permanent).

(iv) *Mitigation planning:* Identification of specific measures to eliminate or minimize adverse impacts during all project phases.

(v) *Residual impact assessment*: Determination of the remaining impacts post-mitigation to assess overall project sustainability.

124. Impact assessment is carried out across distinct project phases as defined above.

(i) *Planning and design phase:* Focuses on the suitability of site selection and planning of potential activities to avoid ecologically sensitive areas, historical or cultural sites, and densely populated zones. The assessment ensures minimal disruption to existing land uses and ecosystems. This phase also evaluates the incorporation of sustainable and environmentally friendly design features, such as appropriate source selection, pollution-reducing technologies, efficient water management systems, and disaster-resilient infrastructure.

(ii) *Construction phase:* Identifies short-term impacts associated with excavation, transportation, material storage, and construction activities. This includes impacts on air quality, noise, waste generation, and local hydrology.

(iii) *Operation phase:* Analyzes long-term impacts arising from the operation and maintenance of the project infrastructure, such as changes in water resource utilization, energy efficiency, and waste management practices.

125. The identification and assessment of impacts have been carried out by considering the proposed activities during pre-, construction, and operational stages. Issues for consideration have been raised by the following means: (i) input from interested and affected parties; (ii) desktop research of information relevant to the proposed project; (iii) site visits and professional assessments by the two environment specialists engaged by the ADB; and (iv) evaluation of proposed design scope and potential impacts based on the environment specialists' past experience and on a value judgment. The impacts of the activities will be described separately on physical, biological/ecological, socio-economic and cultural resources within the zone of influence. Impacts resulting from the sub-project may be adverse during the construction phase, however, significantly beneficial during the operational stage.

126. **Risk assessment criteria.** In this IEE, a structured approach has been employed to assess and manage the environmental impacts of the proposed project. The significance of each potential impact is assessed using an Impact Risk Assessment Matrix, which applies two key criteria: Likelihood (Probability) and Severity (Magnitude). Both are rated on a scale of 1 to 5, enabling a quantitative and consistent assessment of environmental risks.

Table 28: Likelihood (Probability) Scores

Score	Frequency	Description
1	**Very Low**	Rarely occurs (less than 5% chance)
2	**Low**	Unlikely to occur (5-20% chance)
3	**Moderate**	Possible but not certain to occur (20-50% chance)
4	**High**	Likely to occur (50-80% chance)
5	**Very High**	Almost certain to occur (more than 80% chance)

Table 29: Severity (Magnitude) Scores:

Score	Frequency	Description
1	**Very Low**	Minimal impact with negligible environmental changes
2	**Low**	Minor impact with slight environmental changes
3	**Moderate**	Moderate impact with noticeable environmental changes
4	**High**	Significant impact with considerable environmental changes
5	**Very High**	Severe impact with extensive environmental changes

127. The significance of each impact (Risk) is calculated as: Risk = Likelihood (Probability) Score × Severity (Magnitude) Score. The resulting risk scores are categorized into five significance levels as follows:

Table 30: Definitions of Risk Significance Levels

Risk Score (Likelihood x Severity)	Significance Level	Definition	Environmental Context	Actions Required
1-4	Negligible	The impact is minimal and unlikely to cause significant environmental changes.	This category includes impacts that are so minor that they do not noticeably affect the environment. Regular monitoring and minimal intervention are sufficient.	Regular monitoring and minimal intervention if necessary.
5-9	Minor	The impact is minor and may cause	These impacts are slightly more noticeable but still	Implement minimal

Risk Score (Likelihood x Severity)	Significance Level	Definition	Environmental Context	Actions Required
		some noticeable changes, but not severe.	do not significantly alter environmental conditions. Minimal mitigation measures are required.	mitigation measures to manage the impact.
10-14	Moderate	The impact is moderate, causing noticeable environmental changes that need to be managed.	Impacts in this category cause evident changes to the environment that require management to prevent escalation.	Apply standard mitigation measures to reduce the impact.
15-19	Major	The impact is high, causing significant environmental changes that need robust management.	These impacts have substantial adverse effects on the environment and necessitate comprehensive mitigation strategies.	Implement robust mitigation measures to significantly reduce the impact.
20-25	Catastrophic	The impact is very high, causing severe environmental changes that need immediate and significant management.	Impacts in this category are severe and can lead to extensive, possibly irreversible, environmental damage if not addressed promptly.	Take immediate and significant mitigation measures to address the impact.

Table 31: Impact Risk Assessment Matrix

Severity (Magnitude)	Likelihood (Probability)				
	Very Low (1)	Low (2)	Moderate (3)	High (4)	Very High (5)
Very High (5)	5	10	15	20	25
High (4)	4	8	12	16	20
Moderate (3)	3	6	9	12	15
Low (2)	2	4	6	8	10
Very Low (1)	1	2	3	4	5

128. **Mitigation measures framework.** Mitigation measures are developed in line with ADB SPS (2009) principles of avoidance, minimization, and offsetting. These measures are tailored to the specific impacts identified during the assessment. The Environmental Management Plan (EMP) provides a detailed roadmap for implementing these measures, assigning responsibilities, monitoring parameters, and ensuring compliance with national and international environmental regulations. Mitigation refers to the measures that are designed to cope with adverse consequences and to enhance the positive impacts on the environment as a result of the sub-project implementation. Effective implementation of benefit maximization measures and adverse impact mitigation measures would optimize the benefits expected from the sub-project and avoid/minimize the adverse impact from the sub-project. The impacts have been predicted regarding their magnitude (minor, moderate, and high), extent (site-specific, local, and regional), and duration (short-, medium- and long-term), and appropriate benefit enhancement and mitigation measures are suggested in the following sections.

129. **Managing residual impacts.** Residual impacts are the environmental effects that remain after all mitigation measures have been implemented. The objective of mitigation is to reduce these residual impacts to an acceptable level. However, they may not always be reduced to the "Negligible" (1-4) category. The residual impact assessment follows the same risk significance levels to ensure that any remaining impacts are managed appropriately. The

Impact Assessment before (without) mitigation and residual impacts after mitigation for all the impacts identified in the IEE study are summarized in the following Table 32.

Design Impacts							
Source sustainability & downstream impacts due to river water abstraction	Long	Local	Irreversible	Medium		1	1
Increase in salinity due to project water abstraction from river	Long	Local	Reversible	Medium		1	1
Impacts due to over exploitation of groundwater beyond safe limits- salinity intrusion, land subsidence etc., risks	Long	Local	Irreversible	High		3	4
Impacts on endangered dolphins due to abstraction and works	Long	Local	Irreversible	Low		2	3
Planning and pre-construction and location-related impacts							
Disruption of services and Public Utilities	Short	Local	Reversible	Medium		4	3
Removal of Trees	Short	Local	Reversible	Low		4	1
Disturbance to community during surveys, consultations and awareness	Short	Local	Reversible	Low		3	2
Impacts anticipated during construction							
1. Augmentation of Water Intake Facilities at Mollahat and Afil Gate							
Disturbances to community during construction activities at Mollahat intake	Short	Local	Reversible	Low		4	2
Disturbance to river bank due to augmentation of Afil Gate intake	Medium	Local	Permanent	Medium		4	2
Noise and dust emissions	Short	Local	Reversible	Medium	Applicable	4	3
Construction waste	Short	Local	Reversible	Low		4	2
Worker safety	Short	Local	Reversible	Medium	Applicable	4	3
2. Construction of impounding reservoirs (IPRs) at BWTP, Afil Gate, and Mostafa Mor							
Air quality deterioration due to dust emissions	Short	Local	Reversible	Medium	Applicable	4	4
Noise pollution	Short	Local	Reversible	Medium	Applicable	4	3
Soil erosion and sedimentation risks	Short	Local	Reversible	Medium		4	3
Occupational hazards	Short	Local	Reversible	Medium	Applicable	4	3
Transportation of materials and equipment	Short	Local	Reversible	Medium		4	4
Runoff from construction sites	Short	Local	Reversible	Medium		4	3
Water quality impacts	Short	Local	Reversible	Medium	Applicable	4	3
Waste generation from construction debris	Short	Local	Reversible	Low		4	3
Removal of Trees	Short	Local	Reversible	Low		2	2
3. Retrofitting of Bangabandhu and Afil Gate Water Treatment Plants							
Air quality deterioration due to dust emissions	Short	Local	Reversible	Medium	Applicable	4	3
Noise pollution	Short	Local	Reversible	Low	Applicable	4	3
Vibration	Short	Local	Reversible	Medium	Applicable	4	2
Transportation of materials and equipment	Short	Local	Reversible	Medium		4	3
Runoff from construction sites	Short	Local	Reversible	Low		3	2
Water quality impacts	Short	Local	Reversible	Low	Applicable	2	2
Waste generation from construction debris	Short	Local	Reversible	Low		2	2
Occupational hazards	Short	Local	Reversible	Medium		4	4
4. Construction of four clear water distribution reservoirs, overhead tanks, and pump houses							
Air quality deterioration due to dust emissions	Short	Local	Reversible	Medium	Applicable	4	3
Noise pollution	Short	Local	Reversible	Low	Applicable	4	3
Vibration	Short	Local	Reversible	Medium	Applicable	4	2
Transportation of materials and equipment	Short	Local	Reversible	Medium		4	3
Soil erosion and sedimentation:	Short	Local	Reversible	Medium		4	3
Water quality impacts	Short	Local	Reversible	Medium	Applicable	3	4
Waste generation from construction debris	Short	Local	Reversible	Medium		3	3
Impact on nearby structures and land use	Short	Local	Reversible	Low		3	3
Occupational health and safety risks	Short	Local	Reversible	Medium		4	4
Community disturbances:	Short	Local	Reversible	Low		3	3
5. Laying of Transmission and Distribution of Water Pipelines							

Waste generation from construction debris	Short	Local	Reversible	Medium		3	3
Disposal of surplus materials	Short	Local	Reversible	Medium		4	3
Impact on nearby structures and land use	Short	Local	Reversible	Medium		3	3
Occupational health and safety risks	Short	Local	Reversible	Medium	Applicable	4	4
Construction camps, stockpile areas, and storage sites	Short	Local	Reversible	Medium		4	3
Community disturbances	Short	Local	Reversible	Medium		4	4
Access obstruction to private property and public infrastructure, traffic safety	Short	Local	Reversible	Medium		4	4
Impacts of Mayur River crossing	Short	Local	Reversible	Medium		3	4
Impacts of railway line crossing	Short	Local	Reversible	Medium		3	4
Impacts due to road restoration work	Short	Local	Reversible	Medium		4	3
Labor camps and material stockpiling	Short	Local	Reversible	Medium		3	3
Disturbance to visual and landscape aesthetics	Short	Local	Reversible	Medium		3	4
Ecological impacts due to water pollution	Short	Local	Reversible	Low		3	2
6. Impacts of Increased River Water Abstraction from Madhumathi and Bhairab Rivers							
Salinity dynamics and water quality of the two rivers	Long	Regional	Reversible	Low	Applicable	2	5
Impact of extraction on river flow and salinity	Long	Regional	Reversible	Low		2	5
Ecological Impacts due to abstraction of river water	Medium	Local	Reversible	Low		2	4
Operational Impacts during water abstraction	Medium	Local	Reversible	Medium		3	3
Community impacts due to water abstraction	Medium	Regional	Reversible	Low		3	4
7. Impacts of new and rehabilitation of production wells							
Risks to the environment and hydrology due to over abstraction	Long	Regional	Irreversible	High		3	4
Risks of salinity ingress/increase due to over abstraction	Long	Regional	Irreversible	High		3	4
Land subsidence risk: due to over abstraction	Long	Local	Irreversible	High		3	4
Impacts on communities	Short	Local	Reversible	Medium		3	4
8. Impacts due to solar power generation							
Construction-related impacts	Short	Local	Reversible	Low		3	2
Operational impacts	Long	Local	Reversible	Low			Positive B
Economic and community impacts	Long	Local	Reversible	Low			Positive B
9. Impacts of vertical expansion of KWASA HQ Administration Building							
Air quality deterioration due to dust emissions	Short	Local	Reversible	Medium	Applicable	4	3
Noise pollution	Short	Local	Reversible	Medium	Applicable	4	3
Vibration	Short	Local	Reversible	Medium	Applicable	3	3
Transportation of materials and equipment	Short	Local	Reversible	Low		3	3
Soil erosion and sedimentation:	Short	Local	Reversible	Low		3	2
Water quality impacts	Short	Local	Reversible	Low	Applicable	3	2
Waste generation from construction debris	Short	Local	Reversible	Low		3	3
Impact on nearby structures and land use:	Short	Local	Reversible	Low		3	2
Occupational health and safety risks	Short	Local	Reversible	Medium	Applicable	4	4
Community disturbances:	Short	Local	Reversible	Low		3	3
10. Other impacts during construction phase common to all the above work packages							
Impacts due to wastewater generation, collection, and disposal	Short	Local	Reversible	Low		3	3
Impacts due to solid waste generation, collection, and disposal	Short	Local	Reversible	Low		3	3
Impacts due to migrant labourers and operation of labour camps	Short	Local	Reversible	Medium		4	3
Income generation and economic benefits	Short	Local	Reversible	Medium			Positive B
Impacts due to occupational health and safety	Short	Local	Reversible	Medium	Applicable	3	3
Impacts on public health and safety	Short	Local	Reversible	Medium		4	4
Site restoration (at the end of construction) and landscaping	Short	Local	Reversible	Low		4	3
11. Impacts during the operational stage							
Water Leaks	Short	Local	Reversible	Low		4	2
Wastewater from periodic flushing, descaling, and scour maintenance	Short	Local	Reversible	Low		4	2

Increase in sewage generation, pollution & health risks	Long	Local	Reversible	Medium		4	3

B. Design and Location Impacts

1. Surface water source sustainability and impacts due to reduced flow

130. **Water availability and abstraction.** The proposed abstraction from the Madhumati River at Mollahat is 1.56 m³/s (135 MLD), representing only about 0.53% of the river's total dry-season flow, which averages around 292 m³/s. The proposed abstraction from Bhairab River at Afil Gate is 0.17 m³/s (15 MLD), about 0.21% of the river's 80% dependable dry season flow of 80 m³/s. Abstraction from the Madhumati will be reduced to just about 18 MLD during the dry season, and there will be no abstraction from the Bhairab during the four dry months (Mar-June). Rivers carry huge volumes of water in other seasons. Therefore, it can be concluded that proposed water abstraction is not significant and will not lead to any notable reduction in downstream residual flow.

131. **Salinity in Madhmati River.** As discussed earlier, due to tidal influence, river water is subjected to salinity ingress which peaks during the dry season. KWASA monitoring data recorded a total of 51 days and 53 days of higher salinity 2021 and 2023 respectively as against 16 days considered for KWSP Phase 1 project. In 2020, 2021 and 2023, the maximum of daily recorded salinity level was 2,080 mg/l, 3,920 mg/l, and 980 mg/l, respectively. The forecast made in Feasibility Report shows that the salinity may continue to worsen in the dry season months, especially in April and May, and may reach an average of close to 2000 mg/l and 3,000 mg/l in 2035 and 2050, respectively, from about 1,250-1,300 mg/l (2001-2023 average). Salinity levels were assessed duly considering climate change risks (i.e. sea level rise), These findings are considered in the design of water supply system under the Project, and accordingly optimized use from both ground and surface water sources. Consumptive use is discussed in groundwater section.

132. **Changes in salinity due to increased abstraction from Madhumati.** Increase in salinity will adversely affect the use of water for agriculture and other uses. The quantity of water abstracted at the Mollahat intake is just about 0.5% of the total discharge of Madhumati River, even during the dry season. This minimal abstraction volume means that the withdrawal does not significantly alter the river's flow dynamics or its capacity to push back saline water intrusion from the Bay of Bengal. Salinity levels in the Madhumati River fluctuate due to tidal influences between high and low tides. Data from KWASA (2020-2023) indicates that salinity levels during low tide are three times higher than high tide salinity levels, and these variations are in general consistent with natural tidal patterns. Climate change-induced sea level rise (SLR) and reduced upstream freshwater flow are significant contributors to salinity intrusion. As per the feasibility report, upstream abstractions and the reduction in the Ganges River flow over years, primarily due to upstream water diversion, which feeds Padma, Gorai and other rivers including Madhumati River, have a substantial impact on salinity intrusion. It can therefore be concluded that the proposed abstraction of water at the Mollahat intake has a negligible impact on the salinity levels of the Madhumati River. The primary drivers of salinity intrusion are tidal dynamics, reduced upstream freshwater flow and climate change-induced sea level rise. Feasibility report, considering potential future increase in salinity levels, has proposed alternative sources and options for the long-term sustainability of Khulna water supply system. Present project is designed to meet the demand of 2035.

133. **Bhairab River.** Due to high salinity levels in the river, no water abstraction is proposed in the lean season months of March, April, May and June. Intake is operated for 8 months only. As discussed above in the case of the Madhumati River, the primary drivers of salinity intrusion are tidal dynamics, reduced upstream freshwater flow and climate change-induced sea level rise.

134. Seasonal low flows, combined with growing upstream water use, restrict the ability of these rivers to counter tidal ingress. The interplay between tidal mixing and freshwater deficits

highlights the fragile balance required to maintain salinity within treatable limits, making precise and adaptive water management essential. Project therefore proposes a continuous online monitoring system to enable real-time salinity and flow data through SCADA systems to provide operational flexibility to adjust withdrawals dynamically, ensuring that water quality at intake points consistently meets treatment standards. These measures are thus precautionary and adaptive, aiming to safeguard source sustainability under changing climatic and hydrological conditions.

135. **Downstream impacts.** The proposed abstraction is very minimal and therefore will not have any notable impact on downstream residual flow. The community impacts of the proposed abstraction are thus expected to be negligible. Abstraction will not affect downstream users or communities reliant on these rivers for their livelihoods. Fish populations will not be impacted as the salinity levels and natural flow patterns will remain unaffected by project water abstraction. For communities that depend on the rivers for domestic or irrigation needs, the proposed abstraction will not alter the availability or quality of water downstream. No water-use conflicts are envisaged. The minor scale of withdrawal ensures that the overall social fabric and economic activities tied to the rivers remain unaffected. Furthermore, the integration of surface water with groundwater systems will enhance water security for urban areas without compromising the resources available to rural communities or ecological systems.

136. Nevertheless, given changes in salinity dynamics, especially in Madhumati River, which is used for agricultural purposes in the downstream and upstream of Mollahat intake, it is important to sensitise the community about project water abstractions and their negligible impact on water availability or salinity. Public awareness campaigns alleviating concerns if any about reduced water access or ecological degradation shall be conducted. Following mitigation measures are suggested:

(i) Organize periodic public awareness campaigns throughout implementation and operation
(ii) Disclose salinity monitoring data; if feasible, a display system may be installed at the intake facility to show real-time salinity level information from the SCADA to benefit the local communities in water use

2. Groundwater sustainability and related impacts

137. Groundwater plays a crucial role in Khulna's water supply system, especially during the dry season when surface water sources become increasingly saline. At present, about 100 MLD is abstracted by both private parties (30 MLD in KCC area and 40 MLD in extension area), and KWASA (30 MLD). Most of the private demand is in unserved areas within and outside KCC area, and this abstraction is likely to increase in future. As per the assessment conducted as part of the Feasibility Study, the available annual groundwater resources for KWASA area is 48,764 ML or 133.6 MLD, from which 75% of available resource (100 MLD) can be safely utilized as per National Water Management Plan (NWMP) guidelines. The safe yield from deep aquifer is therefore recommended as 100 MLD corresponding to an annual safe yield of 36,500 ML. This is far less than the requirement of 220 MLD.

138. Groundwater availability is limited but is available throughout the year, while surface water availability from Madhumati and Bhairab is minimal or negligible during dry months due to high salinity. Therefore, a conjunctive use of surface water and groundwater is considered in the proposed project with a dynamic management system to optimize resource utilization. Proposed month-wise abstraction is shown in Table 33 to meet the 2035 demand of 220 MLD. IPRs will be filled during the wet season. Additional impounding reservoirs are proposed to store the low-saline fresh water from Madhumati and Bhairav and use the same during dry season.

139. Under this plan, of the total 100 MLD safe groundwater yield, abstraction by private tube wells is estimated at 45 MLD, or 16,425 ML annually. Remaining 20,075 ML per year is considered for KWASA production wells. Of this, KWASA will only utilize 15,554 ML per annum or 43 MLD average daily in the design period (2035). IWM Report mentions that KWASA may need to have provision for 80-100 MLD to address the dry period. Accordingly, the actual daily abstraction rate will vary depending on the seasonal demand, ranging between 25 MLD during the wet season and 118 MLD during two peak dry months as shown in Table 33. Deep groundwater aquifer is considered as a reservoir and abstraction will be kept low during the wet season and will be increased during the dry season, within overall annual abstraction limit.

Table 33: Water supply sources & proposed monthly abstraction (2035)

Facility	Water Source	Quantity of Raw Water Abstraction, MLD											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BWTP	Madhumati	135	135	135	35	35	135	135	135	135	135	135	135
	IPR				18.9	18.9							
Afil Gate WTP	Bhairab	15	15					15	15	15	15	15	15
	IPR			2.7	2.7	2.7	2.7						
KWASA	Tube Well	25	25	37	118.4	118.4	37	25	25	25	25	25	25
Private	Tube well	45	45	45	45	45	45	45	45	45	45	45	45
Total, MLD		**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**

140. **Impacts due to over exploitation of groundwater.** There is no notable impact envisaged on the sensitive groundwater regime in Khulna as long as the abstraction is within safe yield limits. [30] As per the IWM report, increase in groundwater abstraction over the assessed sustainable limits will lead to decline in groundwater levels and resultant changes in groundwater quality due to salinity intrusion. The decline may occur even if the private consumption increases. Over exploitation beyond the safe limits may lead to following issues:

141. **Salinity intrusion:** Monitoring data and modelling show that chloride concentrations in deeper aquifers are already rising in zones such as Daulatpur and Khalishpur, suggesting vulnerability to salinity ingress. Over-exploitation may reverse hydraulic gradients, allowing saline water to intrude into previously freshwater zones, which is a threat compounded by the region's deltaic geology and proximity to tidal rivers.

142. **Cumulative over-extraction:** In densely populated neighbourhoods where both public and private abstraction is concentrated, cumulative over-extraction may lead to localized aquifer stress, declining yields, and reduced aquifer recovery during the wet season. This risk is particularly acute in Golokmoni, Shishupark, and parts of Khalishpur, and therefore proper planning to limit the abstraction shall be ensured.

143. **Potential land subsidence:** Given the soft, compressible sediments in Khulna's subsurface, high-volume and prolonged groundwater extraction may lead to land subsidence. Though gradual, this process can exacerbate flooding risks and compromise infrastructure integrity over time. While no immediate evidence of subsidence has been recorded, precautionary measures to control abstraction is necessary.

144. **Measures included in the project for sustainable groundwater management**. Feasibility study recommended various measures to manage groundwater resources sustainability. Areas within potential groundwater have been identified and accordingly 75 production deep tube well locations will be finalized. These include 28 existing tube wells

[30] The amount of water that can safely be abstracted from an aquifer system where annual withdrawal does not exceed the annual rate of recharge in that aquifer system is termed as safe withdrawal or abstraction (IWM Report, 2024).

which will be rehabilitated under the project. The study recommended following measures, which will be implemented and complied with under the project. Study also recommended a pilot study on managed aquifer recharge (MAR) to evaluate its effect and impact on groundwater recharge potential, storage change and on groundwater quality. Proposed KWSP Phase 2 will support a study on artificial recharge and groundwater management in Khulna City through technical assistance (TA).[31]

(i) Limit production well pump capacity to 0.3–0.5 cusec.
(ii) Maintaining pumping levels above 65 m.
(iii) Operating pumps for a maximum of 18 hours/day, with synchronized shutdowns.
(iv) Ensuring a 500 m spacing between production wells due to limited recharge in urbanized areas.
(v) Monitoring of groundwater and adapting management
(vi) Regulating, monitoring and controlling private wells to limit the overall abstraction to 45 MLD.

145. **Groundwater monitoring.** A comprehensive groundwater monitoring plan is proposed in the project, which is a critical component in groundwater management, ensuring the sustainable management of aquifer resources. Monitoring activities will focus on tracking groundwater levels, quality, and potential contamination risks throughout the project lifecycle. During the construction phase, baseline monitoring of groundwater levels and quality will be conducted to identify existing conditions and establish reference points for assessing impacts. Regular monitoring will continue during drilling activities. In the operation phase, continuous groundwater level monitoring will ensure that abstraction rates remain within safe yield limits, preventing over-extraction and associated risks such as land subsidence and aquifer depletion. Additionally, periodic water quality testing will be implemented to monitor for changes in chemical composition, including salinity and potential contamination from nearby activities. Advanced monitoring technologies, such as automated data loggers and SCADA systems, will be employed to provide real-time insights into groundwater conditions. These measures will enable adaptive management practices to address any deviations from sustainable use thresholds, ensuring the long-term viability of the groundwater resources in the Khulna region.

146. IWM Report emphasizes that KWASA needs to take responsibility for both own production tubewells as well as the impact of private tubewells the total water availability is limited to 100 MLD (55 MLD KWASA + 45 MLD private). Report observes that “If private tubewells result in declining groundwater tables or irreversible contamination of the deep aquifer, not only will the private tubewell owners, but also the public tubewells owned and operated by KWASA will suffer”. It is anticipated that provision of KWASA water supply in the currently uncovered areas within KCC and expanded areas will significantly reduce the dependence and stress on groundwater from private abstractions. However, report also recognizes that since private tubewells are in operation for years providing water supply security within their own property, it may take time to convince private stakeholders to shift public (KWASA) and therefore a systematic approach is suggested including introduction of regulatory system to control groundwater abstraction, reporting and emergency measures during drought conditions and encouraging owners to shift to KWASA (public) supply. Report

[31] Proposed TA among other will Plan and implement initiatives such rainwater harvesting, managed aquifer recharge (MAR)to enhance groundwater replenishment over long-term and mitigate over-extraction risks during dry seasons. However, MAR shall be implemented only after appropriate studies of its feasibility and associated risks on groundwater quality. Attached technical assistance will support KWASA in these initiatives. A pilot study on the MAR proposed under the TA. This may involve construction of pilot scale injunction wells, operation and monitoring to assess the feasibility and risks of MAR. The pilot scheme may have certain environmental impacts during its implementation. These will be assessed during the design of pilot scheme, and mitigation measures will be implemented.

also proposed a pilot study on manager aquifer recharge (MAR) to investigate its potential to enhance groundwater availability in both shallow and deep aquifers. Besides, MAR, Feasibility study report recommends rainwater harvesting and reused treated water to cope with the dry season salinity issue.

147. Considering all the above, following measures shall be implemented to ensure abstraction within safe limits and will not lead to over exploitation:

(i) Utilize the groundwater within the sustainable limits. The sustainability of groundwater in Khulna depends on maintaining a balance between seasonal abstraction and natural recharge. While the proposed abstraction volume aligns with estimated safe yields, the spatial and temporal concentration of pumping introduces risks to aquifer levels, water quality, and land stability. Therefore, adaptive abstraction planning, zonal control on private wells, and continuous groundwater monitoring will be vital for long-term sustainability.
(ii) Strictly follow the groundwater utilization plan and ensure that overall annual abstraction is within the safe yield limits; an average, KWASA withdrawal shall be limited to maximum 100 MLD by KWASA and private parties
(iii) Install and operate groundwater monitoring[32] and management systems, and ensure adaptive management considering the annual weather conditions, eg., drought years.
(iv) Conduct public awareness campaigns on water supply situation, and improved service levels with KWSP Phase 2, and encourage shifting from private to public supply.
(v) Regulate groundwater usage by private parties, coordinate with other government agencies like WARPO to establish policies to regulate, monitor and limit the usage within the established limits, i.e., 45 MLD.
(vi) Plan and implement groundwater augmentation measures, which may include artificial recharge, rainwater harvesting in public and private places, such as rooftop rainwater harvesting, reuse of treated wastewater etc.

3. Impacts on ecological resources and Gangetic dolphins

148. **Impact on ecological resources.** Bhairab River is identified as a habitat for the Gangetic River Dolphin (*Platanista gangetica*), an endangered (EN) species listed on the IUCN Red List. Critical habitat screening confirmed that project influence area is not qualified as a critical habitat for these species. There are various aquatic and fish species in both the Madhumati and Bhairab rivers. Existing intakes on Bhairab and Madhumati are located near the riverbanks– water flows by gravity through an existing underground conduit laid from the riverbed to the intake well (located besides the bank of river). Intakes are equipped with coarse and fine bar screens to prevent the entry of aquatic fauna or any solid waste. Existing conduits are capable of delivering required water (135 MLD from Madhumati intake and 15 MLD from Bhairab intake) therefore no works will be conducted in the rivers.

149. The intake is situated close to riverbank in shallow water zones of Bhairab, while dolphins predominantly move or inhabit mid-channel deeper sections of the river. Given the spatial separation and limited influence zone of the intake, no proposed works in river, and considering minimal abstraction (0.21% for the Bhairab River) no impacts envisaged on the endangered Dolphins. Similarly, project is unlikely to have any impacts on other aquatic species. Project will not significantly alter flow regimes or influence salinity gradients that sustain aquatic biodiversity.

150. **Noise from pumping operation at Bhairab Afil Gate intake**. A jetty is in operation near the Afil gate pumping station, and there is considerable movement of motorboats that

[32] Groundwater monitoring system proposed by IWM Report is given in Appendix 9 for reference.

generate significant noise. Intake is located within an enclosed building, and the new expanded pumping system will also function in an enclosed building, therefore noise impact will be insignificant. Nevertheless, the project will use low-noise generating pumps and motors, which will also minimize occupational health and safety risks.

151. No notable construction noise impacts are anticipated. No works are proposed within the river. At the Bhairab intake, civil works include rehabilitation/retrofitting of the intake sump and pump house and installation of additional pumps. These do not involve any high noise-generating activities. Nevertheless, following good construction practices in the project will further minimize construction noise.

4. Impacts due to Increase in sewage generation and disposal of untreated sewage

152. **Wastewater discharged into the river**. Water supply in Khulna will increase from the present 150 MLD to 220 MLD by 2035. This increase in water supply will increase sewage generation proportionately (80% of domestic water used is generated as wastewater). At present, KWASA is implementing the Khulna Sewerage System Development Project (KSSDP) funded by ADB. In the absence of an operational sewerage system, the majority of households currently use on-site septic tanks and soak pits for wastewater disposal. Low-income families, who cannot afford septic tanks, typically rely on pit latrines. Sullage and overflow from septic tanks from some houses are discharged into open drains and canals that ultimately end up in the river. A few households that lack septic tanks but are equipped with flush toilets discharge waste directly into open drains. These practices pollute the river and adversely impact the river water quality and aquatic species. The scenario will change once the KSSDP is completed and commissioned. KSSDP will serve approximately 850,000 people (55% of the total population of the Khulna City Corporation area) by 2027. [33] The remaining population will be covered in the next phase of the project (to be proposed), ensuring comprehensive sewerage coverage for the entire city. Following mitigation measures are suggested:

(i) Complete the KSSDP works in a timely manner, and ensure all households are connected to the sewerage system in the sewered; expand the system as feasible with future projects
(ii) Coordinate with KCC and ensure that no raw sewage is discharged into open drains and canals and that septic tanks contents are periodically collected, and transferred to a septage treatment plant for treatment and safe discharge
(iii) With the combination of sewerage and septage management system, prevent the discharge of untreated wastewater into open drains, canals and the river.

5. Location Impacts

153. **Site sensitivity and land use.** Locations for the intake structures, production wells, and reservoirs have been carefully selected to avoid sensitive ecosystems such as wetlands, unstable riverbanks, and low-lying agricultural fields. Existing intake points along the Madhumati and Bhairab Rivers are not located in ecologically critical zones. Temporary disturbances near water bodies and agricultural fields will be mitigated through controlled activities and post-construction cleanup and restoration. Production wells are placed away from critical recharge zones, minimizing the risk of over-extraction and water table depletion.

[33] The key components of the project include: (i) establishment of two sewage treatment plants with a combined capacity of 80,000 cubic meters (m^3) per day, (ii) one fecal sludge treatment plant with a capacity of 160 m^3 per day, (iii) construction of 269 kilometers of sewer network to ensure efficient wastewater collection and transportation and (iv) Provision of around 27,000 property-level sewer connections to households and commercial establishments, (v) Capacity development of the Khulna Water Supply and Sewerage Authority (KWASA) to enhance operational and maintenance capabilities, and (vi) awareness-raising campaigns on sanitation and hygiene to promote community engagement and sustainable practices.

Sensitive areas in Khalishpur, Sonadanga, and Daulatpur are excluded from extensive groundwater abstraction due to observed salinity ingress.

154. Construction near residential, educational, and religious sites is minimized to prevent disruptions. Noise and dust control measures, along with scheduled construction hours, will mitigate community impacts. The project intervention design avoids locating facilities in flood-prone areas of low-lying Khulna. Where necessary, embankments and drainage improvements are incorporated into site plans to prevent localized flooding.

155. Distribution reservoirs and pumping stations are located to minimize traffic disruptions. Narrow access roads and urban intersections will be addressed by scheduling material transport during off-peak hours and employing traffic marshals.

C. Pre-Construction Phase Impacts

1. Planning, preparation activities and compliance with requirements

156. **Consents, Permits, NOCs, and Clearances.** Without permission, the project cannot be implemented. Failure to obtain necessary consents, permits, and other appropriate regulatory clearances can result in design revisions and work stoppage.

157. **Mitigation.** All of the necessary consents, permits, and clearances shall be obtained before the award of contract or prior to the start of civil work (as the case may be) and acknowledged in writing and a report on compliance with all obtained permits, clearances, NOCs, etc. Permissions and clearances are required from the following government agencies and departments:

(i) Department of Environment (ECC)
(ii) Khulna City Corporation (road cutting / pipe laying)
(iii) Khulna District Authority (road cutting / pipe laying)
(iv) Roads and Highway Department (road cutting / pipe laying)
(v) Local government engineering department (road cutting / pipe laying)
(vi) Bangladesh Water Development Board / Water Resource Planning Organization (WARPO) (permission to abstract water).

158. **Update IEE and Preparation of SEMP.** PMU will update the IEE based on the final detailed designs and submit it to ADB for review, clearance, and disclosure prior to the commencement of work. The contractor shall be responsible for preparing the Site-Specific Environmental Management Plan (SEMP). The SEMP shall be based on the corresponding EMP in this IEE report, with details on staff implementation schedules, monitoring procedures, and resources, including costs for implementing measures. The SEMP shall also include detailed health and safety plans with monitoring and reporting procedures consistent with national guidelines and internationally recognized standards or guidelines such as the WHO guidelines. The contractor will submit its SEMP to PMU, and PMU will review and approve it accordingly. The approved SEMP will be the basis for monitoring by PMU and PMSC. The SEMP will allow PMU, the construction supervision engineer, to focus on what specific items are expected from the contractor regarding environmental safeguards on a day-to-day basis. With the SEMP, PMU can easily verify the associated environmental requirements each time the contractor requests approval for work schedules.

159. **Community awareness program.** Before the start of the project implementation, the local population should be well aware of the upcoming project. There should be regular interaction with the local population and make them understand the project activities. The important information that needs to be disseminated to people includes, among others, the following:

(i) Overview and objectives of the proposed project.
(ii) Preliminary and/or final detailed design of proposed project components.
(iii) Potential environmental and community impacts (positive and negative) of the project and the proposed mitigation measures for the perceived negative impacts; and
(iv) Grievance redress mechanism and contact details of the project.

160. **Training on EMP implementation.** A lack of proper training to implement the EMP stipulated in the bid document leads to mismanaged environmental safeguards. Therefore, EMP training for the contractors, workers and implementing agency is necessary before construction commences. Training shall be arranged before construction starts with all involved parties: contractors, workers and representatives from KWASA through the PMU to undergo EMP implementation, including spoils management, standard operating procedures (SOP) for construction works, community and occupational health and safety, core labour standards and laws, applicable environmental laws, etc.

161. **Preparation of subplans and implementation to avoid/minimize construction phase impacts.** The potential environmental and social impacts arising from project activities can be effectively mitigated or completely avoided by preparing and implementing specific management plans during the project planning and design stages. To achieve this, KWASA and the contractor(s) will develop and strictly implement the following sub-plans before initiating construction activities:

(i) **Construction Environmental Management Plan.** CEMP integrates environmental management practices specifically tailored to mitigate potential construction-related impacts such as air and noise pollution, water contamination, and ecological disruptions. It includes protocols for routine environmental monitoring, site-specific impact minimization measures, and regular reporting requirements. The contractor will develop the plan, subject to approval by KWASA's environmental specialists, ensuring it is finalized at least one month before construction begins and adhered to strictly during the project implementation phase.
(ii) **Traffic Management Plan.** TMP will detail optimal transportation routes, define strategies to minimize traffic congestion, ensure public safety, and maintain uninterrupted community access during construction. It will include clear guidelines for traffic rerouting, appropriate signage, and deployment of traffic marshals. Prepared by the contractor and reviewed by the PIU, this plan must be finalized and approved at least one month prior to starting construction.
(iii) **Stakeholder Consultation and Information Dissemination Plan**. This plan outlines procedures for effective and continuous communication with stakeholders, including project-affected communities, local businesses, and relevant authorities. This plan includes schedules and mechanisms for regular consultations, dissemination of project information, and grievance redress mechanisms. PIU, with support from the contractor and community representatives, will prepare and initiate this plan at least two months prior to construction and continue implementation throughout the project duration. During the construction phase, it is expected that some problems may be encountered because many of the roads are narrow, with no sidewalks that can be used to lay different utilities. Careful planning and extensive coordination with various social agencies must be established. A well-organized information campaign must precede any construction activity in order to make the public aware of the extent of the problem that might be present during the period of construction.
(iv) **Waste and Spoil Management Plan**. The plan addresses appropriate handling, storage, transportation, recycling, reuse, and disposal of construction

waste and excavated spoil, specifically soil from reservoirs and pipeline construction. The contractor is responsible for preparing and implementing the plan, with oversight from KWASA's environmental team. Approval of this plan is required at least one month before the commencement of construction.

(v) **Construction Safety and Occupational Health Plan**. This focuses on identifying occupational hazards and establishes comprehensive measures for worker safety, including mandatory use of personal protective equipment, safety training programs, and accident prevention protocols. Developed and executed by the contractor and closely supervised by KWASA's designated safety and health monitoring staff, this plan must be approved at least one month prior to construction and regularly updated throughout the construction phase.

(vi) **Emergency Preparedness and Response Plan**. The EPRP provides guidelines for identifying potential construction-related emergencies, including accidental spills, fires, injuries, and extreme weather events, detailing procedures for rapid response and coordination with local emergency services. This plan will be developed by the contractor in coordination with KWASA and local emergency authorities and finalized one month before construction activities commence.

(vii) **Chance find protocol - Flora and Fauna.** Following measures shall be implemented. (a) The contractor will take reasonable precautions to prevent workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal), including fishes, in any water body and hunting of any animal, (b) If any wild animal is found near the construction site at any point in time, the contractor will immediately, upon discovery thereof, acquaint the PMSC and carry out the Environmental Management Specialist's instructions for dealing with the same, and (c) Only if needed, PMSC will report to the nearby Forest Department (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.

(viii) **Chance find protocol - Archaeological Property**. (a) All fossils, coins, articles of the value of antiquity, structures, and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation, (b) The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal, acquaint the PMU through the PMSC of such discovery and carry out the instructions for dealing with the same, waiting for which all work shall be stopped. The PMU will seek direction from the Archaeological Department of Archaeology of Bangladesh and inform the project KWASA to follow the Chance Find Procedures set forth.

2. Disruption to Public Utilities

162. **Impacts.** During the installation of new subsurface infrastructure, it is very easy to damage existing service cables and pipelines or temporarily interrupt supplies to consumers. The levels of potential impacts arising from disruption damage to public utilities are summarized below. Investigations during the IEE suggest there are few services that might be disrupted within the vicinity of the project area. All power and telephone cables are above ground in Khulna city, but underground are water supply pipelines which are assets of the project proponent. A small number of electric or telephone poles may need to be shifted but disruption of services should otherwise be minimal.

Table 34: Potential Impacts of Disruption to Public Utilities

Utility	Nature of Impact	Severity
High Voltage Electricity Cables	Interruption of Supply	Severe production loss and public inconvenience
	Personal Injury	Likely death of the operator
	Cost of Repair/Delay to Works	Very severe
Medium Voltage Electricity Cables	Interruption of Supply	Severe production loss and public inconvenience
	Personal Injury	Probable death or serious injury of operator
	Cost of Repair/Delay to Works	Severe
Low Voltage Electricity Cables	Interruption of Supply	Localized but severe public inconvenience
	Personal Injury	Possible serious injury to the operator
	Cost of Repair/Delay to Works	Minor production loss. Short public inconvenience
Trunk Distribution Pipelines	Interruption of Supply	Significant production loss and public inconvenience
	Personal Injury	Possible injury to the operator
	Cost of Repair/Delay to Works	Severe
Local Networks Water	Interruption of Supply	Localized but significant public inconvenience
	Personal Injury	Unlikely
	Cost of Repair/Delay to Works	Minor
Telephone Cables	Interruption of Supply	Severe disruption to national and international telecommunications
	Personal Injury	Possible injury to the operator
	Cost of Repair/Delay to Works	Limited
Telecom Cables	Interruption of Supply	Disruption to national and international telecommunications
	Personal Injury	Unlikely
	Cost of Repair/Delay to Works	Very Severe

163. **Mitigation Measures.** Available drawings of utility services may not always be accurate; therefore, the contractor shall accurately locate all services, by trial pits, if necessary, before work commences in any given area. Nevertheless, accidents occur where small diameter water pipelines and low voltage power cables are unrecorded or where an excavator operator carelessly swings an extended boom into overhead cables. All such incidents shall be reported to the engineer, and the contractor shall be responsible for the expeditious repair of accidental damage.

164. Damage to any utility at a defined site shall be made good to the satisfaction of the agency responsible at the contractor's cost. Damage to utilities not defined prior to construction, despite the contractor having undertaken all reasonable liaison with the agencies responsible, shall not be the responsibility of the contractor. It shall be the responsibility of KWASA to ensure the utility agencies respond in time to the contractor's requests for information.

165. Contractors shall liaise with each of the agencies responsible for the maintenance of utilities that are to be crossed, temporarily diverted or otherwise affected by the works as to the timing and nature of any disruption of service. Where required, the agency responsible shall be requested by KWASA to carry out the necessary works at the time required and at KWASA's cost. The tender documents contain sufficient information on utilities crossings to permit the contractor to include the cost of the work for which they are responsible in their bid.

3. Removal of Trees

166. **Impacts.** Construction work related to project components may require the clearing of vegetation, including trees. Tree assessment surveys are being done in the proposed location in a topological survey. During the due diligence visits, tree assessments were conducted. Based on the assessment, it is estimated that 8-10 trees within the project area may be felled. Of these trees, 4 are large (DBH > (20 inches), the rest are medium (4 inches < DBH > 20 inches) and no small trees (DBH < 4 inches). Subproject-wise tree felling is shown in Table 35. The number provided here is based on observation and counts as the most possible number. Removal of trees will affect the local ecosystem and habitat of local birds, animals and wildlife. Particularly, the wildlife that is living on the affected trees will permanently lose the ecological services from those trees. Therefore, the removal of mature trees will be a significant loss to the environment, humans and other living organisms benefiting from them.

167. Tree cutting will be avoided. No mature trees will be cut for facility construction, pipe laying or boundary work. As for laying of pipelines, the alignment will be temporarily altered by choosing to avoid the tree.

168. **Mitigation.** The following actions are proposed to mitigate the impact of tree removal:

(i) After the finalization of the designs and layout of the project components, the trees within the proposed construction areas will be marked

(ii) Conduct a survey of trees prior to cutting to identify any bird nests or wildlife and ensure that no disturbance occurs if active nests or wildlife are present.

(iii) Trees within the area required for construction will be felled after prior approval

(iv) Compensation will be provided for the affected trees based on the unit prices of trees determined by the agriculture/horticulture experts. For trees in public-owned lands such as ROWs where no claimant for compensation is confirmed, replacement of the tree shall be undertaken by KWASA at the replacement ratio of three trees for every tree that is cut (i.e., 3:1 ratio)

(v) Only trees that will require removal within the proposed construction areas of the sites will be cut, and

(vi) For trees not proposed to be cut, take all precautions to protect them from any damage from construction activities.

Table 35: Details of Affected Trees

	Component	**Location**	**No of Trees**			
			Large	**Middle**	**Small**	**Total**
1	Access road construction	Labonchara	2	0	0	2
	Roadside Boundary construction	Mostafa Mor	1	2	3	6
	Laying of pipelines		0	0	0	0
2	Construction activity at intake locations	Mollahat, Bhairab river Afil Gate	0	0	0	0
3	Construction of IPR	SWTP	0	0	0	0
7	Construction of CWR	Afil Gate	0	2		2
Sub-total						10

Source: All the data in the table are generated based on field observation, the topological survey is ongoing as of this moment, numbers are subjected to change.

Figure 53: Trees at Labonchara site

Image: ADB consultant's doing tree assessment survey, left is Labonchara and rest two are from Mostafa Mor.

4. Road cutting, excavations and traffic disruptions due to improper planning

169. **Impacts.** Construction of more than 600 km of transmission and distribution pipe network, 70–80% by trenchless and 20–30% by open cut method will be followed for pipe laying. Trenches will inevitably restrict traffic flows to an extent, and roads may have to be closed on occasion. Although work on roads will be conducted at night, except in residential areas, the impact on traffic can still be significant, given the congestion problem that exists in the core business center of the city. The pipelines in the major roads are given in Table 36.

Table 36: Major roads to be excavated for pipe networks

Sl. No.	Name of the Road	Width of Road	Dia. of Pipe (mm)	Trench Width (mm)	Ownershipof Road	Permission Required
1	Khulna Shipyard Road	16.6 m	700–900 mm	150 mm on both sides of the pipes	KCC	Yes
2	Khulna City Bypass Road	20.8 m	700–900 mm	150 mm on both sides of the pipes	RHD	Yes
3	Afil Gate to Mostafa Mor	12.8 m	700–900 mm	150 mm on both sides of the pipes	RHD	Yes

170. All the distribution lines will be placed within the road boundaries, so the distribution line networks are free from crossing main roads. The clear water transmission will cross these three major road crossings; KWASA officials affirm all the permission processes will take place after the DPP gets approved. Road excavation for pipe installation within the city will also result in considerable delays to traffic flows. The impacts of this activity are increased journey time and increased costs associated with delays. Methods for pipe laying and effective traffic management will be key in determining the severity of impacts. Delays will be most noticeable during morning and evening peak hours. Although at present, these are relatively modest across the city, the intensity is becoming more severe in central business areas of the city. Delays will be most serious when they impact ambulances, fire engines, blood bank vans and other emergency vehicles. However, no significant impacts to non-vehicular traffic are expected.

Mitigation

(i) No temporary or permanent work must proceed before the design and drawings are approved by the Project Director, and road cutting permission obtained from relevant authorities (KCC, RHD) by PMU
(ii) The road cutting plan necessary for the application for road cutting permission from the authorities must be prepared by the contractor
(iii) KWASA should apply for road cutting permission prior to starting the work, and the contractor should give full effort and cost for collection of road cutting permission for the required days
(iv) The contractor shall prepare a traffic management plan (road closure program or diversions) and incorporate details of traffic diversions and pedestrian routes. All traffic signs (for regulation and for information) and road markings shall be ensured prior to the start of road cutting and
(v) Road cutting will be done on a section-wise basis (e.g. not exceeding a 50-meter linear distance of excavation works at a given time) depending on the length and width of roads under consideration to avoid or minimize disruption to traffic and pedestrian flow.

171. **Ease of Access related Impacts.** Ease of access to and from the site will be a fundamental requirement. All points of contact between construction and existing traffic will potentially give rise to accident black spots due to the number of turning movements by construction traffic, its low speed, increased damage to the road surface and deposition of mud, chippings, oil and other debris.

172. **Mitigation.** Contractors shall conduct traffic impact assessments to plan traffic management to minimize disturbance of vehicular traffic and pedestrians. Access arrangements for vehicles accessing the project area will be formulated such that they avoid community disturbance and severance, and the plan will include consideration of the following:

(i) Lane availability and minimizing interference with traffic flow past the work site
(ii) Establishment of acceptable working hours and constraints
(iii) Establishment of appropriate linear distance for excavation works at a given time (e.g. not exceeding 50 m) depending on the length and width of roads under consideration
(iv) Agreement on time scale and establishment of traffic flow/delay requirements
(v) Programming issues, including the time of year and available resources
(vi) Discussion of the PMSC's inspection/monitoring role
(vii) Establishment of a complaints management system for the duration of the work.

D. Construction phase impacts

173. The impacts during construction shall include generic construction-related impacts associated with construction activities, which can be mitigated to acceptable levels with the following mitigation measures. Construction impacts are discussed component-wise:

1. Augmentation of Water Intake Facilities at Mollahat and Afil Gate

174. At Mollahat, it is proposed to install an online monitoring system for salinity (Electric conductivity meter, chloride meter, etc.) and automatic adjustment of pumping rate at the existing intake. The proposed engineering schemes for this are: (i) construction of a pre-settling tank; (ii) Installation of additional pumps in the pumphouse; (iii) installation of an online monitoring system. This is expected to facilitate the withdrawal of more water in the dry season.

Figure 54: Photos taken at the Mollahat intake and raw water pump house

The intake location at the Madhumathi River

Upstream of Madhumathi River at intake location

Screens and pump house from the river

Intake from the pump house

Inside the pump house

Exterior view of the pump house

Resettling tank will be constructed on the right-hand side and the building will be extended along the concrete apron to accommodate new pumps.

Note: (i) There will be no new raw water transmission main installed, as the capacity of the existing transmission main is sufficient to pump water to the BWTP. (ii) The increased abstraction of raw water is expected to facilitate the withdrawal of more water in the dry season.

175. **Afil gate.** The existing intake at Afil Gate currently has a capacity to draw 5 MLD of water. Under the proposed project, this capacity will be increased to 15 MLD. The existing land allocated for the intake and pump house is sufficient to accommodate the upgrade. Water from this intake will primarily be extracted during the post-monsoon period, typically between November and December, when salinity levels are at the lowest. The pumped water will then be stored in impounding reservoirs to be constructed at Mostafa Mor and Afil Gate IPR. This section of the river has demonstrated stable banks and consistent water flow over the past two decades, as evidenced by the absence of bank erosion or meandering near the existing intake. Additionally, the river experiences high discharge volumes during the monsoon season, ensuring a reliable water supply for the proposed enhancements.

Figure 55: **Photos taken at the intake location at the Afil Gate (Bhairab River)**

The entrance to the pump station

The existing pump house

The adjoining boat pier

Upstream of Bhairab River from the intake

Figure 56: Proposed site of pump house at Afil Gate

176. **Potential Impacts due to intake works.** The installation of an online monitoring system and adjusting pumping rates are critical measures to ensure sustainable water abstraction. By incorporating smart monitoring tools such as salinity and chloride meters, real-time data on water quality and availability will guide optimal water withdrawal rates, reducing the risk of over-extraction. This approach promotes the efficient use of water resources, particularly during the dry season when water scarcity and salinity intrusion are more pronounced.

177. ***Construction activities at Mollahat intake****.* The construction of pump houses and pre-settling tanks is planned entirely within the existing KWASA intake and pump house premises at Mollahat, ensuring that no additional land acquisition is required. This approach minimizes disruptions to the surrounding environment and avoids socio-economic impacts such as displacement or loss of livelihoods. By limiting construction activities to the existing premises, the project reduces risks associated with land clearing, such as deforestation or habitat loss.

178. ***Augmentation of Afil Gate intake****.* The proposed rehabilitation of the intake facility aims to achieve a pumping capacity of 15 MLD without causing any impact on the river. The existing intake pump house, which is in a severely dilapidated state, will be entirely reconstructed; however, all construction activities will take place outside the river corridor, ensuring no direct disturbance to the river ecosystem. The new intake pumphouse will be positioned further inland along the riverbank. Additionally, design features such as bar screens within the intake chamber will prevent debris from entering the pump station, while a sluice gate will regulate flow, and a grit chamber will efficiently remove coarse sediments, ensuring the intake operations remain environmentally sustainable and protective of the natural settings of the river. Since no additional surface area or land acquisition is required, the project will contain its impacts within the existing facility. This eliminates potential issues such as habitat disruption, community displacement, or land-use conflicts.

179. The construction phase may cause minor impacts, including:

(i) Noise and dust emissions are possible impacts generated by machinery and construction activities, which can affect nearby areas.
(ii) Construction waste such as materials like concrete, steel, and packaging waste could accumulate if not managed properly.
(iii) Worker safety risks are possible as construction sites inherently pose risks of accidents and injuries.

