Initial Environmental Examination

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IND: West Bengal Drinking Water Sector Improvement Project – Bulk Water Supply for Two Blocks in Bankura

Prepared by Public Health Engineering Department, Government of West Bengal for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 11 July 2018)

Currency Unit	–	Indian rupee (₹)
₹1.00	–	$0.014
$1.00	=	₹68.691

ABBREVIATIONS

ADB	–	Asian Development Bank
CPCB	–	Central Pollution Control Board
CTE	–	consent to establish
CTO	–	consent to operate
DSISC		design, supervision and institutional support consultant
EAC	–	expert appraisal committee
EHS	–	environmental, health and safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
GRC	–	grievance redress committee
GRM	–	grievance redress mechanism
GOWB	–	Government of West Bengal
HSGO	–	head, safeguards and gender officer
IBPS	–	intermediate booster pumping station
IEE	–	initial environmental examination
IWD	–	Irrigation and Waterways Department
MOEFCC	–	Ministry of Environment, Forest and Climate Change
WBPCB	–	West Bengal Pollution Control Board
NOC	–	No Objection Certificate
PHED	–	Public Health Engineering Department
PIU	–	project implementation unit
PMC	–	project management consultant
PMU	–	project management unit
PWSS	-	piped water supply scheme
PPTA	–	project preparatory technical assistance
REA	–	rapid environmental assessment
ROW	–	right-of-way
SPS	–	Safeguard Policy Statement
WHO	–	World Health Organization
WTP	–	water treatment plant
WBDWSIP	–	West Bengal Drinking Water Sector Improvement Project

WEIGHTS AND MEASURES

m^3/h	cubic meter per hour
dBA	decibel
°C	degree Celsius
ha	hectare
km	kilometer
lpcd	liter per capita per day
m	meter
mbgl	meters below ground level

mgd	million gallons per day
MLD	million liters per day
mm	millimeter
km^2	square kilometer

NOTE

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

CONTENTS

EXECUTIVE SUMMARY

The proposed West Bengal Drinking Water Sector Improvement Project (WBDWSIP) aims to provide safe, reliable and continuous drinking water as per Government of India's standard to about 2.6 million people in the arsenic, fluoride, and salinity affected selected areas of North 24 Parganas, South 24 Parganas, East Medinipur and Bankura districts of West Bengal.

The project will adopt a sector approach, and subprojects will be selected and proposed for funding adhering to the agreed Subproject Selection Criteria (SSC). Project districts are North 24 Parganas (with two blocks of South 24 Parganas included for distribution network), Bankura and East Medinipur, and subprojects to be covered under the Project will be within these districts only unless otherwise agreed with ADB. Subprojects proposed under the Project stem from a district-wide comprehensive water quality and sustainability planning and completion of the Drinking Water Quality Action Plan (DWQAP) for the concerned district.

WBDWSIP will be implemented over an 6-year period beginning in 2017.

The Subproject. Creation of surface water based bulk water supply system to meet the water demand for the blocks of Indpur and Taldangra in Bankura district under the WBDWSIP. The sub-project will also help in reducing the incidence of ground water depletion and intrusion of fluoride in ground water. The selected blocks are located in the north of the Mukutmonipur reservoir. The subproject includes the following work components: (i) Intake with fixed type Jetty with arrangement for housing pumping machineries and raw water Main for 32 million liters per day (MLD) capacity; (ii) water treatment plant (WTP) of 32 MLD (7 mgd) capacity with booster pumping facilities up to design period 2035 (iii) Intermediate Booster Pumping Station of capacity 4400 kl. (iv) approximately 21 kilometer (km) long primary transmission main from WTP to the intermediate booster pumping station (IBPS).

Project Implementation Arrangements. Public Health Engineering Department (PHED) of Government of West Bengal is the executing and implementing agency for the WBDWSIP. Project management unit (PMU) exclusively established in PHED for the WBDWSIP will implement the project. PMU is assisted by district level Project Implementation Units. Safeguard and gender cell (SGC) in the PMU is responsible for safeguards compliance. Project Management Consultant and PIU-wise design, supervision and institutional support consultant will assist PMU and PIUs in implementation and management of the project.

Screening and Assessment of Potential Impacts. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. As per the Government of India EIA Notification, 2006, this subproject does not require EIA study or environmental clearance. The potential environmental impacts of the subproject have been assessed using ADB's rapid environmental assessment checklist for water supply. The potential negative impacts were identified in relation to pre-construction, construction and operational period.

Categorization. Based on results of the assessment and ADB's SPS, the subproject is classified as environmental Category B, i.e., the subproject is judged to be unlikely to have any significant adverse environmental impacts. However, an initial environmental examination is required/advisable.

Description of the Environment. The subproject components are located in Indpur and Taldangra blocks of Bankura District which is situated on the western part of the State of West Bengal. The total area of the district is 6882 square kilometers (km^2). It extends from $23^0$38' north Latitude and between $86^0$36' and $87^0$47' east longitude. Headquarter of Bankura district is at Bankura, from which this district derived its name It is bounded by Paschim Medinipur in the south and Hooghly district in the north, Purulia district in the west, Bardhaman district in the north and east. In shape, it resembles an isosceles triangle wedged in between Purulia and Bardhaman, with its apex nearly opposite to Raniganj and with an irregular base line resting on Paschim Medinipur and Hooghly. The district is drained by Damodar, Dwarakeswar and Kangsabati river along with their tributaries of which Gandheswari, Silai and Kumari deserve separate mention. The district comprises of 22 blocks and 3 municipalities.

The district physiography is quite varied and marked successively from west to east by zones of plateau, plateau fringe, piedmont zones, marginal plan to delta flank, one merging imperceptive into the other. There are long stretches of paddy fields in the eastern alluvial part, but in the west, the undulating plain and hill tract are covered with low jungle, though traces of taller forest trees are occasionally seen. About 14 percent (%) of the total area of the district is under forest cover. Low forest clad spurs such as Biharinath (447.8 m) and Susunia (439.5 m), which are extensions of the Chhotonagpur table and are found in the northwest of the district. There are several other low hills interspersed here and there. Bankura is drained by Damodar, Dwarakeswar and Kangsabati river along with their tributaries of which Gandheswari, Silai and Kumari deserve separate mention. They have in general a southeasterly flow. The courses of the principal rivers are approximately parallel to each other.

Average elevation of the district is within 448 meters above mean sea level (msl). The district falls under red laterite zone and generally undulating, coarse textured, susceptible to erosion, acidic soil. Bankura is generally arid compared to other parts of Bengal. Annual average rainfall in the district is 1400 mm and the temperature varies from a maximum of ≥44°C and minimum of ≤6°C. The climate in the western portion of the district is drier than the eastern regions. From March to May, the hot westerly winds prevail and the day time temperatures are oppressive. The north-westerly winds are frequent during the early part of March (locally called as "Kal Baisakhi") and help to mitigate the excessive heat. As per the report published by National Institute of Disaster Management (NIDM) in 2013, the districts of Bankura, Purulia, Birbhum and parts of Paschim Midnapore have been affected by drought at regular intervals, mainly due to deficient rainfall and adverse soil conditions. Every summer many parts of the district suffer water shortage with respect to the entire state.

The Project. As per information available in the project report of PHED, only 8.76% of the total rural habitations in the select 2 project blocks are connected with Piped water supply based on ground / sub-surface water source. The impact of ground water abstraction and the associated risks of fluoride contamination in the blocks of Indpur and Taldangra and cannot be undermined. In effect, a comprehensive Piped Water Supply Scheme (PWSS) is essential to be drawn up with respect to sustainable water sources to effectively mitigate the risks and impact of Fluoride contamination. Total population of selected 2 project blocks is 304,415 (rural 304.415 and urban nil) as per 2011 census. Scheduled castes numbered 102,435 (33.64%) and Scheduled tribes numbered 35,600 (11.69%) as per 2011 census. The project area does have any Census town but has 16 Gram Panchayats and 339 habituated villages.

As far as possible, based on the land availability, project components are located within the existing water facilities. The overall improvement plan is to tap the raw water from Mukutmonipur reservoir (also known as Kangsabati reservoir) and treat the water at Water Treatment Plant. The

treated water will be pumped to centrally located IBPS through the Primary transmission main of around 21 km.

The raw water source is Mukutmonipur reservoir. It is located at approximately 3.2 km upstream of the confluence of River Kangsabati and River Kumari. In 1956, a giant water dam reservoir was constructed at Mukutmonipur, about 12 km from Khatra town in the district of Bankura, WB. The Mukutmanipur dam provides major irrigation facilities (Kangsabati Major Irrigation Project) to 8,000 km2 of agricultural land, stretched across Bankura, Purulia, Paschim Medinipur and parts of upper Hooghly.