180. **Mitigation measures.** The impacts are expected to be minor and manageable through following measures:

(i) Dust and noise control is required: Water spraying, noise barriers, and scheduling activities during non-sensitive hours.
(ii) Waste management such as Segregation, recycling, and responsible disposal of construction materials.
(iii) Worker safety is important. Provision of personal protective equipment (PPE), safety training, and first aid facilities.

2. Construction of impounding reservoirs at BWTP, Afil Gate, Mostafa Mor

181. Proposed works include a new IPR at BWTP (385 ML capacity) and Mostafa mor (44 MLD) and the deepening of the existing IPR from 3 m to 10 m. Works include raw water pumping systems, connections and electro-mechanical works.

Figure 57: Photos taken at the location of Impounding Reservoir at BWTP

Existing IPR at BWTP

Existing IPR at BWTP

The land is available at BWTP for the construction of the new IPR

The land available at the BWTP for the construction of the new IPR

Figure 58: Photos taken at the location of Impounding Reservoir at Afil Gate where the dept will be increased from 3 m to 10 m

The present IPR at Afil Gate

The present IPR at Afil Gate with earthen embankments

Figure 59: Proposed Site for the Impounding Reservoir at Mostafa Mor

The present site proposed for the IPR at Mostafa Mor. There are a few trees on the boundary

Present status of site (Feb 2025); low-lying site filled up by landowner to the raise level

The site is a paddy field intermittently inundated with rainwater (this photo has been taken during the dry season)

The site is located on N709 road near Mostafa Mor junction.

Figure 60: The embankments and the pipelines in the IPR at BWTP

Sheet piles and the concrete embankments at the IPR at BWTP

Raw water pipelines conveying water to the WTP

182. The embankments will be constructed in a similar manner to the existing IPR at the BWTP and will be constructed using sheet piles and concrete retaining walls, as shown in Figure 60.

183. At Bangabandhu WTP, the new impounding reservoir is planned with a capacity of 385 ML, approximately half the size of the existing reservoir. The proposed reservoir will have a water depth of 12 m and a surface area of 32,083 m^2. The construction will include connecting channels, a steel arch bridge (30 m), and additional pumps for the existing pumping station. The available land within WTP premises, covering 45,000 m^2, is sufficient for the construction, eliminating the need for additional land acquisition. Anticipated impacts include significant dust and noise pollution generated during excavation and the installation of sheet piles and retaining walls. Occupational health and safety risks are anticipated for workers due to the use

of heavy equipment during excavation and construction activities. Transportation of excavated materials and equipment may cause traffic disruptions and pose accident risks. Soil loosening and disturbance during excavation could lead to erosion, potentially affecting nearby water bodies. Additionally, temporary sedimentation may degrade water quality during the construction phase.

184. At Afil Gate, the existing impounding reservoir, currently holding 57 ML, will be upgraded to a capacity of 192 ML. The IPR at Afil Gate has earthen embankments because the depth is shallow at present at 3 m. However, it is proposed to increase the depth from 3 m to 10 m without expanding the surface area. The increased depth of the IPR will require sheet piles as earth-retaining and embankment protection structures. It is proposed to increase the depth of the Reservoir from 3 m to 10 m. The surface area of the reservoir would not be increased. The reservoir depth will be increased from 3 m to 10 m without expanding the surface area. The current earthen embankments will be replaced with sheet piles for enhanced embankment protection. Impacts include sediment disturbance during the deepening process, which could release trapped materials into the water and temporarily affect its quality. Noise and vibrations from excavation and sheet pile driving may disturb nearby areas. The stability of the embankments may temporarily be compromised during construction, potentially impacting adjacent infrastructure. Aquatic habitats within the reservoir could be disrupted, especially vegetation and benthic organisms. Similar to Bangabandhu WTP, the transportation of construction materials and equipment may lead to traffic disruptions and accidents, while occupational safety risks are also anticipated due to the nature of construction activities. Hence, as explained for other IPRs above, similar issues related to construction work will arise.

185. At Mostafa Mor, a small impounding reservoir with a capacity of 44 ML will be constructed on a one-acre plot of land. This will be constructed on newly acquired land for the construction of CWR No. 2 (Zone 12, 13 and 14). Since this is of relatively small capacity, spread over nearly 1 Acre of land only, it is not expected to cause any significant environmental impact. The site is currently a paddy field that becomes inundated with water (about 1 m) during the rainy season. Some tree removal will be required, including five small moringa trees (DBH < 250 mm), one date palm tree, one palmyra tree, and two Albizia (*Albizia lebbeck*) trees (DBH ~ 600 mm). Floating aquatic plants such as water hyacinth and Ipomoea species are also present. The impacts at this site are relatively minor compared to the other two locations. Habitat alteration will occur due to tree removal and changes to aquatic vegetation. The conversion of a paddy field into a reservoir represents a significant land use change, potentially impacting small-scale farmers. Flooding patterns may be temporarily disrupted during construction, leading to waterlogging in adjacent areas. Dust, noise, and soil erosion are likely during construction activities, though on a smaller scale than at the other sites.

Common impacts across all three locations

(i) Air quality deterioration: Construction activities, including excavation and material transport, will generate significant dust emissions. This will temporarily degrade air quality in the vicinity, particularly during dry and windy conditions. Exhaust emissions from machinery and vehicles will also contribute to localized air pollution.

(ii) Noise pollution: The use of heavy machinery, pile driving, and transportation vehicles will result in elevated noise levels, which could disturb nearby communities, schools, hospitals, and wildlife. Noise impacts may be more significant during pile-driving operations at the BWTP and Afil Gate sites.

(iii) Soil erosion and sedimentation: Excavation and soil displacement activities will expose large areas of soil, increasing the risk of erosion and sediment-laden runoff into nearby water bodies, particularly during the monsoon season. This can lead to siltation of streams and temporary degradation of aquatic habitats.

(iv) Disposal of excavated soil: The large volume of soil excavated during construction, including 450,000 m³ at the BWTP site, 135,000 m³ at Afil Gate and 44,000 m^3 at Mostafa Mor, will require proper disposal. The loose volume of soil increases to 562,500 m³, 168,750 m³ and 55,000 m^3, respectively, due to the bulking factor. Inadequate disposal could lead to secondary impacts such as land use conflicts, dust emissions during transport, and leaching of sediments into water bodies. Designated and environmentally compliant disposal sites must be identified, and the transportation of soil must follow proper containment practices to prevent spillage and environmental contamination.

(v) The use of heavy machinery and manual labor during excavation and other construction activities poses risks of injuries, falls, and accidents. Workers may also be exposed to noise, dust, and extreme weather conditions, requiring stringent occupational health and safety measures.

(vi) Increased transportation of materials, equipment, and excavated soil will lead to higher traffic volumes on local roads, causing congestion and increasing accident risks. Narrow roads near some construction sites may exacerbate these challenges, necessitating traffic management plans.

(vii) Construction runoff may carry sediments, oil, grease, and other contaminants into nearby water bodies, potentially affecting water quality and aquatic ecosystems. This is particularly relevant for sites near rivers and low-lying areas prone to waterlogging.

(viii) The construction process will generate significant amounts of waste, including concrete, steel, packaging materials, and residual soil. Improper handling or disposal of this waste could lead to environmental pollution and land degradation.

Mitigation Measures

- *Mitigation measures for excavated soil disposal*

186. The disposal of the significant volume of excavated soil from the construction of impounding reservoirs (IPRs) at BWTP, Afil Gate, and Mostafa Mor requires a structured approach to ensure environmental compliance and minimize potential land-use conflicts. Given that the soil originates from previously agricultural land, it is unlikely to pose contamination risks; however, basic soil testing will be conducted to confirm its suitability for reuse.

187. Bangladesh has extensive low-lying areas that require landfilling for development, flood protection, or infrastructure projects. These areas present an opportunity to reuse excavated soil beneficially while avoiding disposal in environmentally sensitive locations such as wetlands, water bodies, or densely populated areas. The selected disposal sites will be identified in consultation with local authorities and relevant regulatory agencies to ensure that they align with land-use planning and environmental guidelines.

188. Where feasible, excavated soil will be used for land reclamation projects, backfilling for infrastructure development, or raising low-lying lands to improve flood resilience. Additionally, KWASA can explore selling or providing the soil to local landowners who require filling materials, creating an economically viable and environmentally friendly solution.

189. To prevent environmental degradation, proper disposal site management will be implemented, including erosion control measures, controlled dumping, and adequate drainage planning to prevent waterlogging or unintended sedimentation in surrounding areas. Covered transport trucks will be used during soil transport to minimize dust emissions and spillage, particularly along urban routes.

190. Covered trucks and containment measures will be used during soil transport to minimize dust emissions and prevent spillage along transport routes. During transportation, loose soil can generate dust and spill onto roads, causing air pollution, traffic hazards, and inconvenience to local communities. Trucks will be covered with tarpaulins or similar materials to reduce dust emissions. Additionally, soil must be loaded in a manner that prevents overfilling or spilling during transit. Regular cleaning of vehicle wheels before they leave the construction site will help reduce tracking of soil and debris onto public roads, further minimizing environmental and safety risks.

191. Opportunities for reusing the excavated soil for land reclamation, backfilling, or landscaping within or outside the project area, will be explored where feasible. Reusing excavated soil for constructive purposes reduces the environmental footprint and disposal costs. Soil can be utilized for:

(i) Land reclamation: Restoring degraded or abandoned lands within or near the project area.
(ii) Backfilling: Filling excavated or low-lying areas, particularly for construction stabilization or embankment reinforcement.
(iii) Landscaping: Enhancing green spaces or buffer zones, especially in community areas or along roads. The feasibility of reuse depends on the soil's physical and chemical properties, which must be tested to ensure suitability for specific applications and poses no environmental risks.

192. Regularly monitor disposal sites for compliance with environmental standards to ensure no secondary pollution occurs: Disposal sites should be periodically inspected to ensure adherence to environmental regulations. Monitoring should include:

(i) Surface and groundwater quality: Testing for potential leachate contamination from the disposed soil.
(ii) Air quality: Ensuring minimal dust emissions during disposal activities.
(iii) Stability and erosion control: Verifying that disposed soil is compacted and stabilized to prevent erosion or sediment runoff. Monitoring reports should be documented and reviewed by regulatory authorities to ensure transparency and accountability. Any instances of non-compliance or emerging risks should be promptly addressed with corrective measures.

- *Dust and noise control measures*

193. Dust control is crucial to minimizing air quality impacts during construction. Regular water spraying on dusty areas, particularly at excavation sites and along unpaved roads, will significantly reduce airborne particles. Loose construction materials like sand and gravel should be covered during transportation to prevent dust generation. Noise control can be achieved by installing noise barriers or acoustic screens around high-noise machinery and construction areas close to residential or sensitive zones. Additionally, construction activities generating high noise levels, such as pile driving, should be scheduled during daylight hours to minimize disruption to nearby communities and wildlife. Modern, low-noise machinery should be used wherever possible to further mitigate noise impacts.

- *Soil erosion and sedimentation control*

194. Excavation activities disturb the soil, increasing erosion and sedimentation risks in nearby water bodies. To address this, silt traps, sedimentation ponds, and sediment fences should be installed around construction areas to capture displaced soil before it enters watercourses. Bare soil patches should be stabilized quickly using methods such as planting cover crops, applying biodegradable mats, or using mulch to prevent soil loss. Excavated material should be stored in designated areas, and runoff from these storage areas should be managed to avoid sediment-laden water from affecting nearby water bodies.

- *Waste management practices*

195. Construction generates a variety of wastes, including debris, packaging materials, and potentially hazardous substances. Waste should be segregated at the source into recyclable, non-recyclable, and hazardous categories. Recyclable materials such as steel, concrete, and wood should be collected and sent to recycling facilities. Hazardous materials like lubricants, oils, and paints must be handled and disposed of by licensed waste management companies. Non-recyclable waste should be transported to designated landfill sites. A waste management plan must be implemented to ensure systematic waste collection, storage, and disposal, minimizing the environmental footprint of construction activities.

- *Worker safety protocols*

196. Construction sites pose inherent risks to worker safety, including falls, equipment accidents, and exposure to hazardous materials. Providing workers with appropriate personal protective equipment (PPE) such as helmets, gloves, safety goggles, and high-visibility vests is essential. Regular safety training sessions should be conducted to educate workers on safe practices, emergency procedures, and the proper use of machinery. Clear safety signage should be displayed throughout the construction site, and first aid stations should be easily accessible. Regular safety audits and inspections will ensure compliance with safety protocols and help identify potential hazards.

- *Traffic management plan*

197. Transportation of construction materials and equipment can cause traffic congestion and accidents on local roads. To minimize these impacts, a detailed traffic management plan should be developed. This plan should include designated routes for heavy vehicles, alternative routes for local traffic, and specific time windows for transporting materials to avoid peak traffic hours. Coordination with local authorities and the use of traffic marshals will ensure smooth traffic flow. Temporary road signage and warning boards should be installed to inform road users about ongoing construction activities and potential detours.

- *Vegetation and habitat restoration*

198. Construction activities, particularly at the Mostafa Mor site, will involve the removal of trees and disturbance of aquatic vegetation. To compensate for this loss, native tree species should be replanted in nearby areas after construction. These trees should be selected based on their ecological value and suitability to local conditions. Floating aquatic plants disturbed during construction should be reintroduced where feasible, ensuring the restoration of aquatic habitats. Temporary fencing around sensitive ecological areas during construction will prevent further disturbance to flora and fauna.

- *Water quality and habitat monitoring*

199. During construction, runoff from disturbed areas may carry sediments and contaminants into nearby water bodies, impacting water quality and aquatic habitats. Real-time water quality monitoring systems should be installed to track parameters like turbidity, pH, and dissolved oxygen levels. Temporary barriers or bunds should be set up around construction sites near water bodies to prevent contaminated runoff. Regular inspections should be conducted to ensure that sediment traps and erosion control measures are functioning effectively. In areas where aquatic habitats are affected, post-construction monitoring should ensure that restoration efforts, such as replanting aquatic vegetation, are successful.

3. Retrofitting of Bangabandhu and Afil Gate Water Treatment Plants

200. Works include retrofitting of BWTP from 110 to 135 MLD and Afil Gate WTP from 5 MLD to 15 MLD, including civil, electrical and mechanical works, additional pumps for clear water, and pipeline works.

Figure 61: Photos taken at BWTP

Existing sedimentation tanks of the WTP

Flocculation and sedimentation tanks

Inside the pump house

Filter backwash water is collected at a reservoir located within the WTP site

Inside the chemical storage house

Electrical panel room

Figure 62: Photos taken at Afil Gate WTP

Sedimentation tanks at Afil Gate WTP

Flocculation tanks

 The existing IPR is located adjacent to the WTP	 The WTP and the pump house at the Afil Gate WTP

201. **Impacts due to works in BWTP.** The retrofitting of the Bangabandhu Water Treatment Plant (BWTP) aims to increase its capacity from 110 MLD to 135 MLD through civil works and upgrades to flocculation, sedimentation, and filtration units. The retrofitting activities will take place entirely within the existing WTP premises, which are already a developed and elevated site, thus avoiding the need for additional land acquisition.

202. However, construction activities such as material transportation, installation of new pumps, and electrical and mechanical (E/M) works may generate localized dust and noise pollution. Although the site is distant from residential areas, the movement of vehicles and machinery could impact transportation routes. Occupational health and safety risks, such as injuries due to equipment use, are potential concerns during construction. Furthermore, the potential for minor traffic congestion or accidents exists along the routes used for transporting construction materials.

203. **Mitigation measures.** To mitigate these impacts, dust suppression measures such as water spraying will be implemented during construction. Noise pollution will be managed using site fencing, and high-noise activities will be limited to daylight hours. Construction workers will be provided with appropriate personal protective equipment (PPE) and safety training in line with IFC and international health and safety standards. Regular inspections will ensure compliance with these protocols. Traffic management measures, including designated routes for construction vehicles and scheduling material deliveries during off-peak hours, will minimize disruptions to local communities. Additionally, a comprehensive Environmental Management Plan (EMP) will be followed to address all identified impacts.

204. **Impacts due to Afil Gate WTP works.** The retrofitting of the Afil Gate Water Treatment Plant (WTP) will enhance its capacity from 5 MLD to 15 MLD through modifications to process units, including coagulation, flocculation, sedimentation, and filtration. Like Bangabandhu WTP, this activity will be confined to the existing WTP site, with no need for additional land acquisition or an increase in surface area.

205. Construction activities will result in temporary dust and noise emissions. However, the impacts are expected to be minor, as the site is located within the existing WTP premises. Transportation of construction materials and installation of new equipment, including two centrifugal pumps and associated pipelines, could disrupt local traffic and pose safety risks. Additionally, occupational hazards for workers involved in the retrofitting process are potential concerns.

206. **Mitigation measures.** The impacts will be mitigated by adhering to the EMP, which includes dust suppression measures such as regular site watering and proper storage of materials to prevent airborne particles. Noise impacts will be minimized by using modern equipment with low noise emissions and scheduling high-noise activities during non-sensitive hours. Worker safety will be ensured through the provision of PPE, safety signage, and training

on safe operating procedures. Traffic disruptions will be managed through careful scheduling and coordination with local authorities. Waste management protocols will ensure the proper disposal of construction debris.

207. **Impacts due to clear water transmission pipeline works from Afil Gate WTP**. The construction of a 300-m, 600 mm diameter DI pipeline for clear water transmission will require interconnecting pipes, valves, and appurtenances. Excavation for pipeline installation may temporarily disturb the soil and create localized dust emissions. Noise pollution from excavation machinery and transportation of materials could affect nearby areas. Traffic disruptions along the pipeline route are potential risks during construction. Additionally, improper handling of excavated material or construction waste could lead to environmental pollution.

208. **Mitigation measures.** To address these impacts, silt traps and sediment barriers will be deployed to control soil erosion during excavation. Dust suppression will be achieved through regular watering, and machinery will be maintained to minimize noise emissions. Traffic management measures, such as the use of detours and proper signage, will be implemented to minimize disruptions. Construction waste will be segregated and disposed of responsibly. Workers will receive safety equipment and training to minimize risks of accidents during pipeline installation.

Common impacts and mitigation measures for both WTPs

(i) Dust and noise pollution due to construction activities and material transportation.
(ii) Potential health and safety risks for workers during retrofitting and equipment installation.
(iii) Traffic disruptions on local transportation routes.
(iv) Waste generation from construction debris and discarded materials.
(v) Temporary disturbance to soil and potential runoff during excavation.

Common mitigation measures:

(i) Dust suppression through water spraying and covering materials during transport.
(ii) Noise control using modern low-emission machinery and scheduling construction activities during non-sensitive hours.
(iii) Worker safety is ensured through PPE, safety training, and compliance with international health and safety protocols.
(iv) Waste management practices, including segregation, recycling, and proper disposal of non-recyclable waste.
(v) Traffic management measures such as scheduling transportation during off-peak hours and using designated routes for construction vehicles.
(vi) Erosion control measures, including silt traps and quick restoration of disturbed soil areas post-construction.
(vii) Regular monitoring and compliance with the EMP to address unforeseen impacts effectively.

4. Construction of four clear water distribution reservoirs, overhead tanks and pump houses

209. Clear water reservoirs (CWRs), overhead tanks (OHTs) and pump houses will be constructed at four locations. CWR 1: Labonchara (Zone 11); CWR 2: Land adjscent to Mostafa Mor IPR (Zone 12, 13 and 14); CWR 3: at Afil Gate WTP (Zone 15); CWR 4: at site of abandoned CWR near Afil Gate Mosque (Zone 16).

210. **Impacts due to Works at CWR 1.** The site proposed for CWR 1 is located along the N709 highway (Khulna-Jashore Road) in a paddy field. The area is characterized by unique geographical and infrastructural elements that require careful planning to ensure sustainable construction and minimal environmental impact. The site is separated from the highway by a stream, which flows between the road and the proposed construction area. The presence of this water body necessitates that the natural flow of the stream remains undisturbed. To achieve this, the construction of an access road from the N709 highway to the site must include proper cross-drainage infrastructure, such as culverts or bridges, to allow uninterrupted water flow. Disturbing the stream's flow could lead to flooding in the surrounding paddy fields and affect local ecosystems.

Figure 63: Photos taken at the site proposed for CWR 1, OHT and pump house

The site proposed in a paddy field

There is a stream between the road and the proposed land

There is a line of trees adjoining the roadside, but no need for cutting

There are two small buildings being constructed on the adjoining land by a private party

211. A line of trees is present along the roadside adjoining the site, enhancing the natural aesthetics and providing ecological benefits. No tree cutting is required as the construction footprint does not extend to this area. The preservation of these trees ensures that the visual buffer and ecological integrity of the roadside remain intact.

212. Adjacent to the site, there are two small buildings under construction, developed by a private party. Additionally, a restaurant is located on the opposite side of the proposed land, near the highway boundary. These neighboring structures indicate a mixed-use environment in the vicinity, which must be considered to minimize disturbances caused by construction activities such as noise, dust, and increased traffic. Mitigation measures should be implemented to avoid disrupting the operations of the restaurant and the private construction activities.

213. The land itself will require filling and levelling, as it is currently a low-lying paddy field that may be waterlogged during the rainy season. Filling should be done with proper compaction techniques to ensure the site is adequately prepared for construction. Since the underlying soil is weak, the foundations for CWR 1 and associated structures, such as the

pump house and overhead tank, must be carefully designed to ensure stability. Suitable methods such as piling or raft a foundation system may be necessary to distribute loads and prevent settlement issues.

214. The natural ecology of the stream should be protected throughout the construction process. Silt traps and sedimentation barriers should be installed to prevent construction debris and soil runoff from contaminating the stream. Construction activities near the stream should be limited to ensure its banks and flow are not disrupted.

215. The proposed site access road must be designed to account for the local topography and the stream crossing. Adequate culverts or small bridges should be installed at crossing points, sized to accommodate the stream's flow capacity during peak discharge. The road should be elevated slightly above the surrounding paddy field to ensure all-weather accessibility and prevent waterlogging during heavy rainfall.

216. **Impacts due to works at CWR 2.** The proposed site for CWR 2 and the Overhead Tank (OHT) is located adjacent to the land identified for the Mostafa Mor Impounding Reservoir (IPR). Unlike the site for the IPR, which experiences flooding during the rainy season due to its low elevation, the proposed land for CWR 2 and the OHT is situated on elevated ground above the flood level. This favorable topographical feature ensures that the site remains dry and accessible throughout the year, even during heavy rains or seasonal flooding.

217. The proposed land is currently bare and undeveloped, with no structures, significant vegetation, or large trees that would require removal during the construction phase. The absence of inundation makes the site suitable for constructing critical infrastructure like the CWR and OHT without necessitating extensive flood protection measures.

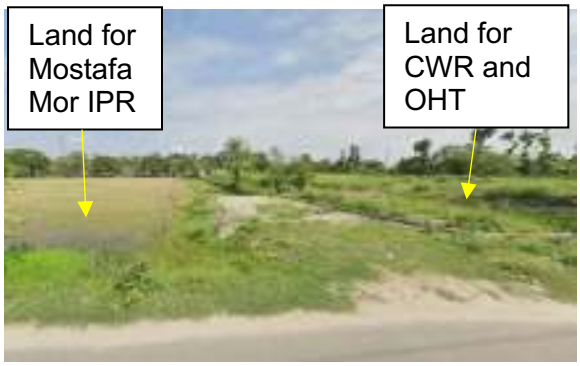
218. The site is well-connected by the Koia Bazar Road, which provides direct access to the Mostafa Mor junction. This junction is a busy location, serving as a hub for local market activities. The nearby fish market is particularly active, contributing to significant pedestrian and vehicular traffic in the area. The narrow width of the Koia Bazar Road presents challenges for transporting construction materials and equipment to the site. Traffic management will be essential to minimize disruptions to the daily activities of market vendors, shoppers, and other road users.

219. The presence of local market activities near the site introduces additional considerations for construction planning. Noise, dust, and construction traffic may affect the operations of the market and the surrounding community. Specific mitigation measures, such as scheduling construction activities during off-peak market hours and using noise barriers, will be necessary to reduce disturbances.

220. The proposed location for CWR 2 and the OHT benefits from the absence of large trees or significant vegetation, eliminating the need for tree cutting or habitat disruption. However, care must be taken to minimize the ecological footprint of construction activities, ensuring that any temporary disturbances, such as dust and noise, do not adversely impact nearby areas.

221. Given its proximity to the Mostafa Mor IPR site and the busy market area, the construction of CWR 2 and the OHT must be carefully coordinated to ensure efficient logistics and minimal community disruption. Proper planning for construction staging areas and material storage will be critical, given the narrow access road and limited space near the market. Temporary widening of access points or designating alternative routes for construction vehicles may be necessary to facilitate smooth operations.

Figure 64: Photos taken at the site proposed for CWR 2, OHT and pump house



The proposed land is adjoining the site proposed for the Mostafa Mor IPR

The land is bare land and does not get inundated during floods

The road to the site (Koia Bazar Road)

The road to the site (Koia Bazar Road)

222. **Impacts due to works at CWR 3.** The proposed site for CWR 3 and the Overhead Tank (OHT) is strategically located within the Afil Gate Water Treatment Plant (WTP) premises, positioned between the Afil Gate Impounding Reservoir (IPR) and the main WTP facility. This proximity to existing infrastructure ensures operational efficiency and minimizes the need for extensive pipeline connections, thereby reducing both costs and potential environmental impacts.

223. The site benefits from being within the established WTP premises, which means that no significant land preparation is required. The area is already levelled and developed, reducing the time and resources needed for site preparation activities. This also minimizes environmental disturbances, such as soil erosion or vegetation removal, during the construction phase.

224. Despite the minimal land preparation required, construction activities must be carried out with careful consideration of nearby structures within the Afil Gate WTP premises. Vibrations generated during excavation, pile driving, or other heavy construction activities could potentially affect the integrity of adjacent facilities, including the WTP, pipelines, and the IPR. It is essential to conduct a pre-construction structural assessment of nearby buildings to identify any vulnerabilities and implement measures to prevent damage.

225. To mitigate the potential impact of vibrations, modern construction techniques, such as the use of vibration-dampening equipment, should be employed. Activities like excavation and foundation work should be monitored closely to ensure vibration levels remain within acceptable thresholds. Additionally, real-time vibration monitoring equipment can be installed to detect and address any issues promptly.

226. The location within an operational WTP premises also necessitates a comprehensive construction plan to avoid disrupting ongoing plant operations. Scheduling construction

activities during non-peak operational hours and coordinating with WTP staff will be essential to ensure seamless integration of the new infrastructure without affecting the plant's water treatment functions.

227. Given the proximity to critical infrastructure, safety measures must be prioritized during construction. Proper signage, fencing, and restricted access to construction zones will help protect workers, WTP staff, and visitors from potential hazards. Regular communication with WTP management will be critical to align construction activities with plant operations.

Figure 65: Photos taken at the site proposed for CWR 3, OHT and pump house

The site proposed for the CWR and the OHT within the Afil Ghate WTP premises

The site proposed in between the Afil Gate IPR and the WTP

228. **Impacts due to works at CWR 4.** The site for CWR 4 is located on the N7: Dhaka-Khulna Highway, a major and busy thoroughfare that requires careful consideration for minimizing disruptions during construction. The project involves the demolition of an existing circular ground CWR, which was constructed approximately 40 years ago using reinforced concrete and equipped with 900 mm DI pipes. This abandoned tank, once used for storing water from a production well, has a substantial size, with a diameter of approximately 24 m and a height of about 6 m.

229. The demolition process will necessitate the removal of not only the tank structure but also its foundation, as the new CWR will be constructed on the same site. The new design involves a square ground tank, which will extend beyond the current footprint of the existing circular tank. This expansion will require additional space preparation and potentially involve minor grading or excavation around the site. The demolition and foundation removal will generate a considerable amounts of debris, including reinforced concrete and metal materials from the DI pipes, which must be managed and disposed in compliance with standards.

230. Given the proximity of the site to critical structures and areas of activity, particular attention is required to avoid disturbances:

- A mosque and school located nearby serve as a place of worship for the local community. Construction activities, particularly demolition, should not disrupt religious practices or create noise pollution during prayer times.
- The N7 highway experiences heavy traffic, both vehicular and pedestrian, necessitating robust traffic management measures to ensure safety and minimize congestion during the movement of construction equipment and materials.
- A small shop adjoining the site should not be disturbed by construction activities, as it is likely to serve the local community and could face economic impacts if access or operations are hindered.

231. Potential challenges include managing vibrations and noise during demolition and subsequent construction, ensuring the safety of nearby pedestrians and vehicles, and mitigating risks of debris falling or spreading into adjacent areas.

Figure 66: Photos taken at the site proposed for CWR 4, OHT and pump house

The existing circular ground SWR has to be demolished.

The new CWR is a square ground tank that will be extended beyond the present footprint.

The site is on N7: Dhaka-Khulna Highway

There is a mosque located nearby

232. **Common Impacts and Mitigation Measures for All Four CWRs**. Impacts due to the construction of ground-level Clear Water Reservoirs (CWRs), Overhead Tanks (OHTs), and associated pump stations across the four sites involves similar activities, leading to common environmental and community impacts. Below is a detailed overview of these common impacts and their corresponding mitigation measures.

- *Air quality deterioration*: Dust generated during excavation, material transportation, and construction activities can degrade air quality. Emissions from construction machinery and vehicles also contribute to localized air pollution.
- *Noise pollution*: High noise levels result from activities such as excavation, concrete pouring, demolition, and the use of machinery like cranes, pile drivers, and pumps. Noise may disturb nearby residents, businesses, and sensitive locations like mosques.
- *Soil erosion and sedimentation*: Excavation and soil disturbance during construction increase the risk of soil erosion. Sediments can be carried into nearby water bodies, affecting water quality and aquatic habitats.
- *Water quality impacts*: Runoff from construction sites may carry sediments, construction materials, or contaminants into nearby streams, ponds, or drainage systems, temporarily affecting water quality.
- *Waste generation*: Construction activities generate solid waste, including debris from demolished structures, concrete, metal scrap, packaging materials, and soil. Improper disposal can lead to environmental pollution.

- *Traffic disruptions*: Transport of materials and equipment to construction sites on busy roads (e.g., N7 and N709 highways) can increase traffic congestion and pose safety risks for pedestrians and vehicles.
- *Occupational health and safety risks*: Construction sites pose risks to workers, including injuries from machinery, falls, and exposure to hazardous materials. Local communities near construction zones are also at risk of accidents due to increased construction activities.
- *Impact on nearby structures and land use*: Vibrations from demolition, excavation, and construction can potentially damage nearby structures. Activities near sensitive locations, such as mosques, shops, or residential areas, may disrupt normal operations.
- *Community disturbances*: Noise, dust, and traffic disruptions can disturb local communities and businesses, particularly near market areas and mosques.

233. **Mitigation measures.** Common mitigation measures applicable to all four CWR works are given below:

-Air quality management

234. Air quality impacts during construction can be effectively mitigated by implementing dust suppression and emission control measures. Regular water spraying at excavation sites, unpaved roads, and material stockpiles will minimize dust generation. Covering loose materials during transportation and properly storing debris can further reduce airborne particles. Machinery and vehicles used during construction should comply with emission standards, and regular maintenance will ensure reduced exhaust emissions. These measures will help maintain better air quality for nearby communities and workers.

-Noise control

235. Noise pollution during construction can be minimized by limiting noisy activities to daylight hours and avoiding sensitive times, such as prayer hours near mosques. Installing noise barriers or acoustic shields around sensitive areas like residential zones and religious sites can further reduce the impact. Using modern machinery equipped with noise-dampening features and ensuring regular maintenance of equipment will help control excessive noise. These efforts will reduce disruptions to local communities and sensitive areas near the construction sites.

-Soil and sediment control

236. Preventing soil erosion and sedimentation is crucial to protect nearby water bodies and maintain site stability. Silt traps, sedimentation ponds, or geotextile barriers should be installed around construction areas to capture displaced soil and prevent it from entering nearby drains or streams. Stabilizing disturbed soil with vegetation, geotextile mats, or other erosion control techniques after construction activities will help restore site conditions and prevent long-term erosion impacts.

-Water quality protection

237. Construction runoff containing sediments, oils, or construction materials must be managed to avoid contamination of nearby water bodies. Bunds, retaining walls, and proper drainage systems should be installed to direct runoff away from water bodies and prevent spills. Wastewater generated during construction should be collected and treated before discharge. Proper storage of hazardous materials, such as oils and chemicals, in spill-proof areas, will minimize the risk of water contamination.

-Waste management

238. Proper waste segregation and disposal practices are essential to reduce environmental pollution. Construction debris should be sorted into recyclable, non-recyclable, and hazardous categories. Materials like steel, concrete, and packaging should be sent for recycling whenever possible. Hazardous waste, such as lubricants, paints, and solvents, must be handled and disposed of by certified waste management providers. A well-implemented waste management plan will ensure systematic collection, storage, and disposal of construction waste, minimizing environmental impacts.

-Traffic management

239. To address traffic disruptions caused by construction vehicles and material transportation, a detailed traffic management plan should be developed. Designated routes for construction vehicles, temporary traffic controls, and clear signage will help maintain traffic flow and pedestrian safety. Deliveries of construction materials and equipment should be scheduled during off-peak hours to reduce congestion. The presence of traffic marshals near construction sites can guide vehicles and pedestrians safely around the area.

-Worker safety and health

240. Ensuring worker safety is a critical aspect of construction management. All workers should be provided with appropriate personal protective equipment (PPE), including helmets, gloves, masks, and safety boots. Regular safety training and emergency drills will help minimize workplace accidents. First aid stations should be readily available at construction sites, and clear evacuation routes should be maintained. Strict enforcement of safety protocols will create a safer working environment for construction personnel.

-Structural integrity monitoring

241. Nearby structures must be protected from potential damage caused by vibrations during construction activities like demolition and excavation. Pre-construction surveys should be conducted to assess the structural conditions of adjacent buildings. Vibration monitoring systems should be installed during construction to ensure that vibrations remain within safe thresholds. Employing vibration-dampening techniques and equipment will further reduce risks to surrounding structures.

-Community engagement and disturbance mitigation

242. Proactive communication with local communities and stakeholders is essential to minimize disturbances during construction. Informing residents and businesses about the construction schedule and expected impacts ensures transparency and builds trust. Grievance redress mechanisms should be established to address any complaints promptly. Fencing off construction zones, providing clear signage, and maintaining access to nearby facilities such as shops and mosques will minimize disruptions to community activities.

Environmental monitoring

243. Continuous environmental monitoring during construction will help ensure compliance with regulatory standards and identify emerging issues. Parameters such as air quality, noise levels, and water quality should be regularly monitored. Monitoring results should guide adjustments to mitigation measures, ensuring that impacts are managed effectively. Incorporating real-time monitoring systems will allow for immediate action when thresholds are exceeded, ensuring better environmental management.

5. Transmission and Distribution of Water Pipelines

244. The construction of pumphouses and distribution networks is essential to address the current and future water demands of the Khulna City Corporation (KCC) area. A looping arrangement has been adopted to integrate new and existing transmission systems,

facilitating the extension of transmission mains within the KCC and extended areas, as shown in Table 37.

Table 37: Summary of pipe laying works proposed under the KWSP Phase II

Component	Description of Work	Unit	No.	Quantity/ Capacity
Existing Raw Water Pipeline from Mollahat to BWTP				
Khal Crossing for existing pipeline	1,400 mm DI (restraint joint) pipe laying under-drain works	m	1	60
New Raw Water Pipeline from Afil Gate Intake to WTP				
Raw Water Pipeline	600 mm HDPE (PN 10) Pipeline including Valves	m		1,500
	250 mm HDPE pipeline from Intake to Mostafa Mor and Mostafa Mor to Afil Gate WTP	m		12,000
Clear Water Transmission Pipeline from Afil Gate WTP				
Pipeline Works	600 mm diameter DI Pipeline	m		300
Clear Water Transmission Mains from BWTP				
DI Pipeline	900 mm	m		16,637
	800 mm	m		4,781
	700 mm	m		12,549
	600 mm	m		77
	500 mm	m		2,181
	400 mm	m		1,585
Mayur River Crossing	River Crossing by HDD Method	m	3	200
Other Drain Crossings	Canal/Drain Crossing by HDD Method	m	25	10
Distribution System Pipeline – Existing Area				
DI Pipe	400 mm	m		1,000
HDPE Pipeline works by HDD Method	400 mm	m		35,000
	315 mm	m		4,000
	250 mm	m		8,000
	200 mm	m		24,000
	160 mm	m		27,000
	110 mm	m		68,000
HDPE Pipeline works by Open cut/trench method	315 mm	m		1000
	250 mm	m		4,000
	200 mm	m		8,000
	160 mm	m		15,000
	110 mm	m		48,000
Pipeline for Production Wells	From 75 Production wells to the nearest Service Reservoirs, 250mm HDPE	m		30,000
Distribution System Pipeline – Extension Area				
DI Pipe	600 mm	m		200
HDPE Pipeline Works by HDD method	560 mm	m		6,800
	400 mm	m		7,200
	315 mm	m		1,000
	200 mm	m		15,000
	160 mm	m		35,000
	110 mm	m		70,000
HDPE Pipeline Works by open cut method	250 mm	m		20,000
	200 mm	m		10,000
	160 mm	m		24,000

Component	Description of Work	Unit	No.	Quantity/ Capacity
	110 mm	m		46,000

245. Critical crossings, such as the Khulna Bypass Road, Mayur River at three locations, and railway lines, are included in the scope of the project. The pipeline route and working areas will involve clearing the Right of Way (RoW) of crops and vegetation, with efforts made to avoid tree removal wherever feasible. Debris from construction will be carefully managed to prevent mixing with trench backfill material and to avoid obstructions in nearby areas. This ensures a clean and organized work environment. River, road, and railway crossings each present unique challenges. The Mayur River crossings will use Horizontal Directional Drilling (HDD) to minimize environmental impacts and prevent bank erosion, while road and railway crossings will employ horizontal boring techniques to reduce disturbances to traffic and public activities. Proper management of excavation spoils is necessary to avoid issues like turbidity and color changes in the river.

246. Drainage systems may be impacted if excavated trench soil is improperly stored or backfilled. Such practices could obstruct existing drainage channels and lead to waterlogging. Careful planning and timely backfilling will ensure these systems remain functional during and after construction. The fish habitat in water bodies, most of which are already polluted, may face temporary disturbances from construction activities at crossing points. Increased turbidity and sediment deposition from trenching and backfilling could further degrade water quality, necessitating precautionary measures to mitigate these effects.

247. HDD methods will significantly reduce impacts at river crossings but require stringent management of drilling fluids to prevent contamination. Riverbanks disturbed during HDD operations must be promptly restored to prevent erosion. Contractors are required to adhere to the ECR, 2023 guidelines to ensure safe and environmentally compliant operations.

248. **Impacts due to pipe laying activities.** Pipeline construction in the Khulna area involves significant interventions, including road excavation, open-cut pipeline installation, trenchless pipe installation by HDD, and work near water bodies. The associated impacts and mitigation measures for these activities are discussed below.

249. Road excavation and open-cut methods disrupt traffic flow and increase dust and noise levels. These activities often generate significant debris and waste materials that may obstruct roadways or drains. Vibrations from heavy machinery can damage nearby structures. Improper management of excavated materials can lead to sedimentation in drains or water bodies. Public safety is compromised when open trenches remain uncovered for extended periods, posing risks to pedestrians and vehicles.

250. Mitigation measures:

- Dust suppression measures, such as regular water spraying, should be implemented to minimize air pollution.
- Noise barriers and scheduling construction activities during off-peak hours can reduce community disturbance.
- Proper disposal of debris and spoil material at designated sites is essential to avoid road blockages.
- Trenches should be adequately barricaded, with clear warning signage to prevent accidents.
- Machinery should be maintained to minimize vibrations, and pre-construction surveys of nearby structures can help address potential damage.

- Additional guidelines and techniques for pipe laying to avoid/mitigate impacts are provided in **Appendix 8** and shall be followed

251. Pipe laying by trenchless Horizontal Directional Drilling (HDD) minimizes surface disturbances but generates drilling fluid and excavation spoils that can pollute nearby water bodies if improperly managed. Noise and vibrations from drilling rigs may disrupt nearby communities. The use of machinery close to sensitive areas, such as residential zones or mosques, can cause temporary inconvenience.

252. Mitigation measures:

- Proper collection, treatment, and disposal of drilling fluids in accordance with ECR, 2023 standards are critical to prevent water pollution.
- Noise-reducing equipment and vibration monitoring can mitigate community disturbances.
- Drilling schedules should be communicated in advance to nearby stakeholders, and restoration of HDD entry and exit pits should be completed promptly.
- Riverbanks should be stabilized to prevent erosion following HDD operations.

253. **Pipe laying works near water bodies***:* Pipe laying near water bodies, especially open trenching, poses risks to aquatic habitats and water quality. Open-cut trenching can increase turbidity, disturb sediment layers, and affect aquatic organisms. HDD activities can also release drilling fluids, altering water colour and quality. Unprotected excavated soils near water bodies may lead to erosion and sedimentation.

254. Mitigation measures:

- HDD should be prioritized for river crossings to reduce environmental disturbances.
- During open-cut trenching, silt barriers and sediment traps should be used to control sediment transport into water bodies.
- Excavated materials should be stored away from riverbanks to prevent runoff.
- Aquatic habitats affected by construction should be restored after pipeline installation.
- Regular monitoring of turbidity and water quality should be conducted to ensure compliance with environmental standards.

Figure 67: Photos taken during pipe laying using HDD during KWSP Phase I

Source: KWASA.

255. **Drainage congestion and roadside drain disturbances:** Pipeline construction often obstructs roadside drains, causing waterlogging and disrupting the natural drainage system. Improper backfilling and the deposition of sediments during excavation exacerbate these issues, especially in urban areas prone to flooding.

256. Mitigation measures:

- Proper planning for trench backfilling and the removal of excess spoil material is essential to maintain drainage functionality.
- Temporary drainage channels or culverts should be installed to manage water flow during construction.
- Regular cleaning of drains impacted by sedimentation will prevent waterlogging.
- The restoration of disturbed drainage systems should be a priority post-construction.

257. **Access obstruction to private property and public infrastructure.** Open trenches, stockpiles of construction materials, and machinery used for HDD or pipeline pre-laying can obstruct access to private properties, businesses, and public spaces. Access to by-roads, junctions, and essential facilities may also be restricted, causing inconvenience to residents and economic losses to businesses.

258. Mitigation measures:

- Access pathways should be maintained at all times, using temporary covers or ramps over trenches.
- Construction schedules should be coordinated with local stakeholders to minimize disruptions.
- Stockpiles of materials and machinery should be placed in designated areas away from high-traffic zones.
- Clear communication with residents and businesses will ensure better cooperation and understanding of construction activities.

259. **Impacts due to Mayur River crossing works:** The Mayur River crossing for pipeline installation can lead to minor to moderate environmental and ecological impacts. During trenching or HDD operations, soil disturbance can increase turbidity in the river, degrading water quality and altering its natural sediment balance. Improper disposal of drilling fluids and excavation spoils may exacerbate water pollution, affecting its color and chemical composition. These activities can also disturb aquatic habitats, displacing organisms and damaging benthic ecosystems, which are already vulnerable due to existing urban pollution. Construction near the riverbanks poses risks of erosion, destabilizing the banks and potentially impacting adjacent land use. Additionally, runoff from stockpiled soil and accidental spills of construction materials or fuel can further pollute the river. Disruptions to community access or navigation along the river may occur, affecting local livelihoods and daily activities.

Figure 68: three locations where pipelines crosses Mayur River

Mitigation measures for Mayur River crossing

- Mitigation measures are essential to minimize the environmental and community impacts of the Mayur River crossing.
- To control turbidity, silt curtains and sediment barriers should be deployed. HDD operations must include sediment containment at entry and exit points.
- Riverbanks must be stabilized post-construction using geotextiles, riprap, or vegetation to prevent erosion. Drilling fluids should be properly collected, treated, and disposed of in compliance with ECR, 2023 guidelines.
- Construction materials, fuels, and lubricants must be stored in spill-proof areas, with bunds installed to prevent runoff during rainfall.
- Scheduling construction outside sensitive periods for aquatic organisms and restoring habitats with native vegetation post-construction will reduce ecological impacts.
- Community engagement is vital to inform residents of construction schedules, ensuring alternative navigation routes and maintaining public safety near construction zones.
- Regular monitoring of turbidity and water quality throughout the project will ensure compliance with environmental standards.

260. **Impacts due to Railway line crossing works**. There are two locations where the transmission mains cross the railway lines: Crossing the N709 Road (Khulna Bypass Road) and Crossing the N7 (Khulna-Jashore Road at Fulbari Gate). The construction of the transmission main across railway lines using HDD may pose risks to workers and construction vehicles operating near active railway tracks. Although the HDD method minimizes surface disturbances, the proximity to the railway line and the presence of moving trains increase the risk of accidents. Vibrations and noise generated by trains can affect worker concentration and safety. Additionally, improper management of drilling fluids and excavation spoil at the entry and exit points can cause localized environmental impacts. Despite these risks, the

presence of auto rail gates and sirens at both locations enhances safety by providing timely alerts for oncoming trains.

261. **Mitigation measures**. Strict safety protocols must be implemented to mitigate risks during HDD operations near railway lines. Workers should receive comprehensive training on railway safety procedures and clear communication channels with railway authorities must be established to monitor train schedules and avoid construction during peak train movements. Drilling sites should be well-secured with barriers and signage to restrict unauthorized access and ensure worker safety. Drilling fluids must be contained and disposed of according to ECR, 2023 guidelines to prevent environmental contamination. The existing auto rail gates and sirens should be regularly checked to ensure proper functionality and additional safety personnel can be deployed to monitor and guide construction vehicles at these critical locations.

262. **Impacts due to road restoration works soon after construction of pipelines.** Road restoration works for the Khulna water supply project involve significant lengths and areas (See Table 38 for the lengths of roads and HDD pits), including resurfacing and rehabilitation of roads affected by pipeline laying. These activities contribute to environmental and community impacts. The restoration process is energy-intensive, involving the use of fossil fuels for mining, transportation, and paving, directly contributing to greenhouse gas emissions. Vehicle emissions during construction indirectly increase air pollution and noise levels, affecting local communities. Additionally, road work often obstructs pedestrian movement and access to nearby properties, posing risks of accidents for both pedestrians and construction workers. Traffic delays and congestion during restoration activities can inconvenience commuters and disrupt local economic activities. Without proper planning, these issues can escalate, leading to long-term dissatisfaction among affected communities.

Table 38: The summary amount of road restoration work

Road Restoration Works				
Clear water Trans. Pipeline	2-m width stretch, 36 km length	m^2		72,000
Dist. DI Pipeline	2-m width stretch, 51 km length	m^2		102,000
Dist. HDPE-HDD Pits	9 m^2 pit size, 50% of 250 km length, 200 m	m^2		5,625
Dist. HDPE- Open trench	1.5-m width stretch, 176 km length	m^2		264,000
Afil Gate Scheme and Production Well Pipeline	2-m width stretch, 33.5 km length	m^2		67,000

263. **Mitigation measures for road restoration work.**

- Use recycled materials. Incorporate reclaimed asphalt and other recycled materials to reduce the demand for virgin resources and lower environmental impacts.
- Utilize concrete mixes with reduced embodied carbon to minimize greenhouse gas emissions during construction.
- Opt for warm-mix asphalt, which requires less energy during production compared to traditional hot-mix asphalt.
- Ensure road restoration accounts for climate change impacts, such as increased rainfall and temperature extremes, by incorporating proper drainage systems and slope stability measures.
- Design roads to withstand extreme weather conditions like floods, storms, and heatwaves to ensure long-term durability.

- Establish native plant species along roadsides to support biodiversity, improve aesthetics, and create ecological corridors.
- Create green buffers between roads and sensitive areas such as wetlands, rivers, and residential zones to reduce noise pollution and enhance environmental quality.
- Install effective sound-absorbing or reflecting barriers near residential areas to mitigate noise pollution from traffic.
- Disruptions: Plan and designate alternative routes for commuters and provide clear signage to manage traffic flow during restoration activities.
- Ensure safe pathways for pedestrians by installing temporary walkways and properly barricading construction zones.
- Collect and dispose of construction debris responsibly, ensuring it does not obstruct drainage systems or affect surrounding areas.
- Inform local communities in advance about restoration schedules and expected disruptions to foster cooperation and minimize inconvenience.
- Conduct frequent inspections of construction activities to assess air quality, noise levels, water quality, and ecological impacts, ensuring compliance with environmental standards.
- Replant native vegetation and improve soil health in areas disturbed by construction to restore ecological balance post-construction.
- Provide safety equipment and regular training to construction workers to reduce accidents and ensure occupational health and safety standards are upheld.

264. **Common impacts and mitigation measures for pipeline construction**

(i) *Air, Noise, and Vibration Impacts:* Pipeline construction generates dust, noise, and vibrations, impacting air quality and disturbing local communities. Prolonged exposure can lead to health issues for workers and nearby residents. Vibration from machinery may also damage nearby structures. Mitigation involves dust suppression through regular watering and covering loose materials. Noise-reducing equipment, scheduling of high-noise activities during daylight hours, and vibration monitoring will help minimize impacts. Pre-construction surveys of nearby structures can address vibration-related risks.

(ii) *Surface and groundwater pollution:* Construction activities can pollute nearby water bodies through runoff, sedimentation, or accidental spills of hazardous materials. Groundwater quality may also be affected by excavation. Mitigation includes using silt barriers, sedimentation traps, and bunds to control runoff. Proper storage and disposal of hazardous materials, such as oils and lubricants, are essential to prevent contamination.

(iii) *Surface drainage and soil erosion:* Excavation and material stockpiling can obstruct drainage systems and lead to soil erosion, especially near water bodies or on sloped terrain. Mitigation measures include creating temporary drainage channels and stabilizing disturbed soil areas with vegetation or geotextile mats post-construction.

(iv) *Waste management and disposal:* Pipeline construction generates solid and liquid waste, including excavated material, packaging, and drilling fluids. Improper disposal can cause environmental pollution. Mitigation include: Segregation of waste into recyclable, non-recyclable, and hazardous categories is essential. Recycling materials where feasible and disposing of waste at designated facilities will minimize environmental impacts.

(v) *Labour camps and material stockpiling:* Temporary labor camps and material stockpiles can disturb nearby communities and landscapes if not properly

managed. Mitigation include: Camps should be located away from residential areas, with proper sanitation and waste disposal facilities. Stockpiles should be organized, covered, and placed in designated zones to avoid visual clutter and environmental disturbance.

(vi) *Occupational and public health and safety:* Construction sites pose risks to workers and the public, including accidents, injuries, and exposure to hazardous materials. Mitigation include: Providing personal protective equipment (PPE), regular safety training, and clear signage will ensure worker safety. Public access to construction zones should be restricted with fencing and warning signs.

(vii) *Disturbance to visual and landscape aesthetics:* Construction activities, including trenching and stockpiling, temporarily alter the visual aesthetics of the area, especially in urban or scenic locations. Mitigation involves restoring disturbed areas post-construction by leveling, revegetation, and proper disposal of waste materials.

(viii) *Ecological impacts:* Pipeline works near water bodies or green spaces can disrupt local flora and fauna. Mitigation include: Avoiding tree cutting, restoring disturbed habitats, and using HDD techniques for sensitive crossings will minimize ecological impacts. Regular monitoring of affected areas will ensure the ecological balance is restored.

6. Construction of new and rehabilitation of production wells

265. It is planned to construct and/or rehabilitate KWASA Production wells (75 numbers) These wells are strategically placed to ensure optimal integration with the broader transmission and distribution network, addressing the growing water demand in both existing and extended service areas. Each production well is connected to the nearest service reservoirs using 250 mm HDPE pipelines, spanning a total length of 30,000 m. This pipeline network forms an integral part of the looping arrangement, enhancing the system's resilience and ensuring efficient water supply across the service area. These production wells play a pivotal role in providing raw water for treatment or direct supply through reservoirs. The feasibility study and the IEE report highlight key operational and environmental considerations for the production wells. Groundwater depletion and contamination risks are potential concerns, necessitating regular monitoring of groundwater levels and quality. Adherence to environmental standards and sustainable extraction practices is essential to mitigate these risks and ensure the long-term viability of groundwater resources. Proper management of drilling operations, well maintenance, and monitoring protocols will be critical to minimizing environmental impacts while optimizing water extraction efficiency.

266. **Impacts due to the construction of production wells.** Construction phase is associated with various environmental and community impacts due to the extensive drilling, associated infrastructure development, and site-specific activities.

(i) Drilling operations generate significant noise and vibration, which can disrupt nearby communities, particularly in residential or sensitive areas such as schools, hospitals, or places of worship. The use of heavy machinery and drilling rigs produces continuous noise exceeding permissible levels if not adequately managed. Vibrations caused by drilling can potentially impact nearby structures, particularly older buildings, and may raise concerns among residents regarding structural safety.

(ii) Drilling activities produce large quantities of slurry and waste materials, including drilling mud and cuttings. If improperly managed, these materials can clog nearby drainage systems, contaminate soil, or degrade water quality in adjacent water bodies. Improper disposal of drilling waste can lead to public health concerns and environmental degradation.