Mukutmonipur reservoir has abundant flow throughout the year even during lean seasons. WBPHED already has a water supply scheme of 6.09 MLD from Mukutmanipur reservoir commissioned in the year 2008 for supplying water to Khatara and Ranibandh blocks serving approximately 73,600 persons in 72 Mouzas and is performing satisfactorily. The reservoir is also the source of another two proposed surface water based piped water supply schemes of PHED:(i) 27 MLD in Khatra, Hirbandh and Ranibandh blocks of Bankura district and (ii) 65 MLD for Manbazar and Bunduan blocks of adjacent Puruliya district. Based on the Mukutmonipur reservoir data of 2005-15 and considering the lowest water storage during lean season as on 1st June before onset of monsoon: the average water storage calculated is 86,440 MLD. The total ultimate abstraction for the WTP is 32 MLD up to design year 2035, which is only 0.03% of the total volume of available water during lean season (February to May). Therefore, the reservoir water is sufficient to meet the demand of the project during lean period. Quality of raw water is, in general, of acceptable quality and that which can be used for potable purposes after conventional treatment and disinfection. This further justifies considering the Mukutmonipur reservoir as the potential sustainable source of raw water. There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake. Further assessment for possible adverse impacts on aquatic species from construction and operations of the water intake and jetty will conducted during detailed engineering design.

The Irrigation and Waterways Department (IWD) has already given a permission of drawl of 32 MLD raw water vide Memo no. 263/1(6)-1, dated 22.6.2017 for drinking water purpose under the Bankura water supply project.

The identified land for proposed WTP is 2.5 km from the proposed intake point and belongs to IWD. The coordinates of the WTP location is 22.99 N and 86.77 E. The Topography is undulating and ground level of the site and surroundings are about 140m above the mean sea level. The land is connected by an approach road to the nearby villages. As per local enquiries carried out during field visits, the site is not prone to flooding, and is barren land. The identified site of IBPS is located at Gobindopur Mouza of the Indpur block and is easily accessible by State Highway No. 2 (SH 2). The land of IBPS is privately owned land and will be acquired from private owner(s). Overall, there are no notable sensitive environmental features in and around the sites. Assessment of the alignment indicated that the length of the primary transmission main from WTP to IBPS is around 21 km.

Potential Environmental Impacts. The subproject is unlikely to cause significant adverse impacts considering: (i) the components will involve general civil construction work with limited or no impact during operational period; (ii) there are no significant sensitive environmental features in the project sites and (iii) predicted impacts are site-specific and likely to be associated with the construction process and are produced because the process is invasive, involving excavation and earth movements. Raw water source is Mukutmonipur reservoir, which has abundant storage of water throughout the year even during lean seasons. Quality of raw water is, in general, of

acceptable quality and that which can be used for potable purposes after conventional treatment and disinfection.

The identified WTP and IBPS sites have few trees, which need to be cleared for the construction; Compensatory measures are suggested in the form of carrying out / planting trees in the ratio of 1:5. Approximately 21 km length of primary transmission main of from WTP to IBPS will be laid along the edge of the roads. It is proposed that the primary rising main shall be laid primarily through open cut method. However, the laying of the rising main through open cut method may not be feasible at major junctions (State/National Highway crossings), congested market areas and crossing over Supur main canal and Silabati river. It is proposed that the transmission main will be laid by 150 m trenchless method in these stretches.

Construction activities shall be confined to the selected sites, and the interference with the general public and community around is minimal. There will be temporary negative impacts, arising mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupational health and safety aspects. During the construction phase of pipeline work along the public roads, impacts arise from the construction dust and noise; disturbance to residents, businesses, traffic by the construction work, and from the need to dispose of large quantities of waste soil. The social impacts (access disruptions) due to construction activities are minimal.

Anticipated impacts of water supply during operation and maintenance will be related to operation of WTP, handling and application of chlorine, operation of pump houses, and repair and maintenance activities. Various provisions are already made in the design: (i) to recirculate wastewater from WTP; (ii) collect, thicken and dispose sludge; (iii) chlorine safety; (iv) use energy efficiency equipment, etc. Water supply system will be operated using the standard operating procedures. It is unlikely that there will be any significant negative impacts. Application and handling of chlorine gas will involve certain risks, and appropriate measures are included in EMP.

Environmental Management Plan. An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels. Locations and site-selection of the proposed infrastructures were considered to further reduce impacts. The EMP includes design and location related measures such as (i) minimizing tree cutting at WTP and IBPS sites by proper planning; (ii) wash water recovery in WTP to improve the efficiency and avoid wastewater generation and disposal; (iii) collection, treatment and beneficial use of treated sludge; (iv) chlorine safety, (v) energy efficient pumping system, and (vi) noise controls.

The EMP includes during construction activities, mitigation measures such as (i) barricading, dust suppression and control measures (ii) traffic management measures for work along the roads and for hauling activities; (iii) provision of walkways and planks over trenches to ensure that access will not be impeded; and (iv) finding beneficial use of excavated materials to an extent that shall render it possible to reduce the quantity that will be disposed. EMP will guide the environmentally-sound construction of the subproject. EMP includes a monitoring program to measure the effectiveness of EMP implementation and includes observations on- and off-site, document checks, and interviews with workers and beneficiaries.

The contractor will be required to submit to PIU, for review and approval, a site environmental plan (SEP) 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 SEP; and (iv)

budget for SEP implementation. No works are allowed to commence prior to approval of SEP. A copy of the EMP/approved SEP will be kept on site during the construction period at all times. The EMP is included in the bid and contract documents. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

Consultation, Disclosure and Grievance Redress Mechanism. The stakeholders were involved in developing the IEE through discussions on-site and through public consultation at several places in the subproject area, after which the views expressed were incorporated into the IEE and in the planning and development of the project. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB and PHED/PMU websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

Monitoring and Reporting. The PMU and PIUs will be responsible for monitoring, and will submit semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website.

Conclusion and Recommendations. As per ADB SPS, the project is classified as environmental Category B and does not require further environmental impact assessment. However, to conform to government guidelines WTP requires consent to establish (CTE) and consent for operate (CTO) from West Bengal Pollution Control Board, which shall be obtained prior to invitation of bids. This IEE shall be updated during the detailed design stage to reflect any changes, amendments and will be reviewed and approved by PMU, and further submitted to ADB for approval. Civil works on subproject will be initiated only after approval of updated IEE by ADB.

I. INTRODUCTION

A. Background

1. The proposed West Bengal Drinking Water Sector Improvement Project (WBDWSIP) aims to provide safe, reliable and continuous drinking water as per Government of India's standard to about 2.6 million people in the Arsenic, Fluoride, and salinity affected selected areas of North 24 Parganas, South 24 Parganas, East Medinipur and Bankura districts of West Bengal.

2. The Project will adopt a sector approach, and subprojects will be selected and proposed for funding adhering to the agreed Subproject Selection Criteria (SSC). Project districts are North 24 Parganas (with two blocks of South 24 Parganas included for distribution network), Bankura and East Medinipur, and subprojects to be covered under the Project will be within these districts only unless otherwise agreed with ADB. Subprojects proposed under the Project stem from a district-wide comprehensive water quality and sustainability planning and completion of the Drinking Water Quality Action Plan (DQWAP) for the concerned district. The DQWAP for the Project districts supported by the Project were prepared by the executing agency, the Public Health and Engineering Department (PHED) of Government of West Bengal (GOWB), with support of project preparatory consultants from the Asian Development Bank (ADB), and has been adopted by PHED to guide present and future drinking water improvement in the districts.

3. The project is aligned with the following impact: drinking water security ensured in West Bengal. The project will have the following outcome: safe, sustainable, and inclusive drinking water service received in project districts. The Project outputs are as follows:

(i) **Output 1: Climate resilient drinking water infrastructure constructed.** The project will provide a minimum of 70 lpcd of continuous potable water through metered connections to the households in selected areas of the project districts. The distribution systems will be designed on a DMA basis. Both the bulk and the distribution systems will be integrated with modern STWM and monitoring tools, including supervisory control and data acquisition and geographic information systems. Bulk water supply systems, consisting of intakes, water treatment plants, and transmission mains, will be sized to provide water supply en route to urban and rural areas. They will be connected into a grid with the existing and the new systems in the project districts, where feasible, to reduce redundancy, improve resilience, and efficiently manage the system; and

(ii) **Output 2: Institutions and capacity of stakeholders for drinking water service delivery strengthened.** The Project will strengthen institutional structures and capacity of PHED, the bulk water supplier up to the Gram Panchayats, and project Gram Panchayats - for efficient and sustainable drinking water service delivery. It will support and enable them to conduct web-based water quantity and quality monitoring, electronic billing and collections, meter reading, and accounting. To ensure long-term asset sustainability and service delivery, GOWB will issue and Government order defining roles and responsibilities of PHED and project Gram Panchayats for sustainable asset management and service delivery which each project Gram Panchayats will endorse prior to commissioning of the system. The Project will introduce innovative practices and high technology on smart water management to create a model for rural water service delivery and bulk water supply systems for the state and the country. It will provide skill training, and generate employment for about 350 locals, of which 33 percent (%) minimum are

expected to be women. It will support the Project Gram Panchayats in creating public awareness on water conservation; water, sanitation and hygiene (WASH); and livelihood enhancement in Project Gram Panchayats. It will also support the state to strengthen water and sanitation safety planning, develop regulatory framework and piloting for septage management in West Bengal.

4. WBDWSIP targets three districts: North 24 Parganas districts is the most Arsenic-affected district in West Bengal; Bankura is heavily affected by Flouride, and East Medinapur is affected by Salinity. These districts are also one of the most water-stressed districts in West Bengal as they are reliant on depleting groundwater sources. Overall, the Project is intended to meet the requirements of "VISION 2020", endorsed by the GOWB and in line within the guidelines and implementation frame-work of National Rural Drinking Water Program (NRDWP).