(iii) Many of the identified well sites are located in areas with narrow access roads and dense urban layouts. The transportation of drilling rigs, pipes, and associated equipment to these sites can cause traffic congestion, leading to delays and disruptions for local residents. Temporary road closures may exacerbate these challenges, particularly during peak traffic hours, affecting mobility for nearby communities.

(iv) Earthworks and drilling activities generate dust, which can affect air quality, particularly during the dry season. Vehicle movement associated with material transport further contributes to air pollution through exhaust emissions and road dust. Such conditions pose respiratory risks for nearby residents and workers if not adequately controlled.

(v) Drilling fluids, if not handled properly, can leach into the soil and potentially contaminate groundwater. Improper storage of fuels, lubricants, and chemicals on-site may also pose contamination risks. Furthermore, the disposal of construction waste and residual slurry poses risks of soil erosion and pollution if not managed systematically.

(vi) Drilling sites located near residential or commercial zones can disrupt daily activities. Noise, dust, restricted access and heavy vehicle movement can inconvenience residents and create temporary discontent within the affected communities. Public concerns over safety, particularly near schools and hospitals, may increase resistance to the project.

267. **Mitigation measures**. To address and minimize these impacts, a comprehensive set of mitigation measures will be implemented during the construction phase.

(i) To mitigate noise and vibration impacts, low-noise equipment will be used wherever feasible, and all machinery will be fitted with noise-dampening devices. Drilling activities will be restricted to daytime hours to minimize disturbance to nearby communities. Pre-construction assessments will identify sensitive structures, and appropriate measures, such as vibration-dampening techniques, will be applied. Regular monitoring will ensure compliance with permissible noise and vibration levels.

(ii) A systematic approach to waste management will be adopted. Drilling slurry will be collected and stored in designated containment areas to prevent spillage. A waste disposal plan will be developed to ensure safe and environmentally compliant disposal at approved facilities. On-site treatment of drilling mud will be considered to minimize environmental impacts.

(iii) To mitigate traffic disruptions, construction schedules will be planned to avoid peak traffic hours, and alternative access routes will be provided where necessary. Traffic marshals will be deployed at key intersections to regulate the movement of heavy vehicles and minimize congestion. Clear communication with local communities will ensure that residents are informed about temporary road closures and alternative routes.

(iv) Dust suppression measures, including regular spraying of water on exposed soil and drilling areas, will be employed. Transport vehicles will be covered to prevent the release of dust and debris. Equipment and vehicles will be maintained regularly to minimize emissions, and air quality monitoring will be conducted to ensure compliance with prescribed standards.

(v) Chemicals, fuels, and drilling fluids will be stored in impermeable, well-contained areas to prevent spills or leaks. Emergency response plans for spill management will be in place, and training will be provided to workers on handling hazardous materials. Drainage systems will be equipped with silt traps to prevent runoff from entering nearby water bodies. Groundwater monitoring will ensure that contamination risks are promptly identified and addressed.

(vi) Local communities will be engaged throughout the construction phase to address their concerns and ensure transparency. Safety measures, including fencing around construction sites and visible warning signage, will be implemented to prevent accidents. Public consultations will provide updates on construction activities and measures taken to minimize disturbances.

5. Solar power generation

268. The project will include renewable energy generation through the installation of floating solar panels and rooftop solar systems. A total of 1.5 MW of electricity will be generated using floating solar panels on the impounding reservoirs (IPRs) at the Bangabandhu WTP (BWTP) and Afil Gate WTP. An additional 2.275 MW of electricity will be generated using rooftop solar systems installed on all 11 distribution reservoirs, bringing the total solar power generation capacity to 3.375 MW. The integration of solar power into the project reduces dependence on conventional energy sources, thereby lowering the carbon footprint of the water treatment and distribution system. Floating solar panels on the IPRs also have added benefits, such as reducing evaporation from the surface and mitigating algal growth by blocking sunlight. This can enhance water quality in the reservoirs and reduce the frequency of maintenance required for water treatment.

269. The use of renewable energy reduces operational costs associated with water treatment and distribution by lowering electricity bills and providing long-term financial savings. The project demonstrates a commitment to sustainable development and renewable energy integration, aligning with national and international climate goals. Additionally, local communities may benefit from awareness and potential job opportunities associated with the operation and maintenance of solar installations. The solar power generation component of the project not only contributes to environmental sustainability but also provides operational and economic advantages. The floating and rooftop systems are efficient, low-impact solutions that support the overall project objectives of enhancing energy efficiency and reducing greenhouse gas emissions.

270. **Construction impacts**. The construction phase for installing floating panels and rooftop systems may temporarily impact the surrounding environment. Activities such as transporting materials, assembling solar panels, and securing them on rooftops or reservoir surfaces could generate noise and dust. However, these impacts are expected to be minimal and short-term, given the modular nature of solar panel installation. Measures such as controlling dust emissions, limiting noise, and careful scheduling of construction activities will mitigate these impacts.

271. **Operational impacts.** During operation, solar power systems are expected to have negligible environmental impacts. Floating panels may marginally affect the reservoir's ecosystem by altering light penetration and thermal dynamics, but these effects are generally minimal and localized. Periodic cleaning of panels to maintain efficiency could require small amounts of water and labor but poses no significant operational challenges. The service life of solar panels is generally 25-30 years, after which many crystalline silicon solar panels will start experience a significant dip in energy production. This affects the power generation and needs to be discarded and replaced with new panels. Solar PV modules are made up of PV cells, which are most commonly manufactured from silicon. Panels mainly consists of glass (75%-90%), followed by plastic, alluminum, silicon, metals etc. The composition of which vary from a silicon-based PV panel to thin film-based PV panel. Heavy metals such as cadmium and lead are found in solar cells, which can harm the natural environment if they are not recycled or disposed of properly. Recycling of discarded end-of-life panels will enable recovering as much material from solar panels as possible e.g., frame and junction box, glass and the silicon wafer, separation and purification of the silicon cells and specialty

metals (e.g., silver, tin, lead, and copper). KWASA shall follow the rules applicable for reuse or disposal of solar panels.

272. Mitigation measures for solar power generation impacts:

(i) To mitigate environmental impacts during construction, ensure firm scheduling of material transport and panel installation to minimize disruption. Dust emissions should be controlled by watering access roads and construction areas, and noise should be managed by restricting activities to daylight hours. For floating solar panels, regular monitoring of the reservoir's thermal and light penetration changes should be conducted to ensure minimal ecological disruption.

(ii) Workers involved in installing rooftop and floating solar systems must follow safety protocols, including using personal protective equipment (PPE) and adhering to proper installation techniques. Ensure that scaffolding and access systems for rooftop installations are secure to prevent accidents. For floating panels, special care must be taken to avoid contamination of reservoir water during installation activities.

(iii) Establish a maintenance schedule for cleaning solar panels to optimize energy output while minimizing water use. Use eco-friendly cleaning agents to prevent contamination of reservoir water. Floating solar systems should be inspected regularly for any structural issues or damage to the anchoring systems.

(iv) Properly manage waste generated during panel installation and replacement. Ensure that damaged or expired solar panels are removed and stored temporarily in an identified place preventing contact with soil or water. Appropriate personal protection equipment (PPE) shall be used. Waste shall be disposed of in compliance with environmental regulations, exploring partnerships with certified recycling facilities where available. This will help minimize the environmental footprint of solar waste. Maintain records of discarded /end-of-life solar panels.

(v) Conduct community awareness programs to explain the benefits of solar power integration and address any concerns about visual impacts or perceived disruptions. Engage local stakeholders in the project's renewable energy goals to build support and foster understanding of its environmental and economic benefits.

6. Vertical expansion of KWASA HQ Administration Building

273. **Impacts.** The proposed vertical expansion of the KWASA Administration Building by adding a seventh floor with a floor area of 6,000 sq. ft. presents a range of construction-related challenges. The restricted space within the KWASA premises for material storage and construction activities complicates logistics. **Coordination** of deliveries and on-site storage is essential to avoid interfering with office operations and ensuring safety. The continuous presence of employees, public visitors, and parked vehicles on the premises heightens the potential for disruptions and safety risks.

(i) Dust, noise, and vibration generated during construction are significant concerns. Dust from construction materials such as cement and sand can affect indoor air quality, posing respiratory risks to employees and visitors. Noise from machinery and tools, if not controlled, may exceed the acceptable limit of 75 dB(A) during daytime as per the Bangladesh Environment Conservation Rules (ECR), 1997, disrupting office productivity. Vibration from activities such as drilling and concrete pouring could cause structural wear and tear, potentially leading to cracks or damages in the existing building.

(ii) The movement of workers within the premises may disturb daily operations, compromise security, and inconvenient employees and visitors. Limited pathways for public movement due to construction activities could result in crowding and safety hazards. Disposal of construction debris is another pressing issue, as the lack of dedicated temporary storage space may lead to accumulation in inappropriate areas, creating obstructions and environmental concerns. Improper debris management could also violate the Bangladesh Environmental Conservation Act, 1995, which mandates the safe handling and disposal of construction waste.

(iii) Additionally, the existing building may experience minor damage such as cracks, chipped paint, or loosened fittings during the construction process. This damage will need immediate repairs to prevent further deterioration. Utilities such as water, electricity, and communication lines might also be disrupted during construction, causing inconvenience to building occupants and impacting daily operations. Such disruptions could contravene service-level agreements with utility providers, underscoring the need for effective planning.

(iv) Construction activities also pose potential safety risks to workers and others within the premises. Without proper safety measures, the likelihood of accidents, including slips, trips, and falls, increases. Regulatory compliance with the Bangladesh National Building Code (BNBC), 2020, and the Labour Act, 2006, is essential to ensure workplace safety.

274. **Mitigation Measures**.

(i) Given the restricted space, materials should be delivered in batches and stored in well-organized, designated areas. Construction zones must be clearly marked and cordoned off to prevent unauthorized access. Pathways for employees and visitors must remain clear, and access control mechanisms should be employed to ensure safe and efficient movement within the premises. Deliveries and heavy construction activities should be scheduled during off-peak hours to reduce disruption.

(ii) Dust suppression measures should include the regular spraying of water on dusty areas and the use of dust screens around construction sites. To comply with the ECR, 1997, dust emissions must be limited to 200 $\mu g/m^3$ in work areas and indoor air quality should be monitored to ensure compliance with permissible limits. Noise levels should not exceed 75 dB(A) during daytime and must be reduced using noise-dampening equipment or barriers. Vibrations must be monitored to ensure they remain within structural safety thresholds, typically 5 mm/s as per international standards (BS 7385 and DIN 4150-3) for occupied structures, and temporary supports should be installed to protect the existing building.

(iii) Construction debris must be stored in covered containers and promptly removed from the site. Disposal should be conducted in compliance with the Bangladesh Environmental Conservation Act, 1995, using authorized facilities or recycling programs where possible. Spillage during transportation must be avoided, and proper documentation of waste handling should be maintained to ensure regulatory compliance.

(iv) Pre-construction surveys should identify and map all utility lines to avoid accidental disruptions. Protective barriers should be installed to safeguard water pipes, electrical conduits, and communication lines. Immediate repair protocols must be established with utility providers to minimize downtime in case of accidental damage. Structural assessments of the existing building should be conducted before construction, and protective measures such as vibration dampeners and scaffolding support should be implemented. Post-

construction repairs, including repainting and structural touch-ups, will restore the building to its original condition.

(v) Workers must be provided with appropriate personal protective equipment (PPE) and trained in safe work practices, including fall protection measures and emergency response protocols. The BNBC, 2020, mandates workplace safety standards that must be enforced, such as securing scaffolding and limiting construction activity to designated zones. Employees and visitors should be informed about construction timelines and access restrictions through notices and signage to minimize inconvenience.

(vi) Regular environmental monitoring for noise, air quality, and vibration levels should be conducted to ensure compliance with national regulatory standards. Reporting mechanisms should be established to address any grievances from employees or the public promptly. By implementing these mitigation measures, the impacts of vertical expansion can be managed effectively, ensuring safety, environmental compliance, and minimal disruption to KWASA operations.

7. Common construction phase impacts and mitigations applicable to all the project components

275. **Impacts related to source of materials***:* The extraction of construction materials such as sand, aggregate, and cement can disrupt natural landforms, leading to erosion, altered drainage patterns, waterlogging, and habitat degradation. Transportation of materials can also generate dust and vehicular emissions, further affecting local air quality.

276. Mitigation:

- Develop and implement a detailed Material Management Plan (MMP) to ensure sustainable sourcing and minimize environmental Impacts.
- Source materials from authorized and environmentally approved licensed material sources, avoiding ecologically sensitive zones.
- Track material use through a materials register to reduce wastage and ensure accountability.
- Use recycled or locally available materials wherever feasible to minimize environmental degradation.

277. **Land scape and visual Impacts**: Clearing vegetation and using heavy machinery for excavation and construction can alter the natural landscape, degrade scenic beauty, and disturb ecosystems. These changes may be visually intrusive, especially near residential and sensitive areas.

278. Mitigation:

- Minimize vegetation clearing and ensure replantation with native species after construction.
- Phase construction activities sequentially to reduce prolonged disturbances at any location.
- Engage professional landscapers to restore areas impacted by construction and maintain vegetation for two years after completion.

279. **Impacts due to construction camps, stockpile areas, and storage sites.** The establishment of construction camps and stockpile areas can lead to waste generation, pollution, and strain on local resources. Mismanagement of hazardous materials poses a risk to soil and water quality.

280. Mitigation:

- Site construction camps in consultation with local authorities to avoid conflict with residential or sensitive areas.
- Provide sanitation facilities, wastewater collection systems, and proper drainage in camps.
- Store hazardous materials in designated bunded areas with spill containment systems.
- Segregate waste at the source and ensure regular collection and disposal in accordance with municipal guidelines.

281. **Impacts on surface water quality***:* Construction activities near water bodies, such as material transport, trenching, and accidental spills, may result in sedimentation, turbidity, and contamination. Improper disposal of wastewater can exacerbate these Impacts.

282. Mitigation:

- Install silt traps and sedimentation basins near watercourses to control runoff.
- Maintain a safe buffer zone (minimum 50 m) between storage areas and water bodies.
- Collect and treat domestic wastewater from construction camps using septic tanks or wastewater treatment units.
- Prohibit the discharge of untreated water or pollutants into natural water bodies.

283. **Air and dust pollution.** Dust generation from excavation, material handling, and vehicle movement can reduce air quality and affect respiratory health. Emissions from construction machinery and vehicles add to the pollution burden.

284. Mitigation:

- Conduct regular water spraying on active construction sites, stockpiles, and access roads.
- Cover all material transport vehicles with tarpaulins to prevent spillage and dust.
- Maintain machinery and vehicles to minimize emissions and comply with air quality standards set by Bangladesh DOE.
- Monitor air quality regularly to ensure compliance.

285. **Noise pollution**: Noise from construction equipment and activities, such as piling, excavation, and material transport, can disturb nearby residents, office workers, and sensitive receptors like mosques, schools and hospitals.

Table 39: Typical Noise Emission from Plant and Equipment

Type of Equipment	Distance between equipment and observer			Standard for the Project (Commercial Areas)	
	5 m	20 m	50 m	Day	Night
Loader	90	78	70	70	60
Grader	90	78	70	70	60
Vibration Roller	86	74	66	70	60
Bulldozer	86	74	66	70	60
Generator	98	86	78	70	60
Impact Drill	87	75	67	70	60
Concrete Mixer	91	79	71	70	60
Concrete Pump	85	70	62	70	60

Type of Equipment	Distance between equipment and observer			Standard for the Project (Commercial Areas)	
	5 m	20 m	50 m	Day	Night
Pneumatic Hammer	84	86	78	70	60

All units are in dB(A).

286. Mitigation:

- Restrict noisy construction activities to daytime hours (7:00 AM to 7:00 PM).
- Install temporary noise barriers around construction zones near sensitive receptors.
- Use modern, low-noise machinery equipped with silencers.
- Provide noise-protection equipment (earplugs, earmuffs) to workers exposed to high noise levels.

287. **Waste management**: Construction generates a mix of solid and liquid waste, including hazardous materials like used oil, paints, and solvents. Improper disposal can lead to soil and water contamination and health hazards.

288. Mitigation:

- Develop and implement a Waste Management Plan (WMP) with clear procedures for waste segregation, storage, and disposal.
- Ensure hazardous waste is stored in bunded, secure areas and disposed of at licensed facilities.
- Maximize the reuse and recycling of construction materials, such as using excavated soil for backfilling.
- Avoid open burning of waste and ensure timely disposal of all non-recyclable waste.

289. **Impacts due the disposal of surplus materials.** Wherever the material excavated from pipeline trenches is suitable, it will be reused, as general backfill, for example, around inspection chambers. It is not expected that surplus material will need to be sent to a municipal landfill. Under the project, 60–70% of sewer pipe will be laid, adopting a trenchless method, which will minimize the disposal of surplus materials. However, any potential excess spoil will impact surrounding areas, particularly the streets and drainage, if no proper measures are put in place.

290. Mitigation. Excavated soil during pipe network excavation and pipelaying activities will be managed and stored appropriately on site with all the proper safety measures to contain them, prevent possible siltation of nearby drainages, and prevent disturbance to community people, including pedestrians. Most, if not all, the excavated soil will be re-used as backfill materials once pipelaying is done. The disposal of excess spoil, if any, including construction materials and debris, shall be carried out in accordance with the construction waste management plan to be prepared by the contractor and approved by the KWASA through the PMU prior to the commencement of work. The normal manner of disposal shall include all necessary precautions for minimizing water and air pollution, drainage impedance, the risk of fire, and damage to ecosystems.

291. **Impacts due to drainage congestion** drainage due to improper disposal of construction debris can lead to waterlogging, localized flooding, and public health risks, especially during the monsoon season.

292. Mitigation:

- Adopt a site clearance procedure to segregate and store topsoil for reuse.
- Ensure construction waste and debris are stored away from drainage paths.
- Install temporary drainage systems to manage runoff during construction.
- Regularly inspect and clean drains to prevent blockages.

293. **Impacts on flora and fauna.** There are no game reserves or wildlife sanctuaries located along the project area, only disturbance from the visual impacts, vehicles and construction equipment may cause disruption of wildlife activity such as breeding and/or feeding. The project will have a minor negative impact on the fauna present in the project area. However, the critical habitat assessment for the project identified that the Bhairab and Madhumathi River system is a critical habitat for the South Asia River Dolphin species. As part of the assessment, all aspects of project components and implementation methodologies have been evaluated to understand if any of these aspects will negatively impact such critical habitat, in particular the Bhairab and Madhumathi River systems. The assessment reveals that none of the components and/or procedures and methodologies considered at all phases of project implementation (pre-construction, construction and operation) will negatively impact the river system. Further assessment reveals that the project itself is regarded as an initiative that will have a direct beneficial impact (i.e., protection) on the critical habitat due to the reduction of pollution load to the river system once the project is put in place in the future.

294. Mitigation: The following mitigation measures, however, will be implemented:

- Setting up and implementing a code of conduct for workers, including no catching or hunting fish and wildlife and no consumption of wildlife products
- While clearing vegetation, it must be ensured that no wildlife is injured and/or die
- Minimize the release of oil, oil wastes or any other substances harmful to aquatic species to any waters, particularly to the Bhairab and Madhumathi rivers.
- New and good-condition machinery with minimum noise will be used in the construction
- Construction work that may generate high noise levels will not be carried out during nighttime so that there would be no disturbance to local birds and animals
- Provide adequate knowledge to the workers regarding the protection of flora and fauna and relevant government regulations and punishments for illegal poaching

295. **Socio-economic Impacts.** Construction works may result in temporary loss of livelihoods and interruption of social and economic activities. If sewerage network installation is conducted in areas where there are shops or other commercial activities, these could lose business while the work is conducted if access is difficult for customers.

296. Mitigation:

- Establish a Grievance Redress Mechanism and respond to grievances
- Trenchless methods shall be used in areas where there are shops or other commercial activities
- The construction works must not interfere with the convenience of the public or with 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 the use of pedestrians and light vehicles
- In critical areas such as institutions, operating hours are factored into work schedules and the workforce is increased for speedy completion
- Advance information on works to be undertaken, including appropriate signage, is provided
- The diversion is done in coordination with the traffic police division for the necessary rerouting of traffic and traffic management.

297. **Income / job opportunities and prevention of potential conflicts by employing local persons.** Primarily a positive impact, the project will create significant temporary employment for construction workers, equipment maintenance and support staff. While a small number of senior project managers may come from overseas and other specialists from elsewhere in Bangladesh, most project staff are expected to be recruited locally from within the native/local workforce. The number of temporary jobs created during the construction period is likely to be 1,000–1,200. Contractors shall give preference to local workers as far as possible.

298. **Disruption of public access.** In addition to the general disruption of communications, pipe laying will result in temporary loss of access as work progresses past individual property entrances. This will be most serious when crossing roads and in front of public buildings and emergency service centers.

299. Mitigation: Disruptions to public access shall be identified in the contractor's traffic management plan, under which suitable notice of intended delays and closures is given to all concerned parties and approved prior to commencing work. Notwithstanding this, all road closures shall be separately notified and agreed upon with the KCC and KWASA as appropriate and through notices posted throughout the affected area at least 48 hours in advance of the proposed closure. Partial closures and traffic delays managed with temporary traffic lights or flagmen need not be separately notified.

- Prepare alternative transportation routes. The diversion shall be done in coordination with the traffic police division for the necessary rerouting of traffic and traffic management
- Consult with businesses and institutions for work schedules. In critical areas such as schools or hospitals, operating hours are factored into work schedules and the workforce is increased for speedy completion
- The period between trench opening and temporary reinstatement should not exceed 48 hours. It is recognized that extraordinary circumstances will occasionally arise, and this period may be extended to four days with the approval of the Engineer. Excavations for inspection chambers in roads shall not remain open for longer than 10 days.
- Access to or from an individual property closing for a period of 2 hours or more. The owner shall be informed at least 24 hours in advance
- Post display board about the nature, duration of construction and contact for complaints
- Schedule material deliveries during low traffic hours
- Restore damaged properties and utilities
- Erect and maintain barricades if required

- Pedestrian access to schools, public libraries, courts, doctor's surgeries, pharmacists, and other premises frequently by the public will be maintained with the use of walking boards. Wheelchair and disabled access shall be maintained.
- All surfaced roads shall be subject to road cleaning and unsurfaced roads to dust suppression, the methodology and frequency of which shall be included in the traffic management plan.

300. **Traffic related impacts – control and safety.** The excavation of trenches and pipe installation along main roads within the city will result in considerable and unavoidable delays to traffic flows. The impact upon vehicular movement will generally be confined to increased journey time and the costs associated with delays, which in most cases will only be a minor inconvenience. Delays will be most noticeable during morning and evening peak 'rush hours' even though these are relatively modest across the city, though the intensity is becoming severe in central business areas of the city at present.

301. ***Mitigation:*** This impact is temporary but highly significant and will cause adverse impacts on all road users. Therefore, the Contractor shall:

- Detailed Traffic Management Plans will be prepared before taking up any construction work and submitted to the Engineer for approval, five days prior to commencement of work on any section of road.
- Contractors should inform the traffic police authority before starting road cutting/excavation. In view of this, dedicated liaison personnel may be appointed to communicate with traffic police.
- Provide, erect and maintain barricades, signs, markings, flags, lights and flagmen as may be required for the information and protection of traffic. The flagmen shall be equipped with red and green flags and lanterns/lights.
- Plan and conduct work in such a way that it can be completed in 6–8 hours with as little as possible traffic interruption, so all this work (and probably most of the daytime work in minor roads) will be conducted by small teams of men, working on short lengths of the network (around 100 - 150 m) at a time.
- Construction should avoid seriously hampering traffic movement, especially at intersection points; thus, trenching should be done at night in busy road sections.
- Construction equipment and materials shall be removed from the busy roads at the end of the night shift.
- Where ramps, temporary carriageways and walkways are required, they should be provided and maintained to a standard suitable in all respects for the class or classes or traffic or pedestrians. These must be kept usable by women, children, patients and people with disabilities.
- An emergency response plan must be prepared for any traffic accident during construction.

302. **Impacts on Physical Cultural Resources.** There are no physical cultural resources (PCRs) listed in the UNESCO World Heritage list of archaeological sites along the entire project alignment. This is confirmed by a mapping of PCRs done for Khulna city. But based on this mapping, there are various socio-cultural and religious establishments such as churches, mosques, and educational institutes like schools and colleges in the area. During construction activities, these socio-cultural establishments may be impacted by noise and dust pollution. Accessibility to these institutions may also be hampered during the construction phase.

303. The project sites are not potential archaeological areas and therefore no impact is envisaged. However, as a precautionary approach, measures or protocols for chance finds will be followed by the project.

304. Mitigation: This impact is temporary and minor in nature. Mitigation measures will include:

- Facilitating access using alternative routes or by using planks with handrails during excavation and construction, including timely completion of construction works
- Establishment of construction site camp and labor camp, maintaining proper distances from the cultural sites
- Affecting dust and noise control measures provided in the EMP and
- In the event of a chance finds, the following measures shall be strictly adopted by the contractor:
    a. strictly follow the protocol by coordinating immediately with PMU and the Bangladesh Department of Archaeology for any suspicion of chance finds during excavation works.
    b. stop work immediately to allow further investigation if any finds are suspected; and
    c. request an authorized person from the Bangladesh Department of Archaeology to observe when excavation resumes for the identification of the potential chance find and comply with further instructions.

305. **Occupational health and safety Impacts**: Workers face risks of accidents from heavy machinery, exposure to dust and noise, and handling hazardous materials. Poor working conditions can lead to long-term health issues.

Mitigation:

- Adhere to the Bangladesh Labor Act, 2006, and WHO guidelines on occupational health and safety.
- Prepare and implement a health and safety plan
- Provide workers with PPE, including helmets, gloves, safety boots, and hearing protection.
- Conduct regular safety training and health check-ups for workers.
- Maintain first-aid facilities, fire extinguishers, and emergency response protocols at construction sites.

306. **Community health and safety Impacts:** Construction activities may increase risks to the local community, including traffic congestion, accidents, and disruption of daily activities. Noise and dust may further impact community well-being.

307. Mitigation:

- Implement a Traffic Management Plan to regulate vehicular movement and minimize disruption.
- Use proper signage and barricades to ensure public safety around construction sites.
- Schedule material transport during off-peak hours to reduce traffic congestion.
- Notify local communities of construction schedules in advance and provide alternative access where necessary.

308. **Improper closure or reinstatement of working areas**: Construction areas left unrestored can lead to long-term environmental degradation and aesthetic issues, impacting the local community and ecosystem.

309. Mitigation:

- Reinstate all disturbed areas to their original condition or better upon completion of construction.
- Remove all construction debris, temporary infrastructure, and materials promptly.
- Ensure replanting native vegetation to restore ecological balance and enhance aesthetic value.

E. Anticipated Impacts – Operations and Maintenance Phase

1. O&M of pipelines, sumps and pump stations

310. The operation and maintenance (O&M) activities associated with the newly constructed pipelines, sumps, and pump stations under the Khulna Water Supply Project (KWSP) Phase II are essential for ensuring the reliability and efficiency of the water supply infrastructure. These activities include leak detection and repair, periodic pipeline flushing, descaling, and pump maintenance. Additional impacts arise from the operation of intake structures, treatment plants, pump houses, and reservoirs.

- Leak detection and repair is needed. The main O&M activity involves detecting and repairing leaks or pipe bursts, which are expected to be minimal due to the use of high-quality pipe materials and sound design practices. Repairing leaks will involve excavation of trenches to access the damaged sections, followed by reconnections or pipe replacement as required. This process is similar to the original pipe-laying activities and may temporarily disrupt local areas.
- Periodic flushing, descaling, and scour maintenance are also needed. To ensure pipeline efficiency, periodic flushing and descaling of feeder mains will be conducted. These activities may generate wastewater containing debris and scales. Without proper collection and disposal, these could affect local drainage systems.
- Noise and vibration from pump operations should be controlled. Pump stations will generate noise and vibrations during operations. Prolonged exposure to noise can cause disturbances to nearby communities and the operational staff.
- Generation of minor quantities of waste should be managed. Small quantities of substances such as lubricants, paints, solvents, and cleaning materials will be generated during regular maintenance activities. If improperly handled, these materials could pose risks to soil and water quality.
- Wastewater and solid waste from office and staff quarters: staff quarters, offices, and treatment plants will generate municipal solid waste (MSW) and wastewater during operations. Inadequate disposal or mismanagement of these wastes could lead to environmental contamination and public health concerns.
- Regular maintenance of infrastructure and maintenance of office buildings, pump stations, and staff quarters will occasionally generate construction debris, leftover paints, and solvents.

311. Mitigation Measures:

- Ensure timely detection of leaks using modern detection technologies to minimize water losses.

- Excavate and repair leaks in a controlled manner, using barricades and signage to reduce public inconvenience.
- Collect and safely dispose of water and any debris generated during repairs.
- Wastewater from flushing and descaling should be collected in designated holding tanks for sedimentation before being disposed of in approved locations.
- For sanitary wastewater from staff quarters and office premises, septic tank-soakage pit systems should be designed according to the guidelines of the Works Division/Municipal Engineer's Office. Proper designs must be submitted to and approved by local authorities before construction.
- Install vibration isolators and noise barriers at pump stations to minimize impacts on surrounding communities and staff.
- Limit operational noise levels to comply with Bangladeshi environmental standards (e.g., maintain noise below 55 dB(A) in residential areas during daytime as per the Environmental Conservation Rules, 1997).
- Store lubricants, paints, and solvents in labeled, leak-proof containers within bunded areas to prevent spillage.
- Arrange for proper collection, segregation, and disposal of MSW according to local authority regulations. Waste should be handed over to the municipal collection system based on approved schedules.
- Dispose of hazardous waste, such as spent lubricants, through licensed waste management agencies.
- Debris from regular maintenance activities must be collected, stored, and disposed of at approved landfill sites.
- Ensure that no waste materials are left unattended or dumped in unauthorized areas.
- Conduct regular training for staff and occupants of the facilities on proper waste segregation, collection, and recycling practices.
- Educate residents and workers about compliance with MSW sorting and collection schedules set by the local authority.
- Obtain building permits and Certificates of Compliance (COC) for staff quarters and office buildings from the relevant local authority to ensure adherence to design and operational standards.
- Adhere to the Bangladesh Environmental Conservation Rules, 1997, and local guidelines for waste and wastewater management.

2. O&M of WTPs

312. **Impacts due to storage, handling, and application of chemicals.** The water treatment process at the Bangabandhu and Asif Gate facilities utilizes various chemicals essential for operations, including disinfectants, lime, anti-scaling agents, anti-corrosive chemicals, cleaning agents, and coagulants. While vital for ensuring water quality, these substances pose significant health and environmental risks if mishandled. Hazardous chemicals such as chlorine and sulfuric acid are of particular concern due to their potential for leaks or spills, which could jeopardize worker safety and the surrounding environment, even though the facilities are situated away from populated areas. Additionally, routine repairs and maintenance of equipment and machinery may result in the spills of oil and grease, further contributing to the environmental risk if not properly managed. Ensuring stringent safety protocols and spill containment measures is critical to mitigating these hazards.

Figure 69: Chemicals stored safely and dispensed using automated meters (BWTP).

313. **Measures.** Appropriate measures such as the following have already adopted by the two water treatment facilities, as they have been in operation for more than 10 years and therefore no notable negative impacts are anticipated during the operation phase. No major accidents or events have been reported at either the Bangabandhu and Asif Gate water treatment plants.

- Reducing the amount of chemicals used in the water treatment process to the extent possible; for instance, pre-oxidation of the source water only when needed, which can reduce the use of chemicals
- Replacing anti-scalants, as far as possible, with more biocompatible alternatives.
- Ensuring that all chemicals used on site are stored according to the relevant international standards to prevent accidental release and hazards to operatives
- Storing all liquids in appropriate leak-proof containers, in sealed, concrete-floored and bunded areas, that will hold 110% of the stored volume of each liquid in the event of a major leak
- Storing different types of liquid separately so that there is no risk of mixing in the event of multiple leaks
- Providing leak/spill detection, collection/capture and safe disposal facilities such as chlorine absorption and neutralization facility
- Providing ventilation, lighting, entry and exit facilities; visible & audible alarm facilities to alert chemical leaks
- Facility for isolation in the event of major leakages
- Eyewash & shower facility, Personal protection and safety equipment for the operators (masks, oxygen cylinders, gloves, etc.)
- Providing training to the staff in the safe handling and application of chemicals, material safety, and standard operating procedures and emergency responses
- Developing emergency response plans
- Operating the site workshop with the highest standards of environmental protection, and all drainage from this area must be collected and passed through an oil separator before discharge
- All equipment and machinery maintenance and servicing must be done in a suitably equipped workshop, and no vehicle maintenance shall be done on-site.

314. **Disposal of filter backwash water.** The filter backwash water from water treatment plants will be recycled back into the aerator, aligning with the sludge management policy implemented by KWASA for sustainable water treatment operations. This approach is

particularly beneficial for large water treatment plants, such as those at Bangabandhu and Asif Gate, each of which has a capacity exceeding 4,500 m³/day. Recycling backwash water not only supports environmental sustainability but also optimizes resource use by reducing the demand for raw water. Reusing backwash water offers significant energy savings. The energy required for pumping and treating backwash water for reuse is comparatively lower than the energy needed for extracting, transporting, and processing an equivalent volume of raw water. This operational efficiency makes backwash water recycling an economically viable and environmentally responsible practice for large-scale water treatment facilities. Currently, both the Bangabandhu Water Treatment Plant (BWTP) and Asif Gate Water Treatment Plant follow this recycling approach. Backwash water is first collected in a settling pond located near the BWTP, where sediments are allowed to settle, ensuring that the recycled water is of acceptable quality for reuse. Once settled, the clarified backwash water is pumped back to the water treatment plant for reprocessing through the aeration and treatment stages.

315. No adverse environmental impacts are anticipated from the backwash water recycling process. Since the backwash water is entirely recycled within the treatment system, there is no discharge or disposal into external water bodies, thereby eliminating risks of contamination or pollution. This closed-loop system further reinforces the sustainability of the water treatment operations, adhering to environmentally sound practices and regulatory guidelines.

316. Therefore, the practice of recycling backwash water in the proposed water treatment plant is a proven, energy-efficient, and environmentally sustainable approach, ensuring compliance with KWASA's sludge management policy while minimizing ecological impacts.

Figure 70: The backwash water is recycled back to the WTP at BWTP

Figure 71: Backwash water is collected at a pond located near the BWTP, and sediments are allowed to settle before being recycled back to the BWTP

317. **WTP sludge management.** The disposal of sludge generated from the water treatment process is a critical environmental concern that must be managed in a sustainable and environmentally compliant manner. The Bangabandhu Water Treatment Plant (BWTP) and Afil Gate Water Treatment Plant (AGWTP) will produce significant quantities of sludge, primarily composed of aluminum hydroxide, iron oxides, and organic matter. While this sludge is considered non-hazardous, improper disposal could result in soil and water contamination, leachate formation, and degradation of surrounding ecosystems. Therefore, a well-structured sludge management plan is essential to ensure that disposal methods are both sustainable and beneficial to the community.

318. **On-site disposal and landfilling**. One of the primary approaches for managing sludge involves using it as a fill material within designated low-lying lands. Both BWTP and AGWTP have sufficient land available where dewatered sludge can be utilized to raise the terrain, eliminating the need for disposal in external sites. Once these sites are filled, they can be repurposed for useful activities such as landscaping, storage areas, or green space development.

319. Additionally, in the periphery of Khulna, several low-lying lands require filling, and KWASA has the opportunity to sell dried sludge to local landowners, creating a cost-effective and mutually beneficial solution. This approach will ensure that sludge is repurposed for productive use rather than being sent to municipal dumpsites, which could pose environmental and regulatory risks.

542 **Alternative reuse: Construction and industrial applications.** Apart from landfilling, sludge can be repurposed in construction materials, particularly for brick manufacturing. Studies have demonstrated that incorporating 5–10% sludge into clay bricks can maintain the necessary compressive strength for construction while reducing the demand for virgin clay. This method not only provides an environmentally friendly alternative for sludge disposal but also eliminates concerns related to leachability, as previous research has shown that no significant leaching of chemicals occurs in the finished bricks.

543 Another alternative is the use of sludge in cement and mortar production, where feasibility studies could determine its suitability for incorporation into construction-grade cementitious materials. Sludge can also be blended with road base materials or compacted for pavement sub-base layers, particularly in low-traffic areas, offering another sustainable reuse option.

320. The sludge accumulated in the sludge lagoons may need to be removed from time to time after sun-drying of the sludge removed from the lagoons. This sludge can be handed over

for clay brickmaking or cement block making. Brickmaking after mixing the dried sludge with clay, or block-making after mixing dried sludge with sand, cement and/or soil are well-developed methods. The two WTPs can successfully recycle the water treatment sludge after mixing it with cement and sand to produce paving blocks (See Figure 72). These cement blocks should conform to Specifications for Cement Blocks, including Compressive Strength Requirements and Toxicity Characteristic Leaching Procedure (TCLP) as specified in USEPA Method 1311, which guarantees the non-mobility of organic and inorganic substances contained in the cement blocks.

321. Researchers[34] have successfully tested clay bricks manufactured from 5–10% dried water treatment sludge. It has been established that mixing 5% dried sludge with clay will produce clay bricks which have a compressive strength of 10–15 N/mm^2, which is very satisfactory for construction work. In all the studies mentioned above, leachability tests have shown that no chemicals in the sludge (e.g., Alum) will leach out when exposed to rain. Therefore, the dried sludge should be recycled rather than disposed of. Moreover, the use of dried sludges will reduce the need for river sand in manufacturing these bricks.

322. Therefore, no impacts are envisaged as there is no disposal of water treatment sludge into water bodies or on land.

Figure 72: Cement Block manufacturing using water and wastewater treatment sludge (Source: MAS Industrial Park in Sri Lanka)

[34] A. G. JASHORE. Vishwajith; K. R. R. Mahanama; L. P. R. J. Wijesinghe (2023). Investigation on the effective disposal of sludge from a water treatment plant, Water Practice and Technology: 18 (1): 130–139.
Rodríguez N. JASHORE., Ramírez S. M., Varela M. T. B., Guillem M., Puig J., Larrotcha E. & Flores J. 2010 Re-use of drinking water treatment plant (DWTP) sludge: characterization and technological behaviour of cement mortars with atomized sludge additions. Cement and Concrete Research 40(5), 778–786.

Note: These products conform to SLS 855 (1989): Specifications for Cement Blocks, including Compressive Strength Requirements and Toxicity Characteristic Leaching Procedure (TCLP) as specified in the USEPA Method 1311.

323. **Land reclamation and soil conditioning**. Land reclamation is another viable option, where dewatered and stabilized sludge can be used to rehabilitate degraded lands, particularly in areas that require soil conditioning and improved water retention capacity. This method is especially useful in barren or salinity-affected lands around Khulna, where the sludge could contribute to improved soil properties.

324. However, before large-scale implementation, site-specific studies must be conducted to ensure that sludge application does not alter soil permeability or nutrient composition in ways detrimental to soil. Additionally, mine backfilling and industrial waste encapsulation can serve as potential disposal alternatives if suitable sites are identified. In such cases, sludge would be used as a filler material in exhausted quarries or within industrial landfills, helping to reduce environmental impact while providing a practical solution for waste management.

325. **Avoiding disposal in environmentally problematic sites**. Given the scale of sludge generation, it is imperative that no disposal takes place at existing municipal dumpsites to avoid complications associated with environmentally problematic sites. Instead, sludge disposal will be confined to designated areas that have been assessed for environmental suitability.

326. On-site sludge containment and stabilization measures will be implemented at both BWTP and AGWTP, ensuring that disposal takes place in a controlled and environmentally responsible manner. In cases where on-site capacity is insufficient, additional sludge disposal sites will be identified in consultation with local authorities and the Department of Environment (DoE), Bangladesh, ensuring compliance with regulatory requirements. These sites will be selected based on factors such as distance from water bodies, groundwater vulnerability, and land use compatibility to prevent secondary contamination.

327. A combination of reuse and environmentally compliant disposal strategies will be adopted for the sustainable management of sludge within the Khulna Water Supply Project (KWSP). While brick manufacturing presents a promising reuse option, other alternatives such as land reclamation, soil conditioning, and cement production will also be explored. The project will strictly avoid disposal in existing municipal dumpsites, instead utilizing on-site disposal within WTPs, designated low-lying lands, or engineered disposal sites specifically designed to prevent environmental contamination. By integrating these measures, KWSP will ensure that sludge management does not pose long-term environmental risks while contributing to resource efficiency and sustainability. Proper community engagement will be a crucial aspect of sludge management to ensure that local residents are informed about disposal methods, potential environmental risks, and mitigation strategies.

328. **Impacts due to poor operation & maintenance practices.** The operation of the Khulna Water Supply Project (KWSP) facilities, including the water treatment plants (WTPs) at Bangabandhu and Asif Gate, as state-of-the-art modern facilities, will rely heavily on the expertise of the selected contractor, the quality and capability of their operations and design teams, and the diligence of the supervising consultant and the client's team. To ensure these facilities meet the highest industry standards, stringent measures have been incorporated into the bidding process and operational framework. These include engaging a well-qualified and experienced contractor through rigorous bidding conditions and processes, implementing detailed operational safety plans, and ensuring the preparation of comprehensive O&M manuals, Health and Safety Plans, Process Safety Management Plans, Risk Management Plans, and Facilities Safety and Security Plans by experts with the requisite qualifications and experience. Further, the contractor and plant operator will be held accountable for professionally implementing these plans and all related operational tasks at all times. Additionally, all mitigation measures outlined in this Chapter and in the Environmental Management Plan (Chapter VIII) must be strictly followed to prevent adverse environmental and operational risks.

329. Moreover, the WTP operations could provide significant additional benefits to the local community. Ensuring that the surrounding villages are supplied with piped, high-quality drinking water, ideally reaching individual households, would significantly improve local living standards. The contractor should also prioritize employing local residents, including disadvantaged individuals, in long-term plant operations roles, mirroring the inclusivity demonstrated during the construction phase. Similarly, the contractor should continue sourcing materials and services locally wherever feasible, thereby boosting the local economy. These actions, combined with the health and lifestyle benefits of reliable water supplies, will enhance the socioeconomic impact of the project while fostering community goodwill and support for the facility.

330. **Planning for drought and river flow reduction:** This is due to upstream irrigation withdrawals and changing hydrological regimes and requires the formulation of seasonal abstraction plans. These plans must be finalized during commissioning and supported by detailed operational protocols for conjunctive use of groundwater and surface water, depending on real-time salinity and flow conditions.

F. Cumulative Impact Assessment

331. The cumulative Impact Assessment evaluates the combined effects of multiple interventions under the Khulna Water Supply Project (KWSP) Phase II, along with other existing and foreseeable developments in the region. This assessment considers direct, indirect, and interactive impacts on the environment, local communities, and socio-economic systems. Given the scale of the KWSP interventions, including the construction and operation of water treatment plants, pipelines, pump stations, and associated infrastructure, the cumulative assessment provides a holistic understanding of the project's overall footprint in the context of Khulna's urban and ecological environment. The focus was on key environmental and social parameters such as water resources, land use, air quality, biodiversity, socio-economic conditions, and public health.

332. **Water resources and quality.** The KWSP will significantly enhance water availability and quality in Khulna through state-of-the-art water treatment plants at Bangabandhu and Asif Gate. However, increased water abstraction from surface water sources, coupled with other urban development projects, may exert cumulative pressure on the Madhumathi and Bhairab Rivers. While recycling backwash water will mitigate wastage, cumulative impacts on water quality due to urban runoff, industrial effluents, and leachate from nearby areas must be monitored.

333. **Mitigation:** Coordinated water management strategies are essential to balance extraction and ecological flow requirements. KWASA should collaborate with industrial stakeholders to regulate effluent discharges into the river systems.

334. **Air quality.** During the construction phase, dust and emissions from KWSP activities will combine with pollutants from ongoing urban infrastructure projects, potentially degrading air quality in certain zones. During operation, emissions from pump stations and vehicular movement may contribute to localized air quality issues.

335. **Mitigation:** Continuous monitoring and implementation of dust suppression measures, as well as maintaining air pollution control equipment in operational facilities, will be critical. Engaging city authorities to enforce stricter vehicular emission standards will complement these efforts.

336. **Biodiversity and habitat**. The KWSP project footprint overlaps with urbanized areas and critical ecosystems, particularly the Madhumathi River system, which is a habitat for the South Asian River dolphin and other aquatic species. Combined with urbanization and increased vessel traffic, the project could exacerbate habitat fragmentation, noise pollution, and ecological stress.

337. **Mitigation:** Biodiversity conservation plans should prioritize noise control measures during construction, monitoring of aquatic species, and ensuring zero discharge of hazardous substances into the river system. KWSP should also integrate biodiversity offsets and support local conservation programs.

338. **Land use and urban development.** The introduction of large-scale infrastructure projects under KWSP, in conjunction with other urban developments in Khulna, will alter land use patterns. While the project focuses on the efficient use of government and public lands, cumulative urban expansion may lead to increased encroachment on sensitive areas such as wetlands and floodplains.

339. **Mitigation:** Collaborative urban planning, focusing on preserving green spaces and integrating climate resilience into land use policies, will reduce cumulative impacts.

340. **Socio-economic and public health.** The KWSP will bring transformative benefits to local communities by improving access to safe drinking water, generating employment, and boosting the local economy. However, the influx of workers and increased population density in some project areas, combined with other developments, may strain local infrastructure, increase solid waste generation, and elevate public health risks.

341. **Mitigation:** Proactive community engagement and health awareness campaigns will mitigate these impacts. Additionally, KWASA should coordinate with municipal authorities to upgrade waste management systems and healthcare facilities to accommodate increased demand.

342. **Climate resilience.** Climate change poses a significant cumulative risk, particularly in flood-prone regions like Khulna. Rising sea levels and extreme weather events may amplify project impacts, such as sedimentation and erosion near intake structures or pipelines.

343. **Mitigation:** Integrating climate-resilient designs into KWSP infrastructure, such as flood-resistant pump stations and treatment facilities, will ensure long-term sustainability. Regular climate risk assessments and adaptive management strategies should be incorporated into project operations.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Public Consultation

344. The public consultation process included (i) identifying project-affected parties, (ii) discussing and providing them with sufficient information about the proposed project activities, (iii) creating opportunities and mechanisms whereby they can participate and raise their issues, comments, and concerns with regard to the proposed project activities; (iv) giving the stakeholders feedback on findings and recommendations; and, (v) ensuring compliance with process requirements of the environmental and related legislation. Different techniques of consultation with stakeholders were used during project preparation (interviews, public meetings, group discussions, etc.). Also, a series of public consultation meetings were conducted during project preparation. Various forms of public consultations have been used to discuss with the community in planning the project design and mitigation measures.

345. Consultations with stakeholders and KWASA engineers have been conducted to discuss project-related details and potential environmental issues. The main comments discussed at the meetings included a requirement to implement proposed interventions and project components as scheduled by competent contractors, speed up the construction process, minimize inconvenience to all households, business entities, institutions, motorists, pedestrians, etc. during construction and form a monitoring committee.

346. As part of the feasibility studies, an extensive consultation program with key stakeholders, including persons interested in or affected by project activities, has been carried out regarding the environmental and community impacts of the proposed project. In line with requirements pertaining to environmental and social considerations of the ADB, consultations and participatory engagement of stakeholders have been initiated at an early stage of the project planning phase. The tools used for consultations are individual meetings, interviews, structured questionnaires, open-ended questionnaires and focus group discussions (FGD). These consultations provided inputs in identifying the needs of communities and relevant stakeholders. Stakeholder consultations details are provided in **Appendix 10.**

347. Also, the following were consulted to obtain their views:

(i) **Stakeholder Consultations:** A series of FGD meetings were conducted in four locations of the project areas. The main purpose of these meetings is to share information about the project and solicit views on how to minimize any community impacts arising from the project implementation could be minimized. In addition, community meetings (FGDs) were held with the participation of the officials of the KWASA (The summary of discussions is given in Table 40).

(ii) **Transect Walk and Opinion Survey:** Local communities, individuals, owners/employees of commercial establishments, who are directly or indirectly affected, were given priority while conducting a public consultation. The main focus was on those who will be affected due to construction work related to pipe laying (A summary of discussions is given in Table 40).

(iii) **Public Consultations and Focus Group Discussions:** Three town-level consultation sessions, including stakeholder meetings and FGDs, were carried out by KWASA with local stakeholders for information dissemination and community participation. These consultations were held at the KWASA head office conference room. These meetings were attended by different cross sections of stakeholders, including land owners, local elites, and general members of the public at the project locations. In addition, the consultations were also attended on occasion by the representative of the City Mayor's offoce, the Managing Director, KWASA, the Assistant Deputy Commissioner (Land Acquisition) Khulna, the Feasibility Study

Team, officers from DoE, LGED, KCC, KDA, BWDB, DPHE and KWASA staff, elected representatives, women groups, representatives of professional groups like businessmen, farmers, teachers, religious leaders, and public representatives. (A summary of discussions is given in Table 40).

348. Overall the participants are aware of the project, and they expressed their willingness to provide support during the execution of the work. The participants informed that the proposed project will be beneficial to their area as it will help improve water supply services. The Project team informed of temporary impacts during construction phase (dust, traffic safety, access etc.,) and the measures that will be undertaken.

Table 40: Summary of Public Consultations

	Date/Location	**Participants Organization**	**Topics Discussed and Issues Raised**	**Response and Incorporation into Project Design**
A. Stakeholders Meeting				
1	Loc: KWASA office date: 2-8-2023 No of participants: 21	KWASA, DPHE, RHD, DoE, KDA, KCC, LGED, Design Cons; PADECO, TEC int.	1. Inception Workshop • Summary of the project – Engineering works • Environmental impacts and mitigation measures • Prospects, stakeholders and future plan	KCC and KDA much appreciated the project. DoE suggestions are incorporated into the project.
2.	Loc: KWASA office Date: 15-1-2024 No of participants: 40+	KWASA, KCC, VCRC	2. Gender Action Plan • This meeting includes people from slum dwellers • Most of the participants were women • NGOs were also invited	The women's participation and response towards the project were very positive.
3	Loc: KWASA office Date: 5-2-2024 No of participants: 18	KWSA, DoE, RHD, KCC, BWDB, LGED, KDA	3. Interim Workshop • Discussed about technical details of the project • Discussed about the next stage of the action	Each government department gave their response and those are incorporated.
4	Loc: KWASA office Date: 11-Dec-2024 No of participants: 72	Officer's from KWASA, NGO wave foundation, journalist from National daily, general participants from different wards specially housewives, political person, Khulna city corporation, businessman etc.	• Meeting was organized KWASA with the support of an NGO • The main agenda was enhancing accountability and risk address amongst the stakeholders at KWASA projects and gave introduction to WASA's future water supply phase 2 project and currently under construction sewerage projects. • Organizers raised issues such as water conservation, responsible usage, GRM and reporting service was highly prioritized.	Community members, especially women, shared concerns about difficulties they face such as water tariffs, irregular water supply, low water pressure, etc. Finally, KWASA officials and NGO representatives addressed the concerns, shared future plans mainly about the importance of implementing KWSP phase 2, and showing their commitment to improving service efficiency and accountability.
B. Focus Group Discussion and Public Consultation				
	Date/Location	**Participants' Occupation**	**Topics Discussed and Issues Raised**	**Response and Incorporation into Project Design**

	Date/Location	Participants Organization	Topics Discussed and Issues Raised	Response and Incorporation into Project Design
1	Loc'n: Mollahat 200 m from intake point. Date: 2-11-2024 No of participants: 6	Shop holder, Farmers, Rice mill owner	• Whether the KWASA water intake causes salinity level increase in the river • Attitude towards the new project • Condition of overall agricultural practices in the area after inauguration of river water intake	No negative responses were observed from the villagers. They welcome the new project.
2	Loc'n: Mollahat 400 m from intake point. Date: 2-11-2024 No of participants: 8	Shopkeepers, Farmers, day-laborers, housewives	• Whether the KWASA water intake causes salinity level increase in the river • Attitude towards the new project Condition of overall agricultural practices in the area after inauguration of river water intake	• Most people demand new projects, and they want a KWASA connection. • Unless salinity naturally increases in the dry season, they observe no salinity problem.
3	Loc'n: Mollahat 800m from intake point. Date: 2-11-2024 No of participants: 19	Boatman, businessmen, farmers, labors, housewives	• Whether the KWASA water intake causes salinity level increase in the river • Attitude towards the new project • Condition of overall agricultural practices in the area after inauguration of river water intake	• The people also demand KWASA connection. • The leader of the farmer assured due to the water intake, the salinity is not increased, only seasonal increase happening, and agricultural condition has no correlation with river water intake
4	Loc'n: Bhairab river intake point intake point. Date: 2-11-24 No of participants: 11	Shopkeeper, boatman, rickshaw puller, labors, small seller	• Dolphin sightings in the Bhairab River • May the increase in intake cause salinity to increase? • Condition of agricultural practices nearby	• The answers are very similar to the people of Mollahat. They observe seasonal salinity and are very positive towards the new project
5	Loc'n: Mostafa Mor Date: 2-11-24 No of participants: 2	PAP & Owner of blacksmith shop	• Informing about the project • Attitude towards the new project • Plans for future	• He is a tenant of the land, he is ready to relocate since there is other options available.
6	Loc'n: Mostafa Mor Date: 2-11-24 No of participants: 5	Rickshaw puller, Farmers	• Brief description of the project • Attitude towards the new project	• They wish for water connectivity but are afraid about the cost involved

349. **Plan for continued public consultations**. Constant communication will be established with the affected communities to address the environmental issues likely to surface during implementation phase. Prior to start of construction, KWASA/PMU with the assistance of PMSC will conduct information dissemination sessions at major intersections and solicit the help of the local community leaders/prominent citizens to encourage the participation of the people to discuss various environmental issues. At ward/neighbourhood

level, focus group meetings will be conducted to discuss and plan construction work with local communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in the project. A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction and operational phases and also regarding the grievance redress mechanism. PMU with the help of PMSC consultants will organize public meetings and will appraise the communities about the progress on the implementation of EMP. Meeting will also be organized at the potential hotspots/sensitive locations before and during the construction. To avoid undue delays in implementation and completion of the project, it is required to identify the issues and points to be discussed at this stage and hold discussions with relevant organizations, institutions, community based organizations in the project area.

Image: ADB consultants conducting FGDs and Transect Walk and Opinion Survey at 200 to 1200m downstream from the intake point of Mollahat.

B. Disclosure of Information

350. Project related information shall be disclosed through public consultation and by making relevant documents available in public locations. PMU and PMSC shall provide relevant safeguards information in a timely manner, in an accessible place and in a form and languages understandable to affected person and other stakeholders. For illiterate people, other suitable communication methods will be used. For the benefit of the community, the summary of the IEE will be translated into the local language (Bangla) and made available at (i) the KWASA office, (ii) area offices, and (iii) contractor's offices.

351. Stakeholders will also be made aware of the grievance register and redress mechanism, including contact information of project agency. During project implementation, relevant information about any major changes to the project scope will be shared with beneficiaries, affected persons, vulnerable groups, and other stakeholders. Public information campaigns via newspaper/radio/TV will be conducted. Prior to start of construction, the PMU will issue a notification of the start date of implementation in local newspapers. A board showing the details of the project will be displayed at the construction site for the information of general public. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.

352. According to the requirements of the ADB SPS for Environment Category B projects, the following will be disclosed on the ADB website after receiving concurrence of KWASA:

(i) Draft/final IEE

(ii) A new or updated IEE

(iii) Environmental monitoring reports, and corrective action plan, if any, prepared during project implementation

VII. GRIEVANCE REDRESS MECHANISM

354. 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.

355. **Common GRM.** A common GRM will be in place for social, environmental, or any other grievances related to the project interventions (both during construction and operations). The GRM will provide an accessible and trusted platform for receiving and facilitating the resolution of affected persons' grievances related to the project. The multi-tier GRM for the project is outlined below, each tier having time-bound schedules and with responsible people identified to address grievances and seeking appropriate people's advice at each stage, as required.

356. **Grievance redress process**. The GRM is a trusted way to voice and resolve concerns linked to the project and an effective way to address affected persons' concerns. The GRM for the Project is outlined below and consists of three levels with time-bound schedules for addressing grievances

357. 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, with assistance from the Environmental Specialist (National) of the design and supervision consultant (DSC). 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 fourteen (14) days. All grievances will be documented with full information about the person (name, address, date of complaint, etc.) and the issue.

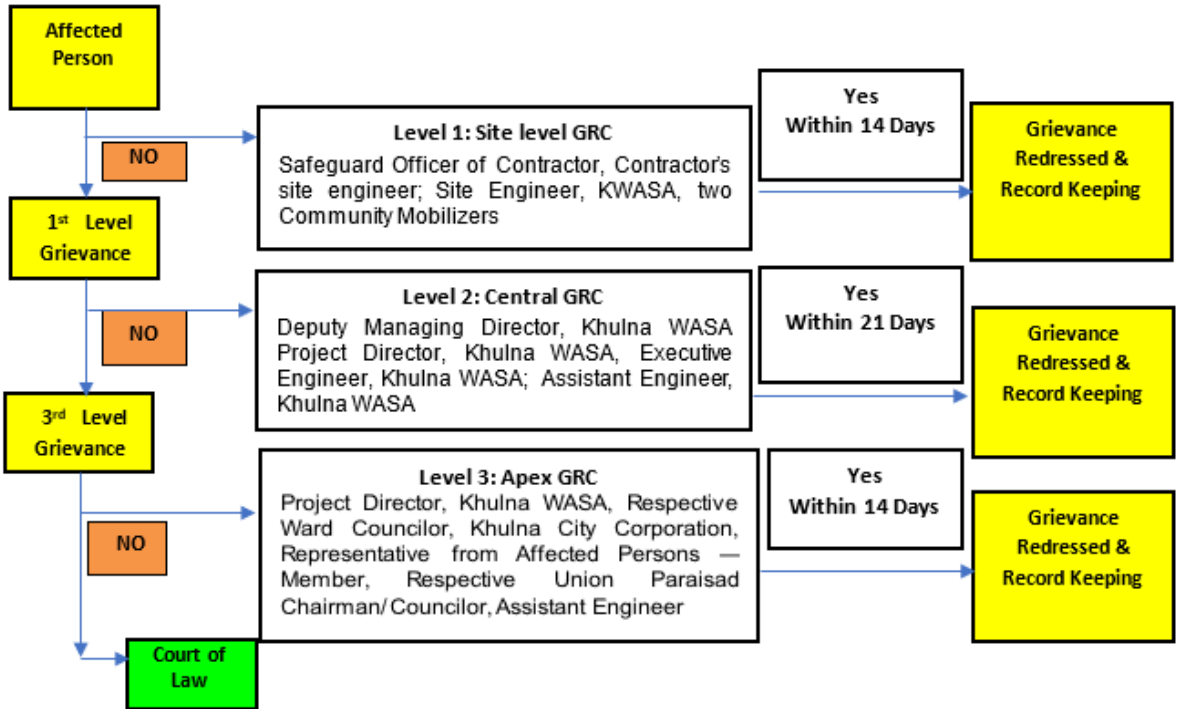
358. Should the grievance remain unresolved, the PMU's Project Director will activate the ***second level*** of the GRM by referring the issue (with written documentation) to the local Grievance Redress Committee (GRC) of the KWASA, who will, based on the review of the grievances, address them in consultation with the PMU and Project Director and affected persons. A hearing will be called with the GRC, if necessary, where the affected person can present the concern/issues. The process will promote conflict resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within twenty-one (21) days.

359. All the grievances that cannot be not addressed at 2nd level within in 21 days of receipt will be brought to the notice of the Apex Grievance Redressal Committee (GRC) - **3rd level grievance**. The Apex GRC will meet twice a month (based on grievances launched with the Apex GRC) and determine the merit of each grievance brought to the committee. The GRC will resolve the grievance within 14 days of receiving the complaint at the 3rd level. The Social Safeguard Officer will communicate all decisions taken by the GRC to the complainant.

360. The functions of the local GRC are: (i) provide support to APs 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 fifteen (15) days; 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 the decisions carried out. In the event that the grievance is not addressed by the PMU or GRC, the affected person can seek legal redress of the grievance in appropriate courts, the *third level* of the GRM. The GRM proposed is in Figure 73.

Figure 73: Grievance Redress Mechanism



361. A well-planned wide public awareness campaign will ensure that awareness of grievance redress procedures is generated using electronic, radio, and print media. The implementing agency will ensure that poor and vulnerable households are made aware of grievance redress procedures and entitlements and will help ensure that their grievances are addressed.

362. Affected parties will have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaints/suggestion boxes, or through telephone hotlines at accessible locations, by e-mail, by post, or by writing in a complaint register in the KWASA Area Engineer's Office (See Annex 3 for the sample grievance registration form). Careful documentation of the name of the complainant, the date of receipt of the complaint, the address/ contact details of the person, the location of the problem area, and how the problem was resolved will be undertaken. The PMU social development/safeguards officer will be overall responsible for timely grievance redressal on environmental and social safeguards issues, registration of grievances, related disclosure, and communication with the aggrieved party.

363. Despite the project GRM, an aggrieved person shall have access to the country's legal system at any stage and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

364. **Composition of GRC.** The Grievance Redress Committee (GRC) will have the following as members:

365. Proposed Members of the Grievance Redress Committee (GRC).

(i) Chairperson: A senior official from the Project Management Unit (PMU) or the Executing Agency (e.g., Khulna City Corporation or other relevant government department).
(ii) Member Secretary: A representative from the Safeguards Team (Environmental or Social Specialist) within the PMU to coordinate grievance-related tasks and maintain documentation.
(iii) Community Representative: A respected member from the local community or an appointed person representing affected stakeholders to ensure the community's voice is heard.
(iv) Environmental Specialist: A technical expert to address grievances related to environmental impacts, such as water quality, waste management, or ecosystem concerns.
(v) Social Development Specialist: A professional to address grievances related to social concerns, including compensation, resettlement, or community impacts.
(vi) Representative from the Contractor's Team: To address construction-related issues (e.g., noise, road blockages, or property damage).
(vii) Local Government Representative: A member from the local government body (e.g., Union Parishad or Ward Councilor) to strengthen local engagement and accountability.
(viii) NGO or Civil Society Representative (Optional): A representative from a trusted local NGO or civil society organization to ensure impartiality and build trust with the affected communities.
(ix) Legal Advisor (Optional): To provide guidance on resolving disputes with legal implications, if necessary.

Table 41: Composition of Grievance Redressal cell

Level 1: Site level GRC	Level 2: Central GRC	Level 3: Apex GRC
• Social Safeguard Officer, EHS Officer of Contractor • Contractor's site engineer • Site Engineer, KWASA • Two Community Mobilizers	• Deputy Managing Director, Khulna WASA – Convener • Project Director, Khulna WASA – Member • Executive Engineer, Khulna WASA –Member • Assistant Engineer, Khulna WASA –Member	• Project Director, Khulna WASA – Convener • Respective Ward Councilor, Khulna City Corporation – Member • Representative from Affected Persons – Member • Respective Union Paraisad Chairman/ Councilor- Member • Assistant Engineer, Khulna WASA

366. The committee should include gender diversity, ensuring representation of women, especially in cases affecting marginalized groups. Members should have relevant expertise and knowledge of the local context to address grievances effectively. The PMU should lead the formation and provide resources for the committee's operations. Regular training and capacity building should be provided to the GRC to handle grievances in line with ADB's guidelines and safeguard policies.

367. The GRC must have at least two women members.

368. **Recordkeeping.** Records will be kept by the PIU of the respective sub-project (and reported to the PMU in a summary form at regular intervals) of all grievances received, including contact details of the complainant, the date on which the complaint was received, nature of the grievance, agreed corrective actions and the date these were effected and final outcome.

369. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the offices of the PIU of the respective sub-project, and the KWASA Area Engineer's office and project website, as well as reported in monitoring reports submitted to the ADB on a semi-annual basis.

370. **Periodic review and documentation of lessons learned.** The Social Development and Safeguards Officer of the PMU, in consultation with the Environmental and Social Safeguards Officers of each PIU, will periodically review the functioning of the GRM and record information on the effectiveness of the mechanism, especially on the project's ability to prevent and address grievances. Lessons learned will be shared with the other governmental organizations and the ADB as required under the National Environmental and Social Safeguards Policy.

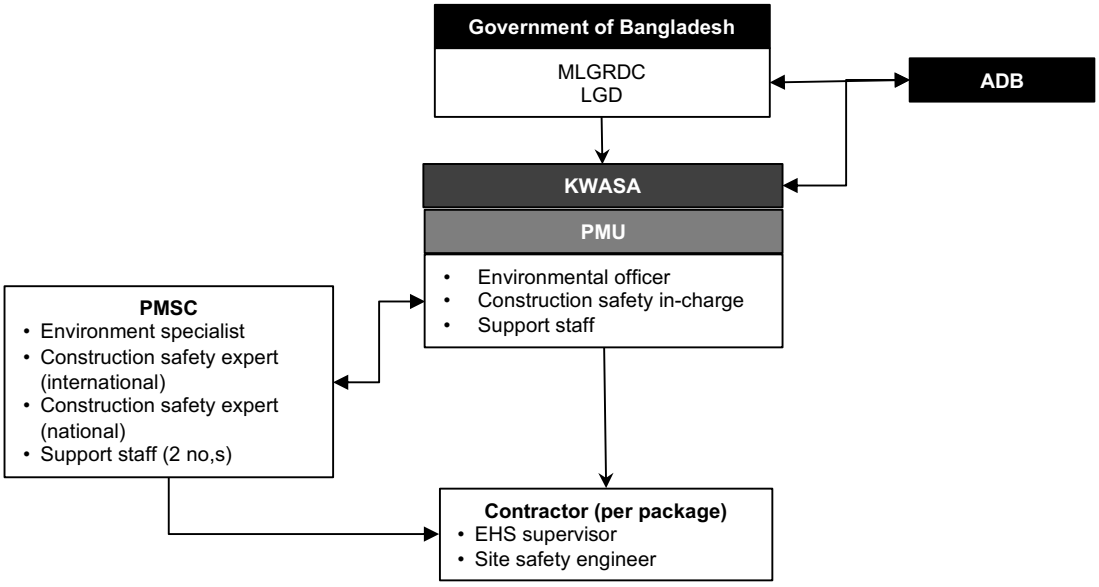
371. **Costs**. All costs involved in resolving the complaints (meetings, consultations, communication, and information dissemination) will be borne by the PIU and/or PMU; cost estimates for grievance redress are included in resettlement (RP) cost estimates.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Institutional Arrangements

372. Local Government Division (LGD) in the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC) will be the executing agency and Khulna Water Supply and Sewerage Authority (KWASA) will be the implementing agency for the project. Project Management Unit (PMU) will be established within KWASA for the project. The PMU, headed by a full-time Project Director and assisted by a Deputy Project Director and other technical, financial, safeguards etc staff will implement the project, including overall planning, management, coordination, supervision, and progress monitoring of the Project. The PMU will be responsible for (i) preparation and implementation of the investment program; (ii) management of Supervisory consultants; (iii) disbursement of funds and recovery loan repayments; and (iv) conducting overall investment program monitoring and evaluation, compliance with safeguards requirements including preparation of necessary investment program reports. Project management and supervision consultant (PMSC) will support the PMU. Contractors will be appointed to build the infrastructure elements. The institutional arrangement for environmental safeguards is illustrated in Figure 74 below. Roles and responsibilities of these agencies in environmental safeguards is discussed in the follow-on sections.

Figure 74: Implementation Arrangement for Environmental Safeguards



ADB = Asian Development Bank; EHS = Environment, Health & Safety; KWASA = Khulna Water Supply and Sewerage Authority, LGD = Local Government Division, MLGRDC = Ministry of Local Government, Rural Development and Cooperatives; PMU = Project Management Unit; PMSC = Project Management and Supervision Consultant;

69. **Roles and Responsibilities of Project Management Unit (PMU).** The PMU established within KWASA, headed by a Project Director, will implement the project and will be responsible for overall planning, management, coordination, supervision, and progress monitoring of the project. The PMU will be staffed with an environmental officer, a construction safety engineer in-charge and support staff who will lead the overall implementation of environmental safeguards. Supported by project management supervision consultant (PMSC), PMU's environmental safeguards responsibilities include:

(i) Ensure project compliance with government requirements and ADB SPS

(ii) Establish a system to ensure environmental safeguards compliance of the project, including monitoring and reporting formats used by PIU, consultants, and contractors.
(iii) Ensure that the draft IEE reports are included in the bidding and contract documents;
(iv) Ensure bidding and contract documents include specific provisions requiring contractors to comply with: (i) all applicable labor laws and core labor standards on (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity, or caste; and (c) elimination of forced labor; and with (ii) the requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities surrounding the subproject site;
(v) Review and confirm draft IEE reports are finalized by the PMSC based on final detailed designs;
(vi) Ensure that no civil works are commenced until corresponding final IEE report is cleared by ADB;
(vii) Review and provide recommendations on the approval of site-specific EMPs (SEMPs) of the contractors;
(viii) Provide oversight on environmental management aspects of the projects, and ensure the SEMPs and EMPs are implemented by the contractors;
(ix) Establish a system to monitor environmental safeguards of the subprojects including monitoring the indicators set out in the monitoring plans of the EMPs;
(x) Facilitate and confirm overall compliance with all government rules and regulations regarding site and environmental clearances as well as any other environmental requirements as relevant;
(xi) Review, monitor and evaluate effectiveness with which the SEMPs and EMPs are implemented, and recommend necessary corrective actions to be taken;
(xii) With support from DSCs, consolidate monthly environmental monitoring reports from the contractors and submit semi-annual environmental monitoring reports to ADB;
(xiii) Ensure timely disclosure of documents (IEE report and monitoring reports) in project website and in a form understandable and accessible to the public;
(xiv) Address any grievances brought about through the grievance redress mechanism (GRM) in a timely manner;
(xv) Undertake regular review of safeguards-related loan covenants, and the compliance during program implementation; and
(xvi) With support from PMSC, organize periodic capacity building and training programs on safeguards for KWASA, PMU, supervising engineers, and contractors.

373. Roles and responsibilities of PMU Safety Officers:

(i) With the support of PMSC, establish and maintain overall project's health and safety systems, promote safe work culture, establish industry specific health and safety performance indicators, and assist safety committee in performance reviews, and follow up actions
(ii) Ensure the subprojects comply with all relevant national laws, rules and regulations on health and safety
(iii) Ensure the bidding and contract documents require contractors to develop or prepare appropriate health and safety management plan following internationally best practices and/or safety standards in water supply infrastructure projects, including the mandatory requirement to employ qualified and experienced health and safety officers;
(iv) With support from the PMSC health and safety experts, lead the following:

a. review of health and safety management plans prepared by contractors;
b. supervision and monitoring of the health and safety management plan implementation in subprojects;
c. provide training to relevant MWSDB and PID-KUKL staff, contractors, and workers on health and safety at the workplace, including emergency preparedness;

(v) Ensure the contractors have their corresponding health and safety management plans approved by PMU and in place prior to commencement of works; and
(vi) Any other tasks as may be necessary to ensure all community and occupational health, and safety measures are implemented at all times in the project.

374. **Roles and Responsibilities of Project Management and Supervision Consultant (PMSC)**. PMSC will support PMU in the implementation of the Project. PMC responsibilities include review and approval of contractor outputs, construction program, work methods, etc., supervision of works, quality assurance, day-to-day contract management, implementation of EMP, and carryout all environmental safeguards related tasks to ensure compliance with ADB and Government requirements, including preparation, update, reviews and approvals, on-site monitoring, corrective actions, reporting, capacity building, training and consultation and disclosure tasks. The PMSC team will include a national environment consultant, and two construction safety engineers (one national and one international). The key responsibilities of the PMSC in environmental safeguards include, but not limited, to the following:

(i) Assist PMU in all environmental safeguards tasks related to the project to ensure project compliance with ADB SPS and government rules and regulations.
(ii) Assist in developing and adapting standard reporting formats, checklist at levels – contractor, PMSC and PMU levels
(iii) Work closely with PMU, PMSC and contractor technical teams to ensure that environmental considerations as per EMP are duly considered in the final designs and implementation;
(iv) Identify statutory clearances / permissions / approvals required for the project and assist the PMU in obtaining the same;
(v) Update the draft IEE and EMP based on the final detailed design,
(vi) Assist in including standards/conditions of regulatory clearances and consents, if any, in the project design, construction and operation;
(vii) Approve environmental monitoring locations (air, noise, etc.,) of the contractor; ensure conduct of baseline and periodic environmental monitoring as per environmental monitoring plan
(viii) Assist PMU in reviewing and approving contractor SEMPs, health and safety plans, traffic management plans and any other associated plans as required
(ix) Carry out site verification and monitoring of EMP/SEMP implementation on a regular basis, monitor the implementation of EMPs/SEMPs and ensure compliance
(x) Provide guidance on resolving issues, if any arise, pertaining to effective and efficient implementation of proposed environmental mitigation measures per EMPs/SEMPs during construction phase. Identify, non-compliance or unanticipated impacts, if any, and initiate corrective actions in consultation with PMU;
(xi) Assist in public consultations, documentation and include inputs from the public consultation in the project design and EMP, and implementation

(xii) Assist in disclosing relevant information on safeguards to affected people and relevant stakeholders;
(xiii) Assist the PMU in the review and approval of monthly monitoring reports submitted by contractor;
(xiv) Assist PMU in preparing semi annual environmental monitoring reports (SEMR) for submission to ADB;
(xv) Identify training needs and implement capacity development activities on environmental safeguards for the PMU, contractors, and other stakeholders;
(xvi) Assist PMU in establishing GRM for the project;
(xvii) Assist PMU in grievance redress, advise the contractor on appropriate actions on grievances, ensure timely resolution and proper documentation;
(xviii) Support all other environmental safeguards-related activities and tasks of the and PMU as may be needed.

375. **Health and Safety**. PMSC will have the following roles and responsibilities related to health and safety:

(i) Establishing and maintaining overall project's health and safety systems, protocols, establish and monitor project performance through industry specific health and safety indicators; work permit methods and communication structures; expert will be responsible for ensuring safety culture at project sites
(ii) Ensuring work site safety is one key responsibility of PMSC in design, implementation, commissioning and operation of the project
(iii) Ensure that the designs assess risks to worker and public safety and specifications are included in the bid documents to mitigate any potential impacts, which should be adequately costed in the BOQ. Sufficient competent staff inputs and qualifications must be included in the bid documents.
(iv) Establish occupational and community health and safety requirements for contractors following provisions of the respective contracts, legal provisions, and project requirements.
(v) Ensure competent staff are appointed by contractors for health and safety tasks. Review and consent to appointment of health and safety related experts/staff proposed to be provided by the contractors as per provision of the contracts.
(vi) Ensure that site-specific health and safety plan is developed and implemented by all contractors in accordance with legal and contractual requirements which must include method statements. Such plan shall be prepared by contractors and be reviewed and approved by PMSC prior to commencement of works.
(vii) Develop and implement a health and safety training program. This should include health and safety orientation for the contractor personnel, and any health and safety designated focal point must be confirmed to have taken the orientation prior to starting their work. The training curriculum should include regular sessions on practical topics over the life of the construction contracts.
(viii) During the construction, supervise contractors' performance of the works on a day-to-day basis, particularly with regard to execution of work as per approved construction methodology ensuring work site safety, safe removal/relocation of utilities and compliance with health and safety plan
(ix) Ensure work site safety, safety of workers, staff and other personnel, road users and communities living around. If PMSC determines that there is a risk and no adequate arrangements for ensuring safety are made or that any work is being carried out in a manner that threatens the safety and/or hampers the progress of the work, PMSC shall notify the concerned contractor on suspension of whole or part of the works for ensuring safety. PMSC shall promptly communicate such notices to the PMU. The suspension shall be lifted

by the PMSC, only upon its determination that the conditions which caused the suspension to have been removed or remedied sufficiently, in the PMSC's professional judgment and following its subsequent inspection of the works.

(x) Plan and ensuring that contractor carrying out drills and exercises on managing emergency situations

(xi) Conducting investigations on accidents and incidents and prepare reports on findings

(xii) Submit a monthly progress report that includes a section on review of all health and safety aspects during the month including reports on all accidents and actions proposed to prevent further occurrence.

(xiii) Promptly report on any such event which has affected or is likely to affect the work site safety.

(xiv) Engage with local communities to raise awareness about the project's health and safety impacts. Address community concerns related to project activities.

376. **Roles and Responsibilities of Contractors**. Contractors are required to carry out all environmental mitigation and monitoring measures outlined in their contract and to undergo safeguards orientation during pre-construction phase. The contractor will be required to appoint a full-time environment, health and safety (EHS) officer, and a safety engineer on site to ensure implementation of EMP during civil works. The contractor will be required to submit to PIU and PMU, for review and approval, a site-specific environmental management plan (SEMP) including: (i) proposed sites and/or locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP in the draft and Final IEE; (iii) monitoring program; and (iv) budget for SEMP implementation. No works can commence unless SEMP is approved by PIU. The contractor will be required to undertake day to day monitoring of the SEMP implementation and submit reports to the PIU on a monthly basis. A copy of the EMP/approved SEMP will be always kept on-site during the construction period. Non-compliance with, or any deviation from, the conditions set out in the EMP/SEMP constitutes a failure in compliance and will require corrective actions. The contractors will be required to conduct environmental awareness and orientation of workers prior to deployment to work sites. IEE and EMP will form part of the contract documents, and the contractor is responsible for implementation of the mitigation and monitoring measures and ensure compliance with all the requirements. Key responsibilities of the EHS officer and safety engineer, in coordination with other contractors' personnel include:

(i) Prepare SEMP including site-specific occupational health and safety plan and submit to PMU for approval prior to start of construction;

(ii) Ensure implementation of SEMP and report to PMU/PMSC on any new or unanticipated impacts;

(iii) Ensure that necessary pre-construction and construction permits are obtained timely

(iv) Supervise work site safety, and provision and use of personnel protection equipment etc.,

(v) Carry out site inspections on a regular basis and prepare site-inspection checklists/reports;

(vi) Record EHS incidents and undertake remedial actions;

(vii) Conduct environmental monitoring (air, noise, etc.,) as per the monitoring plan

(viii) Ensure that appropriate worker facilities are provided at the workplace and labor camps as per the contractual provisions;

(ix) Ensure compliance with all applicable laws and regulations relating to environment, health and safety;

(x) Ensure compliance with all applicable labor laws and core labor standards on: (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value

regardless of gender, ethnicity, or caste; (c) no discrimination in respect of employment and occupation; (d) allow freedom of association and effectively recognize the right to collective bargaining and (e) elimination of forced labor; and with (iv) the requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities surrounding the project sites.

(xi) reinstate pathways, other local infrastructure, and agricultural land to at least their pre-project condition upon the completion of construction; and

(xii) Conduct trainings,[35] orientation and daily briefing sessions to workers on environment, health and safety;

(xiii) Prepare monthly EMP monitoring reports and submit to PMU/PMC;

(xiv) Provide proper information to communities and ensure communities are aware of project-related impacts, mitigation measures, and GRM; and

(xv) Ensure that any complaints and grievances brought about by community and affected persons are received and recorded properly,

(xvi) Coordinate with the PIU, PMC and PMU on any grievances received and ensure that these are addressed in an effective and timely manner.

377. **Capacity development and training in environmental safeguards.** KWASA is implementing ADB funded projects for long time and is well aware of the ADB procedures and safeguards requirement. Project will provide necessary training and capacity building sessions further improve the safeguards implementation. The PMSC will facilitate the implementation of capacity building program for the PMU and contractors, with specific topics on environmental safeguards, some of which are listed below. The capacity building program will be participatory to the extent possible and will employ a variety of approaches to be more effective (such as learning by doing, role playing, group exercises, on-the-job training, etc.). A pre and post training assessment will be undertaken to measure the effectiveness of the program. The contractors will be responsible for conducting site-specific/work-specific orientation on environmental safeguards for their workers.

Table 42: Indicative Training Needs for Environmental Safeguards

Description	Target Participants and Venue	Source of Funds
Introduction and Sensitization to Environmental Issues (1 day) - ADB Safeguards Policy Statement - Government of Bangladesh applicable safeguard laws, regulations and policies including but not limited to core labor standards, OH and S, etc. - Incorporation of EMP into the project design and contracts - Monitoring, reporting and corrective action planning	All staff and consultants involved in the project At PMU level	PMU
Preparing and implementing SEMP (1/2 day - once at the beginning and at a frequency of once in six months during implementation) - site-specific mitigation & monitoring measures - Roles and responsibilities - Public relations, - Consultations - Grievance redress - Monitoring and corrective action planning	All staff and consultants involved in the project All contractors immediately after mobilization of the contractor At PMU level	PMU

[35] 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. Training can provide the foundations of competence, but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence and monitor to ensure that the training provided is relevant and effective.

Description	Target Participants and Venue	Source of Funds
- Reporting and disclosure -Construction site standard operating procedures (SOP) -Chance find (archaeological) protocol - AC pipe protocol - Traffic management plan - Waste management plan - Site clean-up & restoration		
Contractors Orientation to Workers (1/2 day) - Environment, health and safety in project construction (OHS, core labor laws, spoils management, etc.)	Once before start of work, and thereafter regular briefing every month once. Daily briefing on safety prior to start of work All workers (including unskilled laborers)	Contractor's cost

B. Environmental Management Plan (EMP)

188. An Environmental Management Plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable level and monitoring the same. This is presented in the following tables 43 to 48, package wise, which shows the potential environmental impacts, proposed mitigation measures and responsible agencies for implementation and monitoring.

189. A copy of the EMP must be kept at work sites at all times. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

190. For civil works, the contractor will be required to (i) establish an operational system for managing environmental impacts (ii) carry out all of the monitoring and mitigation measures set forth in the EMP; and (iii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate budget for compliance with these EMP measures, requirements and actions.

191. The contractor will be required to submit to PMU, for review and approval, a site-specific environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; (iii) monitoring program as per SEMP; and (iv) budget for SEMP implementation. No works can commence prior to approval of SEMP.

Table 43: Environmental Management Plan – Design and Pre-construction

Aspect	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Cost and Source of Funds
Design stage					
Increased abstraction from Madhumati River (110 to 135 MLD)	No notable impact is envisaged on river flow, downstream uses or salinity due to proposed abstraction, which is just 0.53% of the river's total dry-season flow.	• No mitigation measures required, however, it is important to create awareness among the people on information related to water availability, abstractions and salinity levels, especially at Mollahat intake, Madumati River. Following actions are recommended: • Organize periodic public awareness campaigns throughout implementation and operation • Disclose salinity monitoring data; if feasible, a display system may be installed at the intake facility to display real-time salinity level information from the SCADA to benefit the local communities in water use	PMU, KWASA	KWASA	Project cost
Groundwater abstraction (45 MLD private abstractions + 55 MLD KWASA abstraction	Although project is designed to abstract groundwater within the safe yield (100 MLD), over pumping of groundwater during operation beyond the safe yield due to lack of monitoring and enforcement may have adverse impacts such as increased salinity, land subsidence, significance of which may vary depending on the rate of over exploitation.	• Implement all appropriate measures as suggested by Feasibility Study for KWSP Phase 2, 2024 • Utilize the groundwater within the sustainable limits • Strictly follow the groundwater utilization plan and ensure that overall annual abstraction is within the safe yield limits; an average, KWASA withdrawal shall be limited to maximum 100 MLD by KWASA and private parties • Install and operate groundwater monitoring and management system, and ensure adaptive management considering the annual weather conditions, eg., drought years • Conduct public awareness campaigns on water supply situation, and improved service levels with KWSP Phase 2, and encourage shifting from private to public supply; • Regulate groundwater usage by private parties, coordinate with other government agencies like WARPO to establish policies to regulate, monitor and limit the usage within the established limits, i.e. 45 MLD • Plan and implement groundwater augmentation measures, which may include artificial recharge, rainwater harvesting in public and private places, such	PMU, KWASA	KWASA	Project cost

Aspect	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Cost and Source of Funds
Design stage					
		as rooftop rainwater harvesting, reuse of treated wastewater etc.			
Water abstraction from Bhairab river, Afil gate intake pumping stations works	Poposed abstraction from Bhairab River at Afil Gate is 0.17 m³/s (15 MLD), which is just about 0.21%, no notable impacts envisaged on flow or on endangered Gangetic River dolphins. During construction, hunting / poaching by project personnel, discharge wastewater, noise from operation may have negative impacts. Significance is low given location works in confined area of pumping station.	• Create awareness among the project personnel, local community, fishermen, boatmen etc., • Ensure proper supervision and monitoring • If high noise generating tasks or machinery is necessary, use noise attenuating measures. Do not conduct noisy works before and after sunset. • Conduct periodic noise monitoring during the construction phase. • (iv) Use low noise generating pumps and motors. • (v) During construction, no wastewater shall be discharged into the river. • (vi) During operation phase, the increased water supply will increase sewage generation. The ongoing sewerage project covers about 40% of project area. KWASA shall ensure expansion of sewerage system to the remaining area with the future projects. KWASA shall ensure that in uncovered areas, septage from on-site sanitation facilities are treated and disposed through sewage / septage treatment plants.	Contractor, PMU, KWASA	KWASA	Project cost
Increase in sewage generation due to increase in water supply during operation	Untreated wastewater discharge negatively impact receiving water bodies, land and water pollution, adverse impacts on public health etc.,	• (i) Complete the on going ADB funded Khulna Sewerage System Development Project (KSSDP) works timely, and ensure all households are connected to sewerage system in the sewered; expand the system as feasible with the future projects • (ii) Coordinate with KCC and ensure that no raw sewage is discharged into open drains and canals and that septic tanks contents are periodically collected, and transferred to septage treatment plant for treatment and safe discharge • (iii) With the combination of sewerage and septage management system, prevent discharge of untreated wastewater into open drains, canals and river.	KWASA	LGD	Project cost
		•			
Obtaining project / construction related Permits, Clearances	Delay in obtaining statutory clearance may delay the project implementation and	• All of the necessary consents, permits, and clearances shall be obtained before award of contract or prior to start of civil work (as the case may be) and	PMU, Contractor	PMU, KWASA	Project cost

Aspect	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Cost and Source of Funds
Design stage					
etc.,	may negatively impact the overall project delivery	acknowledged in writing and provide a report on compliance with all obtained permits, clearances, NOCs, etc., Permissions and clearances are required from the following government agencies and departments: • (i) Department of Environment (ECC) • (ii) Khulna City Corporation (road cutting / pipe laying) • (iii) Khulna District Authority (road cutting / pipe laying) • (iv) Roads and Highway Department (road cutting / pipe laying) • (v) Local government engineering department (road cutting / pipe laying) • (vi) Bangladesh Water Development Board / Water Resource Planning Organization (WARPO) (permission to abstract water).			
Planning of activities, public information etc.,	Improper planning, lack of training and lack of public information etc., may lead to delay in works, negative public perception, and improper implementation of EMP.	• Update EMP timely to reflect any changes • Ensure mobilization of contractor's relevant staff and submission and clearance of SEMP prior to start of works • Conduct community awareness and information programs • Conduct training on EMP implementation • Prepare sub-plans as necessary, recommended list is as follows: (ii) Traffic Management Plan, (iii) Stakeholder Consultation and Information Dissemination Plan, (iv) Waste and Spoil Management Plan. (v) Construction Safety and Occupational Health Plan, (vi) Emergency Preparedness and Response Plan, (vii) Chance find protocol.	Contractor, PMSC	PMU	Project cost
Public utilities in the project sites	Public utilities may be disturbed and/or damaged during the works, which may adversely impact services, may also have health and	• (i) Locate underground utilities prior to excavation • (ii) Liaise with respective utility agencies • (iii) Take contingency measures in case of disruption of essential services (such as water supply)	Contractor, PMSC	PMU	Project cost

Aspect	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Cost and Source of Funds
Design stage					
	safety risks				
Tree cutting	Loss of tree cover and impact on wildlife; impact is minimal as project requires only 8-10 trees removal	• (i) After the finalization of the designs and layout of the project components, the trees within the proposed construction areas will be marked • (ii) Conduct a survey of trees prior to cutting to identify any bird nests or wildlife and ensure that no disturbance occurs if active nests or wildlife are present. • (iii) Trees within the area required for construction will be felled after prior approval • (iv) Compensation will be provided for the affected trees based on the unit prices of trees determined by the agriculture/horticulture experts. For trees in public-owned lands such as ROWs where no claimant for compensation is confirmed, replacement of the tree shall be undertaken by KWASA at the replacement ratio of three trees for every tree that is cut (i.e., 3:1 ratio) • (v) Only trees that will require removal within the proposed construction areas of the sites will be cut, and • (vi) For trees not proposed to be cut, take all precautions to protect them from any damage from construction activities.	Contractor., PMSC	PMU	Project cost

Table 44: Environmental Management Plan – for Construction and Operation of Transmission Main and Distribution Pipelines
(Packages 1, 4 and 5)

Package No.	Description of Procurement as per PP WORKS	Unit	QTY
Package-1	Construction of Distribution pipe network with DMA establishment in existing areas including O&M	km	258
	Construction works for modification of 61 DMA in the existing distribution network including O&M	No	61
Package-4	Construction of distribution network with DMA establishment in the extension area and	km	272

	interconnection pipeline for 75 nos production well		
	Construction of service connection including meter installation	No	25,800
Package-5	Construction of Clear Water transmission main including Mayur river and canal crossing	km	38

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
A. Planning Stage - Construction and Operation of Pipelines					
1. Work delays due to improper planning					
1.a) Delays in mobilization and timely implementation of work program & poor coordination and extended duration for project completion	• Scheduling, coordination, procurement, obtaining approvals and project implementation will be expedited to the extent that is practicable. • Standard and good construction practices will be followed at all times. • The possibility of deploying several gangs simultaneously will be pursued, which will allow the work to be completed within the least possible duration. • Finalize construction programs duly considering provisions for work schedule The following plans be developed for implementation: o Area Construction Work Plan o Material Procurement Plans o Transportation Plan for material, equipment, and waste conveyance o Health & Safety Plan; Traffic Management Plan for each road segment o Environmental Management Action Plan o Construction Waste Management Plan o Other plans such as drainage management and erosion control (if any)	Work schedules Respective plans One-off before starting construction	Contractor	Reported to the PMU	Standard Construction Practices and Industry Norms
1.b) Poor environmental management by the Contractor	• Designate an environment specialist who will be in charge of coordination with PMU for updating this IEE and implementing the EMP and EMoP, including the conduct of all surveys, monitoring actions, etc. • Appoint an Environmental specialist with the mobilization of the contractor (throughout design and construction, and intermittent during operations) • Coordinate with the PMU on confirmatory surveys to be conducted during the design phase and complete as required with external experts (if needed)	Mobilization of PMU and PMSC staff with suitable experience and expertise One-off during mobilization, and continuously throughout the contract period	Contractor	Reported to the PMU	Qualification framework for the Environmental Specialist (of the PMSC)

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
1.c) Climate Change Consideration and Vulnerability Screening	• Adopting proper mitigation measures as may be required. • Flow variations and flood flows of the rivers should be considered for the extreme scenario for deciding the finished levels of the intake, pump house and other related structures located in the banks of the river. • Flood levels (for placing the pipeline along the fringes of low-lying areas) and cross drainage structures to be designed and located (during rehabilitation of damaged structures) based on recommendations of hydrological studies to be conducted during the detailed design phase (which has to be done with the consultation of BWDB, KWASA, and LAs). Alteration of rainfall intensities due to climate change, therefore, a change of peak flows of waterways and land-use changes should be clearly studied under hydrological assessments, and appropriate mitigation measures should be incorporated to final designs. • At least three trees should be planted for each tree that is cut. The recommended number would be five trees for each tree cut. • Efforts shall be made to plant additional trees for increasing the carbon sink. The trees may be selected with the help of Forest Department and space for additional planting (if the remaining space within ROW is not adequate) will be secured with the help of KWASA and Community-based Organizations (CBOs).	Throughout the project and flood-prone areas and other possible areas of tree planting (if any)	Design Consultant of the Contractor	PMU	ADB SPS Framework & IFC Sustainability Framework and Performance Standards
1.d) Delays related to the selection of locations for project interventions					
○ Trace of the Transmission mains, Feeder Mains and the distribution network	• The civil works for pipe laying will be carried within the available ROW, and no acquisition of land is required beyond the ROW.	Design details of pipeline traces and plans for other structures; One-off before starting construction	Contractor	PMSC environment management specialist	Detailed designs
○ Worker camps, stockpile areas, storage, and disposal areas	• The labour camps should be located near the subproject locations. • Sites to be considered will result in the least damage to property, vegetation, and least disturbance to the neighborhood, including the traffic. • Residential areas are not the best locations to set up worker camps, given the possibility of social conflicts. • Extreme care will be taken to avoid negative impacts on low lying and marshy areas.	Plans for site selection One-off before starting construction	Contractor	PMSC environment management specialist	-

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	• All locations would be included in design specifications and on plan drawings. • Material and equipment storage yards shall be secured to minimize the risk of theft. They shall also be safe from access by children, animals, etc. • The contractor shall submit a method statement and plans for the storage of hazardous materials (fuels, oils, and chemicals) and emergency procedures.				
1.e) Issues due to delays in the finalization of the trace for the pipelines	• The trace will be finalized with the consultation of all the stakeholders, and any approvals and consents will be obtained without delay.	Design details of the pipeline traces and Plans for other structures One-off before starting construction	Contractor	PMSC environment management specialist	-
○ Railway crossings: There are 2 locations where the pipelines cross the railway lines	Approval from the Bangladesh Railway and close coordination is needed for construction of the pipeline across railway line.	-	PMU		Approvals from Bangladesh Railways
1.f) Work delays due to not obtaining prior approvals/ consents, etc.	• In all instances, KWASA, service providers, contractors, and consultants must comply with relevant national and ADB Safeguard Requirements. The IEE should be thoroughly reviewed to note any pre-requisites and to understand legal, regulatory and Institutional procedures. • A copy of the IEE must be kept on-site and disclosed in KWASA and ADB website for any stakeholders to have access to.	Clearances and approvals One-off before starting construction	PMU facilitated by EA and/or IA Contractor facilitated by the IA and PMU	PMU	Approvals and consents as listed in Chapter II of the IEE Report
1.g) Climatic conditions and local weather patterns	• Rainfall and its runoff in the project area may cause disruption/damage to ongoing works and public inconvenience. • Furthermore, climatic conditions play an important role during the dispersion of noise and air pollutants. Seasonal climatic conditions have been considered for scheduling of construction activities.	Work schedule and plans to accommodate the loss of time due to inclement weather (and contingency plans, if any); One-off before	Contractor	PMU	Climatic and weather patterns; data provided by the BMD.

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		starting construction and updating of plans during construction			
2. Health and safety issues in compliance with Standard Practice					
2.a) Occupational Health and Safety of workers 2.b) Public Safety	• Appointment of an Environmental, Health, and Safety (EHS) Officer will be considered towards the end of the planning stages, before the implementation of any project activity. • Selection of locations and facilities for labour camps will be reviewed by the EHS Officer, in consultation with the KWASA authority • Compliance with EHS requirements will be thoroughly reviewed, and a summary requirement will be prepared (one for workers and another common one for the public, including the workers).	EHS Manuals, Plans, Forms, Schedules, Notices, Registers, Redress Mechanisms, Follow-up, and Monitoring Procedures, Emergency Preparedness and First-aid, Training schedules and methods One-off during mobilization, and continuously throughout the contract period	Contractor's Environmental, Health, and Safety (EHS) personnel. (in consultation with the officials of the PMU)	PMU	National Labour Laws, Guidelines of GoB and IFC EHS Guidelines on Occupational Health and Safety
3. Optimal use of resources, proper waste management and minimization of physical impacts					
3.a) Waste Minimization	• Prepare a solid waste management plan for disposal of spoil, excavated/dredged material and construction debris; Waste shall be disposed of in existing approved sites; new sites shall be developed considering siting guidelines, maintained and operated accordingly	Solid Waste Management Plan (SWM Plan) Consents and Approvals from	Contractor in consultation with the local authority	PMSC environment management specialist	-

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	• Make efforts to minimize the overall material required for the project by adopting various approaches – balanced cut and fill, re-use as much excavated material from this project as possible	the local authority for the collection, transportation, and disposal of MSW and other construction debris			
3.b) Method of construction, Work schedule and closure of areas	• All the works connected with excavations, pipe laying, bedding, backfilling, culvert and bridge crossings, pipe connections and couplings, etc. will be carried out according to approved Standard Methods and Drawings. • Method of Road Crossings should be finalized with the consent of the RHD/ KCC, and LA through the KWASA • Ensure careful planning and scheduling of the activities. Limit work in busy areas to night shifts (if recommended by the KWASA) and public holidays. To minimize the impact on traffic flow, businesses, and road users, as much as possible schedule trenching works during nighttime. For pipe laying during night shifts (if allowed by the KWASA), the Contractor shall be allowed to excavate only the length that could be laid in one night without leaving any obstruction whatsoever for the public during daytime. • Consider low-traffic and non-sensitive areas (other than schools, religious places, and commercial/business) for daytime trenching works. • Increase workforce in areas to be excavated during the daytime. • Prepare a traffic management plan and road safety plan.	Construction Method Statements & Work schedules and Schedules for road closures One-off before starting construction for approval and continuously throughout the contract period	PMSC environment management specialist to coordinate with the contractor	PMU safeguards officer to approve schedule and areas	-
3.c) Selection of pipe material	• Strength parameters should satisfy the Specifications	Test reports, and certification from Approved and Accredited Independent Testing Agencies, prior to supply of pipeline	Material Supplier through the Contractor	PMU	Standards and Specifications for pipe material
3.d) Selection of construction material and sourcing	• The contractor shall prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, bedding material, etc.), and submit these to the PMSC for approval before the commencement of any work. Where materials are mined, proof must be provided of authorization to utilize these materials from the Bureau of Mineral Development (BMD) and Department of Environment (DoE).	Criteria for selection of licensed material sources One-off prior to starting of work	Sub-contractors through the Contractor	PMSC environment management specialist to check permits from the DoE	QA Standards and strength requirements for construction material

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		Continuous material test reports during construction		and BMD	Environmental Conservation Rules, 1997
3.e) Excavation of trenches	• Minimum possible width is specified in trench details (pipe diameter + working space) to minimize damages to road surfaces, and proper shoring methods will be adopted. • If needed, adequate support to boundary walls and other structures will be provided.	Detailed construction method statements clearly indicating trench widths and excavation methods Before construction	Contractor	PMU	Standard Construction Practices (150 mm each side of the pipe for Trench)
3.f) Labour gangs	• Recruitment of laborers, both unskilled and skilled, from the locality, will reduce the need for having large labour camps and will lead to lesser impacts due to such labour camps during the construction stage.	Labour recruitment plans and criteria for selection of sub-contractors; Records of training Before the commencement of civil works	Sub-contractors through the Contractor	PMSC environment management specialist	Labor Recruitment Guidelines
3.g) Training of site staff on general and environmental safeguards	• Ensure all site personnel have a basic level of environmental awareness training. • Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained of any potential hazards associated with their task. • No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the contractor. • All employees must undergo safety training.	Criteria for recruitment of site staff Records of training Before the commencement of civil works and hiring new employees	Contractor	PMU safeguards officer; PMSC environment management specialist	ADB SPS Framework
3.f) Noise and vibrations	• Time of operation of construction equipment and vehicles engaged in the transportation of construction materials will be planned well so as not to	See EMP for Construction Phase	Contractor	PMU safeguards officer; PMSC	Noise and Vibration Control

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	disturb the public. However, noise and vibration will be confined to the periphery of the work sites only are temporary in nature.			environment management specialist	Regulations
3.g) Air quality	• Dust and gaseous emissions are expected due to machinery and equipment and during construction processes (e.g., transportation, excavation, construction activities, and stockpiling. Proper planning of construction and transport activities will be given priority. Proper mitigation methods will be adopted to control obnoxious gases, and dust generated if any.	See EMP for Construction Phase	Contractor		-
3.Jashore) Drainage and Hydrology	• The section of the pipeline which borders low lying and marshy lands (e.g., paddy fields and low-lying areas such as along Gopalganj to Khulna Road and Khulna to Jashore Road, where work activities need careful planning to avoid local flooding and any negative impacts on the aquatic ecosystems. • Other project components are not expected to have any negative impact on the drainage and hydrology of the area. • Runoff from the project will produce a highly variable discharge regarding volume and quality, and in most instances will have no discernable environmental impact. • Identify & demarcate drainage paths on the sites, & excavated roads • Integrate these channels in the layout plans so that natural drainage is not disturbed; Provide cross drainage structures wherever necessary along the excavated roads (especially the narrow roads), and yards.	See EMP for Construction Phase	Contractor	PMU safeguards officer and PMSC environment management specialist	GoB and the local authority requirements and specifications
4. Minimizing Community impacts					
5.a) Land use and livelihoods	• The land used in the project area comprises of rural agricultural settings in some areas and urban setting within the distribution area. The built-up areas consist of mainly housing, commercial and industrial facilities, home gardens and small-scale agricultural plots. • There are a few government/private offices and buildings bordering the roads, a few educational institutes, religious places, and commercial establishments such as shops, restaurants. • The transportation corridors constitute existing roads in the project area. Proper planning of construction activities will minimize the impact on day-to-day activities of the people.	Work plans and Traffic Management Plans One-off prior to start of construction work and continuous monitoring during the construction phase	Contractor	PMU	-

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
5.b) Traffic flow and access to property, sites, and by-roads	• Impacts on the traffic flow as a result of construction vehicles and transportation of material will be a minor impact. Local communities will be regularly consulted regarding the location of construction schedules, access and hauling routes, and other activities that are likely to cause disturbances during construction. • Information on road closures and proposed detours will be communicated via notices, pamphlets, road signages, etc. • Plan transportation routes so that heavy vehicles do not use narrow local roads, except near the delivery site. • Schedule transport and hauling activities during non-peak hours. No vehicles should be parked on roadsides for long periods. • Keep the roadsides free from all unnecessary obstructions. • Notify affected sensitive receptors by providing signboards with information about the nature and duration of construction works and contact numbers for concerns/complaints	Traffic Management Plans Transportation Plans and schedules Clearances and approvals One-off before starting construction work and continuous monitoring during the construction phase	Contractor	PMSC environment management specialist and resettlement specialist	
5.d) Community and public awareness	• Careful planning and coordination with all the stakeholders be established. • A well-planned information campaign must precede any construction activity to make the public aware of the extent of the issues that might occur during construction. The road closure, together with the proposed detour, needs to be communicated via notices, pamphlets, road signage, etc. • Open liaison channels shall be established between KWASA, contractors, and interested and affected parties such that any queries, complaints, or suggestions can be dealt with quickly and by the appropriate persons.	Strategies and methods to conduct Community and Public Awareness prior to commencement of civil works Continuous implementation during construction and O&M period	Contractor in coordination with the GN, and/or any other NGO and Community Leaders	PMU safeguards officer and PMSC environment management specialist	-
5.e) Aesthetics, landscape character, and sense of place	• There are no large structures proposed. Therefore, the project is considered to be compatible with the surrounding landscape and is not expected to negatively impact the existing visual quality or landscape character of the area.	Project Plans One-off prior to start of construction work and	PMSC	PMU	-

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		continuous monitoring during the construction phase			

B. PHYSICAL IMPACTS DURING CONSTRUCTION PHASE AND MITIGATION					
1. Anticipated impacts due to land preparation activities, removal of road and paved surface and excavation of trenches					
1.a) Land preparation activities	• Implement a Construction Waste Management Plan (C-WMP); include waste minimization measures in the plan • The Contractor shall not enter or occupy for any purpose with men, tools, equipment, construction materials, or with materials excavated from any trench or pit in any private property outside the designated site boundaries without written permission from the owner and/or tenant of the property. • All spoil, topsoil, demolition waste, and cut vegetation should be covered by secure tarpaulins whenever transported offsite, to prevent material being blown away by trucks • Avoid stockpiling any excess spoils at the site for long periods. Such material should be disposed of at approved/designated areas without delay • If the disposal is required, the site shall be selected from barren lands, no/least vegetated areas; sites should be away from residential areas, forests, water bodies (streams and the low-lying stretches), and any other sensitive land uses • Spoil/wastes should be properly segregated for collection & disposal to the designated disposal site; recyclable/reusable material shall be collected separately for alternative use, free distribution or sold in the local recycling material market • Prohibit burning of construction and domestic waste; Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection areas/bins/craters, etc.; create awareness of waste designations	Implementation of construction method statement and Implementation of C-WMP Weekly visual site observations Monthly Waste audits	Contractor	Environment Management Specialist, PMSC	Good construction practices and industry standards Use available Guides for C-WMP (Construction waste management, USEPA, Dec 2007[36]

[36] Available at: https://Jashore.epa.gov/sites/production/files/2014-03/ documents /017419.pdf)

	• Conduct site clearance and restoration to original condition after the completion of construction work especially along the pipeline routes, site, and yard areas; ensure that site is properly restored before issuing of completion certificates.				
1.b) Excavation work	▪ If needed, for rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals. • Mechanical excavations shall be immediately followed by skilled workers who will trim and clean the excavations/trenches to proper size and depth as required in the plan. • Proper shoring of excavations/trenches will prevent the side (slopes) from collapse and settlement of adjacent land surface, and pavements due to extra loads applied on the edge of the trench (within the 'zone of influence') during construction work. • Sloping of the sides should be avoided as it would need more excavation and would cause more damage to the existing paved surfaces.	Construction method statement Weekly visual site observations Monitoring of site management practices as the work progresses	Contractor	Environment Management Specialist, PMSC	Detailed design documents Shoring design manuals and methods as adopted by the Contractor
1.c) Storage and transportation of construction debris and excavated material Removal of paved surfaces and excavated material	• The contractor shall haul away all excavated materials from the excavation site and stockpiled in an area designated or approved by the PIU. • <u>Re-use of excavated material:</u> The stockpile shall be processed where it is deposited so that it can be brought back to the trenches as selected filling material. • To the extent possible, excavated material will be directly loaded (from excavators or manually) into hauling vehicles, without leaving it on site; For this purpose, hauling vehicles must always be present at the excavation site, however, parked suitably not interrupting excavation and site works. Engines should be shut off while these vehicles are idling.	Construction method statement Implementation of C-WMP and regular waste audits Monitoring of site management practices as the work progresses	Contractor	Environment Management Specialist, PMSC	For re-use of excavated materials: Follow guidelines proposed by the KWASA or CSC.