5. In line with the national objectives, GOWB has decided to consistently ensure the availability of safe and acceptable drinking water supply in sufficient quantity to the district of Bankura, which has been affected by Fluoride contamination (10 of the 22 Blocks in Bankura are affected by Fluoride contamination). The need for comprehensive piped water supply was necessitated on account of the absence of reliable[1] and sustainable ground water sources[2], poor coverage of piped water supply and also in the backdrop of social backwardness and high tribal population[3].

6. Based on the water quality test results and analysis, it may be inferred that pattern of fluoride contamination in the district varies from being severely affected to blocks which remain unaffected. A matrix has been framed to separate out the Blocks which are critically affected by fluoride contamination from those which are only moderately affected or unaffected. The details of the severity of the Blocks affected by fluoride contamination within Bankura is given below:

Table 1:Severity of Blocks Affected by Fluoride Contamination

	Fluoride Contamination	Name of Blocks	Number of Blocks
1	Critically affected	Bankura-II, Barjora, Chhatna, Gangajalghati, Hirbandh, Mejhia, Raipur, Saltora, Simlapal and Taldangra, Indpur,	11
2	Moderately affected	Bankura-I, Indus, Khatra, Onda, Sarenga and Sonamukhi	6
3	Un-affected	Bishnupur, Joypur, Kotulpur, Patrasayer and Ranibundh	5
Total Number of Blocks			22

7. Based on the various investigations and lithological study (as provided in the Central Ground Water Board brochure), the blocks in Bankura can be categorized with respect to ground water potential to make an even comparison on the water security scenario. The CGWB in its ground water brochure has indicated 3 major issues related to Bankura district, namely: (i) fluoride contamination (ii) iron concentration beyond permissible limit and (iii) declining ground water levels. To make a fair assessment of the criticality of the blocks, it is imperative that a broader framework be prepared and emphasis be provided to the blocks which are severely water stressed.

Table 2: Groundwater Potential of Blocks in Bankura

	Ground Water Potential	Name of Blocks	Number of Blocks

[1] As per the Central Ground Water Board Report, the blocks in the western part of the district have hydro-geological formations, which are unsuitable for large scale water abstraction.

[2] An assessed 4.6% of rural households in Bankura have treated tap water as per the District Census handbook for Bankura-2011.

[3] An estimated 33.5% of rural population are Scheduled Castes and 11.5% belong to the Schedule Tribes as per the District Census handbook for Bankura-2011.

1	Poor	Bankura-I and II, Chhatna, Gangajalghati, Hirbundh, Indpur, Khatra, Mejhia, Onda, Ranibundh, Saltora, Sarenga	12
2	Poor to medium	Joypur, Patrasayer, Raipur, Taldangra,	4
3	Medium to High	Barjora, Bishnupur, Indus, Kotulpur, Simlapal, Sonamukhi	6
Total Number of Blocks			22

Source: CGWB.

8. Presently, the demand of the rural areas within the fold of the selected 2 blocks of Indpur and Taldangra (henceforth referred as project area) is met from ground water and sub-surface sources. With increase in population, and increase in ground water withdrawal (for agricultural and drinking water purposes), the ground water resources are getting depleted. Also, in select areas, the ground water is affected by fluoride contamination.

9. Primarily the prioritization and appraisal of the WS Scheme is based on the Preliminary Project Report prepared by the PHED, as a part of its endeavor to provide Piped Water Supply to the rural areas as per the plan outlined in "VISION-2020". The selected 2 blocks have been prioritized by PHED for comprehensive coverage with surface based WS Scheme and is proposed for implementation under the Tranche 1 of the WBDWSIP funded by ADB. The objective of the subproject is to provide sustainable water supply at a rate 70 liters per capita per day (lpcd) to each household in all habitations in the Indpur and Taldangra blocks. A detailed description of the components is provided in Section III.

B. Purpose of the Initial Environmental Examination Report

10. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. The potential environmental impacts of the subproject have been assessed using ADB rapid environmental assessment (REA) checklist for water supply (Appendix 1). Then potential negative impacts were identified in relation to pre-construction, construction and operation of the improved infrastructure, and results of the assessment show that the subproject is unlikely to cause significant adverse impacts. Thus, this initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

11. This IEE is based on the preliminary project report prepared by PHED, and a technical due diligence report prepared by the project preparatory technical assistance (PPTA) team and will be finalized during implementation stage by DBO contractor to reflect any changes and latest subproject designs. The IEE was based mainly on field reconnaissance surveys and secondary sources of information. No field monitoring (environmental) survey was conducted however, the environmental monitoring program developed as part of the environmental management plan (EMP) will require the contractors to establish the baseline environmental conditions prior to commencement of civil works. The results will be reported as part of the environmental monitoring report and will be the basis to ensure no degradation will happen during subproject implementation. Stakeholder consultation was an integral part of the IEE.