1.e) Scheduling of work and Closure of areas	• Excavation, construction of sub- and superstructures, erection, fixing and installation of instruments and machinery, interconnection with existing pipelines, hydro-testing, backfilling, landscaping and pavement restoration shall be completed within a specified period. The construction method statement should be regularly reviewed in consultation with the PMU, and location-specific work plan for each day's work should be planned. The length of the work for each day should be scheduled depending on the sensitivity of the location, and considering the constraints, prerequisites, conditions put forward by all the stakeholders. • The contractor should mobilize all the resources that are needed for each day's work and complete the day's work within the stipulated time. • Contingency plans for the mobilization of resources (labour, equipment, vehicles and machinery, health and safety provisions, etc.) should be in place all the time. The contractor must maintain all the materials necessary in his inventory, and equipment and machinery available with access to any additional resources (as a contingency measure), so that these can be easily hauled to the construction site when needed	Construction method statement and activity plans Monitoring of site management practices as the work progresses Public complaints	Contractor	Environment Management Specialist, PMSC	Detailed Design documents, Construction method statement and Activity Plans approved by the PMU.
1.f) Access to existing built-up areas, houses, buildings, commercial buildings, institutions, etc.	▪ The contractor shall make available in his stock steel plates and wooden planks which will be deployed to provide temporary access to building carports and garages, street crossings, and other locations within the project area where such interventions are necessary. ▪ Advance road signage indicating the road detour and alternative routes. Provide signboards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/ complaints. • All necessary measures should be taken to complete the work within the minimum allocated time.	Construction method statement and inventory Warning signs and barricades Monitoring of site management practices as the work progresses	Contractor	Environment Management Specialist, PMSC	Minimal disturbance to existing operations of the WTP, traffic flow and occupants of quarters
2. Impacts on natural flow and existing drainage pattern and hydrology					
2.a) Impacts on drainage canals, natural drainage paths and activities that would cause (local) flooding	• Contractor's activities shall not lead to local flooding conditions as a result of blocked drainage paths and drains or any other modifications to build- and/or natural drainage canals/paths. • The contractor shall take all necessary measures, as directed by the PMU to keep all drainage paths and drains clear of blockage at all times. • If flooding or stagnation of water is caused by contractors' activities, contractors shall provide suitable means to (a) prevent loss of access to any land or property, and (b) prevent damage to land and property. • Contractor shall not select land within flood-prone areas and low-lying fringes to dispose of excavated and spoil material, locations for material	Throughout the project area with special attention to low-lying areas along the Gopalganj to Khulna Road and Khulna to Jashore Road Continuous	Contractor	Environment Management Specialist, PMSC	Detailed design documents Site-specific Drainage Management Plan should be developed

	stockpiles, yards and other locations where other construction materials are stored	monitoring during the rainy season and during major storm events			
3. Impacts on water quality due to silt runoff discharges and spoil from construction activities					
3.a) Deterioration of Water quality	• Dispose of spoils in designated disposal areas • Avoid earthworks during rainy days and monsoon season to prevent soil run-off and schedule works during the dry season when the water levels are low • Avoid stockpiling of earth fill during the rainy season unless covered by tarpaulins or plastic sheets; Install temporary silt traps or sedimentation basins along drainage leading to water bodies • Place storage areas for chemicals, fuels & lubricants away from any drainage leading to water bodies and low-lying areas; Store fuel, construction chemicals, etc., under shelter and on an impervious floor, also avoid spillage • Pump out the water collected in the pits/excavations to a temporary sedimentation basin prior to disposal of only clarified water into drainage channels/streams and the low-lying areas • Consider safety aspects related to trench/pit collapse due to the accumulation of water; dispose any residuals at the identified disposal site, and stockpile construction material away from wetlands and water bodies, floodplains and reservations/low-lying areas • Do not clean, wash machinery and equipment near water bodies; prevent any waste/water from discharging to water bodies or the low-lying areas • Inspect all vehicles daily for fluid leaks before leaving the vehicle staging area, and repair any leaks before the vehicle resumes operation • Excess water sprinkling on soil, material to control dust may also generate runoff which may enter the water bodies; this should be avoided by controlled water sprinkling	One-off work program to establish the baseline; Water quality monitoring data Waste disposal manifest/ record Visual site observations Complaints from community	Contractor	Environment Management Specialist, PMSC	No visible increase in water pollution due to the project Zero complaints from the community
4. Effect on the traffic on the local road network					
4.a) Traffic and access related impacts	• Construction schedules will be finalized to allow accessibility from alternative routes • Temporary traffic management schemes will be used at the commencement of the project	Urban areas where disturbances to vehicle movements would occur.	Contractor	Environment Management Specialist, PMSC	Traffic Management Plans Detailed Design documents

	• If roads are damaged due to project-related transportation activities, reinstatement of road sections be carried out as per specifications, and method statement will be given at the commencement of the project. • Nighttime illumination should be in place at every location where the road is narrow, diverted and structures are repaired and any other places where PMU recommends doing so. • Monitor and record road crashes (if any) during construction and maintenance stages and takes appropriate remedial actions	Continuous throughout the construction period Public complaints			
5. Impacts due to Pollution: Noise and Vibration, Dust and Air Quality, Light, and Soil Erosion due to construction and Hazardous Waste Management					
5.a) Noise & Vibration	• Maximum permissible noise levels for construction activities must be less than or equal to 75 Leq T during daytime (06.00 – 21.00 hrs) and 50 Leq T during nighttime (21.00 – 06.00 hrs). • Conduct regular monitoring of noise levels as per the monitoring plan • Minimize the noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimize sound impact to surrounding sensitive receptor. Avoid loud random noise from sirens, air compression, etc. • Avoid using multiple high noise generating equipment/activities simultaneously • Identify any buildings at risk from vibration damage • Horns should not be used unless it is necessary • Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals <u>Health Impacts of Noise and Vibration</u> • If workers are exposed to noise above noise exposure limit, the contractor must investigate options for engineered noise control, such as using low-noise excavators, jackhammers, drills, and power generators. • Limit the duration of each worker depending on the Exposure Levels and Time Limits for corresponding exposure levels (follow Occupational Safety Standards) • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. • Use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.	One-off work program to establish the baseline Continuous site auditory observations Continuous vibration monitoring by 'feeling state' monitoring Weekly noise monitoring data using a mobile measuring device Vibration measurements using measuring equipment, if needed Complaints from community	Contractor	Environment Management Specialist, PMSC	National environmental Regulations by DoE, ECR 97 and 2023. Construction Method Statement
		Noise and vibration levels of equipment and machinery	Contractor through a professional JASHORE&S	Environment Management Specialist, PMSC	Specification of the EH&S Standards of the IFC for exposure

		(obtained from specifications) Occupational Health and Safety Plan Regular check-ups for workers who are exposed to continuous high levels of noise and vibration	expert		levels and time limits of exposure for high noise and vibration Or adopt guidelines as specified in The Control of Noise at Work Regulations (2005) of the UK.
5.b) Dust and Air Quality	**Air quality impacts: Site works** • As far as possible, plan site clearance and earthwork activities towards the end of the rainy season and avoid inter-monsoons, when the soils will be damp naturally and without being subject to downpours • To suppress dust, the contractor should sprinkle water on exposed soil and stockpiled material on-site sufficiently frequently, depending on the weather • If dust generation is significant, provide a dust screen of appropriate height; Provide a cover or a windbreaker around the sites to minimize the wind-carried air-borne dust; this will minimize dust generation, and also drifting of soil from excavated trenches • Control access to the work area, prevent unnecessary movement of vehicles, workers, public trespassing into work areas; limiting soil disturbance will minimize dust generation	Schedule of works Dust suppression measures - visual site observations Weekly review of site practices Public complaints	Contractor	Environment Management Specialist, PMSC	Construction Method Statement Transportation Plans Zero complaints from the community No visible increase in dust and particulate matters on buildings located adjacent to the roads National Ambient Air Quality Regulations, ECR 97 and 2023.
	Air quality impacts: material haulage, vehicle and equipment use • Vehicles travelling to and from the construction site must adhere to speed limits to avoid producing excessive dust. • Use tarpaulins to cover loose material (soil, sand, aggregate) when transported by trucks • Clean wheels and undercarriage of haul trucks before leaving construction site/quarry; Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water • Stabilize surface soils where loaders, support equipment, and vehicles will operate by using water and maintain surface soils in a stabilized condition • Access and other cleared surfaces, including backfilled trenches, must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust.	Transportation Plan Dust suppression measures - Visual site observations Ambient air quality monitoring as per EMP Weekly Vehicle emission testing records	Contractor	Environment Management Specialist, PMSC	

	• Ensure that all the construction equipment, machinery are fitted with emission control devices, which are operating correctly; ensure that only those vehicles and equipment in good condition and are in good maintenance are used for project construction. Vehicles and machinery are to be kept in good working order and to meet manufacturer's specifications for safety, fuel consumption, etc. • Vehicles/equipment should have a valid Vehicle Emission Certificate (VEC) obtained from the Bangladesh Road Transport Authority (BRTA) showcasing emissions below the specified limits; Maintain VEC records of all vehicles at all times for ready inspection at the work sites	Complaints from community As work progresses			
5.C) Hazardous waste management	• Any hazardous waste shall be stored at the designated place before disposal. The contractor shall ensure the material safety data sheets of chemicals are posted inconspicuous areas. • To avoid water and soil contamination due to concrete batching plants, storage areas, and wash-down areas, leak and spill prevention plans shall be established. Any accidental leaks/spills shall be arrested and cleaned appropriately, and such procedures shall be established. Workers shall be trained and made aware of such procedures. • Oil interceptors shall be provided at appropriate locations (e.g., vehicle service areas); Residual and hazardous wastes such as asphalt and bituminous waste, solvents, oils, fuels, and lubricants shall be disposed of in approved disposal sites approved by the PMU. • Hazardous material, including oil and grease to be collected in leak-proof, properly-labelled containers and stored appropriately. Proper signs should be displayed for hazardous waste) and should be handed over to authorized third parties who have waste oil handling or recycling licenses • Bins and/or skips shall be emptied regularly, and waste shall be disposed of at the pre-approved site. Waybills for all such disposals are to be kept by the contractor for review by the environment management specialist.	One-off for preparation and establishment of the Operations Manual that should include a Hazardous Waste Management Plan Visual site observation of proper management practices by weekly inspection of waste storage area Monthly waste audits	Contractor A specialist contractor who is authorized to handle hazardous waste	Environment Management Specialist, PMSC to monitor and report to the LA	Construction Method Statement National Environmental Regulations, ERC 97and 2023.
5.d) Pollution from asphalt and batching plant operation (This is **applicable only if** the Contractor is involved in asphalt batching which is needed for road rehabilitation work)	• Ensure that batching plant is installed with in-built air pollution and dust control system; for fugitive emissions/dust from the loading area, provide dust screen around the components • Ensure that plant is well operated & maintained at all times according to O&M manuals provided by the equipment manufacturer; • The asphalt loading area is equipped with a leak-proof concrete floor, from which all drainage is collected and treated as necessary before discharge	Establishment of batching plant One-off for preparation and establishment of the Operations Manual Operations manual should include a waste	Contractor	Environment Management Specialist, PMSC to monitor and report to the KWASA.	National Environmental Regulations, ECR 97 and 2023.

	• Asphalt trucks and especially drums are washed out only in a designated area, which should also be equipped with a leak-proof floor, from which drainage is collected and treated as necessary • All chemicals used in asphalt preparation are properly stored, whether dry, in powder or granular form, or as liquids. Storage facilities should be as specified in the appropriate international standard and should include equipment to extract dust and completely contain any spillage from leaks Conduct waste audits and inspections according to the EMoP	management plan Visual site observation by weekly inspection of waste storage area Monthly Waste audits			
C. ECOLOGICAL IMPACTS AND MITIGATION					
1.a) Ecological Impacts due to loss / destruction / fragmentation of habitats	• Ensure that all construction activities are conducted strictly within the site footprints (including labour camps, offices, vehicle parking and other activities that might normally be located in an exterior contractor's area); no clearance of vegetation/trees outside footprint is permitted • Prohibit any deliberate killing or harming of animals on or off-site; any hunting or fishing or in nearby areas by site personnel; preventive actions shall be put in place by the contractor for hunting/killing of wild animals • Ensure that all construction work or other activities near the site perimeter are conducted with particular care and include measures to reduce noise and dust to the minimum possible • Create awareness in all site staff & workers on the importance of the animals and plants on-site and in the surrounding area, and their vulnerability • To protect site personnel, training should also be provided to enable them to recognize and deal safely & humanely with all venomous animals that may be encountered (e.g., snakes and scorpions) • Conduct site preparation activities, including vegetation removals, outside of the breeding season for wildlife, including migratory birds	Awareness of staff/workers	Contractor	Environment Management Specialist, PMSC	Guidelines provided by the *ECR 97 and 2023.
1.b) Impacts on protected species of flora and fauna	• Prepare a method statement following accepted construction procedures near low-lying areas. This, among other things, includes pollution control (water, air, noise), limiting disturbance, not harming wildlife, etc. • Create awareness among workers on wildlife and protected species • Conduct work in areas close to water bodies when the water level is low	Awareness of staff/workers	Contractor	Environment Management Specialist, PMSC	Rapid Confirmatory Survey Report

1.c) Impact on flora and fauna due to local air pollution, noise, and vibration, light pollution	• Noise and vibration controls should be adopted. • Air-borne dust should be kept to a minimum.	Weekly review of site practices	Contractor	Environment Management Specialist	Construction Method Statement and Location-specific Action Plan
D. SOCIO-ECONOMIC IMPACTS AND MITIGATION					
1.a) Community impacts due to Establishment of labour camps	• Contractor's activities and movement of staff to be restricted to designated construction areas • Any conflicts between the workers and the local communities should be resolved with caution. Community leaders, Union Parishad (UP) and other responsible persons should be informed of any incident without delay. • The possibility of the hiring of labour from the same locality and avoiding the setting up of labour camps should be looked into.	One-off before starting of work: Construction camp/yard establishment & management plan Weekly Interviews with workers and local people	Contractor in coordination with the GN, and/or any other NGO and Community Leaders	PMU Social Safeguards Officer and Environment Management Specialist, PMSC	Zero complaints from community and workers
	• Providing appropriate conditions when putting up and maintaining temporary labour camps, accommodation and making sure that the conditions do not impact on the health and well-being of occupants	Prior to the establishment of labour camps and during labourers occupy such camps	Contractor	PMU Social Safeguard Officer	minimum requirements based on internationally-recognized best practices[37]
1.b) Disruption to traffic/ transportation 1.c) Impacts to roadside structures and vehicle parking 1.d) Impact due to obstruction to access property 1.e) Impacts on the development activities in the vicinity	• The contractor should inform neighbours in writing of such activities at least 24 hours beforehand. This can take place by way of leaflets placed in the postboxes giving the environment management specialist's and contractor's details or other method approved by the environment management specialist. Provide signboards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints. • The contractor will ensure that there is the provision of alternate access to business establishments during the construction so that there is no closure of these shops or any loss of clientele.	One-off before starting work: Construction management action plan Monthly Interviews with local people and affected parties Public complaints Continuous monitoring as	Contractor	PMU Social Safeguards Officer & Environment Management Specialist, PMSC	Construction method statement and Location-specific Activity Plans Zero complaints from community and workers
	• The contractor will ensure that any damage to properties and utilities will be restored or compensated to pre-work conditions.				
	• Disruption of access for local residents, commercial establishments, institutions, etc. must be minimized and must have the environment				

[37] For a standard list refer to: https://Jashore.osha.gov/laws-regs/regulations/standardnumber/1910/1910.142

	management specialist's permission. Provide walkways and metal sheets where required to maintain access for people and vehicles. • Consult businesses and institutions regarding operating hours, and factor this in work schedules.	work progresses			
2.a) Safety of Workers Occupational health & safety	• Comply with IFC EHS Guidelines on Occupational Health and Safety[38] • Prepare a comprehensive & site-specific Health and Safety Plan (JASHORE&SP) describing in detail how the health and safety of all site personnel (workers, staff, and visitors) will be maintained at all times. It is to provide guidance on establishing a management strategy and applying practices that are intended to eliminate, or reduce, fatalities, injuries, and illnesses for workers performing activities and tasks associated with the project. • Provide compulsory JASHORE&S orientation training to all new workers to ensure that they are apprised of JASHORE&S Plan including rules of work, PPE, preventing injury to fellow workers, etc.; Conduct regular toolbox safety briefings; tendencies, causes, risks & safe procedures • Conduct periodic safety audit, identify and remove potential hazard; Ensure that qualified first-aid is provided at all times; equipped first-aid stations shall be easily accessible throughout the worksites and camps; Provide medical insurance coverage to workers. • Secure all installations from unauthorized intrusion and accident risks. • Provide supplies of potable drinking water; Provide clean eating areas where workers are not exposed to hazardous or noxious substances. • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present; visitors not to enter hazard areas unescorted • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas • Ensure moving equipment is outfitted with audible backup alarms • Mark and provide signboards 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. • Disallow worker exposure to high noise for more than 8 hours/day without hearing protection. Use of hearing protection shall be enforced actively.	Health & Safety Plan Implementation of measures Weekly interviews with workers Occupational health and safety plan Number of accidents and work-related injuries Complaints from community Continuous monitoring as work progresses	Contractor Labour sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist	Construction method Statement Detailed JASHORE&S Plans prepared according to guidelines Zero accident and work-related injuries Zero complaints from community and workers

[38] http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES

	• Employ workers with adequate experience, training, and know-how. These workers shall be led by an experienced supervisor or engineer who will provide the leadership in daily activities. • General regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on-site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g., fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on-site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • The contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, the EE and/or a translator shall be called to the site to explain further aspects of environmental or social behaviour that are unclear. • The rules that are explained in the worker conduct section must be followed at all times.				
2.b) Health and Safety of the Public	<u>Public safety during work along with public roads</u> • Adopt standard and safe practices for road construction • Ensure access to houses and business along the alignment; provide wooden planks, metal sheet with protective barricades/rails to allow access to the properties • Provide temporary traffic control (e.g., flagmen) & signs where necessary to improve safety and provide directions • Restrict public access to all areas where construction works are on-going through the use of barricading and security personnel • Ensure that all material, equipment, workers and all activities are conducted within the demarcated/barricaded strip of land along the road; there should be no spillage of any activity outside this zone • Clearly separate work area with traffic/pedestrian flow; provide public information boards to identify the work area easily • Warning signs, blinkers will be attached to the barricading to caution the public about the hazards associated with the works such as the presence of trenches / deep excavation • Plan carefully using a section-by-section approach, so that open trenches are quickly closed, and road restored	Work methods and implementation of measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the communication and participation strategy	Contractor Labour sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist to monitor PMU to coordinate with the Khulna WASA.	Zero complaints from community and workers

	• Control dust pollution – implement dust control measures as suggested under air quality • Organize public awareness campaigns.				
	<u>Safety risk due to construction vehicle/equipment movement on public roads</u> • Prepare a Transportation Plan for material, waste, and equipment; consult highways agencies, police and other relevant authorities during both planning & implementation • Plan transportation routes to avoid heavily populated areas; Schedule deliveries to avoid congested areas during morning and evening peak traffic periods; Proper coordination to combine deliveries where possible, to avoid under-utilization of vehicles and reduce the number of journeys • Source materials in the close proximity (within the Khulna city) and other local outlets wherever possible, to reduce the length of delivery journeys • Conduct awareness programs for communities who live along the roads about the movement of heavy vehicles and traffic safety measures • Provide safety, information and caution boards where necessary • There are schools (especially pre-schools) along the roads, construction vehicle movement shall be restricted during the school opening and closing hours; if unavoidable, place traffic guards at school and other sensitive places, like hospitals, temples, etc. Notify affected sensitive receptors by providing signboards with information about the nature and duration of construction works and contact numbers for concerns/complaints • Coordinate with the Traffic Police for temporary road diversions and for provision of traffic aids if congestion cannot be avoided during peak hours.	Implementation of Transportation Plan and Monthly monitoring Weekly Visual site observations, interviews with workers and community	Contractor and Sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist to monitor and report to KWASA PMU to coordinate with the Police; traffic department Khulna circle.	Construction method statement and Location-specific Activity Plans
	<u>Community health</u> • Lighting on the construction site shall be pointed downwards and away from oncoming traffic and nearby houses. • Mitigation and suppression of air-borne dust (especially during windy days) • The site must be kept clean to minimize the visual impact of the site. If screens are used, this must be moved and re-erected as work progresses. • Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbors. • Notice of particularly noisy activities must be given to residents/businesses adjacent to the construction site. Examples of	Work methods and implementation of measures Weekly visual site observations, interviews with workers and community Complaints from community	Contractor and Sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC to monitor and report to KWASA	Zero complaints from community and workers

	these include noise generated by jackhammers, diesel generator sets, excavators, etc. • Noisy activities must be restricted to the times given in the project specification or general conditions of the contract.	Activities based on the communication and participation strategy			
2.c) Other impacts related to workers and their camp operations	• Avoid/minimize the requirement to establish camps by hiring and employing local workers as far as possible; the presence of workers throughout the day and night during the construction work will disturb the environment • If necessary, contractor to identify a barren, vacant land (preferably private unused land) to establish the camp nearby; ensure that such camp is at least 500 m away from habitation, water bodies, scrublands etc., • Prepare & implement Construction Camp Management Plan (CCMP). The plan should include: o Layout plan showing all the proposed facilities, offices, material storage area (separately for hazardous waste, fuel, chemicals, etc.), amenities, repair and washing areas, and circulation areas/roads o Integrate drainage, water pollution, air and noise control measures o Drinking water, sanitation, washing, eating and resting places for workers o Proper liquid waste, solid waste collection, treatment, & disposal system o Fire safety, medical facilities • Separate the workers living areas and material storage areas, worksites clearly with a fencing and separate entry and exit • Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers • The camp shall be provided with proper drainage, there shall not be any water accumulation. Provide drinking water, water for other uses, & sanitation facilities, provide means of collection and disposal of sewage. • Manage solid waste according to the following preference hierarchy: reuse, recycling, and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable/recyclable waste shall be collected and sold in the local market	Approved location plan Complaints from community Construction Camp Management Plan Monthly visual observations, interviews with workers and local people Waste disposal manifest /record keeping by contractor's environmental specialist.	Contractor and Sub-contractors	Environment Management Specialist, PMSC to monitor and report to KWASA.	Construction method statement Location-Specific Construction Camp Management Plan which should include plans for Solid Waste Management, Drainage Management and provision of proper Sanitation

3) Impacts on the Cultural and historical environment	• All the staff and laborer's of the contractor are informed about the possible items of historical or archaeological value, which include old stone foundations, tools, clayware, jewelry, remains fossils, etc. • If something of this nature is uncovered, the Department of Archaeology of Bangladesh shall be contacted, and work shall be stopped immediately. • Conduct an Archaeological Impact Assessment, if needed.	Records of Chance Finds	Contractor	Environment Management Specialist, PMSC to report to the Dept. of Archaeology	Written permission from the Dept. of Archaeology and their guidelines for construction work to proceed
4) Grievance Redressals	• Should the construction staff be approached by members of the public or other stakeholders, the staff shall assist them in locating the environment management specialist or contractor or provide a number by which they may contact the environment management specialist or contractor. • The conduct of the construction staff when dealing with the public or other stakeholders shall be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site by the environment management specialist. • Environment management specialist and contractor are responsible for ongoing communication with people affected by the project. • The contact information of PMU, PMSC, and contractor shall be posted visibly at each construction site. • A complaints register (refer to the grievance redressal mechanism) shall be housed at the site office. This shall be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the contractor. This summary of the register shall be included in the monthly report to be submitted by the contractor to PMSC. • Interested and affected parties' need to be made aware of the existence of the complaints book and the methods of communication available to them. • The contractor must address queries and complaints by (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. • The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance, along with the action taken, to the environment management specialist within 48 hours of receipt of such complaint/grievance. • Grievance Redress Mechanism as outlined in Chapter VII should be clearly understood by the Contractor and his staff.	Work methods and implementation of GRM measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the communication and participation strategy	<u>Minor Grievances</u> Contractor <u>Other Grievances</u> PMU Social Safeguards Officer or Grievances Redressal Committee (GRC) or Program Steering Committee (PSC)	PMU Social Safeguards Officer & Environment Management Specialist, PMSC To coordinate with PMU, GRC or PSC and maintain records	Grievance Redress Mechanism

C. Operation of Pipelines					
Detection and repair of leaks and pipe bursts	• Leak repair work will be similar to pipe-laying work as earlier explained. Trenches will be dug to find the leaking area and the faulty connection will be refitted, or pipe will be removed and replaced if necessary. Although the impact is likely to be minimal due to a new and well-designed, efficient system, it must be ensured that leak detection and restoration time is minimized to the extent possible.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA
Periodic flushing of the pipeline, descaling and scour maintenance and other activities	• These need no special mitigation, other than collection of water after descaling and allowing deposition of scales, which can then be disposed of safely.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA

Table 45: Environmental Management Plan – for Construction and Operation of Impounding Reservoir at BWTP including pumping station, Upgrading the capacity of existing BWTP5 MLD and Upgrading the capacity of existing intake facilities at Mollahat and Construction of pre-setting tank (Package 3)

Package-3	Construction of Impounding Reservoir (385,000 m^3) at BWTP Samantoshena including pumping station	No	1
	Upgrading the capacity of existing Bangabandhu water treatment plant (BWTP) from the capacity of 110 – 135 MLD	No	1
	Upgrading the capacity of existing intake facilities at Mollahat (110 – 135 MLD) and Construction of pre-setting tank	No	1

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
A. Planning Stage - Construction and Operation of Pipelines					
1. Work delays due to improper planning					
1.a) Delays in mobilization and timely implementation of work program & poor coordination and extended duration for project completion	• Scheduling, coordination, procurement, obtaining approvals and project implementation will be expedited to the extent that is practicable. • Standard and good construction practices will be always followed. • The possibility of deploying several gangs simultaneously will be pursued, which will allow the work to be completed within the least possible duration. • Finalize construction programs duly considering provisions for work schedule The following plans be developed for implementation: o Area Construction Work Plan o Material Procurement Plans o Transportation Plan for material, equipment, and waste conveyance o Health & Safety Plan; Traffic Management Plan for each road segment o Environmental Management Action Plan o Construction Waste Management Plan o Other plans such as drainage management and erosion control (if any)	Work schedules Respective plans One-off before starting construction	Contractor	Reported to the PMU	Standard Construction Practices and Industry Norms
1.b) Poor environmental management by the Contractor	• Designate an environment specialist who will oversee coordination with PMU for updating this IEE and implementing the EMP and EMoP, including the conduct of all surveys, monitoring actions, etc. • Appoint an Environmental specialist with the mobilization of the contractor (through design and construction, and intermittent during operations) • Coordinate with the PMU on confirmatory surveys to be conducted during the design phase and complete as required with external experts (if needed)	Mobilization of PMU and PMSC staff with suitable experience and expertise One-off during mobilization, and	Contractor	Reported to the PMU	Qualification framework for the Environmental Specialist (of the PMSC)

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		continuous throughout the contract period			
1.c) Climate Change Consideration and Vulnerability Screening	• Climate change vulnerability checks in compliance with provisions provided in the IEE Report. • Adopting proper mitigation measures as may be required. • Flow variations and flood flows of the rivers should be considered for the extreme scenario for deciding the finished levels of the intake, pump house and other related structures located on the banks of the river. • Flood levels (for placing the pipeline along the fringes of low-lying areas) and cross drainage structures to be designed and located (during rehabilitation of damaged structures) based on recommendations of hydrological studies to be conducted during the detailed design phase (which must be done with the consultation of BWDB, KWASA, and LAs). Alteration of rainfall intensities due to climate change, therefore, a change of peak flows of waterways and land-use changes should be clearly studied under hydrological assessments, and appropriate mitigation measures should be incorporated to final designs. • At least three trees should be planted for each tree that is cut. The recommended number would be five trees for each tree to cut. • Efforts shall be made to plant additional trees to increase the carbon sink. The trees may be selected with the help of the Forest Department and space for additional planting (if the remaining space within ROW is not adequate) will be secured with the help of KWASA and Community-based Organizations (CBOs).	Throughout the project and flood-prone areas and other possible areas of tree planting (if any)	Design Consultant of the Contractor	PMU	ADB SPS Framework & IFC Sustainability Framework and Performance Standards
1.d) Delays related to the selection of locations for project interventions					
○ Location for the raw water intake, pump house, WTP, storage tanks, and staff quarters & OIC's office	• Land ownership of the premises where the raw water intake and pump house, WTP, storage tank and pump houses, offices, pump house have been already acquired by KWASA. The land where the storage tank to be built at Mollahat WTP facility belongs to the KWASA; hence, no further land acquisition is envisaged. • No mitigation measures are needed.	-	-		
○ Worker camps, stockpile areas, storage, and disposal areas	• The labour camps should be located near the subproject locations. • Sites to be considered will result in the least damage to property, vegetation, and least disturbance to the neighborhood, including the traffic.	Plans for site selection One-off before	Contractor	PMSC environment management specialist	-

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	• Residential areas are not the best locations to set up worker camps, given the possibility of social conflicts. • Extreme care will be taken to avoid negative impacts on low lying and marshy areas. • All locations would be included in design specifications and on plan drawings. • Material and equipment storage yards shall be secured to minimize the risk of theft. They shall also be safe from access by children, animals, etc. • The contractor shall submit a method statement and plans for the storage of hazardous materials (fuels, oils, and chemicals) and emergency procedures.	starting construction			
1.f) Work delays due to not obtaining prior approvals/ consents, etc.	• In all instances, KWASA, service providers, contractors, and consultants must comply with relevant national and ADB Safeguard Requirements. The IEE should be thoroughly reviewed to note any pre-requisites and to understand legal, regulatory and Institutional procedures. • A copy of the IEE must be kept on-site and disclosed on KWASA and ADB website for any stakeholders to have access to.	Clearances and approvals One-off before starting construction	PMU facilitated by EA and/or IA Contractor facilitated by the IA and PMU	PMU	Approvals and consents listed in Chapter II of the IEE Report
1.g) Climatic conditions and local weather patterns	• Rainfall and its runoff in the project area may cause disruption/damage to ongoing works and public inconvenience. • The project area receives considerably high rainfall. Flooding is a frequent event. Flash floods can occur which can disrupt (or even severely damage) the partially constructed structure of the raw water intake. Therefore, all attempts must be made to complete the work during the dry season • Furthermore, climatic conditions play an important role during the dispersion of noise and air pollutants. Seasonal climatic conditions have been considered for scheduling construction activities. Avoid construction activities such as excavation, pipeline laying, and intake structure works during the monsoon months, typically **June to September** in Khulna.	Work schedule and plans to accommodate the loss of time due to inclement weather (and contingency plans, if any). One-off before starting construction and updating plans during construction	Contractor	PMU	Climatic and weather patterns; data provided by the BMD.
2. Health and safety issues in compliance with Standard Practice					
2.a) Occupational Health and Safety of workers 2.b) Public Safety	• The appointment of an Environmental, Health, and Safety (EHS) Officer will be considered towards the end of the planning stages, before the implementation of any project activity. • Selection of locations and facilities for labour camps will be reviewed by the EHS Officer, in consultation with the KWASA authority	EHS Manuals, Plans, Forms, Schedules, Notices, Registers,	Contractor's Environmental, Health, and Safety (EHS) personnel.	PMU	National Labour Laws, Guidelines of GoB and IFC EHS

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	• Compliance with EHS requirements will be thoroughly reviewed, and a summary requirement will be prepared (one for workers and another common one for the public, including the workers).	Redress Mechanisms, Follow-up, and Monitoring Procedures, Emergency Preparedness and First-aid, Training schedules and methods One-off during mobilization, and continuous throughout the contract period	(in consultation with the officials of the PMU)		Guidelines on Occupational Health and Safety
3. Optimal use of resources, proper waste management and minimization of physical impacts					
3.a) Waste Minimization	• Prepare a solid waste management plan for disposal of spoil, excavated/dredged material and construction debris; Waste shall be disposed of in existing approved sites; new sites shall be developed considering siting guidelines, maintained and operated accordingly • Make efforts to minimize the overall material required for the project by adopting various approaches – balanced cut and fill, re-use as much excavated material from this project as possible	Solid Waste Management Plan (SWM Plan) Consents and Approvals from the local authority for the collection, transportation, and disposal of MSW and other construction debris	Contractor in consultation with the local authority	PMSC environment management specialist	-
3.c) Selection of equipment and installations and material	• Pipe Strength parameters should satisfy the Specifications • Equipment, machinery and strength parameters should satisfy industry-standard Specifications	Test reports, and certification from Approved and Accredited Independent Testing Agencies, prior to supply of	Material Supplier through the Contractor	PMU	Standards and Specifications for pipe material

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		pipeline			
3.d) Selection of construction material and sourcing	• Material for the construction of sumps, pump houses and buildings will be procured from licensed material sources who have obtained proper approvals for material sourcing. • The contractor shall prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, bedding material, etc.), and submit these to the PMSC for approval before the commencement of any work. Where materials are mined, proof must be provided of authorization to utilize these materials from the Bureau of Mineral Development (BMD) and Department of Environment (DoE).	Criteria for selection of licensed material sources One-off prior to starting work Continuous material test reports during construction	Sub-contractors through the Contractor	PMSC environment management specialist to check permits from the DoE and BMD	QA Standards and strength requirements for construction material Environmental Conservation Rules, 1997
3.e) Excavation of trenches	• Minimum possible width is specified in trench details (pipe diameter + working space) to minimize damage to road surfaces, and proper shoring methods will be adopted. • If needed, adequate support to boundary walls and other structures will be provided.	Detailed construction method statements clearly indicating trench widths and excavation methods. Before construction	Contractor	PMU	Standard Construction Practices (150 mm each side of the pipe for Trench)
3.f) Labour gangs	• Recruitment of laborers, both unskilled and skilled, from the locality will reduce the need for having large labour camps and will lead to lesser impacts due to such labour camps during the construction stage.	Labour recruitment plans and criteria for selection of sub-contractors. Records of training Before the commencement of civil works	Sub-contractors through the Contractor	PMSC environment management specialist	Labor Recruitment Guidelines
3.g) Training of site staff on general and environmental safeguards	• Ensure all site personnel have a basic level of environmental awareness training. • Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained in any potential hazards associated with their task. • No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the contractor. • All employees must undergo safety training.	Criteria for recruitment of site staff Records of training Before the	Contractor	PMU safeguards officer; PMSC environment management specialist	ADB SPS Framework

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		commencement of civil work and hiring new employees			
3.f) Noise and vibrations	• Time of operation of construction equipment and vehicles engaged in the transportation of construction materials will be planned well so as not to disturb the public. However, noise and vibration will be confined to the periphery of the work sites only are temporary in nature.	See EMP for Construction Phase	Contractor	PMU safeguards officer; PMSC environment management specialist	Noise and Vibration Control Regulations
3.g) Air quality	• Dust and gaseous emissions are expected due to machinery and equipment and during construction processes (e.g., transportation, excavation, construction activities, and stockpiling. Proper planning of construction and transport activities will be given priority. Proper mitigation methods will be adopted to control obnoxious gases, and dust generated if any.	See EMP for Construction Phase	Contractor		-
3.Jashore) Drainage and Hydrology	• Designs of the raw water intake should consider the hydrological variations of the Rivers, especially the flood flows. • Construction planning of the intake structure should be planned based on the hydrological predictions of the River. • Other project components are not expected to have any negative impact on the drainage and hydrology of the area. • Runoff from the project will produce a highly variable discharge regarding volume and quality, and in most instances will have no discernable environmental impact. • Identify & demarcate drainage paths on the sites, & excavated roads • Integrate these channels into the layout plans so that natural drainage is not disturbed; Provide cross drainage structures wherever necessary along the excavated roads (especially the narrow roads), and yards.	See EMP for Construction Phase	Contractor	PMU safeguards officer and PMSC environment management specialist	GoB and the local authority requirements and specifications
4. Avoiding ecological impacts					
4.a) Loss of VEC and impacts on the natural environment	• There are no areas of ecological diversity that occurs within the locations of project interventions. The land for the intake structure at the banks of the Madhumoti River. • The land identified for the construction of the IPR is part of the BWTP premises and is bare land. • Though these lands have no threatened or vulnerable species, it is recommended to carry out a rapid survey to identify protected plants (if any) in the location earmarked for project interventions (including the access roads to the raw water	Rapid survey to identify any protected plants survey & markings on sitemaps One-off survey List of trees that	Contractor (if needed, through a pre-approved party) to identify Contractor 3 for each of the tree species that are cut.	PMU supported by an independent consultant (Ecologist) to draft a TPP.	Wetland Management Strategy as proposed by the KWASA has its own Tree plantation guidelines.

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	intake and the WTP) to avoid the need to remove/cut any trees/plants to the extent that is practicable. • Make a list of trees that are cut down and compensate for the loss of these trees by planting at least three trees (five trees are recommended) for each tree that is cut	are cut and draw up a Tree plantation program. TPP			Replanting programme as recommended by the BFD.
5. Minimizing Community impacts					
5.a) Land use and livelihoods	• The land used in the project area is entirely within the KWASA premises and there are no community impacts due to project implementation. • The transportation corridors constitute existing roads in the project area. Proper planning of construction activities will minimize the impact on day-to-day activities of the people.	Work plans and Traffic Management Plans One-off prior to start of construction work and continuous monitoring during the construction phase	Contractor	PMU	-
5.b) Traffic flow and access to property, sites, and by-roads	• Impacts on the traffic flow because of construction vehicles and transportation of material will have a minor impact. Local communities will be regularly consulted regarding the location of construction schedules, access and hauling routes, and other activities that are likely to cause disturbances during construction. • Information on road closures and proposed detours will be communicated via notices, pamphlets, road signages, etc. • Plan transportation routes so that heavy vehicles do not use narrow local roads, except near the delivery site at the WTP premises. • Schedule transport and hauling activities during non-peak hours. No vehicles should be parked on roadsides for long periods. • Keep the roadsides free from all unnecessary obstructions. • Notify affected sensitive receptors by providing signboards with information about the nature and duration of construction works and contact numbers for concerns/complaints	Traffic Management Plans Transportation Plans and schedules Clearances and approvals One-off before starting construction work and continuous monitoring during	Contractor	PMSC environment management specialist and resettlement specialist	

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		the construction phase			
5.e) Aesthetics, landscape character, and sense of place	• There are no large structures proposed. Therefore, the project is compatible with the surrounding landscape and is not expected to negatively impact on the existing visual quality or landscape character of the area.	Project Plans One-off prior to start of construction work and continuous monitoring during the construction phase	PMSC	PMU	-

B. PHYSICAL IMPACTS DURING CONSTRUCTION PHASE AND MITIGATION					
6. Anticipated impacts due to land preparation activities					
1.a) Land preparation activities	• Implement a Construction Waste Management Plan (C-WMP); include waste minimization measures in the plan • The Contractor shall not enter or occupy for any purpose with men, tools, equipment, construction materials, or with materials excavated from any trench or pit in any private property outside the designated site boundaries without written permission from the owner and/or tenant of the property. • All spoil, top-soil, demolition waste, and cut vegetation should be covered by secure tarpaulins whenever transported offsite, to prevent material being blown away by trucks • Avoid stockpiling any excess spoils at the site for long periods. Such material should be disposed of at approved/designated areas without delay • If the disposal is required, the site shall be selected from barren lands, no/least vegetated areas; sites should be away from residential areas, forests, water bodies (streams and the low-lying stretches), and any other sensitive land uses • Spoil/waste should be properly segregated for collection & disposal to the designated disposal site; recyclable/reusable material shall be collected	Implementation of construction method statement and Implementation of C-WMP Weekly visual site observations Monthly Waste audits	Contractor	Environment Management Specialist, PMSC	Good construction practices and industry standards Use available Guides for C-WMP (Construction waste management, USEPA, Dec 2007[39]

[39] Available at: https://Jashore.epa.gov/sites/production/files/2014-03/ documents /017419.pdf)

	separately for alternative use, free distribution or sold in the local recycling material market • Prohibit burning construction and domestic waste; Ensure that waste is not haphazardly thrown in and around the project site; provide proper collection areas/bins/craters, etc.; create awareness of waste designations • Conduct site clearance and restoration to original condition after the completion of construction work, especially along the pipeline routes, site, and yard areas, and around the WTP premises; ensure that site is properly restored before issuing of completion certificates.				
1.b) Excavation work	▪ If needed, for rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals. • Mechanical excavations shall be immediately followed by skilled workers who will trim and clean the excavations/trenches to proper size and depth as required in the plan. • Proper shoring of excavations/trenches will prevent the side (slopes) from collapse and settlement of adjacent land surface, and pavements due to extra loads applied on the edge of the trench (within the 'zone of influence') during construction work. • Sloping of the sides should be avoided as it would need more excavation and would cause more damage to the existing paved surfaces.	Construction method statement Weekly visual site observations Monitoring of site management practices as the work progresses	Contractor	Environment Management Specialist, PMSC	Detailed design documents Shoring design manuals and methods as adopted by the Contractor
1.c) Storage and transportation of construction debris and excavated material	• The contractor shall haul away all excavated materials from the excavation site and stockpile them in an area designated or approved by the PMU. • Re-use of excavated material: The stockpile shall be processed where it is deposited so that it can be brought back to the trenches as selected filling material. • To the extent possible, excavated material will be directly loaded (from excavators or manually) into hauling vehicles, without leaving it on site; For this purpose, hauling vehicles must always be present at the excavation site, however, parked suitably not interrupting excavation and site works. Engines should be shut off while these vehicles are idling.	Construction method statement Implementation of C-WMP and regular waste audits Monitoring of site management practices as the work progresses	Contractor	Environment Management Specialist, PMSC	For re-use of excavated materials: Follow guidelines proposed by the KWASA or CSC.

1.e) Scheduling of work and Closure of areas	• Excavation, construction of sub- and superstructures, erection, fixing and installation of instruments and machinery, interconnection with existing pipelines, hydro-testing, backfilling, landscaping and pavement restoration shall be completed within a specified period. The construction method statement should be regularly reviewed in consultation with the PMU, and a location-specific work plan for each day's work should be planned. The length of the work for each day should be scheduled depending on the sensitivity of the location, and considering the constraints, prerequisites, and conditions put forward by all the stakeholders. • The contractor should mobilize all the resources that are needed for each day's work and complete the day's work within the stipulated time. • Contingency plans for the mobilization of resources (labour, equipment, vehicles and machinery, health and safety provisions, etc.) should be in place all the time. The contractor must maintain all the materials necessary in his inventory, and equipment and machinery available with access to any additional resources (as a contingency measure), so that these can be easily hauled to the construction site when needed	Construction method statement and activity plans Monitoring of site management practices as the work progresses Public complaints	Contractor	Environment Management Specialist, PMSC	Detailed Design documents, Construction method statement and Activity Plans approved by the PMU.
7. Impacts on natural flow and existing drainage pattern and hydrology					
2.a) Impacts on drainage canals, natural drainage paths and activities that would cause (local) flooding	• Contractor's activities shall not lead to local flooding conditions because of blocked drainage paths and drains or any other modifications to build- and/or natural drainage canals/paths. • The contractor shall take all necessary measures, as directed by the PMU, to keep all drainage paths and drains clear of blockage at all times. • If flooding or stagnation of water is caused by contractors' activities, contractors shall provide suitable means to (a) prevent loss of access to any land or property, and (b) prevent damage to land and property. • Contractor shall not select land within flood-prone areas and low-lying fringes to dispose of excavated and spoil material, locations for material stockpiles, yards and other locations where other construction materials are stored	Throughout the project area with special attention to low-lying areas Continuous monitoring during the rainy season and during major storm events	Contractor	Environment Management Specialist, PMSC	Detailed design documents Site-specific Drainage Management Plan should be developed
8. Impacts on water quality due to silt runoff discharges and spoil from construction activities					
3.a) Deterioration of Water quality	• Dispose of spoils in designated disposal areas • Avoid earthworks during rainy days and monsoon season to prevent soil run-off and schedule works during the dry season when the water levels are low • Avoid stockpiling of earth fill during the rainy season unless covered by tarpaulins or plastic sheets; Install temporary silt traps or sedimentation basins along drainage leading to water bodies • Place storage areas for chemicals, fuels & lubricants away from any drainage leading to water bodies and low-lying areas; Store fuel, construction chemicals, etc., under shelter and on an impervious floor, also avoid spillage	One-off work program to establish the baseline; Water quality monitoring data Waste disposal	Contractor	Environment Management Specialist, PMSC	No visible increase in water pollution due to the project Zero complaints from the

	• Pump out the water collected in the pits/excavations to a temporary sedimentation basin prior to disposal of only clarified water into drainage channels/streams and the low-lying areas • Consider safety aspects related to trench/pit collapse due to the accumulation of water; dispose of any residuals at the identified disposal site, and stockpile construction material away from wetlands and water bodies, floodplains and reservations/low-lying areas • Do not clean wash machinery and equipment near water bodies; prevent any waste/water from discharging to water bodies or the low-lying areas • Inspect all vehicles daily for fluid leaks before leaving the staging area, and repair any leaks before the vehicle resumes operation • Excess water sprinkling on soil, material to control dust may also generate runoff which may enter the water bodies; this should be avoided by controlled water sprinkling	manifest/ record Visual site observations Complaints from community			community
9. Effect on the traffic on the local road network					
4.a) Traffic and access related impacts	• If roads are damaged due to project-related transportation activities, reinstatement of road sections be carried out as per specifications, and method statement will be given at the commencement of the project. • Monitor and record road crashes (if any) during construction and maintenance stages and takes appropriate remedial actions	Urban areas where disturbances to vehicle movements would occur. Continuous throughout the construction period Public complaints	Contractor	Environment Management Specialist, PMSC	Traffic Management Plans Detailed Design documents
10. Impacts due to Pollution: Noise and Vibration, Dust and Air Quality, Light, and Soil Erosion due to construction and Hazardous Waste Management					

5.a) Noise & Vibration	• Maximum permissible noise levels for construction activities must be less than or equal to 75 Leq T during daytime (06.00 – 21.00 hrs) and 50 Leq T during nighttime (21.00 – 06.00 hrs). • Conduct regular monitoring of noise levels as per the monitoring plan • Minimize the noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and using portable street barriers to minimize sound impact to surrounding sensitive receptors. Avoid loud random noise from sirens, air compression, etc. • Avoid using multiple high noise generating equipment/activities simultaneously • Identify any buildings at risk from vibration damage • Horns should not be used unless it is necessary <u>Health Impacts of Noise and Vibration</u> • If workers are exposed to noise above noise exposure limit, the contractor must investigate options for engineered noise control, such as using low-noise excavators, jackhammers, drills, and power generators. • Limit the duration of each worker depending on the Exposure Levels and Time Limits for corresponding exposure levels (follow Occupational Safety Standards) • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. • Use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.	One-off work program to establish the baseline Continuous site auditory observations Continuous vibration monitoring by 'feeling state' monitoring Weekly noise monitoring data using a mobile measuring device Vibration measurements using measuring equipment, if needed Complaints from community Noise and vibration levels of equipment and machinery (obtained from specifications) Occupational Health and Safety Plan Regular check-ups for workers who are exposed to continuous high	Contractor Contractor through a professional JASHORE&S expert	Environment Management Specialist, PMSC Environment Management Specialist, PMSC	National environmental Regulations by DoE, ECR 97 and 2023. Construction Method Statement Specification of the EH&S Standards of the IFC for exposure levels and time limits of exposure for high noise and vibration Or adopt guidelines as specified in The Control of Noise at Work Regulations (2005) of the UK.

		levels of noise and vibration			
5.b) Dust and Air Quality	**Air quality impacts: Site works** • As far as possible, plan site clearance and earthwork activities towards the end of the rainy season and avoid inter-monsoons, when the soil will be damp naturally and without being subject to downpours • To suppress dust, the contractor should sprinkle water on exposed soil and stockpiled material on-site sufficiently frequently, depending on the weather • If dust generation is significant, provide a dust screen of appropriate height; Provide a cover or a windbreaker around the sites to minimize the wind-carried air-borne dust; this will minimize dust generation, and also drifting of soil from excavated trenches • Control access to the work area, prevent unnecessary movement of vehicles, workers, public trespassing into work areas; limiting soil disturbance will minimize dust generation	Schedule of work Dust suppression measures - visual site observations Weekly review of site practices Public complaints	Contractor	Environment Management Specialist, PMSC	Construction Method Statement Transportation Plans Zero complaints from the community No visible increase in dust and particulate matters on buildings located adjacent to the roads National Ambient Air Quality Regulations, ECR 97 and 2023.
	Air quality impacts: material haulage, vehicle and equipment use • Vehicles travelling to and from the construction site must adhere to speed limits to avoid producing excessive dust. • Use tarpaulins to cover loose material (soil, sand, aggregate) when transported by trucks • Clean wheels and undercarriage of haul trucks before leaving construction site/quarry; Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water • Stabilize surface soils where loaders, support equipment, and vehicles will operate by using water and maintain surface soils in a stabilized condition • Access and other cleared surfaces, including backfilled trenches, must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust. • Ensure that all the construction equipment and machinery are fitted with emission control devices, which are operating correctly; ensure that only those vehicles and equipment in good condition and are in good maintenance are used for project construction. Vehicles and machinery are to be kept in good working order and to meet manufacturers' specifications for safety, fuel consumption, etc. • Vehicles/equipment should have a valid Vehicle Emission Certificate (VEC) obtained from the Bangladesh Road Transport Authority (BRTA) showcasing emissions below the specified limits; Maintain VEC records of all vehicles at all times for ready inspection at the work sites	Transportation Plan Dust suppression measures - Visual site observations Ambient air quality monitoring as per EMP Weekly Vehicle emission testing records Complaints from community As work progresses	Contractor	Environment Management Specialist, PMSC	
5.d) Impacts on soil and geology: Loss of productive soil	• Within the project premises, exposed areas and areas of loose soil shall be turfed or planted with shrubs. Retention of the ground cover and vegetation (to the extent as possible) is the most natural and effective way of protecting	Throughout the project area with special attention	Contractor	Environment Management Specialist,	Construction Method Statement

due to erosion, Slope stability, Soil contamination	soil from erosion by wind and rain; the feasibility of phasing site clearance in this way to reduce these impacts should be investigated when the construction work is planned in detail by the Contractor. • Land used for yards, labour camps, and offices, temporary access roads, shall be rehabilitated and restored back to its original use as practical as possible • Fresh and unstable slopes, loose rock and boulders shall be appropriately protected. Embankment surfaces shall be compacted and turfed. Proper drainage improvement works shall be done along with toes areas of embankments and slopes. • Movement of construction vehicles shall be restricted to access roads, haulage routes and yards to prevent damage to roads and pavements. • Concrete, slurry, paints, and chemicals such as bituminous products, fuel, lubricants, paints, solvents, and other chemicals shall be stored at designated places, well-sheltered and impervious floors (preferable paved). The paving area of the storage yards is provided with a gentle slope and shall be made so that any leaks/spills can be collected into a chamber for safe disposal. Such chemicals shall be well-managed, and efforts shall be made to minimize the waste generation.	to yards, vehicle parking, and servicing areas and construction activities near wetland areas Near construction sites, camp sites, storage yards, vehicle parks, yards, and temporary offices Along with embankments of the wetland areas		PMSC	Location-specific Drainage Management Plan
5.e) Hazardous waste management	• Any hazardous waste shall be stored at the designated place before disposal. The contractor shall ensure the material safety data sheets of chemicals are posted in conspicuous areas. • To avoid water and soil contamination due to concrete batching plants, storage areas, and wash-down areas, leak and spill prevention plans shall be established. Any accidental leaks/spills shall be arrested and cleaned appropriately, and such procedures shall be established. Workers should be trained and made aware of such procedures. • Oil interceptors shall be provided at appropriate locations (e.g., vehicle service areas); Residual and hazardous wastes such as asphalt and bituminous waste, solvents, oils, fuels, and lubricants shall be disposed of in approved disposal sites approved by the PMU. • Hazardous material, including oil and grease to be collected in leak-proof, properly labelled containers and stored appropriately. Proper signs should be displayed for hazardous waste) and should be handed over to authorized third parties who have waste oil handling or recycling licenses • Bins and/or skips shall be emptied regularly, and waste shall be disposed of at the pre-approved site. Waybills for all such disposals are to be kept by the contractor for review by the environment management specialist.	One-off for preparation and establishment of the Operations Manual that should include a Hazardous Waste Management Plan Visual site observation of proper management practices by weekly inspection of waste storage area Monthly waste audits	Contractor A specialist contractor who is authorized to handle hazardous waste	Environment Management Specialist, PMSC to monitor and report to the LA	Construction Method Statement National Environmental Regulations, ERC 97and 2023.

C. ECOLOGICAL IMPACTS AND MITIGATION					
1.a) Ecological Impacts due to loss / destruction / fragmentation of habitats	• Ensure that all construction activities are conducted strictly within the site footprints (including labour camps, offices, vehicle parking and other activities that might normally be located in an exterior contractor's area); no clearance of vegetation/trees outside footprint is permitted • Prohibit any deliberate killing or harming of animals on or off-site; any hunting or fishing or in nearby areas by site personnel; preventive actions shall be put in place by the contractor for hunting/killing of wild animals • Ensure that all construction work or other activities near the site perimeter are conducted with particular care and include measures to reduce noise and dust to the minimum possible • Create awareness in all site staff & workers on the importance of the animals and plants on-site and in the surrounding area, and their vulnerability • To protect site personnel, training should also be provided to enable them to recognize and deal safely & humanely with all venomous animals that may be encountered (e.g., snakes and scorpions) • Conduct site preparation activities, including vegetation removals, outside of the breeding season for wildlife, including migratory birds	Awareness of staff/workers	Contractor	Environment Management Specialist, PMSC	Guidelines provided by *ECR 97 and 2023.
1.b) Impacts on protected species of flora and fauna	• Prepare a method statement following accepted construction procedures near low-lying areas. This, among other things, includes pollution control (water, air, noise), limiting disturbance, not harming wildlife, etc. • Create awareness among workers on wildlife and protected species • Conduct work in areas close to water bodies when the water level is low	Awareness of staff/workers	Contractor	Environment Management Specialist, PMSC	Rapid Confirmatory Survey Report
1.c) Impact on flora and fauna due to local air pollution, noise, and vibration, light pollution	• Noise and vibration controls should be adopted. • Air-borne dust should be kept to a minimum.	Weekly review of site practices	Contractor	Environment Management Specialist	Construction Method Statement and Location-specific Action Plan
D. SOCIO-ECONOMIC IMPACTS AND MITIGATION					
1.a) Community impacts due to Establishment of labour camps	• Contractor's activities and movement of staff to be restricted to designated construction areas • Any conflicts between the workers and the local communities should be resolved with caution. Community leaders, Union Parishad (UP) and other responsible people should be informed of any incident without delay.	One-off before starting work: Construction camp/yard establishment & management plan	Contractor in coordination with the GN, and/or any other NGO and Community Leaders	PMU Social Safeguards Officer and Environment Management Specialist,	Zero complaints from community and workers

	• The possibility of the hiring of labour from the same locality and avoiding the setting up of labour camps should be looked into.	Weekly Interviews with workers and local people		PMSC	
	• Providing appropriate conditions when putting up and maintaining temporary labour camps, accommodation and making sure that the conditions do not impact on the health and well-being of occupants	Prior to the establishment of labour camps and during labourers occupy such camps	Contractor	PMU Social Safeguard Officer	minimum requirements based on internationally recognized best practices[40]
1.b) Disruption to traffic/ transportation 1.c) Impacts on roadside structures and vehicle parking 1.d) Impact due to obstruction to access property 1.e) Impacts on the development activities in the vicinity	• The contractor will ensure that any damage to properties and utilities will be restored or compensated for pre-work conditions. • Disruption of access for local residents, commercial establishments, institutions, etc. must be minimized and must have the environment management specialist's permission. Provide walkways and metal sheets where required to maintain access for people and vehicles. • Consult businesses and institutions regarding operating hours, and factor this in work schedules.	One-off before starting work: Construction management action plan Monthly Interviews with local people and affected parties Public complaints Continuous monitoring as work progresses	Contractor	PMU Social Safeguards Officer & Environment Management Specialist, PMSC	Construction method statement and Location-specific Activity Plans Zero complaints from community and workers
2.a) Safety of Workers Occupational health & safety	• Comply with IFC EHS Guidelines on Occupational Health and Safety[41] • Prepare a comprehensive & site-specific Health and Safety Plan (JASHORE&SP) describing in detail how the health and safety of all site personnel (workers, staff, and visitors) will be always maintained. It is to provide guidance on establishing a management strategy and applying practices that are intended to eliminate, or reduce, fatalities, injuries, and illnesses for workers performing activities and tasks associated with the project. • Provide compulsory JASHORE&S orientation training to all new workers to ensure that they are apprised of JASHORE&S Plan including rules of work,	Health & Safety Plan Implementation of measures Weekly interviews with workers Occupational health and safety plan	Contractor Labour sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S	Construction method Statement Detailed JASHORE&S Plans prepared according to guidelines Zero

[40] For a standard list refer to: https://Jashore.osha.gov/laws-regs/regulations/standardnumber/1910/1910.142
[41] http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES

	PPE, preventing injury to fellow workers, etc.; Conduct regular toolbox safety briefings; tendencies, causes, risks & safe procedures • Conduct periodic safety audit, identify and remove potential hazard; Ensure that qualified first-aid is always provided; equipped first-aid stations shall be easily accessible throughout the worksites and camps; Provide medical insurance coverage to workers. • Secure all installations from unauthorized intrusion and accident risks. • Provide supplies of potable drinking water; Provide clean eating areas where workers are not exposed to hazardous or noxious substances. • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present; visitors not to enter hazard areas unescorted • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas • Ensure moving equipment is outfitted with audible backup alarms • Mark and provide signboards 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 public as appropriate. • Disallow worker exposure to high noise for more than 8 hours/day without hearing protection. Use of hearing protection shall be enforced actively. • Employ workers with adequate experience, training, and know-how. These workers shall be led by an experienced supervisor or engineer who will provide the leadership in daily activities. • General regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on-site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g., fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on-site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • The contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, the EE and/or a translator shall be called to the site to explain further aspects of environmental or social behaviour that are unclear.	Number of accidents and work-related injuries Complaints from community Continuous monitoring as work progresses		Specialist	accident and work-related injuries Zero complaints from community and workers

	• The rules that are explained in the worker conduct section must be always followed.				
2.b) Health and Safety of the Public	<u>Public safety during work along with public roads</u> • Adopt standard and safe practices for road construction • Ensure access to houses and businesses along the alignment; provide wooden planks, metal sheet with protective barricades/rails to allow access to the properties • Provide temporary traffic control (e.g., flagmen) & signs where necessary to improve safety and provide directions • Restrict public access to all areas where construction works are on-going using barricading and security personnel • Ensure that all material, equipment, workers and all activities are conducted within the demarcated/barricaded strip of land along the road; there should be no spillage of any activity outside this zone • Clearly separate work areas with traffic/pedestrian flow; provide public information boards to identify the work area easily • Warning signs, blinkers will be attached to the barricading to caution the public about the hazards associated with the works such as the presence of trenches / deep excavation • Plan carefully using a section-by-section approach, so that open trenches are quickly closed, and road restored • Control dust pollution – implement dust control measures as suggested under air quality • Organize public awareness campaigns.	Work methods and implementation of measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the communication and participation strategy	Contractor Labour sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist to monitor PMU to coordinate with the Khulna WASA.	Zero complaints from community and workers
	<u>Safety risk due to construction vehicle/equipment movement on public roads</u> • Prepare a Transportation Plan for material, waste, and equipment; consult highways agencies, police and other relevant authorities during both planning & implementation • Plan transportation routes to avoid heavily populated areas; Schedule deliveries to avoid congested areas during morning and evening peak traffic periods; Proper coordination to combine deliveries where possible, to avoid under-utilization of vehicles and reduce the number of journeys • Source materials in proximity (within the Khulna city) and other local outlets wherever possible, to reduce the length of delivery journeys • Conduct awareness programs for communities who live along the roads about the movement of heavy vehicles and traffic safety measures • Provide safety, information and caution boards where necessary • There are schools (especially pre-schools) along the roads, construction vehicle movement shall be restricted during the school opening and closing hours; if unavoidable, place traffic guards at school and other sensitive places, like hospitals, temples, etc. Notify affected sensitive receptors by	Implementation of Transportation Plan and Monthly monitoring Weekly Visual site observations, interviews with workers and community	Contractor and Sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist to monitor and report to KWASA	Construction method statement and Location-specific Activity Plans

	providing signboards with information about the nature and duration of construction works and contact numbers for concerns/complaints • Coordinate with the Traffic Police for temporary road diversions and for provision of traffic aid if congestion cannot be avoided during peak hours.			PMU to coordinate with the Police; traffic department Khulna circle.	
	<u>Community health</u> • Lighting on the construction site shall be pointed downwards and away from oncoming traffic and nearby houses. • Mitigation and suppression of air-borne dust (especially during windy days) • The site must be kept clean to minimize the visual impact of the site. If screens are used, this must be moved and re-erected as work progresses. • Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbors. • Notice of particularly noisy activities must be given to residents/businesses adjacent to the construction site. Examples of these include noise generated by jackhammers, diesel generator sets, excavators, etc. • Noisy activities must be restricted to the times given in the project specification or general conditions of the contract.	Work methods and implementation of measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the communication and participation strategy	Contractor and Sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC to monitor and report to KWASA	Zero complaints from community and workers
2.c) Other impacts related to workers and their camp operations	• Avoid/minimize the requirement to establish camps by hiring and employing local workers as far as possible; the presence of workers throughout the day and night during the construction work will disturb the environment • If necessary, contractor to identify a barren, vacant land (preferably private unused land) to establish the camp nearby; ensure that such camp is at least 500 m away from habitation, water bodies, scrublands etc., • Prepare & implement Construction Camp Management Plan (CCMP). The plan should include: o Layout plan showing all the proposed facilities, offices, material storage area (separately for hazardous waste, fuel, chemicals, etc.), amenities, repair and washing areas, and circulation areas/roads o Integrate drainage, water pollution, air and noise control measures o Drinking water, sanitation, washing, eating and resting places for workers o Proper liquid waste, solid waste collection, treatment, & disposal system o Fire safety, medical facilities • Separate the workers' living areas and material storage areas, worksites clearly with a fencing and separate entry and exit	Approved location plan Complaints from community Construction Camp Management Plan Monthly visual observations, interviews with workers and local people Waste disposal manifest /record	Contractor and Sub-contractors	Environment Management Specialist, PMSC to monitor and report to KWASA.	Construction method statement Location-Specific Construction Camp Management Plan which should include plans for Solid Waste Management, Drainage Managemen

	• Ensure conditions of livability at work camps are always maintained at the highest standards possible; living quarters and construction camps shall be provided with standard materials with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers • The camp shall be provided with proper drainage, there shall not be any water accumulation. Provide drinking water, water for other uses, & sanitation facilities, provide means of collection and disposal of sewage. • Manage solid waste according to the following preference hierarchy: reuse, recycling, and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable/recyclable waste shall be collected and sold in the local market	keeping by contractor's environmental specialist.			t and provision of proper Sanitation
3) Impacts on the Cultural and historical environment	• All the staff and laborers of the contractor are informed about the possible items of historical or archaeological value, which include old stone foundations, tools, clayware, jewelry, fossils, etc. • If something of this nature is uncovered, the Department of Archaeology of Bangladesh shall be contacted, and work shall be stopped immediately. • Conduct an Archaeological Impact Assessment, if needed.	Records of Chance Finds	Contractor	Environment Management Specialist, PMSC to report to the Dept. of Archaeology	Written permission from the Dept. of Archaeology and their guidelines for construction work to proceed
4) Grievance Redressals	• Should the construction staff be approached by members of the public or other stakeholders, the staff should assist them in locating the environment management specialist or contractor or provide a number by which they may contact the environment management specialist or contractor. • The conduct of the construction staff when dealing with the public or other stakeholders shall be in a manner that is always polite and courteous. Failure to adhere to this requirement may result in the removal of staff from the site by the environment management specialist. • Environment management specialists and contractors are responsible for ongoing communication with people affected by the project. • The contact information of PMU, PMSC, and contractor shall be posted visibly at each construction site. • A Complaints Register shall be included in the monthly report to be submitted by the contractor to PMSC. • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. • The contractor must address queries and complaints by (i) documenting details of such communications; (ii) submitting these for inclusion in the complaints register; (iii) bringing issues to the environment management	Work methods and implementation of GRM measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the communication and participation strategy	<u>Minor Grievances</u> Contractor <u>Other Grievances</u> PMU Social Safeguards Officer or Grievances Redressal Committee (GRC) or Program Steering Committee (PSC)	PMU Social Safeguards Officer & Environment Management Specialist, PMSC To coordinate with PMU, GRC or PSC and maintain records	Grievance Redress Mechanism

	specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. • The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance, along with the action taken, to the environment management specialist within 48 hours of receipt of such complaint/grievance. • Grievance Redress Mechanism as outlined in Chapter VII should be clearly understood by the Contractor and his staff.				
C. Operational Stage - Operation of newly constructed/upgraded facilities					
Detection and repair of leaks and pipe bursts	• Leak repair work will be similar to pipe-laying work as earlier explained. Trenches will be dug to find the leaking area and the faulty connection will be refitted, or pipe will be removed and replaced if necessary. Although the impact is likely to be minimal due to a new and well-designed, efficient system, it must be ensured that leak detection and restoration time is minimized to the extent possible.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA
Periodic flushing of the pipeline, descaling and scour maintenance and other activities	• These need no special mitigation, other than collection of water after descaling and allowing deposition of scales, which can then be disposed of safely.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA
Poor operation & maintenance practices leading to adverse impacts	• Make sure that the plant is operational in compliance with all the contractual conditions and requirements of KWASA • Ensure that O&M manuals, JASHORE&S Plan, Process • The Safety Management Plan, Risk Management Plan, Facilities Safety and Security Plan, and the necessary programmes for compliance with all other applicable safety regulations, are all prepared by the contractor through individuals with appropriate qualifications and extensive experience. Make these manuals available in the local Language, if needed. • Ensuring that the above plans and other plans and programmes, and indeed all the work tasks involved in operating the RODP are thoroughly and professionally always implemented by the Plant Manager • Ensure that well-qualified and experienced operators are engaged throughout operations. Make sure that the Contractor trains the operators and transfers the technical know-how appropriately. • Establish ISO14001 practices and certification as a good practice model that can be continued after the plant is transferred to KWASA	During Commissioning At the time of handling over the WTP Throughout the operational period	PMU when commissioning and handing over the WTP. Plant Manager, KWASA		Appointment of well qualified DBO contractor, preparation and implementation of plans, following SOPs in O&M ISO 14001 Certification Employ safety/

					environmental officers who have ISO certification.
Cleaning of the bar screens and the grit chamber	• Make sure that the debris collected at the screens and the grit collected in the grit chamber is removed and disposed on ground. Such debris and grit should not be dumped back in the IPR. • In cases of flooding, the debris, grit and sediments collected at the intake channel should be removed at disposed on ground. These should not be dumped back into the river	Throughout the operational period	Plant Manager, KWASA		-
Supply of safe potable water	• Water that is supplied should confirm to ECR 97 and 2023 Bangladesh Drinking Water Quality Standards and WHO Drinking Water Quality Guidelines at all times, without exception.		Plant Manager, KWASA		Bangladesh Drinking Water Quality Standards WHO Drinking Water Quality Guidelines
Being a dependable and a reliable source of water supply	• Formulate Operational Plans based on the Policies, Guidelines and Good Practices of the KWASA • Draft and implement short-, medium and long-term plans to ensure reliability of water supply (quality as defined by Bangladesh Standard Specification for Drinking Water (BDS 1240:2019), adequate quantity to meet the water demand and accessibility) • Ensure level of service is in consistent with the Policies of the KWASA and to the satisfaction of the expectations of consumers • Establish procedures to inform the consumers of interruptions to water supply • Establish procedures to respond to public complaints, comments and suggestions Establish procedures to respond to service breakdowns, and emergencies	Definition of Level of Service in consistent with existing Policies Operational Procedures Emergency Response Procedures O&M Procedures Public Relations Policy	Plant Manager, KWASA		Policies of the KWASA
Management of water treatment sludge generated at the WTP	• Ensure that water treatment sludge is dried, collected and stored properly prior to its final use. • Long-term sludge management plan must be drafted and implemented	Sludge management plan	Plant Manager, KWASA		Established methods of water treatment

	(suggested method of sludge management is to use it in brick/block production)	Check the leachability of chemical substances in the sludge in selected samples, if used for brick production			sludge management
Impacts due to Storage, Handling, Application of Chemicals	• Reducing the amount of chemicals used in the water treatment process to the extent possible; for instance, pre-oxidation of the source water only when needed which can reduce the use of chemicals • Replacing anti-sealants, as far as possible, by more biocompatible alternatives. • Ensuring that all chemicals used on site are stored according to the relevant international standards, to prevent accidental release and hazards to operatives • Storing all liquids in appropriate leak-proof containers, in sealed, concrete floored and bunded areas, that will hold 110% of the stored volume of each liquid in the event of a major leak • Storing different types of liquid separately so that there is no risk of mixing in the event of multiple leaks • Providing leak/spill detection, collection / capture and safe disposal facilities such as chlorine absorption and neutralization facility • Providing ventilation, lighting, entry and exit facilities; visible & audible alarm facilities to alert chemical leaks • Facility for isolation in the event of major leakages • Eye wash & shower facility, Personal protection and safety equipment for the operators (masks, oxygen cylinders, gloves, etc.,) • Providing training to the staff in safe handling and application of chemicals, material safety, and standard operating procedures and emergency responses • Developing emergency response plans • Operating the site workshop with the highest standards of environmental protection, and all drainage from this area must be collected and passed through an oil separator before discharge All equipment/machinery maintenance and servicing should be done in a suitably equipped workshop, and no vehicle maintenance should be done on site.	Procedures established for procurement, transport, storage, use and disposal of chemicals Safety procedures in safe handling of chemicals	Plant Manager, KWASA		Established methods for safe handling of water treatment chemicals

Generation of substances used for lubrication, paints and solvents, cleaning material in small quantities during O&M	Construction debris, lubricants, paints, solvents, and the substances should be properly collected stored and disposed of.	O&M procedures Records of generation of hazardous wastes	Sub-contractors, workers of KWASA	OIC of the WTP, KWASA	Acceptable procedures to collect and handover hazardous material to authorized collectors.
Periodic flushing of the pipelines, descaling and scour maintenance and other activities	These need no special mitigation, other than collection of water after descaling and allowing deposition of scales, which can then be disposed of safely.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA
Noise and vibration due to operations of the pumps	Make sure that the pumps that are fixed generate noise levels that conform to the required levels. No mitigation measures are needed if the noise level at the boundary of the WTP does not exceed 55 dB(A) during the day and 45 dB(A) during the night If noise levels are higher than these limits, then appropriate noise abatement measures should be in place.	Noise levels measured at the boundary of the Waterworks premises to verify the noise levels do not violate regulatory limits. Measurements made if neighbours complain about high noise and/or vibration	PMU	OIC of the WTP, KWASA	National Noise Control Regulations of ECR 97 and 2023.
Management of MSW	Proper collection and storage of MSW and be handed over to local authority depending on MSW collection schedules. Complying with rules of the local authority on proper sorting and collection schedules	Bins/chambers for collection of MSW and provisions for the local authority to collect MSW regularly	Occupants of the staff quarters	OIC of the WTP, KWASA	MSW segregation and collection procedures of the local authority
Wastewater collection and disposal	Sanitary wastewater collected at the WTP premises and staff quarters should be disposed of safely.	Designs of the septic-soakage pit arrangements	Occupants of the staff quarters	OIC of the WTP, To obtain approval for the designs	Designs of the septic-soakage pit arrangements approved by the local authority

Accidents & emergences	• Ensure that Emergency Response Plans and contingency Plans are in place prior to start of operation • Conduct awareness programs & mock drills • Implement emergency response plans • Undertaking corrective actions where required	Quarterly Monitoring Report Corrective Action Plan Throughout the operation phase	KWASA		Emergency Response Plans and Contingency Plans prepared based on Industry Standards and Safety Procedures

Table 46: Environmental Management Plan – for Construction and Operation of Afil Gate Intake, Construction and Upgrading of Afil Gate SWTP, Construction of Transmission Main and Construction of the Impounding Reservoir at Mostafa Mor (Package 6)

Package-6	Construction for SWTP and Upgradation of existing SWTP at Afil Gate (5.5 MLD to 15.5 MLD)	MLD	10
	Construction for Upgradation of Afil Gate Intake facilities (5-20MLD)	No	1
	Construction of Raw water transmission line (630 mm) from river intake to Afil Gate SWTP	km	2
	Construction of Raw water transmission line (250 mm die) from Afil Gate to Mustofa Mor including pumping station	km	13
	Construction of Impounding reservoir at Afil Gate (upgrading) and Mustofa Mor	cum	236,000

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
A. Planning Stage - Construction and Operation of Pipelines					
6. Work delays due to improper planning					
1.a) Delays in mobilization and timely implementation of work program & poor coordination and extended duration for project completion	• Scheduling, coordination, procurement, obtaining approvals and project implementation will be expedited to the extent that is practicable. • Standard and good construction practices will be followed at all times. • The possibility of deploying several gangs simultaneously will be pursued, which will allow the work to be completed within the least possible duration. • Finalize construction programs duly considering provisions for work schedule The following plans be developed for implementation: o Area Construction Work Plan o Material Procurement Plans o Transportation Plan for material, equipment, and waste conveyance o Health & Safety Plan; Traffic Management Plan for each road segment o Environmental Management Action Plan o Construction Waste Management Plan o Other plans such as drainage management and erosion control (if any)	Work schedules Respective plans One-off before starting construction	Contractor	Reported to the PMU	Standard Construction Practices and Industry Norms
1.b) Poor environmental management by the Contractor	• Designate an environment specialist who will be in charge of coordination with PMU for updating this IEE and implementing the EMP and EMoP, including the conduct of all surveys, monitoring actions, etc. • Appoint an Environmental specialist with the mobilization of the contractor (through design and construction, and intermittent during operations) • Coordinate with the PMU on confirmatory surveys to be conducted during the design phase and complete as required with external experts (if needed)	Mobilization of PMU and PMSC staff with suitable experience and expertise One-off during	Contractor	Reported to the PMU	Qualification framework for the Environmental Specialist (of the PMSC)

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		mobilization, and continuous throughout the contract period			
1.c) Climate Change Consideration and Vulnerability Screening	• Climate change vulnerability checks in compliance with provisions provided in the IEE Report. • Adopting proper mitigation measures as may be required. • Flow variations and flood flows of the rivers should be considered for the extreme scenario for deciding the finished levels of the intake, pump house and other related structures located on the banks of the river. • Flood levels (for placing the pipeline along the fringes of low-lying areas) and cross drainage structures to be designed and located (during rehabilitation of damaged structures) based on recommendations of hydrological studies to be conducted during the detailed design phase (which has to be done with the consultation of BWDB, KWASA, and LAs). Alteration of rainfall intensities due to climate change, therefore, a change of peak flows of waterways and land-use changes should be clearly studied under hydrological assessments, and appropriate mitigation measures should be incorporated to final designs. • At least three trees should be planted for each tree that is cut. The recommended number would be five trees for each tree to cut. • Efforts shall be made to plant additional trees to increase the carbon sink. The trees may be selected with the help of the Forest Department and space for additional planting (if the remaining space within ROW is not adequate) will be secured with the help of KWASA and Community-based Organizations (CBOs).	Throughout the project and flood-prone areas and other possible areas of tree planting (if any)	Design Consultant of the Contractor	PMU	ADB SPS Framework & IFC Sustainability Framework and Performance Standards
1.d) Delays related to the selection of locations for project interventions					
○ Location for the raw water intake, pump house, WTP, storage tanks, and staff	• Land ownership of the premises where the raw water intake and pump house, WTP, storage tank and pump houses, offices, pump house have been already acquired by KWASA. The land where the storage tank to be built at Afil Gate WTP facility belongs to KWASA; hence, no further land acquisition is envisaged. • No mitigation measures are needed.	-	-		

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
quarters & OIC's office					
○ Trace of the Transmission mains, Feeder Mains and the Transmission main	• The civil works for pipe laying will be carried within the available ROW, and no acquisition of land is required beyond the ROW.	Design details of pipeline traces and plans for other structures. One-off before starting construction	Contractor	PMSC environment management specialist	Detailed designs
○ Worker camps, stockpile areas, storage, and disposal areas	• The labour camps should be located near the subproject locations. • Sites to be considered will result in the least damage to property, vegetation, and least disturbance to the neighborhood, including the traffic. • Residential areas are not the best locations to set up worker camps, given the possibility of social conflicts. • Extreme care will be taken to avoid negative impacts on low lying and marshy areas. • All locations would be included in design specifications and on plan drawings. • Material and equipment storage yards shall be secured to minimize the risk of theft. They shall also be safe from access by children, animals, etc. • The contractor shall submit a method statement and plans for the storage of hazardous materials (fuels, oils, and chemicals) and emergency procedures.	Plans for site selection One-off before starting construction	Contractor	PMSC environment management specialist	-
1.e) Issues due to delays in the finalization of the intake and the SWTP	• The designs will be finalized with the consultation of all the stakeholders, and any approvals and consents will be obtained without delay.	Design details of the pipeline traces and Plans for other structures One-off before starting construction	Contractor	PMSC environment management specialist	-
○ Railway crossings: There are 2 locations where the pipelines cross the	Approval from the Bangladesh Railway and close coordination is needed for construction of the pipeline across railway line.	-	PMU		Approvals from Bangladesh Railways

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
railway lines					
1.f) Work delays due to not obtaining prior approvals/ consents, etc.	• In all instances, KWASA, service providers, contractors, and consultants must comply with relevant national and ADB Safeguard Requirements. The IEE should be thoroughly reviewed to note any pre-requisites and to understand legal, regulatory and Institutional procedures. • A copy of the IEE must be kept on-site and disclosed on KWASA and ADB website for any stakeholders to have access to.	Clearances and approvals One-off before starting construction	PMU facilitated by EA and/or IA Contractor facilitated by the IA and PMU	PMU	Approvals and consents as listed in Chapter II of the IEE Report
1.g) Climatic conditions and local weather patterns	• Rainfall and its runoff in the project area may cause disruption/damage to ongoing works and public inconvenience. • The project area receives considerably high rainfall. Flooding is a frequent event. Flash floods can occur which can disrupt (or even severely damage) the partially constructed structure of the raw water intake. Therefore, all attempts have to be made to complete the work during the dry season (avoiding the months such as May-June & October) • Furthermore, climatic conditions play an important role during the dispersion of noise and air pollutants. Seasonal climatic conditions have been considered for scheduling construction activities. Avoid construction activities such as excavation, pipeline laying, and intake structure works during the monsoon months, typically **June to September** in Khulna.	Work schedule and plans to accommodate the loss of time due to inclement weather (and contingency plans, if any). One-off before starting construction and updating plans during construction	Contractor	PMU	Climatic and weather patterns; data provided by the BMD.
7. Health and safety issues in compliance with Standard Practice					
2.a) Occupational Health and Safety of workers 2.b) Public Safety	• The appointment of an Environmental, Health, and Safety (EHS) Officer will be considered towards the end of the planning stages, before the implementation of any project activity. • Selection of locations and facilities for labour camps will be reviewed by the EHS Officer, in consultation with the KWASA authority • Compliance with EHS requirements will be thoroughly reviewed, and a summary requirement will be prepared (one for workers and another common one for the public, including the workers).	EHS Manuals, Plans, Forms, Schedules, Notices, Registers, Redress Mechanisms, Follow-up, and Monitoring Procedures, Emergency Preparedness and First-aid, Training	Contractor's Environmental, Health, and Safety (EHS) personnel. (in consultation with the officials of the PMU)	PMU	National Labour Laws, Guidelines of GoB and IFC EHS Guidelines on Occupational Health and Safety

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		schedules and methods One-off during mobilization, and continuous throughout the contract period			
8. Optimal use of resources, proper waste management and minimization of physical impacts					
3.a) Waste Minimization	• Prepare a solid waste management plan for disposal of spoil, excavated/dredged material and construction debris; Waste shall be disposed of in existing approved sites; new sites shall be developed considering siting guidelines, maintained and operated accordingly • Make efforts to minimize the overall material required for the project by adopting various approaches – balanced cut and fill, re-use as much excavated material from this project as possible	Solid Waste Management Plan (SWM Plan) Consents and Approvals from the local authority for the collection, transportation, and disposal of MSW and other construction debris	Contractor in consultation with the local authority	PMSC environment management specialist	-
3.b) Method of construction, Work schedule and closure of areas	• All the works connected with excavations, pipe laying, bedding, backfilling, culvert and bridge crossings, pipe connections and couplings, etc. will be carried out according to approved Standard Methods and Drawings. • Method of Road Crossings should be finalized with the consent of the RHD/ KCC, and LA through the KWASA • Ensure careful planning and scheduling of the activities. Limit work in busy areas to night shifts (if recommended by the KWASA) and public holidays. To minimize the impact on traffic flow, businesses, and road users, as much as possible schedule trenching works during nighttime. For pipe laying during night shifts (if allowed by KWASA), the Contractor shall be allowed to excavate only the length that could be laid in one night without leaving any obstruction whatsoever for the public during daytime. • Consider low-traffic and non-sensitive areas (other than schools, religious places, and commercial/business) for daytime trenching works. • Increase workforce in areas to be excavated during the daytime.	Construction Method Statements & Work schedules and Schedules for road closures One-off before starting construction for approval and continuously throughout the contract period	PMSC environment management specialist to coordinate with the contractor	PMU safeguards officer to approve schedule and areas	-

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	• Prepare a traffic management plan and road safety plan.				
3.c) Selection of pipe material Selection of equipment and installations and material	• Pipe Strength parameters should satisfy the Specifications • Equipment, machinery and strength parameters should satisfy industry-standard Specifications	Test reports, and certification from Approved and Accredited Independent Testing Agencies, prior to supply of pipeline	Material Supplier through the Contractor	PMU	Standards and Specifications for pipe material
3.d) Selection of construction material and sourcing	• Material for the construction of sumps, pump houses and buildings will be procured from licensed material sources who have obtained proper approvals for material sourcing. • The contractor shall prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, bedding material, etc.), and submit these to the PMSC for approval before the commencement of any work. Where materials are mined, proof must be provided of authorization to utilize these materials from the Bureau of Mineral Development (BMD) and Department of Environment (DoE).	Criteria for selection of licensed material sources One-off prior to starting work Continuous material test reports during construction	Sub-contractors through the Contractor	PMSC environment management specialist to check permits from the DoE and BMD	QA Standards and strength requirements for construction material Environmental Conservation Rules, 1997
3.e) Excavation of trenches	• Minimum possible width is specified in trench details (pipe diameter + working space) to minimize damage to road surfaces, and proper shoring methods will be adopted. • If needed, adequate support to boundary walls and other structures will be provided.	Detailed construction method statements clearly indicating trench widths and excavation methods. Before construction	Contractor	PMU	Standard Construction Practices (150 mm each side of the pipe for Trench)
3.f) Labour gangs	• Recruitment of laborers, both unskilled and skilled, from the locality will reduce the need for having large labour camps and will lead to lesser impacts due to such labour camps during the construction stage.	Labour recruitment plans and criteria for selection of sub-contractors. Records of training Before the	Sub-contractors through the Contractor	PMSC environment management specialist	Labor Recruitment Guidelines

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		commencement of civil works			
3.g) Training of site staff on general and environmental safeguards	• Ensure all site personnel have a basic level of environmental awareness training. • Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained in any potential hazards associated with their task. • No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the contractor. • All employees must undergo safety training.	Criteria for recruitment of site staff Records of training Before the commencement of civil work and hiring new employees	Contractor	PMU safeguards officer; PMSC environment management specialist	ADB SPS Framework
3.f) Noise and vibrations	• Time of operation of construction equipment and vehicles engaged in the transportation of construction materials will be planned well so as not to disturb the public. However, noise and vibration will be confined to the periphery of the work sites only are temporary in nature.	See EMP for Construction Phase	Contractor	PMU safeguards officer; PMSC environment management specialist	Noise and Vibration Control Regulations
3.g) Air quality	• Dust and gaseous emissions are expected due to machinery and equipment and during construction processes (e.g., transportation, excavation, construction activities, and stockpiling. Proper planning of construction and transport activities will be given priority. Proper mitigation methods will be adopted to control obnoxious gases, and dust generated if any.	See EMP for Construction Phase	Contractor		-
3.Jashore) Drainage and Hydrology	• Designs of the raw water intake should consider the hydrological variations of the Rivers, especially the flood flows. • Construction planning of the intake structure should be planned based on the hydrological predictions of the River • The section of the pipeline which borders low lying and marshy lands (e.g., paddy fields and low-lying areas such as along Gopalganj to Khulna Road and Khulna to Jashore Road, where work activities need careful planning to avoid local flooding and any negative impacts on the aquatic ecosystems. • Other project components are not expected to have any negative impact on the drainage and hydrology of the area. • Runoff from the project will produce a highly variable discharge regarding volume and quality, and in most instances will have no discernable environmental impact. • Identify & demarcate drainage paths on the sites, & excavated roads • Integrate these channels into the layout plans so that natural drainage is not disturbed; Provide cross drainage structures wherever necessary along the excavated roads (especially the narrow roads), and yards.	See EMP for Construction Phase	Contractor	PMU safeguards officer and PMSC environment management specialist	GoB and the local authority requirements and specifications

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
9. Avoiding ecological impacts					
4.a) Loss of VEC and impacts on the natural environment	• The project is situated within rural areas where agricultural activities are predominant (including monoculture plantations), and existing built-up areas and densely populated urban areas. • There are no areas of ecological diversity that occurs within the locations of project interventions. The land for the intake structure at the banks of the Madhumati River is part of a home garden which has commonly found fruit bearing tree species. The land identified for the construction of WTP is part of a rubber plantation. The land at Mostofa Mor is bare land. • Though these lands have no threatened or vulnerable species, it is recommended to carry out a rapid survey to identify protected plants (if any) in the location earmarked for project interventions (including the two access roads to the raw water intake and the WTP) to avoid the need to remove/cut any trees/plants to the extent that is practicable. • Make a list of trees that are cut down and compensate for the loss of these trees by planting at least three trees (five trees are recommended) for each tree that is cut	Rapid survey to identify any protected plants survey & markings on sitemaps One-off survey List of trees that are cut and draw up a Tree plantation program. TPP	Contractor (if needed, through a pre-approved party) to identify Contractor 3 for each of the tree species that are cut.	PMU supported by an independent consultant (Ecologist) to draft a TPP.	Wetland Management Strategy as proposed by the KWASA has its own Tree plantation guidelines. Replanting programme as recommended by the BFD.
10. Minimizing Community impacts					
5.a) Land use and livelihoods	• The land used in the project area comprises of rural agricultural settings in some areas and urban settings within the distribution area. The built-up areas consist of mainly housing, commercial and industrial facilities, home gardens and small-scale agricultural plots. • There are a few government/private offices and buildings bordering the roads, a few educational institutes, religious places, and commercial establishments such as shops and restaurants. • The transportation corridors constitute existing roads in the project area. Proper planning of construction activities will minimize the impact on day-to-day activities of the people.	Work plans and Traffic Management Plans One-off prior to start of construction work and continuous monitoring during the construction phase	Contractor	PMU	-
5.b) Traffic flow and access to property, sites,	• Impacts on the traffic flow as a result of construction vehicles and transportation of material will have a minor impact. Local communities will be regularly consulted regarding the location of construction schedules, access and hauling	Traffic Management Plans	Contractor	PMSC environment management	

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
and by-roads	routes, and other activities that are likely to cause disturbances during construction. • Information on road closures and proposed detours will be communicated via notices, pamphlets, road signages, etc. • Plan transportation routes so that heavy vehicles do not use narrow local roads, except near the delivery site at the WTP premises. • Schedule transport and hauling activities during non-peak hours. No vehicles should be parked on roadsides for long periods. • Keep the roadsides free from all unnecessary obstructions. • Notify affected sensitive receptors by providing signboards with information about the nature and duration of construction works and contact numbers for concerns/complaints	Transportation Plans and schedules Clearances and approvals One-off before starting construction work and continuous monitoring during the construction phase		specialist and resettlement specialist	
5.d) Community and public awareness	• Careful planning and coordination with all the stakeholders be established. • A well-planned information campaign must precede any construction activity to make the public aware of the extent of the issues that might occur during construction. The road closure, together with the proposed detour, needs to be communicated via notices, pamphlets, road signage, etc. • Open liaison channels shall be established between KWASA, contractors, and interested and affected parties such that any queries, complaints, or suggestions can be dealt with quickly and by the appropriate persons.	Strategies and methods to conduct Community and Public Awareness prior to commencement of civil works Continuous implementation during construction and O&M period	Contractor in coordination with the GN, and/or any other NGO and Community Leaders	PMU safeguards officer and PMSC environment management specialist	-
5.e) Aesthetics, landscape character, and sense of place	• There are no large structures proposed. Therefore, the project is considered to be compatible with the surrounding landscape and is not expected to negatively impact on the existing visual quality or landscape character of the area.	Project Plans One-off prior to start of construction work and continuous monitoring during the construction phase	PMSC	PMU	-

B. PHYSICAL IMPACTS DURING CONSTRUCTION PHASE AND MITIGATION					
11. Anticipated impacts due to land preparation activities, removal of road and paved surface and excavation of trenches					
1.a) Land preparation activities	• Implement a Construction Waste Management Plan (C-WMP); include waste minimization measures in the plan • The Contractor shall not enter or occupy for any purpose with men, tools, equipment, construction materials, or with materials excavated from any trench or pit in any private property outside the designated site boundaries without written permission from the owner and/or tenant of the property. • All spoil, top-soil, demolition waste, and cut vegetation should be covered by secure tarpaulins whenever transported offsite, to prevent material being blown away by trucks • Avoid stockpiling any excess spoils at the site for long periods. Such material should be disposed of at approved/designated areas without delay • If the disposal is required, the site shall be selected from barren lands, no/least vegetated areas; sites should be away from residential areas, forests, water bodies (streams and the low-lying stretches), and any other sensitive land uses • Spoil/waste should be properly segregated for collection & disposal to the designated disposal site; recyclable/reusable material shall be collected separately for alternative use, free distribution or sold in the local recycling material market • Prohibit burning construction and domestic waste; Ensure that waste is not haphazardly thrown in and around the project site; provide proper collection areas/bins/craters, etc.; create awareness of waste designations • Conduct site clearance and restoration to original condition after the completion of construction work, especially along the pipeline routes, site, and yard areas, and around the WTP premises; ensure that site is properly restored before issuing of completion certificates.	Implementation of construction method statement and Implementation of C-WMP Weekly visual site observations Monthly Waste audits	Contractor	Environment Management Specialist, PMSC	Good construction practices and industry standards Use available Guides for C-WMP (Construction waste management, USEPA, Dec 2007[42]
1.b) Excavation work	▪ If needed, for rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals. • Mechanical excavations shall be immediately followed by skilled workers who will trim and clean the excavations/trenches to proper size and depth as required in the plan. • Proper shoring of excavations/trenches will prevent the side (slopes) from collapse and settlement of adjacent land surface, and pavements due to extra	Construction method statement Weekly visual site observations Monitoring of site management practices as the	Contractor	Environment Management Specialist, PMSC	Detailed design documents Shoring design manuals and methods as adopted by

[42] Available at: https://Jashore.epa.gov/sites/production/files/2014-03/ documents /017419.pdf)

	loads applied on the edge of the trench (within the 'zone of influence') during construction work. • Sloping of the sides should be avoided as it would need more excavation and would cause more damage to the existing paved surfaces.	work progresses			the Contractor
1.c) Storage and transportation of construction debris and excavated material Removal of paved surfaces and excavated material	• The contractor shall haul away all excavated materials from the excavation site and stockpile in an area designated or approved by the PIU. • Re-use of excavated material: The stockpile shall be processed where it is deposited so that it can be brought back to the trenches as selected filling material. • To the extent possible, excavated material will be directly loaded (from excavators or manually) into hauling vehicles, without leaving it on site; For this purpose, hauling vehicles must always be present at the excavation site, however, parked suitably not interrupting excavation and site works. Engines should be shut off while these vehicles are idling.	Construction method statement Implementation of C-WMP and regular waste audits Monitoring of site management practices as the work progresses	Contractor	Environment Management Specialist, PMSC	For re-use of excavated materials: Follow guidelines proposed by the KWASA or CSC.
1.e) Scheduling of work and Closure of areas	• Excavation, construction of sub- and superstructures, erection, fixing and installation of instruments and machinery, interconnection with existing pipelines, hydro-testing, backfilling, landscaping and pavement restoration shall be completed within a specified period. The construction method statement should be regularly reviewed in consultation with the PMU, and a location-specific work plan for each day's work should be planned. The length of the work for each day should be scheduled depending on the sensitivity of the location, and considering the constraints, prerequisites, and conditions put forward by all the stakeholders. • The contractor should mobilize all the resources that are needed for each day's work and complete the day's work within the stipulated time. • Contingency plans for the mobilization of resources (labour, equipment, vehicles and machinery, health and safety provisions, etc.) should be in place all the time. The contractor must maintain all the materials necessary in his inventory, and equipment and machinery available with access to any additional resources (as a contingency measure), so that these can be easily hauled to the construction site when needed	Construction method statement and activity plans Monitoring of site management practices as the work progresses Public complaints	Contractor	Environment Management Specialist, PMSC	Detailed Design documents, Construction method statement and Activity Plans approved by the PMU.
1.f) Access to existing built-up areas, houses, buildings, commercial buildings, institutions, etc.	▪ The contractor shall make available in his stock steel plates and wooden planks which will be deployed to provide temporary access to building carports and garages, street crossings, and other locations within the project area where such interventions are necessary. ▪ Advance road signage indicating the road detour and alternative routes. Provide signboards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/ complaints. • All necessary measures should be taken to complete the work within the minimum allocated time.	Construction method statement and inventory Warning signs and barricades Monitoring of site management	Contractor	Environment Management Specialist, PMSC	Minimal disturbance to existing operations of the WTP, traffic flow and occupants of quarters

		practices as the work progresses			
12. Impacts on natural flow and existing drainage pattern and hydrology					
2.a) Impacts on drainage canals, natural drainage paths and activities that would cause (local) flooding	• Contractor's activities shall not lead to local flooding conditions as a result of blocked drainage paths and drains or any other modifications to build- and/or natural drainage canals/paths. • The contractor shall take all necessary measures, as directed by the PMU, to keep all drainage paths and drains clear of blockage at all times. • If flooding or stagnation of water is caused by contractors' activities, contractors shall provide suitable means to (a) prevent loss of access to any land or property, and (b) prevent damage to land and property. • Contractor shall not select land within flood-prone areas and low-lying fringes to dispose of excavated and spoil material, locations for material stockpiles, yards and other locations where other construction materials are stored	Throughout the project area with special attention to low-lying areas along the Gopalganj to Khulna Road and Khulna to Jashore Road Continuous monitoring during the rainy season and during major storm events	Contractor	Environment Management Specialist, PMSC	Detailed design documents Site-specific Drainage Management Plan should be developed
13. Impacts on water quality due to silt runoff discharges and spoil from construction activities					
3.a) Deterioration of Water quality	• Dispose of spoils in designated disposal areas • Avoid earthworks during rainy days and monsoon season to prevent soil running off and schedule works during the dry season when the water levels are low • Avoid stockpiling of earth fill during the rainy season unless covered by tarpaulins or plastic sheets; Install temporary silt traps or sedimentation basins along drainage leading to water bodies • Place storage areas for chemicals, fuels & lubricants away from any drainage leading to water bodies and low-lying areas; Store fuel, construction chemicals, etc., under shelter and on an impervious floor, also avoid spillage	One-off work program to establish the baseline; Water quality monitoring data Waste disposal manifest/ record Visual site	Contractor	Environment Management Specialist, PMSC	No visible increase in water pollution due to the project Zero complaints from the community

	• Pump out the water collected in the pits/excavations to a temporary sedimentation basin prior to disposal of only clarified water into drainage channels/streams and the low-lying areas • Consider safety aspects related to trench/pit collapse due to the accumulation of water; dispose of any residuals at the identified disposal site, and stockpile construction material away from wetlands and water bodies, floodplains and reservations/low-lying areas • Do not clean wash machinery and equipment near water bodies; prevent any waste/water from discharging to water bodies or the low-lying areas • Inspect all vehicles daily for fluid leaks before leaving the staging area, and repair any leaks before the vehicle resumes operation • Excess water sprinkling on soil, material to control dust may also generate runoff which may enter the water bodies; this should be avoided by controlled water sprinkling	observations Complaints from community			
14. Effect on the traffic on the local road network					
4.a) Traffic and access related impacts	• Construction schedules will be finalized to allow accessibility from alternative routes • Temporary traffic management schemes will be used at the commencement of the project • If roads are damaged due to project-related transportation activities, reinstatement of road sections be carried out as per specifications, and method statement will be given at the commencement of the project. • Nighttime illumination should be in place at every location where the road is narrow, diverted and structures are repaired and any other places where PMU recommends doing so. • Monitor and record road crashes (if any) during construction and maintenance stages and takes appropriate remedial actions	Urban areas where disturbances to vehicle movements would occur. Continuous throughout the construction period Public complaints	Contractor	Environment Management Specialist, PMSC	Traffic Management Plans Detailed Design documents
15. Impacts due to Pollution: Noise and Vibration, Dust and Air Quality, Light, and Soil Erosion due to construction and Hazardous Waste Management					

5.a) Noise & Vibration	• Maximum permissible noise levels for construction activities must be less than or equal to 75 Leq T during daytime (06.00 – 21.00 hrs) and 50 Leq T during nighttime (21.00 – 06.00 hrs). • Conduct regular monitoring of noise levels as per the monitoring plan • Minimize the noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and using portable street barriers to minimize sound impact to surrounding sensitive receptors. Avoid loud random noise from sirens, air compression, etc. • Avoid using multiple high noise generating equipment/activities simultaneously • Identify any buildings at risk from vibration damage • Horns should not be used unless it is necessary • Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals <u>Health Impacts of Noise and Vibration</u> • If workers are exposed to noise above noise exposure limit, the contractor must investigate options for engineered noise control, such as using low-noise excavators, jackhammers, drills, and power generators. • Limit the duration of each worker depending on the Exposure Levels and Time Limits for corresponding exposure levels (follow Occupational Safety Standards) • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. • Use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.	One-off work program to establish the baseline Continuous site auditory observations Continuous vibration monitoring by 'feeling state' monitoring Weekly noise monitoring data using a mobile measuring device Vibration measurements using measuring equipment, if needed Complaints from community Noise and vibration levels of equipment and machinery (obtained from specifications) Occupational Health and Safety Plan Regular check-ups for workers who are exposed to continuous high	Contractor Contractor through a professional JASHORE&S expert	Environment Management Specialist, PMSC Environment Management Specialist, PMSC	National environmental Regulations by DoE, ECR 97 and 2023. Construction Method Statement Specification of the EH&S Standards of the IFC for exposure levels and time limits of exposure for high noise and vibration Or adopt guidelines as specified in The Control of Noise at Work Regulations (2005) of the UK.

		levels of noise and vibration			
5.b) Dust and Air Quality	**Air quality impacts: Site works** • As far as possible, plan site clearance and earthwork activities towards the end of the rainy season and avoid inter-monsoons, when the soil will be damp naturally and without being subject to downpours • To suppress dust, the contractor should sprinkle water on exposed soil and stockpiled material on-site sufficiently frequently, depending on the weather • If dust generation is significant, provide a dust screen of appropriate height; Provide a cover or a windbreaker around the sites to minimize the wind-carried air-borne dust; this will minimize dust generation, and also drifting of soil from excavated trenches • Control access to the work area, prevent unnecessary movement of vehicles, workers, public trespassing into work areas; limiting soil disturbance will minimize dust generation	Schedule of works Dust suppression measures - visual site observations Weekly review of site practices Public complaints	Contractor	Environment Management Specialist, PMSC	Construction Method Statement Transportation Plans Zero complaints from the community No visible increase in dust and particulate matters on buildings located adjacent to the roads National Ambient Air Quality Regulations, ECR 97 and 2023.
	Air quality impacts: material haulage, vehicle and equipment use • Vehicles travelling to and from the construction site must adhere to speed limits to avoid producing excessive dust. • Use tarpaulins to cover loose material (soil, sand, aggregate) when transported by trucks • Clean wheels and undercarriage of haul trucks before leaving construction site/quarry; Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water • Stabilize surface soils where loaders, support equipment, and vehicles will operate by using water and maintain surface soils in a stabilized condition • Access and other cleared surfaces, including backfilled trenches, must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust. • Ensure that all the construction equipment and machinery are fitted with emission control devices, which are operating correctly; ensure that only those vehicles and equipment in good condition and are in good maintenance are used for project construction. Vehicles and machinery are to be kept in good working order and to meet manufacturers' specifications for safety, fuel consumption, etc. • Vehicles/equipment should have a valid Vehicle Emission Certificate (VEC) obtained from the Bangladesh Road Transport Authority (BRTA) showcasing emissions below the specified limits; Maintain VEC records of all vehicles at all times for ready inspection at the work sites	Transportation Plan Dust suppression measures - Visual site observations Ambient air quality monitoring as per EMP Weekly Vehicle emission testing records Complaints from community As work progresses	Contractor	Environment Management Specialist, PMSC	
5.d) Impacts on soil and geology: Loss of productive soil	• Within the project premises, exposed areas and areas of loose soil shall be turfed or planted with shrubs. Retention of the ground cover and vegetation (to the extent as possible) is the most natural and effective way of protecting	Throughout the project area with special attention	Contractor	Environment Management Specialist,	Construction Method Statement

due to erosion, Slope stability, Soil contamination	soil from erosion by wind and rain; the feasibility of phasing site clearance in this way in order to reduce these impacts should be investigated when the construction work is planned in detail by the Contractor. • Land used for yards, labour camps, and offices, temporary access roads, shall be rehabilitated and restored back to its original use as practical as possible • Fresh and unstable slopes, loose rock and boulders shall be appropriately protected. Embankment surfaces shall be compacted and turfed. Proper drainage improvement works shall be done along with toes areas of embankments and slopes. • Movement of construction vehicles shall be restricted to access roads, haulage routes and yards to prevent damage to roads and pavements. • Concrete, slurry, paints, and chemicals such as bituminous products, fuel, lubricants, paints, solvents, and other chemicals shall be stored at designated places, well-sheltered and impervious floors (preferable paved). The paving area of the storage yards is provided with a gentle slope and shall be made so that any leaks/spills can be collected into a chamber for safe disposal. Such chemicals shall be well-managed, and efforts shall be made to minimize the waste generation.	to yards, vehicle parking, and servicing areas and construction activities near wetland areas Near construction sites, camp sites, storage yards, vehicle parks, yards, and temporary offices Along with embankments of the wetland areas		PMSC	Location-specific Drainage Management Plan
5.e) Hazardous waste management	• Any hazardous waste shall be stored at the designated place before disposal. The contractor shall ensure the material safety data sheets of chemicals are posted in conspicuous areas. • To avoid water and soil contamination due to concrete batching plants, storage areas, and wash-down areas, leak and spill prevention plans shall be established. Any accidental leaks/spills shall be arrested and cleaned appropriately, and such procedures shall be established. Workers should be trained and made aware of such procedures. • Oil interceptors shall be provided at appropriate locations (e.g., vehicle service areas); Residual and hazardous wastes such as asphalt and bituminous waste, solvents, oils, fuels, and lubricants shall be disposed of in approved disposal sites approved by the PMU. • Hazardous material, including oil and grease to be collected in leak-proof, properly labelled containers and stored appropriately. Proper signs should be displayed for hazardous waste) and should be handed over to authorized third parties who have waste oil handling or recycling licenses • Bins and/or skips shall be emptied regularly, and waste shall be disposed of at the pre-approved site. Waybills for all such disposals are to be kept by the contractor for review by the environment management specialist.	One-off for preparation and establishment of the Operations Manual that should include a Hazardous Waste Management Plan Visual site observation of proper management practices by weekly inspection of waste storage area Monthly waste audits	Contractor A specialist contractor who is authorized to handle hazardous waste	Environment Management Specialist, PMSC to monitor and report to the LA	Construction Method Statement National Environmental Regulations, ERC 97and 2023.