C. Report Structure

11. This Report contains the following ten (10) sections including the executive summary at the beginning of the report:

(i) Executive summary;

(ii) Introduction;
(iii) Description of the project;
(iv) Policy, legal and administrative framework
(v) Description of the environment;
(vi) Anticipated environmental impacts and mitigation measures;
(vii) Public consultation and information disclosure;
(viii) Grievance redress mechanism;
(ix) Environmental management plan; and
(x) Conclusion and recommendation.

II. DESCRIPTION OF THE PROJECT

A. Project Area

12. Proposed project area falls in Bankura district of West Bengal. Bankura is located in the western part of the State of West Bengal. The District Bankura is bounded by latitude $22^0$38' N and longitude $86^0$36' E to $87^0$47' E. The Damodar river flows along the northern boundary of the district. The district is bounded by Bardhaman in the north, Purulia in the west and Paschim Medinapur in the south.

13. The total area of Bankura district[4] is 6882 km^2. As per the latest Census data (2011), the population of the district[5] is 3,596,674. It is the 3rd least populated district in West Bengal (After Alipurduar and Purulia) with Population Density of 523 persons/km^2. The district has 22 Panchayet Samitis,[6] with 190 Gram Panchayats,[7] consisting of 3823 Villages and 6638 habitations.

14. The total number of urban centers is 12, of which 3 are Municipalities (Bankura, Bishnupur and Sonamukhi), and the remaining 9 are Census towns,[8] (Khatra, Ledisol, Jhanti Pahari, Kotulpur, Simlapal, Raipur Bazar, Ghutgarya, Barjora and Beliatore). Bankura district has 22 blocks, divided into 3 subdivisions, namely Bankura Sadar, Khatra and Bishnupur. The details of blocks within each subdivision and the municipalities are shown below.

Table 3: Administrative Division of Bankura

	Sub-Division	Block Details	Municipality
1	Bankura Sadar	Bankura-I, Bankura-II, Barjora, Chhatna, Gangajalghati, Mejia, Onda and Saltora	Bankura
2	Khatra	Indpur, Khatra, Hirbandh, Raipur, Sarenga, Ranibundh, Simlapal and Taldangra	-
3	Bishnupur	Indas, Joypur, Patrasayer, Kotulpur, Sonamukhi and Bishnupur	Bishnupur and Sonamukhi

[4] As per Provisional Census Report 2011 of Bankura District.
[5] District Census Handbook-2011.
[6] The Panchayat Samiti is the rural local self-government system at the block level. They form the middle level of the Panchayati Raj Institutions in India. It acts as a link between Village Panchayats (Gram Panchayats) and Zila Parishad (District council). Each district is divided into a number of blocks and each block consists of a number of adjoining villages (Gram Panchayat). For each block again there is a Panchayat Samiti.
[7] Gram Panchayat is the organization of elected members of Gram Sabha of the village. A Gram Sabha consists of members that include every adult of the village or Gram.
[8] Census Towns (CTs) are rural pockets with (a) A minimum population of 5000 (b) where, at least 75% of the male main working population engaged in non-agricultural pursuits and (c) have a density of population of at least 400 per km^2.

15. Communication Network and Connectivity. The critical importance of a road network and connectivity to the inhabited villages and in building up of a comprehensive piped water supply network is of paramount importance, considering the need to implement and maintain a sustainable water supply system. While a good road network is appropriate to gain accessibility to the various habitations, a rail network normally creates impediments in the laying of pipeline across them. Bankura does not have an exhaustive rail network. However, it is well connected to Howrah (approximately 235 km) Bardhaman and Asansol.

16. The subproject components locations are in two selected blocks of Indpur and Taldangra. As far as possible, based on the land availability, project components are located within the existing water facilities. Total population of selected 2 project blocks (hereinafter referred to as the Project area) is 304,415 (rural 304.415 and urban nil) as per 2011 census. The total project area is 652.34 km^2 which is totally rural area. The entire project area is located on the left bank of the river Silai and is bounded by Chhatna , Bankura I and Onda Community Development Blocks on the north; Bishnupur (Bankura block) and Garhbeta II Community Development Blocks of Paschim Medinipur district on the east; Khatra and Simlapal Community Development Blocks on the south and Hirbandh (Bankura) and Puncha Community Development Blocks of Purulia district, on the west. The project area does have any census town but has 16 Gram Panchayats. Details of project area including Gram Panchayats in each block is shown below:

Table 4: Details of Project Area and Gram Panchayets

	Block	Area[a] (km^2)		Number of Gram Panchayats
		Total	Rural	
1	Indpur	302.60	302.60	7
2	Taldangra	349.74	349.74	9
Total		**652.34**	**652.34**	**16**

[a] District Census Handbook-2011: Bankura.
Source: Census 2011.