5.f) Pollution from asphalt and batching plant operation (This is **applicable only if** the Contractor is involved in asphalt batching which is needed for road rehabilitation work)	• Ensure that the batching plant is installed with in-built air pollution and dust control system; for fugitive emissions/dust from the loading area, provide dust screen around the components • Ensure that the plant is well operated & maintained at all times according to O&M manuals provided by the equipment manufacturer. • The asphalt loading area is equipped with a leak-proof concrete floor, from which all drainage is collected and treated as necessary before discharge • Asphalt trucks and especially drums are washed out only in a designated area, which should also be equipped with a leak-proof floor, from which drainage is collected and treated as necessary • All chemicals used in asphalt preparation are properly stored, whether dry, in powder or granular form, or as liquids. Storage facilities should be as specified in the appropriate international standard and should include equipment to extract dust and completely contain any spillage from leaks Conduct waste audits and inspections according to the EMoP	Establishment of batching plant One-off for preparation and establishment of the Operations Manual Operations manual should include a waste management plan Visual site observation by weekly inspection of waste storage area Monthly Waste audits	Contractor	Environment Management Specialist, PMSC to monitor and report to KWASA.	National Environmental Regulations, ECR 97 and 2023.
C. ECOLOGICAL IMPACTS AND MITIGATION					
1.a) Ecological Impacts due to loss / destruction / fragmentation of habitats	• Ensure that all construction activities are conducted strictly within the site footprints (including labour camps, offices, vehicle parking and other activities that might normally be located in an exterior contractor's area); no clearance of vegetation/trees outside footprint is permitted • Prohibit any deliberate killing or harming of animals on or off-site; any hunting or fishing or in nearby areas by site personnel; preventive actions shall be put in place by the contractor for hunting/killing of wild animals • Ensure that all construction work or other activities near the site perimeter are conducted with particular care and include measures to reduce noise and dust to the minimum possible • Create awareness in all site staff & workers on the importance of the animals and plants on-site and in the surrounding area, and their vulnerability • To protect site personnel, training should also be provided to enable them to recognize and deal safely & humanely with all venomous animals that may be encountered (e.g., snakes and scorpions) • Conduct site preparation activities, including vegetation removals, outside of the breeding season for wildlife, including migratory birds	Awareness of staff/workers	Contractor	Environment Management Specialist, PMSC	Guidelines provided by *ECR 97 and 2023.

1.b) Impacts on protected species of flora and fauna	• Prepare a method statement following accepted construction procedures near low-lying areas. This, among other things, includes pollution control (water, air, noise), limiting disturbance, not harming wildlife, etc. • Create awareness among workers on wildlife and protected species • Conduct work in areas close to water bodies when the water level is low	Awareness of staff/workers	Contractor	Environment Management Specialist, PMSC	Rapid Confirmatory Survey Report
1.c) Impact on flora and fauna due to local air pollution, noise, and vibration, light pollution	• Noise and vibration controls should be adopted. • Air-borne dust should be kept to a minimum.	Weekly review of site practices	Contractor	Environment Management Specialist	Construction Method Statement and Location-specific Action Plan
D. SOCIO-ECONOMIC IMPACTS AND MITIGATION					
1.a) Community impacts due to Establishment of labour camps	• Contractor's activities and movement of staff to be restricted to designated construction areas • Any conflicts between the workers and the local communities should be resolved with caution. Community leaders, Union Parishad (UP) and other responsible people should be informed of any incident without delay. • The possibility of the hiring of labour from the same locality and avoiding the setting up of labour camps should be looked into.	One-off before starting work: Construction camp/yard establishment & management plan Weekly Interviews with workers and local people	Contractor in coordination with the GN, and/or any other NGO and Community Leaders	PMU Social Safeguards Officer and Environment Management Specialist, PMSC	Zero complaints from community and workers
	• Providing appropriate conditions when putting up and maintaining temporary labour camps, accommodation and making sure that the conditions do not impact on the health and well-being of occupants	Prior to the establishment of labour camps and during labourers occupy such camps	Contractor	PMU Social Safeguard Officer	minimum requirements based on internationally recognized best practices[43]
1.b) Disruption to traffic/ transportation 1.c) Impacts on	• The contractor should inform neighbours in writing about such activities at least 24 hours beforehand. This can take place by way of leaflets placed in the postboxes giving the environment management specialist's and contractor's details or other method approved by the environment management specialist. Provide signboards for pedestrians to inform them of	One-off before starting work: Construction management action plan	Contractor	PMU Social Safeguards Officer & Environment	Construction method statement and Location-

[43] For a standard list refer to: https://Jashore.osha.gov/laws-regs/regulations/standardnumber/1910/1910.142

roadside structures and vehicle parking 1.d) Impact due to obstruction to access property 1.e) Impacts on the development activities in the vicinity	nature and duration of construction works and contact numbers for concerns/complaints. • The contractor will ensure that there is the provision of alternate access to business establishments during the construction so that there is no closure of these shops or any loss of clientele. • The contractor will ensure that any damage to properties and utilities will be restored or compensated for pre-work conditions. • Disruption of access for local residents, commercial establishments, institutions, etc. must be minimized and must have the environment management specialist's permission. Provide walkways and metal sheets where required to maintain access for people and vehicles. • Consult businesses and institutions regarding operating hours, and factor this in work schedules.	Monthly Interviews with local people and affected parties Public complaints Continuous monitoring as work progresses		Management Specialist, PMSC	specific Activity Plans Zero complaints from community and workers
2.a) Safety of Workers Occupational health & safety	• Comply with IFC EHS Guidelines on Occupational Health and Safety[44] • Prepare a comprehensive & site-specific Health and Safety Plan (JASHORE&SP) describing in detail how the health and safety of all site personnel (workers, staff, and visitors) will be maintained at all times. It is to provide guidance on establishing a management strategy and applying practices that are intended to eliminate, or reduce, fatalities, injuries, and illnesses for workers performing activities and tasks associated with the project. • Provide compulsory JASHORE&S orientation training to all new workers to ensure that they are apprised of JASHORE&S Plan including rules of work, PPE, preventing injury to fellow workers, etc.; Conduct regular toolbox safety briefings; tendencies, causes, risks & safe procedures • Conduct periodic safety audit, identify and remove potential hazard; Ensure that qualified first-aid is provided at all times; equipped first-aid stations shall be easily accessible throughout the worksites and camps; Provide medical insurance coverage to workers. • Secure all installations from unauthorized intrusion and accident risks. • Provide supplies of potable drinking water; Provide clean eating areas where workers are not exposed to hazardous or noxious substances. • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present; visitors not to enter hazard areas unescorted • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas • Ensure moving equipment is outfitted with audible backup alarms • Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment,	Health & Safety Plan Implementation of measures Weekly interviews with workers Occupational health and safety plan Number of accidents and work-related injuries Complaints from community Continuous monitoring as work progresses	Contractor Labour sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist	Construction method Statement Detailed JASHORE&S Plans prepared according to guidelines Zero accident and work-related injuries Zero complaints from community and workers

[44] http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES

	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. • Disallow worker exposure to high noise for more than 8 hours/day without hearing protection. Use of hearing protection shall be enforced actively. • Employ workers with adequate experience, training, and know-how. These workers shall be led by an experienced supervisor or engineer who will provide the leadership in daily activities. • General regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on-site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g., fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on-site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • The contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, the EE and/or a translator shall be called to the site to explain further aspects of environmental or social behaviour that are unclear. • The rules that are explained in the worker conduct section must be followed at all times.				
2.b) Health and Safety of the Public	<u>Public safety during work along with public roads</u> • Adopt standard and safe practices for road construction • Ensure access to houses and businesses along the alignment; provide wooden planks, metal sheet with protective barricades/rails to allow access to the properties • Provide temporary traffic control (e.g., flagmen) & signs where necessary to improve safety and provide directions • Restrict public access to all areas where construction works are on-going through the use of barricading and security personnel • Ensure that all material, equipment, workers and all activities are conducted within the demarcated/barricaded strip of land along the road; there should be no spillage of any activity outside this zone • Clearly separate work areas with traffic/pedestrian flow; provide public information boards to identify the work area easily	Work methods and implementation of measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the	Contractor Labour sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist to monitor PMU to	Zero complaints from community and workers

	• Warning signs, blinkers will be attached to the barricading to caution the public about the hazards associated with the works such as the presence of trenches / deep excavation • Plan carefully using a section-by-section approach, so that open trenches are quickly closed, and road restored • Control dust pollution – implement dust control measures as suggested under air quality • Organize public awareness campaigns.	communication and participation strategy		coordinate with the Khulna WASA.	
	<u>Safety risk due to construction vehicle/equipment movement on public roads</u> • Prepare a Transportation Plan for material, waste, and equipment; consult highways agencies, police and other relevant authorities during both planning & implementation • Plan transportation routes to avoid heavily populated areas; Schedule deliveries to avoid congested areas during morning and evening peak traffic periods; Proper coordination to combine deliveries where possible, to avoid under-utilization of vehicles and reduce the number of journeys • Source materials in the close proximity (within the Khulna city) and other local outlets wherever possible, to reduce the length of delivery journeys • Conduct awareness programs for communities who live along the roads about the movement of heavy vehicles and traffic safety measures • Provide safety, information and caution boards where necessary • There are schools (especially pre-schools) along the roads, construction vehicle movement shall be restricted during the school opening and closing hours; if unavoidable, place traffic guards at school and other sensitive places, like hospitals, temples, etc. Notify affected sensitive receptors by providing signboards with information about the nature and duration of construction works and contact numbers for concerns/complaints • Coordinate with the Traffic Police for temporary road diversions and for provision of traffic aid if congestion cannot be avoided during peak hours.	Implementation of Transportation Plan and Monthly monitoring Weekly Visual site observations, interviews with workers and community	Contractor and Sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist to monitor and report to KWASA. PMU to coordinate with the Police; traffic department Khulna circle.	Construction method statement and Location-specific Activity Plans
	<u>Community health</u> • Lighting on the construction site shall be pointed downwards and away from oncoming traffic and nearby houses. • Mitigation and suppression of air-borne dust (especially during windy days) • The site must be kept clean to minimize the visual impact of the site. If screens are used, this must be moved and re-erected as work progresses. • Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbors. • Notice of particularly noisy activities must be given to residents/businesses adjacent to the construction site. Examples of these include noise generated by jackhammers, diesel generator sets, excavators, etc.	Work methods and implementation of measures Weekly visual site observations, interviews with workers and community Complaints from	Contractor and Sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC to monitor and report to KWASA	Zero complaints from community and workers

	• Noisy activities must be restricted to the times given in the project specification or general conditions of the contract.	community Activities based on the communication and participation strategy			
2.c) Other impacts related to workers and their camp operations	• Avoid/minimize the requirement to establish camps by hiring and employing local workers as far as possible; the presence of workers throughout the day and night during the construction work will disturb the environment • If necessary, contractor to identify a barren, vacant land (preferably private unused land) to establish the camp nearby; ensure that such camp is at least 500 m away from habitation, water bodies, scrublands etc., • Prepare & implement Construction Camp Management Plan (CCMP). The plan should include: o Layout plan showing all the proposed facilities, offices, material storage area (separately for hazardous waste, fuel, chemicals, etc.), amenities, repair and washing areas, and circulation areas/roads o Integrate drainage, water pollution, air and noise control measures o Drinking water, sanitation, washing, eating and resting places for workers o Proper liquid waste, solid waste collection, treatment, & disposal system o Fire safety, medical facilities • Separate the workers' living areas and material storage areas, worksites clearly with a fencing and separate entry and exit • Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers • The camp shall be provided with proper drainage, there shall not be any water accumulation. Provide drinking water, water for other uses, & sanitation facilities, provide means of collection and disposal of sewage. • Manage solid waste according to the following preference hierarchy: reuse, recycling, and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable/recyclable waste shall be collected and sold in the local market	Approved location plan Complaints from community Construction Camp Management Plan Monthly visual observations, interviews with workers and local people Waste disposal manifest /record keeping by contractor's environmental specialist.	Contractor and Sub-contractors	Environment Management Specialist, PMSC to monitor and report to KWASA.	Construction method statement Location-Specific Construction Camp Management Plan which should include plans for Solid Waste Management, Drainage Management and provision of proper Sanitation
3) Impacts on the Cultural and historical environment	• All the staff and laborers of the contractor are informed about the possible items of historical or archaeological value, which include old stone foundations, tools, clayware, jewelry, fossils, etc. • If something of this nature is uncovered, the Department of Archaeology of Bangladesh shall be contacted, and work shall be stopped immediately. • Conduct an Archaeological Impact Assessment, if needed.	Records of Chance Finds	Contractor	Environment Management Specialist, PMSC to report to the Dept. of Archaeology	Written permission from the Dept. of Archaeology and their guidelines

					for construction work to proceed
4) Grievance Redressals	• Should the construction staff be approached by members of the public or other stakeholders, the staff should assist them in locating the environment management specialist or contractor or provide a number by which they may contact the environment management specialist or contractor. • The conduct of the construction staff when dealing with the public or other stakeholders shall be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site by the environment management specialist. • Environment management specialists and contractors are responsible for ongoing communication with people affected by the project. • The contact information of PMU, PMSC, and contractor shall be posted visibly at each construction site. • A complaints register (referring to the grievance redressal mechanism) shall be housed at the site office. This shall be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the contractor. This summary of the register shall be included in the monthly report to be submitted by the contractor to PMSC. • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. • The contractor must address queries and complaints by (i) documenting details of such communications; (ii) submitting these for inclusion in the complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. • The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance, along with the action taken, to the environment management specialist within 48 hours of receipt of such complaint/grievance. • Grievance Redress Mechanism as outlined in Chapter VII should be clearly understood by the Contractor and his staff.	Work methods and implementation of GRM measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the communication and participation strategy	<u>Minor Grievances</u> Contractor <u>Other Grievances</u> PMU Social Safeguards Officer or Grievances Redressal Committee (GRC) or Program Steering Committee (PSC)	PMU Social Safeguards Officer & Environment Management Specialist, PMSC To coordinate with PMU, GRC or PSC and maintain records	Grievance Redress Mechanism
C. Operation of newly built/upgraded facilities					
Detection and repair of leaks and pipe bursts	• Leak repair work will be similar to pipe-laying work as earlier explained. Trenches will be dug to find the leaking area and the faulty connection will be refitted, or pipe will be removed and replaced if necessary. Although the impact is likely to be minimal due to a new and well-designed, efficient	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA

	system, it must be ensured that leak detection and restoration time is minimized to the extent possible.				
Periodic flushing of the pipeline, descaling and scour maintenance and other activities	• These need no special mitigation, other than collection of water after descaling and allowing deposition of scales, which can then be disposed of safely.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA
Poor operation & maintenance practices leading to adverse impacts	• Make sure that the plant is operational in compliance with all the contractual conditions and requirements of KWASA • Ensure that O&M manuals, JASHORE&S Plan, Process • The Safety Management Plan, Risk Management Plan, Facilities Safety and Security Plan, and the necessary programmes for compliance with all other applicable safety regulations, are all prepared by the contractor through individuals with appropriate qualifications and extensive experience. Make these manuals available in the local Language, if needed. • Ensuring that the above plans and other plans and programmes, and indeed all of the work tasks involved in operating the RODP are thoroughly and professionally implemented at all times by the Plant Manager • Ensure that well-qualified and experienced operators are engaged throughout operations. Make sure that the Contractor trains the operators and transfers the technical know-how appropriately. • Establish ISO14001 practices and certification as a good practice model that can be continued after the plant is transferred to KWASA	During Commissioning At the time of handling over the WTP Throughout the operational period	PMU when commissioning and handing over the WTP. Plant Manager, KWASA		Appointment of well qualified DBO contractor, preparation and implementation of plans, following SOPs in O&M ISO 14001 Certification Employ safety/ environmental officers who have ISO certification.
Cleaning of the bar screens and the grit chamber	• Make sure that the debris collected at the screens and the grit collected in the grit chamber is removed and disposed on ground. Such debris and grit should not be dumped back in the IPR. • In cases of flooding, the debris, grit and sediments collected at the intake channel should be removed at disposed on ground. These should not be dumped back into the river	Throughout the operational period	Plant Manager, KWASA		-
Supply of safe potable water	• Water that is supplied should confirm to ECR 97 and 2023 Bangladesh Drinking Water Quality Standards and WHO Drinking Water Quality Guidelines at all times, without exception.		Plant Manager, KWASA		Bangladesh Drinking Water Quality

					Standards WHO Drinking Water Quality Guidelines
Being a dependable and a reliable source of water supply	• Formulate Operational Plans based on the Policies, Guidelines and Good Practices of the KWASA • Draft and implement short-, medium and long-term plans to ensure reliability of water supply (quality as defined by Bangladesh Standard Specification for Drinking Water (BDS 1240:2019), adequate quantity to meet the water demand and accessibility) • Ensure level of service is in consistent with the Policies of the KWASA and to the satisfaction of the expectations of consumers • Establish procedures to inform the consumers of interruptions to water supply • Establish procedures to respond to public complaints, comments and suggestions • Establish procedures to respond to service breakdowns, and emergencies	Definition of Level of Service in consistent with existing Policies Operational Procedures Emergency Response Procedures O&M Procedures Public Relations Policy	Plant Manager, KWASA		Policies of the KWASA
Management of water treatment sludge generated at the WTP	• Ensure that water treatment sludge is dried, collected and stored properly prior to its final use. • Long-term sludge management plan has to be drafted and implemented (suggested method of sludge management is to use it in brick/block production) •	Sludge management plan Check the leachability of chemical substances in the sludge in selected samples, if used for brick production	Plant Manager, KWASA		Established methods of water treatment sludge management
Impacts due to Storage, Handling, Application of Chemicals	• Reducing the amount of chemicals used in the water treatment process to the extent possible; for instance, pre-oxidation of the source water only when needed which can reduce the use of chemicals • Replacing anti-sealants, as far as possible, by more biocompatible alternatives.	Procedures established for procurement, transport, storage, use and disposal of chemicals	Plant Manager, KWASA		Established methods for safe handling of water treatment chemicals

	• Ensuring that all chemicals used on site are stored according to the relevant international standards, to prevent accidental release and hazards to operatives • Storing all liquids in appropriate leak-proof containers, in sealed, concrete floored and bunded areas, that will hold 110% of the stored volume of each liquid in the event of a major leak • Storing different types of liquid separately so that there is no risk of mixing in the event of multiple leaks • Providing leak/spill detection, collection / capture and safe disposal facilities such as chlorine absorption and neutralization facility • Providing ventilation, lighting, entry and exit facilities; visible & audible alarm facilities to alert chemical leaks • Facility for isolation in the event of major leakages • Eye wash & shower facility, Personal protection and safety equipment for the operators (masks, oxygen cylinders, gloves, etc.,) • Providing training to the staff in safe handling and application of chemicals, material safety, and standard operating procedures and emergency responses • Developing emergency response plans • Operating the site workshop with the highest standards of environmental protection, and all drainage from this area must be collected and passed through an oil separator before discharge • All equipment/machinery maintenance and servicing should be done in a suitably equipped workshop, and no vehicle maintenance should be done on site.	Safety procedures in safe handling of chemicals			
Generation of substances used for lubrication, paints and solvents, cleaning material in small quantities during O&M	• Construction debris, lubricants, paints, solvents, and the substances should be properly collected stored and disposed of.	O&M procedures Records of generation of hazardous wastes	Sub-contractors, workers of KWASA	OIC of the WTP, KWASA	Acceptable procedures to collect and handover hazardous material to authorized collectors.
Periodic flushing of the pipelines, descaling and scour maintenance and other activities	• These need no special mitigation, other than collection of water after descaling and allowing deposition of scales, which can then be disposed of safely.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA

Noise and vibration due to operations of the pumps	Make sure that the pumps that are fixed generate noise levels that conform to the required levels. No mitigation measures are needed as long as the noise level at the boundary of the WTP does not exceed 55 dB(A) during the day and 45 dB(A) during the night • If noise levels are higher than these limits, then appropriate noise abatement measures should be in place.	Noise levels measured at the boundary of the Waterworks premises to verify the noise levels do not violate regulatory limits. Measurements made if neighbours complain about high noise and/or vibration	PMU	OIC of the WTP, KWASA	National Noise Control Regulations of ECR 97 and 2023.
Management of MSW	Proper collection and storage of MSW and be handed over to local authority depending on MSW collection schedules. • Complying with rules of the local authority on proper sorting and collection schedules	Bins/chambers for collection of MSW and provisions for the local authority to collect MSW regularly	Occupants of the staff quarters	OIC of the WTP, KWASA	MSW segregation and collection procedures of the local authority
Wastewater collection and disposal	Sanitary wastewater collected at the WTP premises and staff quarters should be disposed of safely. •	Designs of the septic-soakage pit arrangements	Occupants of the staff quarters	OIC of the WTP, To obtain approval for the designs	Designs of the septic-soakage pit arrangements approved by the local authority
Accidents & emergences	• Ensure that Emergency Response Plans and contingency Plans are in place prior to start of operation • Conduct awareness programs & mock drills • Implement emergency response plans • Undertaking corrective actions where required	Quarterly Monitoring Report Corrective Action Plan Throughout the operation phase	KWASA		Emergency Response Plans and Contingency Plans prepared based on Industry Standards and Safety Procedures

Table 47: Environmental Management Plan – for Construction and Operation of Distribution reservoirs, Overhead tank and Pumping station including O&M & Vertical extension of KWASA headquarter building (from 6th to 7th floor) (Package 7)

Package-7	Construction of Distribution reservoirs, Overhead tank and Pumping station including O&M	No	4
	Vertical extension of KWASA headquarter building (from 6th to 7th floor)	sqm	600

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
Planning Stage - Construction and Operation of Pipelines					
1. Work delays due to improper planning					
1.a) Delays in mobilization and timely implementation of work program & poor coordination and extended duration for project completion	• Scheduling, coordination, procurement, obtaining approvals and project implementation will be expedited to the extent that is practicable. • Standard and good construction practices will be followed at all times. • The possibility of deploying several gangs simultaneously will be pursued, which will allow the work to be completed within the least possible duration. • Finalize construction programs duly considering provisions for work schedule The following plans be developed for implementation: o Area Construction Work Plan o Material Procurement Plans o Transportation Plan for material, equipment, and waste conveyance o Health & Safety Plan; Traffic Management Plan for each road segment o Environmental Management Action Plan o Construction Waste Management Plan o Other plans such as drainage management and erosion control (if any)	Work schedules Respective plans One-off before starting construction	Contractor	Reported to the PMU	Standard Construction Practices and Industry Norms
1.b) Poor environmental management by the Contractor	• Designate an environment specialist who will be in charge of coordination with PMU for updating this IEE and implementing the EMP and EMoP, including the conduct of all surveys, monitoring actions, etc. • Appoint an Environmental specialist with the mobilization of the contractor (through design and construction, and intermittent during operations) • Coordinate with the PMU on confirmatory surveys to be conducted during the design phase and complete as required with external experts (if needed)	Mobilization of PMU and PMSC staff with suitable experience and expertise One-off during mobilization, and continuous	Contractor	Reported to the PMU	Qualification framework for the Environmental Specialist (of the PMSC)

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
		throughout the contract period			
1.c) Climate Change Consideration and Vulnerability Screening	• Climate change vulnerability checks in compliance with provisions provided in the IEE Report. • Adopting proper mitigation measures as may be required. • At least three trees should be planted for each tree that is cut. The recommended number would be five trees for each tree to cut. • Efforts shall be made to plant additional trees to increase the carbon sink. The trees may be selected with the help of the Forest Department and space for additional planting (if the remaining space within ROW is not adequate) will be secured with the help of KWASA and Community-based Organizations (CBOs).	Throughout the project and flood-prone areas and other possible areas of tree planting (if any)	Design Consultant of the Contractor	PMU	ADB SPS Framework & IFC Sustainability Framework and Performance Standards
1.d) Delays related to the selection of locations for project interventions					
○ Location for the pump houses	• Confirm that the land ownership of all premises for pump houses, storage tanks, and other facilities under Package 7 is legally secured by KWASA, including sites at Labonchara, Mostafa Mor, Afil Gate, and the KWASA headquarters. • Clearly demarcate the boundaries of KWASA-owned land at all construction sites to prevent encroachments or unauthorized activities during project implementation. • Conduct site inspections to ensure no informal settlements or temporary structures exist within the identified boundaries to avoid conflicts or delays. • Engage with local authorities and stakeholders near the construction sites to address any potential concerns regarding access, noise, or dust during construction activities. • If modifications to existing structures or land use are necessary, follow a legally compliant and transparent process to obtain any additional permissions or agreements required.	-	-		
○ Worker camps, stockpile areas, storage, and disposal areas	Worker camps should be located as close as possible to the subproject sites (distribution reservoirs, overhead tanks, pump houses, and the KWASA headquarters extension) while minimizing disruption to nearby communities and infrastructure.	Plans for site selection One-off before	Contractor	PMSC environment management specialist	-

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	Select sites that cause minimal damage to property, vegetation, and nearby ecological features, ensuring the least disturbance to the surrounding neighborhood, including local traffic and residential areas. Avoid setting up worker camps in residential areas to mitigate the risk of social conflicts and complaints from the community. Choose camp and storage locations that are elevated and avoid low-lying or marshy areas to prevent flooding and minimize environmental impacts. Ensure all selected locations for camps, stockpiles, and storage areas are identified in project designs and clearly marked on site plan drawings. Secure storage yards for materials and equipment to prevent theft and unauthorized access by children, animals, or unauthorized personnel. The contractor must prepare and submit a method statement detailing the storage of hazardous materials (e.g., fuels, oils, and chemicals) and outline emergency procedures to manage spills or accidents effectively.	starting construction			
1.f) Work delays due to not obtaining prior approvals/ consents, etc.	• In all instances, KWASA, service providers, contractors, and consultants must comply with relevant national and ADB Safeguard Requirements. The IEE should be thoroughly reviewed to note any pre-requisites and to understand legal, regulatory and Institutional procedures. • A copy of the IEE must be kept on-site and disclosed on KWASA and ADB website for any stakeholders to have access to.	Clearances and approvals One-off before starting construction	PMU facilitated by EA and/or IA Contractor facilitated by the IA and PMU	PMU	Approvals and consents listed in Chapter II of the IEE Report
1.g) Climatic conditions and local weather patterns	• Rainfall and its runoff in the project area may cause disruption/damage to ongoing works and public inconvenience. • The project area receives considerably high rainfall. Flooding is a frequent event. Flash floods can occur which can disrupt (or even severely damage) the partially constructed structure of the raw water intake. Therefore, all attempts have to be made to complete the work during the dry season (avoiding the months such as May-June & October) • Furthermore, climatic conditions play an important role during the dispersion of noise and air pollutants. Seasonal climatic conditions have been considered for scheduling construction activities. Avoid construction activities such as excavation, pipeline laying, and intake structure works during the monsoon months, typically **June to September** in Khulna.	Work schedule and plans to accommodate the loss of time due to inclement weather (and contingency plans, if any). One-off before starting construction and updating plans during construction	Contractor	PMU	Climatic and weather patterns; data provided by the BMD.
2. Health and safety issues in compliance with Standard Practice					

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
2.a) Occupational Health and Safety of workers 2.b) Public Safety	• The appointment of an Environmental, Health, and Safety (EHS) Officer will be considered towards the end of the planning stages, before the implementation of any project activity. • Selection of locations and facilities for labour camps will be reviewed by the EHS Officer, in consultation with the KWASA authority • Compliance with EHS requirements will be thoroughly reviewed, and a summary requirement will be prepared (one for workers and another common one for the public, including the workers).	EHS Manuals, Plans, Forms, Schedules, Notices, Registers, Redress Mechanisms, Follow-up, and Monitoring Procedures, Emergency Preparedness and First-aid, Training schedules and methods One-off during mobilization, and continuous throughout the contract period	Contractor's Environmental, Health, and Safety (EHS) personnel. (in consultation with the officials of the PMU)	PMU	National Labour Laws, Guidelines of GoB and IFC EHS Guidelines on Occupational Health and Safety
3. Optimal use of resources, proper waste management and minimization of physical impacts					
3.a) Waste Minimization	• Prepare a solid waste management plan for disposal of spoil, excavated/dredged material and construction debris; Waste shall be disposed of in existing approved sites; new sites shall be developed considering siting guidelines, maintained and operated accordingly • Make efforts to minimize the overall material required for the project by adopting various approaches – balanced cut and fill, re-use as much excavated material from this project as possible	Solid Waste Management Plan (SWM Plan) Consents and Approvals from the local authority for the collection, transportation, and disposal of MSW and other construction debris	Contractor in consultation with the local authority	PMSC environment management specialist	-
3.c) Selection of equipment and	• Pump and Pipe Strength parameters should satisfy the Specifications	Test reports, and certification from	Material Supplier through the	PMU	Standards and

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
installations and material	• Equipment, machinery and strength parameters should satisfy industry-standard Specifications	Approved and Accredited Independent Testing Agencies, prior to supply of pipeline	Contractor		Specifications for pipe material
3.d) Selection of construction material and sourcing	• Material for the construction of sumps, pump houses and buildings will be procured from licensed material sources who have obtained proper approvals for material sourcing. • The contractor shall prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, bedding material, etc.), and submit these to the PMSC for approval before the commencement of any work. Where materials are mined, proof must be provided of authorization to utilize these materials from the Bureau of Mineral Development (BMD) and Department of Environment (DoE).	Criteria for selection of licensed material sources One-off prior to starting work Continuous material test reports during construction	Sub-contractors through the Contractor	PMSC environment management specialist to check permits from the DoE and BMD	QA Standards and strength requirements for construction material Environmental Conservation Rules, 1997
3.e) Excavation of trenches	• For connection of transmission mains, minimum possible width is specified in trench details (pipe diameter + working space) to minimize damage to road surfaces, and proper shoring methods will be adopted. • If needed, adequate support to boundary walls and other structures will be provided.	Detailed construction method statements clearly indicating trench widths and excavation methods Before construction	Contractor	PMU	Standard Construction Practices (150 mm each side of the pipe for Trench)
3.f) Labour gangs	• Recruitment of laborers, both unskilled and skilled, from the locality will reduce the need for having large labour camps and will lead to lesser impacts due to such labour camps during the construction stage.	Labour recruitment plans and criteria for selection of sub-contractors. Records of training Before the commencement of civil works	Sub-contractors through the Contractor	PMSC environment management specialist	Labor Recruitment Guidelines
3.g) Training of	• Ensure all site personnel have a basic level of environmental awareness training.	Criteria for	Contractor	PMU	ADB SPS

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
site staff on general and environmental safeguards	• Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained in any potential hazards associated with their task. • No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the contractor. • All employees must undergo safety training.	recruitment of site staff Records of training Before the commencement of civil work and hiring new employees		safeguards officer; PMSC environment management specialist	Framework
3.Jashore) Noise and vibrations	• Time of operation of construction equipment and vehicles engaged in the transportation of construction materials will be planned well so as not to disturb the public. However, noise and vibration will be confined to the periphery of the work sites only are temporary in nature.	See EMP for Construction Phase	Contractor	PMU safeguards officer; PMSC environment management specialist	Noise and Vibration Control Regulations
3.i) Air quality	• Dust and gaseous emissions are expected due to machinery and equipment and during construction processes (e.g., transportation, excavation, construction activities, and stockpiling. Proper planning of construction and transport activities will be given priority. Proper mitigation methods will be adopted to control obnoxious gases, and dust generated if any.	See EMP for Construction Phase	Contractor		-
3.g) Drainage and Hydrology	• Project components are not expected to have any negative impact on the drainage and hydrology of the area. • Runoff from the project will produce a highly variable discharge regarding volume and quality, and in most instances will have no discernable environmental impact. • Identify & demarcate drainage paths on the sites, & excavated roads • Integrate these channels into the layout plans so that natural drainage is not disturbed; Provide cross drainage structures wherever necessary along the excavated roads (especially the narrow roads), and yards.	See EMP for Construction Phase	Contractor	PMU safeguards officer and PMSC environment management specialist	GoB and the local authority requirements and specifications
4. Avoiding ecological impacts					
4.a) Loss of VEC and impacts on the natural environment	• There are no areas of ecological diversity that occurs within the locations of project interventions. • The land identified for the construction of the distribution tanks are bare land. • Though these lands have no threatened or vulnerable species, it is recommended to carry out a rapid survey to identify protected plants (if any) in the location earmarked for project interventions (including the access roads to the sites) to avoid the need to remove/cut any trees/plants to the extent that is practicable.	Rapid survey to identify any protected plants survey & markings on sitemaps One-off survey	Contractor (if needed, through a pre-approved party) to identify Contractor 3 for each of the tree species that	PMU supported by an independent consultant (Ecologist) to draft a TPP.	Wetland Management Strategy as proposed by the KWASA has its own Tree plantation

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	• Make a list of trees that are cut down and compensate for the loss of these trees by planting at least three trees (five trees are recommended) for each tree that is cut	List of trees that are cut and draw up a Tree plantation program. TPP	are cut.		guidelines. Replanting programme as recommended by the BFD.
5. Minimizing Community impacts					
5.a) Land use and livelihoods	• The land used in the project area is entirely within the KWASA premises and there are no community impacts due to project implementation. • The transportation corridors constitute existing roads in the project area. Proper planning of construction activities will minimize the impact on day-to-day activities of the people.	One-off prior to start of construction work and continuous monitoring during the construction phase	Contractor	PMU	-
5.b) Traffic flow and access to property, sites, and by-roads	• Impacts on the traffic flow as a result of construction vehicles and transportation of material will have a minor impact. Local communities will be regularly consulted regarding the location of construction schedules, access and hauling routes, and other activities that are likely to cause disturbances during construction. • Information on road closures and proposed detours will be communicated via notices, pamphlets, road signages, etc. • Plan transportation routes so that heavy vehicles do not use narrow local roads, except near the sites. • Schedule transport and hauling activities during non-peak hours. No vehicles should be parked on roadsides for long periods. • Keep the roadsides free from all unnecessary obstructions. • Notify affected sensitive receptors by providing signboards with information about the nature and duration of construction works and contact numbers for concerns/complaints	Traffic Management Plans Transportation Plans and schedules Clearances and approvals One-off before starting construction work and continuous monitoring during the construction phase	Contractor	PMSC environment management specialist and resettlement specialist	

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
5.e) Aesthetics, landscape character, and sense of place	• There are no large structures proposed. Therefore, the project is considered to be compatible with the surrounding landscape and is not expected to negatively impact on the existing visual quality or landscape character of the area.	Project Plans One-off prior to start of construction work and continuous monitoring during the construction phase	PMSC	PMU	-

E. PHYSICAL IMPACTS DURING CONSTRUCTION PHASE AND MITIGATION					
16. Anticipated impacts due to land preparation activities					
1.a) Land preparation activities	• Implement a Comprehensive Construction Waste Management Plan (C-WMP): Include waste minimization strategies, clearly define roles for waste segregation, and ensure compliance with disposal protocols. Special care should be taken at sensitive sites like the KWASA headquarters to minimize disruptions. • Ensure that all construction activities, including land clearing and material storage, are confined within the designated boundaries. Written permission from property owners and tenants must be obtained for any access or use of private property outside the project area. • All spoil, topsoil, demolition waste, and cut vegetation must be securely covered with tarpaulins during transport to prevent material dispersal. At KWASA headquarters, extra care should be taken to avoid disrupting ongoing administrative operations or pedestrian areas. • Excess spoils and debris should not be stored at construction sites for extended periods. Prompt disposal of designated locations should be ensured, especially in urban areas like the KWASA headquarters and near residential neighborhoods around CWRs. • Disposal sites must be chosen from barren or non-sensitive lands, away from residential zones, water bodies, and ecologically sensitive areas. Ensure compliance with environmental regulations and approval from local authorities.	Implementation of construction method statement and Implementation of C-WMP Weekly visual site observations Monthly Waste audits	Contractor	Environment Management Specialist, PMSC	Good construction practices and industry standards Use available Guides for C-WMP (Construction waste management, USEPA, Dec 2007[45]

[45] Available at: https://Jashore.epa.gov/sites/production/files/2014-03/ documents /017419.pdf)

	• Separate recyclable and reusable materials for repurpose or sale in the local recycling market. Ensure proper bins or collection areas are provided, especially near active construction zones like the pump stations and OHTs. • Ensure that no construction or domestic waste is burned at the project sites. Set up clear waste disposal protocols with designated collection points and create awareness among workers about proper waste handling. • After completing construction activities, restore all disturbed areas, including pipeline routes, land surrounding CWRs, OHTs, and the KWASA headquarters, to their original conditions. Verification of proper restoration should be mandatory before issuing completion certificates.				
1.b) Excavation work	• When excavation encounters rock or reinforced concrete, use silent rock cracking chemicals, non-explosive blasting chemicals, or concrete breaking agents to minimize vibrations and noise, especially near sensitive sites such as KWASA headquarters and residential areas around CWRs and OHTs. • Ensure that mechanical excavations are promptly followed by skilled workers to trim and clean the trenches or excavation areas to the precise size and depth specified in the design plan. This minimizes over-excavation and ensures stability. • : Install shoring systems for trenches and excavations to prevent collapse of trench sides. This is critical for ensuring worker safety and preventing settlement of adjacent structures, roads, and pavements. Pay special attention to urban areas with higher pedestrian and vehicular activity. • Avoid unnecessary sloping of excavation sides, especially in paved or confined areas, to reduce the extent of surface damage. This practice also minimizes the post-construction burden. • Restrict heavy equipment and material storage near trench edges to avoid destabilization and ensure structural integrity of adjacent land surfaces, pavements, and buildings.	Construction method statement Weekly visual site observations Monitoring of site management practices as the work progresses	Contractor	Environment Management Specialist, PMSC	Detailed design documents Shoring design manuals and methods as adopted by the Contractor
1.c) Storage and transportation of construction debris and excavated material	• Designated Stockpiling Areas: Ensure that all excavated materials are hauled away from the excavation sites and stored only in areas designated or approved by the PIU. These areas should be strategically located to avoid disruption to local traffic, sensitive areas, or access to KWASA headquarters and construction zones for CWRs and OHTs. • Reuse Excavated Material: Maximize the reuse of excavated material by processing stockpiles at designated locations for use as selected backfill material in trenches or other construction activities. This reduces the environmental footprint and transportation costs. • Direct Loading of Excavated Material: To minimize site clutter and avoid double handling, excavated material should be directly loaded into hauling vehicles. Ensure that vehicles are present at the site during excavation operations but parked at a safe distance to avoid interference with excavation works or risks of collapse.	Construction method statement Implementation of C-WMP and regular waste audits Monitoring of site management practices as the work progresses	Contractor	Environment Management Specialist, PMSC	For re-use of excavated materials: Follow guidelines proposed by the KWASA or CSC.

	• Minimize Idling of Vehicles: Hauling vehicles at excavation sites must keep engines turned off while idling to reduce air pollution and noise in urban settings near sensitive areas, such as schools, mosques, or residential zones around construction sites. • Secure Transport of Material: Ensure all materials transported from excavation sites are securely covered (e.g., with tarpaulins) to prevent spillage or dust generation during transit, particularly along roads with heavy pedestrian or vehicular traffic.				
1.e) Scheduling of work and Closure of areas	• Excavation, construction, installation, interconnection, testing, backfilling, landscaping, and pavement restoration must be completed within the prescribed timeline, with daily work plans prepared based on site sensitivity and stakeholder constraints. • All necessary resources, including labor, equipment, vehicles, and materials, must be mobilized in advance to ensure tasks are completed on time with minimal disruptions. • Maintain contingency plans for labor, machinery, vehicles, and health and safety provisions, ensuring additional resources are accessible when required. • Adjust work schedules based on site-specific conditions, such as proximity to sensitive areas, traffic patterns, or critical infrastructure, to minimize disruptions. • Efficiently manage road closures or restricted areas with proper notifications and signage to reduce inconvenience to local residents, businesses, and commuters.	Construction method statement and activity plans Monitoring of site management practices as the work progresses Public complaints	Contractor	Environment Management Specialist, PMSC	Detailed Design documents, Construction method statement and Activity Plans approved by the PMU.
17. Impacts on natural flow and existing drainage pattern and hydrology					
2.a) Impacts on drainage canals, natural drainage paths and activities that would cause (local) flooding	• Maintain clear access and unblocked natural drainage paths at all construction sites, including areas for distribution reservoirs, overhead tanks, pump stations, and the KWASA headquarters extension, to prevent localized flooding. • Conduct routine inspections of construction zones to identify and promptly clear debris or materials obstructing natural or artificial drainage channels. • In the event of flooding caused by construction activities, implement immediate corrective measures, such as drainage restoration, water redirection, or dewatering, to minimize impacts on adjacent properties or infrastructure. • Avoid storing construction materials, spoil, or equipment in flood-prone zones near the identified CWR and OHT locations to reduce the risk of water stagnation and sedimentation during heavy rainfall. • Develop and enforce temporary drainage management plans for sites such as Labonchara, Mostafa Mor, and Afil Gate during the construction of water infrastructure, ensuring minimal disruption to surrounding communities and ecosystems.	Throughout the project area with special attention to low-lying areas Continuous monitoring during the rainy season and during major storm events	Contractor	Environment Management Specialist, PMSC	Detailed design documents Site-specific Drainage Management Plan should be developed

18. Impacts on water quality due to silt runoff discharges and spoil from construction activities					
3.a) Deterioration of Water quality	• For construction activities at sites like Labonchara and Mostafa Mor CWRs, ensure that spoils and excavated materials are disposed of in designated, approved areas, away from sensitive water bodies and drainage paths. • Earthworks near streams (e.g., N709 highway site for CWR 1) must be scheduled during the dry season to prevent soil runoff into nearby drainage channels. Establish silt traps or sedimentation barriers to capture sediment before it reaches these channels. • For pump house and overhead tank construction at Mostafa Mor and Afil Gate, store chemicals, fuels, and lubricants in sheltered and impervious areas, far from any natural or artificial drainage leading to water bodies or wetlands. Incorporate spill containment measures. • At all CWR and OHT sites, prevent runoff by covering stockpiled earth and materials during rain and regularly inspecting temporary bunds or barriers near streams and ponds for effectiveness. • Any water from excavation pits or foundation works should be collected, settled in sedimentation basins, and then discharged into nearby drainage systems or low-lying areas, ensuring it meets discharge standards. • Prohibit cleaning of machinery and vehicles at or near project sites, especially at locations close to streams or ponds, like Labonchara or Afil Gate premises. Designate off-site cleaning areas equipped with containment. At the KWASA headquarters building site, ensure that construction runoff does not affect nearby urban drainage systems. Install temporary water retention structures to prevent discharge into city drains or enter the water bodies; this should be avoided by controlled water sprinkling	One-off work program to establish the baseline; Water quality monitoring data Waste disposal manifest/ record Visual site observations Complaints from community	Contractor	Environment Management Specialist, PMSC	No visible increase in water pollution due to the project Zero complaints from the community
19. Effect on the traffic on the local road network					
4.a) Traffic and access related impacts	• If roads are damaged due to project-related transportation activities, reinstatement of road sections be carried out as per specifications, and method statement will be given at the commencement of the project. • Monitor and record road crashes (if any) during construction and maintenance stages and takes appropriate remedial actions	Urban areas where disturbances to vehicle movements would occur. Continuous throughout the construction period	Contractor	Environment Management Specialist, PMSC	Traffic Management Plans Detailed Design documents

		Public complaints			
20. Impacts due to Pollution: Noise and Vibration, Dust and Air Quality, Light, and Soil Erosion due to construction and Hazardous Waste Management					
5.a) Noise & Vibration	• Ensure compliance with maximum permissible noise levels, maintaining less than or equal to 75 Leq T during daytime (06:00–21:00 hrs) and 50 Leq T during nighttime (21:00–06:00 hrs). Noise monitoring should be conducted regularly as per the monitoring plan to ensure adherence. • Use noise-reducing equipment, such as vehicle silencers and jackhammers fitted with noise-reducing mufflers and install portable noise barriers around the construction site to minimize noise impacts on nearby sensitive receptors, such as residential buildings or office spaces. • Avoid concurrent use of multiple high noise-generating equipment to limit cumulative noise levels. Plan activities like hammering and concrete mixing during less sensitive times. • Identify nearby buildings vulnerable to vibration damage, particularly older structures, and conduct pre-construction structural assessments. Implement vibration-dampening techniques and avoid activities that generate high-intensity vibrations close to these buildings. • Minimize the use of vehicle horns and loud alarms unless necessary for safety. Encourage alternative communication methods like hand signals or visual indicators for site operations. <u>Health Impacts of Noise and Vibration</u> • If workers are exposed to noise above noise exposure limit, the contractor must investigate options for engineered noise control, such as using low-noise excavators, jackhammers, drills, and power generators. • Limit the duration of each worker depending on the Exposure Levels and Time Limits for corresponding exposure levels (follow Occupational Safety Standards) • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. • Use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.	One-off work program to establish the baseline Weekly noise monitoring data using a mobile measuring device Vibration measurements using measuring equipment, if needed Complaints from community Noise and vibration levels of equipment and machinery Occupational Health and Safety Plan Regular check-ups for workers who are exposed to continuous high levels of noise and vibration	Contractor Contractor through a professional JASHORE&S expert	Environment Management Specialist, PMSC Environment Management Specialist, PMSC	National environmental Regulations by DoE, ECR 97 and 2023. Construction Method Statement Specification of the EH&S Standards of the IFC for exposure levels and time limits of exposure for high noise and vibration Or adopt guidelines as specified in The Control of Noise at Work Regulations (2005) of the UK.
5.b) Dust and Air Quality	**Air quality impacts: Site works**	Schedule of work Dust suppression	Contractor	Environment Management Specialist,	Construction Method Statement

	• As far as possible, plan site clearance and earthwork activities towards the end of the rainy season and avoid inter-monsoons, when the soil will be damp naturally and without being subject to downpours • To suppress dust, the contractor should sprinkle water on exposed soil and stockpiled material on-site sufficiently frequently, depending on the weather • If dust generation is significant, provide a dust screen of appropriate height; Provide a cover or a windbreaker around the sites to minimize the wind-carried air-borne dust; this will minimize dust generation, and also drifting of soil from excavated trenches • Control access to the work area, prevent unnecessary movement of vehicles, workers, public trespassing into work areas; limiting soil disturbance will minimize dust generation	measures - visual site observations Weekly review of site practices Public complaints		PMSC	Transportation Plans Zero complaints from the community No visible increase in dust and particulate matters on buildings located adjacent to the roads National Ambient Air Quality Regulations, ECR 97 and 2023.
	Air quality impacts: material haulage, vehicle and equipment use • Vehicles travelling to and from the construction site must adhere to speed limits to avoid producing excessive dust. • Use tarpaulins to cover loose material (soil, sand, aggregate) when transported • Clean wheels and undercarriage of haul trucks before leaving construction site/quarry; Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water • Stabilize surface soils where loaders, support equipment, and vehicles will operate by using water and maintain surface soils in a stabilized condition • Access and other cleared surfaces, including backfilled trenches, must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust. • Ensure that all the construction equipment and machinery are fitted with emission control devices, which are operating correctly; ensure that only those vehicles and equipment in good condition and are in good maintenance are used for project construction. Vehicles and machinery are to be kept in good working order and to meet manufacturers' specifications for safety, fuel consumption, etc. • Vehicles/equipment should have a valid Vehicle Emission Certificate (VEC) obtained from the Bangladesh Road Transport Authority (BRTA) showcasing emissions below the specified limits; Maintain VEC records of all vehicles at all times for ready inspection at the work sites	Transportation Plan Dust suppression measures - Visual site observations Ambient air quality monitoring as per EMP Weekly Vehicle emission testing records Complaints from community As work progresses	Contractor	Environment Management Specialist, PMSC	
5.d) Impacts on soil and geology: Loss of productive soil due to erosion, Slope stability, Soil contamination	• Within the KWASA building extension and reservoir construction sites, exposed areas and loose soil should be stabilized by turfing, planting shrubs, or other protective measures. Retaining existing vegetation, where feasible, can naturally and effectively minimize soil erosion caused by wind and rain. Phasing site clearance to limit exposed soil at any one time should be investigated during detailed construction planning.	Throughout the project area with special attention to yards, vehicle parking, and servicing areas and construction	Contractor	Environment Management Specialist, PMSC	Construction Method Statement Location-specific Drainage Management

	• Areas used for temporary facilities, such as material storage yards, labor camps, and temporary access roads, should be restored to their original condition or a practical equivalent upon completion of construction activities. • Slopes and embankments created during excavation or filling activities must be stabilized through compaction, turfing, or planting vegetation. Proper drainage systems should be installed at the toe of slopes and embankments to manage runoff and reduce erosion risks. • Construction vehicle movements should be limited to designated access roads and haulage routes to prevent soil compaction and damage to natural soil profiles outside the working areas. • All construction chemicals, including concrete slurry, paint, bituminous products, fuels, lubricants, and solvents, should be stored in designated areas with impervious flooring and appropriate shelter. Storage areas must have a gentle slope to channel leaks or spills into a collection chamber for safe disposal. Proper management and minimization of waste generation from these materials are essential to prevent soil contamination.	activities near wetland areas Near construction sites, camp sites, storage yards, vehicle parks, yards, and temporary offices Along with embankments of the wetland areas			Plan
5.e) Hazardous waste management	• Hazardous waste generated during the construction of distribution reservoirs, overhead tanks, pumping stations, and the KWASA building extension should be securely stored at designated locations until disposal. Material Safety Data Sheets (MSDS) for all hazardous chemicals should be posted in conspicuous areas for easy reference by workers. • Prevent soil and water contamination from construction activities, including concrete batching, equipment washing, and storage areas, by implementing a leak and spill prevention plan. Any accidental leaks or spills must be immediately contained and cleaned following established procedures. Workers must receive training on these procedures to ensure proper response. • Install oil interceptors at vehicle servicing and maintenance areas to prevent contamination from oils and lubricants. Residual and hazardous waste, such as bituminous waste, solvents, and used oils, should be disposed of only at sites approved by the PMU. • Collect oil, grease, and other hazardous materials in leak-proof, clearly labeled containers. These materials should be stored in properly designated areas with appropriate signage and handed over to authorized third parties licensed for waste handling or recycling. • Provide bins and skips for hazardous and non-hazardous waste at construction sites and empty them regularly. Waste disposal must be conducted at pre-approved locations, and contractors should maintain waybills for all disposals to facilitate inspection by the Environmental Management Specialist.	One-off for preparation and establishment of the Operations Manual that should include a Hazardous Waste Management Plan Visual site observation of proper management practices by weekly inspection of waste storage area Monthly waste audits	Contractor A specialist contractor who is authorized to handle hazardous waste	Environment Management Specialist, PMSC to monitor and report to the LA	Construction Method Statement National Environmental Regulations, ERC 97and 2023.
F. ECOLOGICAL IMPACTS AND MITIGATION					

1.a) Ecological Impacts due to loss / destruction / fragmentation of habitats	• All construction activities, including those for distribution reservoirs, overhead tanks, pumping stations, and the vertical extension of the KWASA headquarters, must be strictly confined to the designated site footprints. Vegetation clearance beyond the construction footprint is prohibited to minimize habitat destruction. • Site personnel must be prohibited from deliberate harm to animals, hunting, or fishing in or around the construction area. The contractor should implement preventive measures and strict enforcement to protect wildlife. • Activities near site perimeters, particularly in areas with existing vegetation or potential wildlife presence, should be conducted with care. Mitigation measures should be adopted to minimize noise, dust, and vibrations that could disrupt nearby habitats. • Create awareness among all workers and site personnel about the ecological significance of the local fauna and flora. Emphasize the importance of conservation and avoiding disturbance to plants and animals within and near the project area. • Provide training for workers to safely identify and manage encounters with venomous or dangerous animals, such as snakes or scorpions, ensuring their safety and humane treatment of wildlife. • Schedule site preparation and vegetation clearance activities outside the breeding seasons of local wildlife, including migratory birds, to avoid disrupting critical life cycles.	Awareness of staff/workers	Contractor	Environment Management Specialist, PMSC	Guidelines provided by *ECR 97 and 2023.
1.b) Impacts on protected species of flora and fauna	• Prepare a method statement following accepted construction procedures near low-lying areas. This, among other things, includes pollution control (water, air, noise), limiting disturbance, not harming wildlife, etc. • Create awareness among workers on wildlife and protected species • Conduct work in areas close to water bodies when the water level is low	Awareness of staff/workers	Contractor	Environment Management Specialist, PMSC	Rapid Confirmatory Survey Report
1.c) Impact on flora and fauna due to local air pollution, noise, and vibration, light pollution	• Noise and vibration controls should be adopted. • Air-borne dust should be kept to a minimum.	Weekly review of site practices	Contractor	Environment Management Specialist	Construction Method Statement and Location-specific Action Plan
G. SOCIO-ECONOMIC IMPACTS AND MITIGATION					
1.a) Community impacts due to Establishment of labour camps	• Contractor's activities and movement of staff to be restricted to designated construction areas • Any conflicts between the workers and the local communities should be resolved with caution. Community leaders, Union Parishad (UP) and other responsible people should be informed of any incident without delay.	One-off before starting work: Construction camp/yard establishment & management plan	Contractor in coordination with the GN, and/or any other NGO and Community Leaders	PMU Social Safeguards Officer and Environment Management Specialist,	Zero complaints from community and workers

	• The possibility of the hiring of labour from the same locality and avoiding the setting up of labour camps should be looked into.	Weekly Interviews with workers and local people		PMSC	
	• Providing appropriate conditions when putting up and maintaining temporary labour camps, accommodation and making sure that the conditions do not impact on the health and well-being of occupants	Prior to the establishment of labour camps and during labourers occupy such camps	Contractor	PMU Social Safeguard Officer	minimum requirements based on internationally recognized best practices[46]
1.b) Disruption to traffic/ transportation 1.c) Impacts on roadside structures and vehicle parking 1.d) Impact due to obstruction to access property 1.e) Impacts on the development activities in the vicinity	• Develop and implement a traffic management plan specific to Package 7 construction sites, including alternative routes for vehicles, temporary diversions, and clear signage to ensure safe navigation around construction zones. Schedule construction activities during off-peak traffic hours to minimize disruptions. • Confine construction activities to designated areas to avoid damage to roadside structures. Protective barriers or shields should be installed near sensitive structures, and temporary parking areas should be designated to compensate for disruptions to vehicle parking. • Ensure uninterrupted access to properties by providing temporary pathways or crossings. Coordinate with affected residents and businesses to address their needs and provide advanced notice of any planned obstructions or construction schedules. • Communicate with stakeholders and local developers to mitigate impacts on development activities near the construction zones. Align construction schedules to minimize overlap with neighboring projects and ensure proper coordination to prevent conflicts.	One-off before starting work: Construction management action plan Monthly Interviews with local people and affected parties Public complaints Continuous monitoring as work progresses	Contractor	PMU Social Safeguards Officer & Environment Management Specialist, PMSC	Construction method statement and Location-specific Activity Plans Zero complaints from community and workers
2.a) Safety of Workers Occupational health & safety	• Comply with IFC EHS Guidelines on Occupational Health and Safety[47] • Prepare a comprehensive & site-specific Health and Safety Plan (JASHORE&SP) describing in detail how the health and safety of all site personnel (workers, staff, and visitors) will be maintained at all times. It is to provide guidance on establishing a management strategy and applying practices that are intended to eliminate, or reduce, fatalities, injuries, and illnesses for workers performing activities and tasks associated with the project. • Provide compulsory JASHORE&S orientation training to all new workers to ensure that they are approved of JASHORE&S Plan including rules of work,	Health & Safety Plan Implementation of measures Weekly interviews with workers Occupational health and safety	Contractor Labour sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of	Construction method Statement Detailed JASHORE&S Plans prepared according to guidelines

[46] For a standard list refer to: https://Jashore.osha.gov/laws-regs/regulations/standardnumber/1910/1910.142
[47] http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES

	PPE, preventing injury to fellow workers, etc.; Conduct regular toolbox safety briefings; tendencies, causes, risks & safe procedures • Conduct periodic safety audit, identify and remove potential hazard; Ensure that qualified first-aid is provided at all times; equipped first-aid stations shall be easily accessible throughout the worksites and camps; Provide medical insurance coverage to workers. • Secure all installations from unauthorized intrusion and accident risks. • Provide supplies of potable drinking water; Provide clean eating areas where workers are not exposed to hazardous or noxious substances. • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present; visitors not to enter hazard areas unescorted • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas • Ensure moving equipment is outfitted with audible backup alarms • Mark and provide signboards 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. • Disallow worker exposure to high noise for more than 8 hours/day without hearing protection. Use of hearing protection shall be enforced actively. • Employ workers with adequate experience, training, and know-how. These workers shall be led by an experienced supervisor or engineer who will provide the leadership in daily activities. • General regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on-site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g., fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on-site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • The contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, the EE and/or a translator shall be called to the site to explain further aspects of environmental or social behaviour that are unclear.	plan Number of accidents and work-related injuries Complaints from community Continuous monitoring as work progresses		an JASHORE&S Specialist	Zero accident and work-related injuries Zero complaints from community and workers
2.b) Health and	Public safety during work along with public roads	Work methods and	Contractor	PMU Social	Zero

Safety of the Public	• Adopt standard and safe practices for road construction • Ensure access to houses and businesses along the alignment; provide wooden planks, metal sheet with protective barricades/rails to allow access to the properties • Provide temporary traffic control (e.g., flagmen) & signs where necessary to improve safety and provide directions • Restrict public access to all areas where construction works are on-going through the use of barricading and security personnel • Ensure that all material, equipment, workers and all activities are conducted within the demarcated/barricaded strip of land along the road; there should be no spillage of any activity outside this zone • Clearly separate work areas with traffic/pedestrian flow; provide public information boards to identify the work area easily • Warning signs, blinkers will be attached to the barricading to caution the public about the hazards associated with the works such as the presence of trenches / deep excavation • Plan carefully using a section-by-section approach, so that open trenches are quickly closed, and road restored • Control dust pollution – implement dust control measures as suggested under air quality • Organize public awareness campaigns.	implementation of measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the communication and participation strategy	Labour sub-contractors	Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist to monitor PMU to coordinate with the Khulna WASA.	complaints from community and workers
	<u>Safety risk due to construction vehicle/equipment movement on public roads</u> • Prepare a Transportation Plan for material, waste, and equipment; consult highways agencies, police and other relevant authorities during both planning & implementation • Plan transportation routes to avoid heavily populated areas; Schedule deliveries to avoid congested areas during morning and evening peak traffic periods; Proper coordination to combine deliveries where possible, to avoid under-utilization of vehicles and reduce the number of journeys • Source materials in the close proximity (within the Khulna city) and other local outlets wherever possible, to reduce the length of delivery journeys • Conduct awareness programs for communities who live along the roads about the movement of heavy vehicles and traffic safety measures • Provide safety, information and caution boards where necessary • There are schools (especially pre-schools) along the roads, construction vehicle movement shall be restricted during the school opening and closing hours; if unavoidable, place traffic guards at school and other sensitive places, like hospitals, temples, etc. Notify affected sensitive receptors by providing signboards with information about the nature and duration of construction works and contact numbers for concerns/complaints • Coordinate with the Traffic Police for temporary road diversions and for provision of traffic aid if congestion cannot be avoided during peak hours.	Implementation of Transportation Plan and Monthly monitoring Weekly Visual site observations, interviews with workers and community	Contractor and Sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC with the assistance of an JASHORE&S Specialist to monitor and report to KWASA PMU to coordinate with the Police; traffic department	Construction method statement and Location-specific Activity Plans

				Khulna circle.	
	Community health • Lighting on the construction site shall be pointed downwards and away from oncoming traffic and nearby houses. • Mitigation and suppression of air-borne dust (especially during windy days) • The site must be kept clean to minimize the visual impact of the site. If screens are used, this must be moved and re-erected as work progresses. • Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbors. • Notice of particularly noisy activities must be given to residents/businesses adjacent to the construction site. Examples of these include noise generated by jackhammers, diesel generator sets, excavators, etc. • Noisy activities must be restricted to the times given in the project specification or general conditions of the contract.	Work methods and implementation of measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the communication and participation strategy	Contractor and Sub-contractors	PMU Social Safeguards Officer & Environment Management Specialist, PMSC to monitor and report to KWASA	Zero complaints from community and workers
2.c) Other impacts related to workers and their camp operations	• Avoid/minimize the requirement to establish camps by hiring and employing local workers as far as possible; the presence of workers throughout the day and night during the construction work will disturb the environment • If necessary, contractor to identify a barren, vacant land (preferably private unused land) to establish the camp nearby; ensure that such camp is at least 500 m away from habitation, water bodies, scrublands etc., • Prepare & implement Construction Camp Management Plan (CCMP). The plan should include: o Layout plan showing all the proposed facilities, offices, material storage area (separately for hazardous waste, fuel, chemicals, etc.), amenities, repair and washing areas, and circulation areas/roads o Integrate drainage, water pollution, air and noise control measures o Drinking water, sanitation, washing, eating and resting places for workers o Proper liquid waste, solid waste collection, treatment, & disposal system o Fire safety, medical facilities • Separate the workers living areas and material storage areas, worksites clearly with a fencing and separate entry and exit • Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers	Approved location plan Complaints from community Construction Camp Management Plan Monthly visual observations, interviews with workers and local people Waste disposal manifest /record keeping by contractor's environmental specialist.	Contractor and Sub-contractors	Environment Management Specialist, PMSC to monitor and report to KWASA.	Construction method statement Location-Specific Construction Camp Management Plan which should include plans for Solid Waste Management, Drainage Management and provision of proper Sanitation

	• The camp shall be provided with proper drainage, there shall not be any water accumulation. Provide drinking water, water for other uses, & sanitation facilities, provide means of collection and disposal of sewage. • Manage solid waste according to the following preference hierarchy: reuse, recycling, and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable/recyclable waste shall be collected and sold in the local market				
3) Impacts on the Cultural and historical environment	• All the staff and laborer's of the contractor are informed about the possible items of historical or archaeological value, which include old stone foundations, tools, clayware, jewelry, remains fossils, etc. • If something of this nature is uncovered, the Department of Archaeology of Bangladesh shall be contacted, and work shall be stopped immediately. • Conduct an Archaeological Impact Assessment, if needed.	Records of Chance Finds	Contractor	Environment Management Specialist, PMSC to report to the Dept. of Archaeology	Written permission from the Dept. of Archaeology and their guidelines for construction work to proceed
4) Grievance Redressals	• Should the construction staff be approached by members of the public or other stakeholders, the staff should assist them in locating the environment management specialist or contractor or provide a number by which they may contact the environment management specialist or contractor. • The conduct of the construction staff when dealing with the public or other stakeholders shall be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site by the environment management specialist. • Environment management specialists and contractors are responsible for ongoing communication with people affected by the project. • The contact information of PMU, PMSC, and contractor shall be posted visibly at each construction site. • Complaints register (refer to the grievance redressal mechanism) shall be housed at the site office. This shall be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the contractor. This summary of the register shall be included in the monthly report to be submitted by the contractor to PMSC. • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. • The contractor must address queries and complaints by (i) documenting details of such communications; (ii) submitting these for inclusion in the complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction.	Work methods and implementation of GRM measures Weekly visual site observations, interviews with workers and community Complaints from community Activities based on the communication and participation strategy	<u>Minor Grievances</u> Contractor <u>Other Grievances</u> PMU Social Safeguards Officer or Grievances Redressal Committee (GRC) or Program Steering Committee (PSC)	PMU Social Safeguards Officer & Environment Management Specialist, PMSC To coordinate with PMU, GRC or PSC and maintain records	Grievance Redress Mechanism

	• The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance, along with the action taken, to the environment management specialist within 48 hours of receipt of such complaint/grievance. • Grievance Redress Mechanism as outlined in Chapter VII should be clearly understood by the Contractor and his staff.				
C. Operation of the new facilities					
1. Detection and repair of leaks and pipe bursts	• Leak repair work will be similar to pipe-laying work as earlier explained. Trenches will be dug to find the leaking area and the faulty connection will be refitted, or pipe will be removed and replaced if necessary. Although the impact is likely to be minimal due to a new and well-designed, efficient system, it must be ensured that leak detection and restoration time is minimized to the extent possible.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA
2. Periodic flushing of the pipeline, descaling and scour maintenance and other activities	• These need no special mitigation, other than collection of water after descaling and allowing deposition of scales, which can then be disposed of safely.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA
3. Poor operation & maintenance practices leading to adverse impacts	• Make sure that the plant is operational in compliance with all the contractual conditions and requirements of KWASA • Ensure that O&M manuals, JASHORE&S Plan, Process • The Safety Management Plan, Risk Management Plan, Facilities Safety and Security Plan, and the necessary programmes for compliance with all other applicable safety regulations, are all prepared by the contractor through individuals with appropriate qualifications and extensive experience. Make these manuals available in the local Language, if needed. • Ensuring that the above plans and other plans and programmes, and indeed all of the work tasks involved in operating the RODP are thoroughly and professionally implemented at all times by the Plant Manager • Ensure that well-qualified and experienced operators are engaged throughout operations. Make sure that the Contractor trains the operators and transfers the technical know-how appropriately. • Establish ISO14001 practices and certification as a good practice model that can be continued after the plant is transferred to KWASA	During Commissioning At the time of handling over Throughout the operational period	PMU when commissioning. Plant Manager, KWASA		Appointment of well qualified DBO contractor, preparation and implementation of plans, following SOPs in O&M ISO 14001 Certification Employ safety/

					environmental officers who have ISO certification.
4. Being a dependable and a reliable source of water supply	• Formulate Operational Plans based on the Policies, Guidelines and Good Practices of the KWASA • Draft and implement short-, medium and long-term plans to ensure reliability of water supply (quality as defined by Bangladesh Standard Specification for Drinking Water (BDS 1240:2019), adequate quantity to meet the water demand and accessibility) • Ensure level of service is in consistent with the Policies of the KWASA and to the satisfaction of the expectations of consumers • Establish procedures to inform the consumers of interruptions to water supply • Establish procedures to respond to public complaints, comments and suggestions Establish procedures to respond to service breakdowns, and emergencies	Definition of Level of Service in consistent with existing Policies Operational Procedures Emergency Response Procedures O&M Procedures Public Relations Policy	Plant Manager, KWASA		Policies of the KWASA
5. Generation of substances used for lubrication, paints and solvents, cleaning material in small quantities during O&M	Construction debris, lubricants, paints, solvents, and the substances should be properly collected stored and disposed of.	O&M procedures Records of generation of hazardous wastes	Sub-contractors, workers of KWASA	OIC of the WTP, KWASA	Acceptable procedures to collect and handover hazardous material to authorized collectors.
6. Periodic flushing of the pipelines, descaling and scour maintenance and other activities	These need no special mitigation, other than collection of water after descaling and allowing deposition of scales, which can then be disposed of safely.	As part of the O&M of the improved system	KWASA	KWASA	O&M Manuals and Standards set by KWASA
7. Noise and vibration due to operations of the pumps	Make sure that the pumps that are fixed generate noise levels that conform to the required levels. No mitigation measures are needed as long as the noise level at the boundary of the pumping stations do not exceed 55 dB(A) during the day and 45 dB(A) during the night	Noise levels measured at the boundary of the Waterworks premises to verify the noise levels do not violate	PMU	OIC of the WTP, KWASA	National Noise Control Regulations of ECR 97 and 2023.

	If noise levels are higher than these limits, then appropriate noise abatement measures should be in place.	regulatory limits. Measurements made if neighbours complain about high noise and/or vibration			
8. Accidents & emergences	• Ensure that Emergency Response Plans and contingency Plans are in place prior to start of operation • Conduct awareness programs & mock drills • Implement emergency response plans • Undertaking corrective actions where required	Quarterly Monitoring Report Corrective Action Plan Throughout the operation phase	KWASA		Emergency Response Plans and Contingency Plans prepared based on Industry Standards and Safety Procedures

Table 48: Environmental Management Plan – for Supply & Installation of on-grid Solar power generation system (green energy) with all accessories including O&M (Package 8)

Package-8	Supply & Installation of on-grid Solar power generation system (green energy) with all accessories including O&M	MW	4

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
A. Planning Stage - Construction and Operation of Pipelines					
1. Work delays due to improper planning					
1.a) Delays in mobilization and timely implementation of work program & poor coordination and extended duration for project completion	• Scheduling, coordination, procurement, obtaining approvals and project implementation will be expedited to the extent that is practicable. • Standard and good construction practices will be followed at all times. • The possibility of deploying several gangs simultaneously will be pursued, which will allow the work to be completed within the least possible duration. • Finalize construction programs duly considering provisions for work schedule The following plans be developed for implementation: o Area Construction Work Plan o Material Procurement Plans o Transportation Plan for material, equipment, and waste conveyance o Health & Safety Plan; Traffic Management Plan for each road segment o Environmental Management Action Plan o Construction Waste Management Plan o Other plans such as drainage management and erosion control (if any)	Work schedules Respective plans One-off before starting construction	Contractor	Reported to the PMU	Standard Construction Practices and Industry Norms
1.b) Poor environmental management by the Contractor	• Designate an environment specialist who will be in charge of coordination with PMU for updating this IEE and implementing the EMP and EMoP, including the conduct of all surveys, monitoring actions, etc. • Appoint an Environmental specialist with the mobilization of the contractor (through design and construction, and intermittent during operations)	Mobilization of PMU and PMSC staff with suitable experience and expertise One-off during mobilization, and	Contractor	Reported to the PMU	Qualification framework for the Environmental Specialist (of the PMSC)

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	• Coordinate with the PMU on confirmatory surveys to be conducted during the design phase and complete as required with external experts (if needed)	continuous throughout the contract period			
2. Health and safety issues in compliance with Standard Practice					
2.a) Occupational Health and Safety of workers 2.b) Public Safety	• The appointment of an Environmental, Health, and Safety (EHS) Officer will be considered towards the end of the planning stages, before the implementation of any project activity. • Compliance with EHS requirements will be thoroughly reviewed, and a summary requirement will be prepared (one for workers and another common one for the public, including the workers).	EHS Manuals, Plans, Forms, Schedules, Notices, Registers, Redress Mechanisms, Follow-up, and Monitoring Procedures, Emergency Preparedness and First-aid, Training schedules and methods	Contractor's Environmental, Health, and Safety (EHS) personnel. (in consultation with the officials of the PMU)	PMU	National Labour Laws, Guidelines of GoB and IFC EHS Guidelines on Occupational Health and Safety
3. Site selection, Optimal use of resources, proper waste management and minimization of physical impacts					
3.a) Selection of equipment and installations and material	• PV Panels, Inverters, Equipment, machinery and strength parameters should satisfy industry-standard Specifications • Source panels and equipment from certified vendors. • Include sustainability criteria in procurement contracts. • Ensure packaging minimizes waste and is recyclable.	Test reports, and certification from Approved and Accredited Independent Testing Agencies, prior to supply of	Material Supplier through the Contractor	PMU	Standards and Specifications for PV installations ISO 14001

Environmental Mitigation Measures Action Plan – Planning Stage					
Activity and/or impact	**Considerations to avoid and/or mitigate impacts**	**Location/ Parameter/ Monitoring Frequency**	**Responsible for Implementation**	**Responsible for Monitoring**	**Guidelines/ Standards**
	• Secure transport plans to avoid material damage during transit.	pipeline Vendor locations. Parameters: Material certification, packaging quality. Frequency: During procurement.			Bangladesh Renewable Energy Policy
3.b) Site selection and feasibility	• Avoid ecologically sensitive and densely populated areas. • Ensure integration with existing reservoir and rooftop infrastructure. • Conduct structural load and wind resistance assessments for rooftop solar installations.	Reservoirs and rooftops. Parameters: Feasibility reports Frequency: Once during planning.	Contractor	Reported to the PMU	- Renewable Energy Policy, Bangladesh - ADB SPS 2009
3.c) Engineering design	• Ensure rooftop solar designs comply with structural safety standards. • Design floating solar systems to minimize ecological disruption. • Develop anchoring systems to avoid interference with reservoir beds. • Plan energy-efficient wiring and grid integration to ensure optimal performance.	Design offices Parameters: Structural safety, wiring plans. Frequency: During design phase.	Contractor	Reported to the PMU	- Building Construction Rules - Bangladesh Electrical Code

B. PHYSICAL IMPACTS DURING CONSTRUCTION PHASE AND MITIGATION					
Transport and material handling	• Use covered trucks to prevent dust during transport. • Schedule deliveries during off-peak hours to reduce traffic congestion. • Designate safe unloading zones away from residential areas. • Inspect vehicles for fluid leaks and ensure they meet emission standards.	Transport routes and unloading zones. Parameters: Vehicle emissions, material condition. Frequency: Daily.	Contractor	Reported to the PMU	Motor Vehicles Ordinance 1983 ADB SPS 2009
Installation of floating solar panels	• Use non-invasive anchoring systems to protect the reservoir bed. • Monitor water quality before, during, and after installation. • Avoid installation activities during fish breeding seasons. • Implement sediment barriers to prevent runoff into reservoirs.	Reservoir sites. Parameters: Water quality, sediment control. Frequency: Weekly during construction.	Contractor	Reported to the PMU	Bangladesh Water Act 2013 ADB SPS 2009
Installation of rooftop solar panels	• Conduct structural inspections before installation. • Use secure scaffolding and fall protection systems. • Schedule activities to minimize noise and disruption. • Follow safety protocols for working at heights.	Rooftop sites Parameters: Structural integrity, worker safety. Frequency: Daily during installation.	Contractor	Reported to the PMU	Building Construction Rules OSHA Standards
Noise and dust control	• Water roads and construction areas to suppress dust. • Limit noise-generating activities to daytime hours. • Use noise-dampening equipment and install barriers near sensitive receptors. • Monitor noise levels regularly to ensure compliance with permissible limits.	Construction sites. Parameters: Dust levels, noise monitoring logs. Frequency: Daily.	Contractor	Reported to the PMU	Noise Pollution Rules ECA, 1995

Worker safety	• Provide PPE to all workers, including helmets, harnesses, and gloves. • Conduct safety training for all workers. • Maintain first aid stations and emergency response plans on-site. • Restrict unauthorized personnel from accessing construction zones.	Worker camps and construction zones. Parameters: PPE usage, safety logs. Frequency: Daily.	Contractor	Reported to the PMU	Bangladesh Labour Act 2006 OSHA Standards
C. Operational Stage - Operation of the PV Power Generation Facility					
Maintenance of floating solar panels	• Regularly inspect anchoring systems and floating structures. • Use eco-friendly cleaning agents to prevent contamination • Monitor reservoir ecosystems for changes in light penetration and water temperature. • Ensure timely repair of damaged components to avoid energy losses.	Reservoir sites Parameters: Anchoring stability, water quality. Frequency: Quarterly.	KWASA	KWASA	Bangladesh Water Act 2013 ADB SPS 2009
Maintenance of rooftop solar panels	• Clean panels using minimal water and avoid harsh chemicals. • Inspect rooftop structures for damage or drainage issues. • Regularly test electrical connections for optimal performance. • Ensure all maintenance work is carried out safely using PPE and secured scaffolding.	Rooftop sites. Parameters: Electrical tests, drainage inspection. Frequency: Monthly.	KWASA	KWASA	Bangladesh Electrical Code ISO 45001
Waste management	• Segregate waste into recyclable and hazardous categories. • Partner with certified facilities for recycling expired panels. • Store hazardous waste in labeled, leak-proof containers. • Conduct regular waste audits to ensure compliance with disposal regulations.	Maintenance facilities. Parameters: Waste segregation logs. Frequency: Monthly.	KWASA	KWASA	Hazardous Waste Management Rules 2021 ADB SPS 2009
Community engagement	• Educate local communities on the benefits of solar power. • Address any concerns regarding visual impacts or operational noise. • Share energy savings and environmental benefits through public reports. • Foster community support by highlighting contributions to climate goals.	Local communities. Parameters: Community feedback logs. Frequency: Biannually.	KWASA	KWASA	ADB SPS 2009 Bangladesh Renewable Energy Policy

C. Environmental Management and Monitoring Costs

378. The contractor's cost for site establishment, preliminary activities, construction, defect liability activities, and environmental mitigation measures related to EMP implementation during planning, design, and construction will be incorporated into the contractual agreements and engineer's costs, which will be binding on contractor for implementation. Most of the mitigation measures require the contractors to adopt good site practice, which are part of their normal procedures already, so there are unlikely to be major costs associated with compliance. There are some of the provisions in bid documents like compliance of the requirements of health and safety during construction works as per applicable labour laws, labour insurance, equipment fitness, provision of labour welfare facilities, healthcare facilities etc. which are unanimously bound to contractor bidding for the project therefore it is understood that costs for such requirements are bound to contractor and no need to consider as cost of EMP implementation. Regardless of this, any costs of mitigation by the construction contractors are included in the budgets for the civil works and do not need to be estimated separately here. Mitigation that is the responsibility of PMU will be provided as part of their management of the project, so this also does not need to be duplicated here. Cost for the capacity building program is included. Costs of monitoring to be conducted for environmental parameters during the project implementation is also included in the table. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of the implementing agency (KWASA). All monitoring during the operation and maintenance phase will be conducted by KWASA; therefore, there are no additional costs. The activities identified in the EMP mainly include site inspections and informal discussions with workers and the local community, and this will be the responsibility of PMU with the assistance of PMSC, costs of which are part of project management.

Table 49: Indicative Costs for implementing the EMP and monitoring

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
A.	**Packages 1, 4 and 5**					
1	**Obtaining Permits & Contractor permission**					
a	Excavation permits and approvals	Pre-construction		Lump-sum	50,000	Contractor costs.
b	EHS supervision	Pre & construction	months	36 months x 3 x BDT 50,000	5,400,000	Contractor costs.
c	Site safety engineer	Pre & construction	months	36 months x 3 x BDT 50,000	5,400,000	Contractor costs.
2	**Mitigation measures for civil works**					
a	Water Sprinkling for dust suppression	Construction	m^3	3 m^3 per day for 200 days x BDT 500/m^3	300,000	Contract cost related to civil works
b	Barricading sites for public safety	Construction		Lump-sum	100,000	Contract cost related to civil works

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
C	Implementing traffic management plans	Construction		Lump-sum	500,000	Contract cost related to civil works
D	Public access disruption: Provision of alternative access routes and safety measures.	Construction		As required		Included as part of the construction cost
E	Restoration of construction sites	Construction		As required		Included as part of the construction cost
F	Emergency preparedness, worker health and safety, community disruptions	Construction		As required		Included as part of the construction cost
3	**Monitoring Measures**					
A	Air quality monitoring	Pre-construction (Baseline monitoring)	per sam -ple	8 samples x 1 time x BDT 6,000 per sample	48,000	Contract cost related to civil works
		Construction (periodic monitoring - quarterly)	per sam -ple	8 samples x 8 times x BDT 6,000 per sample	384,000	Contract cost related to civil works
B	Noise monitoring	Pre-construction (Baseline monitoring)		8 samples x 1 time x BDT 2,000 per sample	16,000	Contract cost related to civil works
		Construction (periodic monitoring - quarterly)	per sam -ple	8 locations x 8 times x BDT 2,000 per location (daytime only)	128,000	Contract cost related to civil works
C	Water quality	Pre-construction (Baseline monitoring)		4 samples x 1 time x BDT 6,000 per sample	24,000	Contract cost related to civil works
		Construction (periodic monitoring - quarterly)	per sam -ple	4 samples x 8 times x BDT 6,000 per sample	192,000	Contract cost related to civil works
	Total for A: Packages 1, 4 and 5				**12,542,000**	
B. Package 2						
1	**Obtaining Permits**					

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
a	Permit for production tube wells construction	Pre-construction		Lump-sum	750,000	KWASA costs
b	EHS supervision	Pre construction & construction	mon ths	36 months x 1 x BDT 50,000	1,800,000	Contractor costs.
c	Site safety engineer	Pre construction & construction	mon ths	36 months x 1 x BDT 50,000	1,800,000	Contractor costs.
2	**Mitigation Measures for Civil Works**					
a	Dust and noise barriers	Construction	m^2	BDT 25,000 per site x 75 locations	1,875,000	Contract cost related to civil works
b	Barricading sites for public safety	Construction		BDT 5,000 per site x 75 locations	375,000	Contract cost related to civil works
c	Restoration of construction sites	Construction		As required		Included as part of the construction cost
d	Emergency preparedness, worker health and safety, community disruptions	Construction		As required		Included as part of the construction cost
3	**Monitoring Measures**					
a	Air quality monitoring	Pre-construction (Baseline monitoring)		75 samples x 1 time x BDT 6,000 per sample	450,000	Contract cost related to civil works
		Construction (periodic monitoring - monthly)	per sam -ple	75 samples x 4 times x BDT 6,000 per sample	1,800,000	Contract cost related to civil works
b	Noise monitoring	Pre-construction (Baseline monitoring)	per sam -ple	75 samples x 1 time x BDT 2,000 per sample	150,000	Contract cost related to civil works
		Construction (periodic monitoring - monthly)	per sam -ple	75 locations x 4 times x BDT 2,000 per location (daytime only)	600,000	Contract cost related to civil works

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
c	Ground water quality	Drulling and commissioning (baseline monitoring & end of DLP)	per sam -ple	75 samples x 2 time x BDT 6,000 per sample	900,000	Contract cost related to civil works
		Operation	Periodic monitoring as required during WTP operation (yearly)			Contract cost related to civil works
	Total for B: Package 2				**10,500,000**	
C.	**Package 3**					
1	**Obtaining Permits**					
a	Ensure water extraction permits and approvals are secured	Pre-construction		Lump-sum	50,000	KWASA costs
b	EHS supervision	Pre construction & construction	mon ths	36 months x 1 x BDT 50,000	1,800,000	Contractor costs.
c	Site safety engineer	Pre construction & construction	mon ths	36 months x 1 x BDT 50,000	1,800,000	Contractor costs.
2	**Mitigation measures for civil works**					
a	Barricading sites for public safety	Construction		Lump-sum	50,000	Contract cost related to civil works
b	Public access disruption: Provision of safety measures.	Construction		As required		Part of the construction cost
c	Restoration of construction sites	Construction		As required		Part of the construction cost
d	Emergency preparedness and contingency Worker health and safety	Construction		As required		Part of the construction cost
3	**Monitoring Measures**					
a	Air quality monitoring	Pre-construction (Baseline monitoring)		3 samples x 1 time x BDT 6,000 per sample	18,000	Contract cost related to civil works
		Construction	per	3 samples x 12	196,000	Contract cost

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
		(periodic monitoring - monthly)	sam -ple	times x BDT 6,000 per sample		related to civil works
b	Noise level monitoring	Pre-construction (Baseline monitoring at the IPR and BWTP		3 samples x 1 time x BDT 2,000 per sample	6,000	Contract cost related to civil works
		Construction (periodic monitoring – monthly at the IPR and BWTP)	per sam -ple	3 locations x 12 times x BDT 2,000 per location (daytime only)	76,000	Contract cost related to civil works
c	Vibration level monitoring	Pre-construction (Baseline monitoring at the IPR and BWTP		3 samples x 1 time x BDT 2,000 per sample	6,000	Contract cost related to civil works
		Construction (continuous monitoring – at the IPR and BWTP)		Purchase of geophones and accelerometers for vibration monitoring and data loggers (BDT 75,000 x 2 units each and data loggers)	150,000	Contract cost related to civil works
c	Water quality	Pre-construction (Baseline monitoring)	per sam -ple	2 samples x 1 time x BDT 6,000 per sample	12,000	Contract cost related to civil works
		Construction (periodic monitoring - monthly)	per sam -ple	2 samples x 12 times x BDT 6,000 per sample	144,000	Contract cost related to civil works
		WTP Commissioning (raw & treated water)	per sam -ple	2 samples x 2 times x BDT 6,000 per sample	24,000	Contract cost related to civil works
		WTP operation (raw & treated water)	Periodic monitoring (monthly) as required during WTP operation			This is part of KWASA operational cost
	Sludge/ sediment	Pre construction	per sam	5 samples x 1 time x BDT	125,000	Contract cost related to civil

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
		(baseline)	-ple	25,000 per sample		works
		Operation	Periodic monitoring as required during WTP operation (yearly)			This is part of KWASA operational cost
	Total for C: Package 3				**4,332,000**	
D.	**Package 6**					
1	**Obtaining Permits**					
a	Ensure water extraction permits and approvals are secured	Pre-construction		Lump-sum	50,000	These consents are to be obtained by the contractor under the contract sum.
b	EHS supervision	Pre construction & construction	mon ths	36 months x 1 x BDT 50,000	1,800,000	Contractor costs.
c	Site safety engineer	Pre construction & construction	mon ths	36 months x 1 x BDT 50,000	1,800,000	Contractor costs.
2	**Mitigation Measures for civil works**					
a	Water Sprinkling for dust suppression	Construction	m^3	5 m^3 per day for 200 days x BDT 500/m^3	500,000	Contract costs related to civil works
b	Dust and noise barriers	Construction	Unit	BDT 150,000 at Mostafa Mor IPR	150,000	Contract costs related to civil works
c	Barricading sites for public safety	Construction		Lump-sum	250,000	Contract cost related to civil works
d	Implementing traffic management plans	Construction		Lump-sum	500,000	Contract cost related to civil works
e	Public access disruption: Provision of alternative access routes and safety measures.	Construction		As required		Part of the construction cost
f	Restoration of construction sites	Construction		As required		Part of the construction cost

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
g	Emergency preparedness and contingency Worker health and safety	Construction		As required		Part of the construction cost
3	**Monitoring Measures**					
a	Air quality monitoring	Pre-construction (Baseline monitoring)		8 samples x 1 time x BDT 6,000 per sample	48,000	Contract cost related to civil works
		Construction (periodic monitoring - monthly)	per sam -ple	8 samples x 24 times x BDT 6,000 per sample	1,152,000	Contract cost related to civil works
b	Noise monitoring	Pre-construction (Baseline monitoring)		8 samples x 1 time x BDT 2,000 per sample	16,000	Contract cost related to civil works
		Construction (periodic monitoring - monthly)	per sam -ple	8 locations x 24 times x BDT 2,000 per location (daytime only)	384,000	Contract cost related to civil works
c	Vibration level monitoring	Pre-construction (Baseline monitoring at the IPR and WTP		3 samples x 1 time x BDT 2,000 per sample	6,000	Contract cost related to civil works
		Construction (continuous monitoring – at the IPR and WTP		Purchase of geophones and accelerometer s for vibration monitoring and data loggers (BDT 75,000 x 2 units each and data loggers)	150,000	Contract cost related to civil works
c	Water quality	Pre-construction (Baseline monitoring)	per sam -ple	2 samples x 1 time x BDT 6,000 per sample	12,000	Contract cost related to civil works
		Construction (periodic monitoring - monthly)	per sam -ple	2 samples x 12 times x BDT 6,000 per sample	144,000	Contract cost related to civil works
		WTP Commissioni	per sam	2 samples x 2 times x BDT	24,000	Contract cost related to civil

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
		ng (raw & treated water)	-ple	6,000 per sample		works
		WTP operation (raw & treated water)	Periodic monitoring (monthly) as required during WTP operation			This is part of KWASA operational cost
6	Sludge/ sediment	Pre construction (baseline)	per sam -ple	4 samples x 1 time x BDT 25,000 per sample	100,000	Contract cost related to civil works
		Operation	Periodic monitoring as required during WTP operation (yearly)			This is part of KWASA operational cost
	Total for D: Package 6				**7,086,000**	
E. Package 7						
1	**Personnel**					
A	EHS supervision	Pre construction & construction	mon ths	36 months x 1 x BDT 50,000	1,800,000	Contractor costs.
B	Site safety engineer	Pre construction & construction	mon ths	36 months x 1 x BDT 50,000	1,800,000	Contractor costs.
2	**Mitigation Measures for Civil Works**					
a	Water Sprinkling for dust suppression	Construction	m^3	At Distribution Reservoirs and OHTs: 4 m^3 per day for 300 days x BDT 500/m^3	600,000	Contract cost related to civil works
				At KWASA Building: 2 m^3 per day for 500 days x BDT 500/m^3	500,000	Contract cost related to civil works
b	Dust and noise barriers	Construction	m^2	At KWASA Building: 1,500 m^2 x BDT 450/m^2	675,000	Contract cost related to civil works
c	Barricading sites for public safety	Construction		Lump-sum	400,000	Contract cost related to civil works

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
d	Public access disruption: Provision of alternative access routes and safety measures.	Construction		As required		Part of the construction cost
e	Restoration of construction sites	Construction		As required		Part of the construction cost
f	Emergency preparedness and contingency Worker health and safety Community disruptions	Construction		As required		Part of the construction cost
3	**Monitoring Measures**					
a	Air quality monitoring	Pre-construction (Baseline monitoring)	per sam -ple	5 samples x 1 time x BDT 6,000 per sample	30,000	Contract cost related to civil works
		Construction (periodic monitoring - monthly)	per sam -ple	5 samples x 24 times x BDT 6,000 per sample	720,000	Contract cost related to civil works
b	Noise monitoring at the Distribution Reservoir sites	Pre-construction (Baseline monitoring)	per sam -ple	8 samples x 1 time x BDT 2,000 per sample	16,000	Contract cost related to civil works
		Construction (periodic monitoring - monthly)	per sam -ple	8 locations x 24 times x BDT 2,000 per location (daytime only)	384,000	Contract cost related to civil works
b	Noise monitoring at KWASA Building	Pre-construction (Baseline monitoring)	per sam -ple	2 samples x 1 time x BDT 2,000 per sample	4,000	Contract cost related to civil works
		Construction (continuous monitoring)		Purchase of geophones and accelerometers for vibration monitoring and data loggers (BDT 75,000 x 1 unit each and data loggers)	75,000	Contract cost related to civil works
c	Water quality	Pre-construction	per sam	4 samples x 1 time x BDT	24,000	Contract cost related to civil

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
		(Baseline monitoring)	-ple	6,000 per sample		works
		Construction (periodic monitoring - monthly)		4 samples x 24 times x BDT 6,000 per sample	576,000	Contract cost related to civil works
	Total for E: Package 7				**7,604,000**	
F.	**Package 8**					
1	**Personnel**					
A	EHS supervision	Pre construction & construction	mon ths	36 months x 1 x BDT 50,000	1,800,000	Contractor costs.
2	**Mitigation Measures for Civil Works**					
a	Restoration of construction sites	Construction		As required		Part of the construction cost
b	Emergency preparedness and contingency Worker health and safety Community disruptions	Construction		As required		Part of the construction cost
3	**Monitoring Measures**					
a	Noise monitoring	Pre-construction (Baseline monitoring)		2 samples x 1 time x BDT 2,000 per sample	4,000	Contract cost related to civil works
		Construction (periodic monitoring - monthly)	per sam -ple	2 locations x 12 times x BDT 2,000 per location (daytime only)	48,000	Contract cost related to civil works
b	Water quality	Pre-construction (Baseline monitoring)	Use the measured water quality parameters by KWASA at BWTP IPR, where PV panels are put up.			-
		Construction (periodic monitoring - monthly)				-
	Total for F: Package 8				**1,852,000**	

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
Common costs to be incurred for all the packages						
G	**Public consultations and information disclosure**					
1	Information disclosure and consultations including a public awareness campaign through the media	During pre-construction and construction phase,		As per requirement	50,000	Contract cost related to civil works
	Total for G				**50,000**	
JASHORE	**Capacity Building**					
1	Introduction and Sensitization to Environmental Issues (1 day) for all staff and consultants involved in the project	Pre-construction	Per day	Lump-sum BDT 150,000 per day	150,000	Costs allocated to the PMU
2	Preparing and implementing SEMP (1/2 day - once at the beginning and at a frequency of once in six months during implementation) for all staff and consultants involved in the project and all contractors immediately after mobilization of the contractor	Pre-construction after awarding the contract and once every six months during implementation	Per day	Lump-sum BDT 50,000 per half-day	350,000	Costs allocated to the PMU
3	Contractors Orientation to Workers (1/2 day) - Environment, health and safety in project construction (OHS, core labor laws, spoils management, etc.) for all workers (including unskilled laborers)	Once before start of work, and thereafter regular briefing every month once. Daily briefing on safety prior to start of work	Per session	Lump-sum 30,000 per session	1,000,000	Costs to be allocated to the Contractor

	Component	Project stage	Unit	Number and Rate	Cost (BDT)	Source of Funds
4	Training workshop on Health & Safety Regulations and implementation of Health & Safety measures	This one-day workshop is for technical staff (PIU, LA and Contractors) who are responsible for the implementation of the project interventions		Lump-sum 100,000 per day	100,000	Covered under PMU cost
	Total for JASHORE				**1,650,000**	
I	**Grievance Redressal**					
1	GRM implementation	Costs involved in resolving complaints meetings, consultations, communication, and reporting/information dissemination		Lump-sum	500,000	Covered under PMU cost Part of the administration cost of PMU
	Total for I				**500,**000	
J	**Contingencies and liabilities**					
1	Any unanticipated impact due to project implementation	Mitigation of any unanticipated impact arising during the construction phase and defect liability period		Lump-sum	250,000	Contractor's liability Covered under contractor's insurance
	Total for J				**250,**000	
Total for A + B + C + D + E + F + G + JASHORE + I + J					**46,316,000**	

Note: monitoring locations, parameters, frequency, methods etc., for environmental parameters like air, water, noise etc., will be finalized during the pre-construction stage and reflected in the SEMP. This will duly take into considerations and applicable standards and will optimize the monitoring between different packages within the same area implemented simultaneously. Recommended monitoring parameters: Air quality (PM2.5, PM10, SO2, NOX, CO), Surface water quality (DO, BOD5, COD, TSS, Nitrate, phosphate, salinity, fecal coliform, oil & grease); drinking water quality – essential parameters as per ECR, 2023, noise (equivalent day and night time), sludge / sediment (specific heavy metals, alumina, nutrients etc.,)

D. Monitoring and Reporting

35. Before the commencement of any civil work, the contractor will submit a compliance report[48] to the PMSC ensuring that all identified pre-construction environmental impact mitigation measures as detailed in the EMP will be undertaken. The PMSC will review the report and approve the report, and after that, the PMU will allow the commencement of civil works. PMU and the PMSC will be responsible for monitoring. During construction, results from internal monitoring by the contractor will be reflected in their monthly EMP implementation reports to the PMU. PMSC will review and advise contractors for corrective actions if necessary. PMSC will prepare quarterly report based on contractor's monthly report and their own supervision and monitoring and on-site verifications, and submitted to PMU for review and further actions. Based on monthly and quarterly reports and measurements, PMU assisted by PMSC will prepare and submit semi-annual environmental monitoring report (SEMR) to ADB for review and disclosure on ADB website. Once concurrence from the ADB is received, SEMR will also disclosed on KWASA website. The SEMR submissions to ADB shall continue until project completion.

36. ADB will review project performance against the project commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system.

[48] This compliance report will include information on (i) barricades and warning signs; (ii) area for setting up of construction camps; (iii) methodology for surveys; (iv) area for establishing lay-down and storage; (v) sources of materials; (vi) records of environmental awareness, safety training, and orientation of workers prior to deployment to work sites; (vii) contact information of the environmental supervisors; and (viii) construction method statement.

IX. CONCLUSION AND RECOMMENDATION

A. Findings

379. The project's components, including intake structures at Mollahat and Afil Gate, impounding reservoirs, water treatment plant (WTP) upgrades, overhead tanks (OHTs), pump houses, and distribution networks, have been designed to avoid significant land acquisition and resettlement by utilizing existing rights-of-way and designated lands. Baseline environmental assessments reveal that the project area encompasses urban and peri-urban zones with a mix of water bodies, agricultural fields, and densely populated settlements. Ecologically, the region hosts common species, including birds, amphibians, and aquatic organisms, but no major endemic or threatened species have been identified at the project sites, except one species, Gangetic River dolphin, an endangered species, in Bhairab River. The assessment shows no likely impact on these species as no works are proposed in the river, and water abstraction from the river is miniscule (0.21%) compared to water availability.

380. Key technical details include the proposed 385 ML impounding reservoir at Bangabandhu WTP for freshwater storage and dilution, the augmentation of the Afil Gate impounding reservoir from 57 ML to 192 ML, and the abstraction of groundwater within a sustainable limit of 15,500 ML annually. These measures aim to mitigate salinity ingress during dry seasons while enhancing water supply reliability. Advanced monitoring systems, such as SCADA for non-revenue water management and real-time salinity monitoring, will further improve operational efficiency.

381. Construction activities are expected to have localized but significant environmental and community impacts, but these are temporary and mitigable. Excavation and civil works for pipelines, reservoirs, and intake structures will generate dust, noise, and vibrations, posing health risks to workers and nearby residents. Sediment runoff from exposed soils may affect water bodies, while the use of machinery and transport vehicles will contribute to air pollution and traffic congestion. Temporary road closures for pipeline installation may disrupt local mobility and access to properties and businesses. Waste generation, including construction debris, oils, and lubricants, presents additional environmental risks. Moreover, disturbances to local biodiversity, particularly in wetland areas near intake sites, are anticipated due to vegetation clearance and habitat alteration.

382. Negative environmental impacts are mostly restricted to the construction stage. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible; thus, environmental impacts attributable to the project design or location were not significant. However, community impacts due to construction activities are unavoidable, as the residential and commercial establishments exist along the project corridor. Anticipated impacts during the construction period include (i) temporary disruption of services during realignment of existing utilities along the corridor; (ii) temporary closure of roads for laying of the Feeder Main; (iii) interference with accesses to properties and businesses due to construction works; (iv) risk of accidents associated with vehicular traffic and transport of materials; (v) increased volume of construction vehicles on the roads that may lead to increased wear and tear of roads in the vicinity of the project sites; and (vi) exposure to increased noise, dust, vibrations, hazardous chemicals (oils and lubricants), and waste materials. The EMP will assist the PMU, PMSC, and contractors in mitigating the environmental impacts and guide them in the environmentally sound execution of the proposed project. The EMP will also ensure efficient lines of communication between the implementing agency, project management unit, and contractors.

383. The fauna and flora observed are common species that are found in urban, peri-urban areas and low-lying areas. A few endemic and threatened species have been recorded at the project site, but none are restricted to the project area. Therefore, the project will not have major adverse impacts on the habitats or fauna and flora within the proposed project site.

384. All the impacts are limited to the construction phase, and there are no long-term residual impacts. These are impacts that are common to pipeline construction along roads, and trenching projects in urban areas, and there are well-developed methods for mitigating impacts. The best mitigation method is to complete the construction work in the shortest possible time. Measures such as conducting work in the dry season and minimizing the inconvenience by employing best construction practices will be adopted. Traffic management and ensuring the safety of the public will be a high priority during pipe-laying on busy roads. Temporary community impacts due to construction activities are not avoidable, as residential and commercial establishments exist along the project corridor. The affected parties and the neighbourhood should be consulted regularly, and their consent, support, and cooperation are vital for mitigating community impacts.

385. Mitigation measures have been integrated into the project design and Environmental Management Plan (EMP) to address these challenges effectively. Sediment control measures, such as silt fences and sediment traps, will prevent runoff into water bodies. Dust suppression through water spraying and the use of covered vehicles will minimize air pollution. Noise-reducing equipment and scheduling of noisy activities during daytime will reduce disturbances to nearby communities. To address traffic disruptions, comprehensive traffic management plans will ensure alternate routes and timely restoration of affected roads. Proper waste management protocols will include segregation, storage, and disposal of hazardous and non-hazardous waste in compliance with national regulations.

386. Retrofitting and expanding WTPs may introduce risks of chemical spills and hazardous waste, such as brine from desalination processes, if not managed properly. Additionally, maintenance activities, such as leak repairs and periodic flushing of pipelines, could temporarily disrupt services and generate waste.

387. Establishing baseline environmental parameters is necessary to implement the Environmental Monitoring Plan. Monitoring of the baseline quality of water, air, and noise/vibration levels is recommended to be carried out at sampling locations as outlined in the Environmental Monitoring Plan during the pre-construction stage. Repeated sampling during the construction and operational periods should be done at the same locations that were used to establish baseline parameters. Thus, changes can be easily compared to assess and evaluate the effectiveness of the mitigation strategies as outlined in the Environmental Management Plan.

388. Operational impacts primarily concern the sustainability of water abstraction and treatment processes. Increased river water abstraction, particularly during dry seasons, however, the assessment shows that there are no notable impacts envisaged on salinity levels or local hydrology. Groundwater withdrawal is proposed within sustainable limits and requires careful monitoring to ensure compliance and prevent aquifer depletion and land subsidence. The proposed abstraction from the Madhumati River (0.53% of the flow) and the Bhairab River (0.21% of the flow) is insignificant and will not alter the river's flow dynamics or its capacity to push back saline water intrusion from the Bay of Bengal and will have no notable impacts on downstream uses or on river ecology. Detailed groundwater studies estimated an annual safe yield of 36,500 ML, and the project is designed within this limit. Proper monitoring and enforcement of the 45 MLD limit on private consumption is essential to limit the abstraction to sustainable levels.

389. Anticipated impacts during operation and maintenance will be related to detection and repair of leaks and pipe bursts. These are, however, likely to be minimal, as proper design and selection of good quality pipe material shall mean that leaks are minimal. Leak repair work will be similar to the pipe-laying work.

390. During operations, advanced monitoring systems will track water quality and abstraction levels, enabling proactive responses to salinity ingress and hydrological changes. Upgraded SCADA systems will optimize non-revenue water management, while groundwater recharge initiatives will help maintain aquifer sustainability. Regular maintenance of WTPs and pipelines will follow strict safety protocols to minimize risks associated with chemical handling and equipment repairs.

391. A project-specific grievance redress mechanism will be established to receive, evaluate, and facilitate resolution of the concerns of affected persons, complaints, and grievances related to the social and environmental impacts at all levels of the project. A copy of the EMP shall be kept on-site during the construction period at all times. The EMP shall be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document shall constitute non-compliance.

392. The project will need effective stakeholder coordination to minimize social disruptions during construction. Managing traffic congestion and maintaining public safety in densely populated areas require robust planning and execution. The sustainability of groundwater and surface water resources hinges on accurate monitoring and adaptive management, which demand technical expertise and financial resources. Moreover, addressing the ecological impacts on wetlands and aquatic habitats requires careful habitat restoration efforts post-construction.

393. The project, once completed, will have a significant impact on the quality of water supply services from which the beneficiaries will have positive cumulative impacts. Improved water supply systems will induce secondary development by way of improvements in water infrastructure and services, added residential developments, commercial, and business facilities and increased densities are expected to develop and enhance the project area. This can be considered a long-term cumulative benefit of the project. Given that the efficiency and quality of water supply services would significantly improve within the project implementation or service coverage zones over time, as a positive long-term cumulative impact, there are no significant cumulative negative impacts expected on future water supply.

394. To ensure the project’s success, several recommendations are proposed. First, baseline environmental parameters for air, water, and noise should be established prior to construction and regularly monitored throughout the project lifecycle. This will facilitate the evaluation of mitigation effectiveness and enable timely adjustments. Second, public consultations and information disclosure should continue to engage local communities and address their concerns, fostering transparency and support. Third, training programs for KWASA staff and contractors should emphasize environmental management, safety protocols, and the use of advanced monitoring systems.

395. Additionally, the project should explore pilot initiatives for groundwater recharge and brine management to enhance long-term sustainability. Strengthening institutional capacity within KWASA through updated business plans and tariff policies will ensure financial sustainability and improved service delivery. Lastly, a robust grievance redress mechanism should be established to promptly address complaints and maintain stakeholder trust.

B. Conclusions and Recommendations

396. The proposed activities involve the upgrade/construction of the intakes at Mollahat and Afil Gate WTP, retrofitting of the BWTP and Afil Gate WTP, and four clear water reservoirs and water storage tanks/pump houses, construction of transmission mains, one additional floor for the KWASA HQ building and solar power generation and the construction of two large-diameter raw water mains, transmission mains and feeder mains and a distribution network The potential environmental impacts that have been identified during the study are temporary, manageable, and will occur mainly during the pre-construction and construction stages of the project. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible; thus, environmental impacts attributable to the project design or location were not significant. Source sustainability assessed and project is designed within the sustainable abstraction limits. Therefore, with proper implementation of mitigation measures as outlined in the EMP, construction can proceed with minimal environmental disruption.

397. According to the analysis of existing baseline data and prediction of impacts, the proposed construction activities fall under Environmental Category B based on the ADB Guidelines. Thus, a full Environmental Impact Assessment (EIA) for the project is not required.

398. To ensure the project's success, several recommendations are proposed. First, baseline environmental parameters for air, water, and noise should be established prior to construction and regularly monitored throughout the project lifecycle. This will facilitate the evaluation of mitigation effectiveness and enable timely adjustments. Second, public consultations and information disclosure should continue to engage local communities and address their concerns, fostering transparency and support. Third, training programs for KWASA staff and contractors should emphasize environmental management, safety protocols, and the use of advanced monitoring systems.

399. This IEE will be updated during the detailed design and / or implementation phase to reflect any changes. The updated IEE shall be submitted to ADB for review, clearance, and disclosure. No works can commence until the IEE is updated to reflect changes in components. and the site-specific environmental management plan (SEMP), including other work plans, prepared by the Contractor, is approved by the PMU. In the event of unanticipated impact and/or any design change and/or non-compliance during the subproject implementation period, the IEE shall be updated to include (i) assessment of the unanticipated impact and corresponding mitigation measures; and/or (ii) information on the design change and assessment of associated environmental impacts, if any; and/or (iii) corrective actions, associated cost and schedule; respectively. Further, the PMU shall:

- Include EMP in the bidding and contract documents;
- Obtain all statutory clearances and ensure relevant conditions or requirements, if any, are incorporated in the project
- Update/revise this IEE based on detailed design and/or if there are unanticipated impacts or significant changes in scope in any component of the subproject;
- Conduct safeguards induction for the Contractors after award of contract;
- Ensure Contractors appoint qualified environment, health, and safety (EHS) officers prior to the start of works;
- Disclose information and establishment of a GRM in a timely manner;
- Strictly supervise EMP implementation;
- Continue consultations with stakeholders; and

- Monitor and report status of implementation of the EMP on a regular basis as indicated in the IEE.
- During operation, continuously monitor and ensure withdrawal within established safe limits, implement adaptive management, establish a mechanism or policy and regulate groundwater usage by private parties

400. This IEE report has been prepared in accordance with ADB SPS requirements for projects classified as Category B for environment. With the above premises considered, the classification of Category B for environment is confirmed. Separately, per ECA, 1995 and ECR, 2023 of Bangladesh, the KWSP Phase 2 project is classified under “Red” category. Hence, preparation of an environmental impact assessment (EIA) based on DOE approved terms of reference is mandatory. Upon approval of the submitted EIA, ECC must be obtained from the DOE prior to award of contract.