B. Existing Water Supply Situation

17. Incidence of ground water level depletion and intrusion of fluoride in ground water is reported from vast area of the district. High iron concentration in groundwater is also recorded in the district. The water demand is met through (i) piped water supply scheme (PWSS) with ground/sub-surface water source, conveyed either through direct pumping and or through an overhead tank (OHR) or (ii) spot sources (primarily hand pumps and shallow tube wells). As per information available in the project report of PHED, out of the 639 habitations in the 2 blocks of Indpur and Taldangra, 56 habitations have been covered with PWSS, while the remaining 583 are still uncovered. The Command area of the scheme comprising of the habitations covered existing PWSS is shown in table below.

Table 5: Habitations Covered under Piped Water Supply Schemes

	Name of Block	Total Habitations	Habitations Covered under Piped Water Supply Scheme, Based on			Habitations under Piped Water Supply Scheme	Percentage of Total Habitations connected to Piped Water Supply (%)
			Surface Source	Sub-surface Source	Ground Water		
1	Indpur[a]	283	-	18	11	29	10
2	Taldangra[b]	356	-	-	27	27	8

Total	**639**	**-**	**18**	**38**	**56**	**8.76**

[a] The Sub-surface source is of River Silabati.
[b] Excludes Water Supply Scheme under Dual Use Solar Pump.
Source: PHED.

18. In effect, only 8.76% of the total rural habitations in the 2 Blocks are connected with piped Water Supply. The impact of ground water abstraction and the associated risks (of Fluoride contamination) in the blocks of Indpur and Taldangra and cannot be undermined. In effect, a comprehensive piped Water Supply Scheme is essential to be drawn up with respect to sustainable water sources to effectively mitigate the risks and impact of Fluoride contamination

19. There is no PWSS with surface water source. The PHED has commissioned only one sub-surface water based piped water supply scheme in Indpur block (year 2011-2012) covering a design population of 8,040 in 18 habitation. This scheme known as Goaladanga involves raw water abstraction from river Silabati.

C. Proposed Project

20. The assessment of net water demand is derived based on (i) Domestic water demand at 70 lpcd and (ii) Institutional Water Demand as 5% of the Domestic Water Demand. Again, Gross water demand to be worked out considering (i) Transmission and Distribution Losses as 10% of the demand and (ii) Treatment Plant Losses as 5%. The net and gross water demand pertaining for the 2 blocks in the design years is worked out below.

Table 6: Net and Gross Water Demand-Design Years

	Block	**Net Water Demand** (MLD)			**Raw Water Demand** (MLD)		
		Yr-2020	**Yr-2035**	**Yr-2050**	**Yr-2020**	**Yr-2035**	**Yr-2050**
1	Indpur	12.9	15.6	18.9	15.1	18.3	22.1
2	Taldangra	12.3	15.2	18.7	14.4	17.7	21.8
Total		**25.2**	**31.2**	**37.6**	**29.5**	**36**	**43.9**

21. Total water demand is 32 million liters per day (MLD) up to design period 2035. The Raw water source is Mukutmonipur reservoir (also known as Kangsabati reservoir). It is located at approximately 3.2 km upstream of the confluence of River Kangsabati and River Kumari. In 1956, a giant water dam/reservoir was constructed at Mukutmanipur, about 12 km from Khatra town in the district of Bankura, West Bengal. The Mukutmonipur reservoir provides major irrigation facilities (the Kangsabati Major Irrigation Project) across Bankura, Purulia, Paschim Medinipur and parts of upper Hooghly.

22. The reservoir has two regulators supplying to a left bank feeder canal of 192 cumec design capacity and a right bank feeder canal of 70 cumec capacity. The left bank feeder after some distance bifurcates into two, the Supur main canal and the Khatra Main canal. Khatra main canal crosses the river Silabati through barrage (Silabati barrage), after which it is known as Indpur main canal. The right bank canal crosses the river Bhairabbanki and the river Tarafeni via two barrages (Tarafeni barrage and Bhairabbanki barrage) on these rivers. Salient features of the reservoir are given below:

Table 7: Salient Features of Mukutmonipur Reservoir

	Description	Remarks
1	Location	Mukutmanipur, District Bankura on the rivers Kangsabati and Kumari about 3.2 km. upstream of their confluence.
2	Type of Dam	Earthen Gravity Dam with Concrete Saddle Spillway
3	Catchment Area	3625 km^2 (1400 $miles^2$)
4	Length of Dam	11.27 km (7 miles) including Dyke and Hillock
5	Height of Dam (Max.)	41.15 m (135 ft) above river bed
6	Length of Spillway/No. of Bays	125.00 m (440 ft) 11 (width of each bay 9.14 m)
7	Optimum Pond level	134.11 m (410 ft)
8	Design flood level	135.63 m (445 ft)
9	Design Discharge	5663.32 cumecs (2,00,000 cusecs)
10	Total storage (DS and LS)	103614.16 ha m (8,40,000 ac. ft.)
11	Total submerged area	13,668 ha (33,760 acre)
12	Canal and Barrage Discharge	Left - 192.55 cumecs (6,800 cusecs) Right - 70.75 cumecs (2,500 cusecs)
13	Pickup Barrages	i) Silabati, ii) Bhairabanki, iii) Tarafeni

cumec =cubic meter per second, ft = foot, ha = hectare, km = kilometer, m = meter, km^2 = square kilometer.
Source: Irrigation and Waterways Department, GOWB.

23. Mukutmonipur reservoir has abundant flow throughout the year even during lean seasons. WBPHED already has a water supply scheme of 6.09 MLD from Mukutmanipur reservoir commissioned in the year 2008 for supplying water to Khatara and Ranibandh blocks serving approximately 73,600 persons in 72 Mouzas and is performing satisfactorily. The reservoir is also the source of another two proposed surface water based piped water supply schemes of PHED: (i) 27 MLD in Khatra, Hirbandh and Ranibandh blocks of Bankura district and (ii) 65 MLD for Manbazar and Bunduan blocks of adjacent Puruliya district. Based on the Mukutmonipur reservoir data of 2005-15 (Appendix 16) and considering the lowest water storage during lean season as on 1st June before onset of monsoon: the average water storage calculated is 86,440 MLD. The total ultimate abstraction for the water treatment plant (WTP) is 32 MLD up to design year 2035, which comprises only 0.03% of the total volume of available water during lean season (February to May). Therefore, the reservoir water is sufficient to meet the demand of the project during lean period. Quality of raw water is, in general, of acceptable quality and that which can be used for potable purposes after conventional treatment and disinfection. This further justifies considering the Mukutmonipur reservoir as the potential sustainable source of raw water. There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake.

24. The Irrigation and Waterways Department (IWD) has already given a permission of drawl of 32 MLD raw water vide Memo no. 263/1(6)-1, dated 22 June 2017 for drinking water purpose under the Bankura water supply project has 11 been (Appendix 16).

25. The overall improvement plan is to tap the raw water from Mukutmonipur reservoir and treat the water at WTP close to the intake point. The proposed WTP land belongs to Irrigation and Waterways Department, Government of West Bengal (IWD). The treated water will be pumped to intermediate booster pumping station (IBPS) located at Gobindopur mouza of Indpur block. The assessment of the alignment indicated that the length of the primary transmission main from WTP to IBPS is around 21 km.

26. Following Table shows the nature and size of the various components of the subproject. Location of subproject components and conceptual layout plans are shown in Figure 1 to Figure 5.

Table 8: Proposed Water Supply Subproject Components

Infrastructure	Function	Description	Location
Raw water intake with fixed type Jetty	(i) Abstract water from the Mukutmonipur reservoir and pump it to water treatment plant (WTP) inlet	Intake with Fixed Type Jetty with arrangement for housing pumping machineries. Mukutmonipur reservoir has abundant water throughout the year. Quality of river water is in general of acceptable quality, which can be used for potable purposes after conventional treatment and disinfection. The Irrigation and Waterways Department (IWD) has already given a permission of drawl of 32 million liters per day (MLD) raw water.	Latitude: 22.984015 N Longitude: 86.781074° E Average GL=133 m Raw water source for the subproject is Mukutmonipur reservoir. The proposed intake site is located at Satsol Mouza of Khatra block. There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake.
Raw water main from Intake	Raw water main will be laid to supply raw water from intake to WTP with the help of raw water pumping machineries.	The raw water main is proposed to follow the shortest possible route, keeping in view the velocity considerations to avoid silting and other physical considerations. Based on an assessed velocity (of minimum 1.2 m/s and maximum 2.4 m/s), the indicative pipe diameters ranging from 1000 to 1400 millimeters (mm)	Pipe supporting bridge will be constructed for installation of raw water main to transmit raw water from intake to WTP.
Water Treatment Plant	Treatment of raw water to meet the drinking water standards. Conventional water treatment is proposed to treat the raw water from the Mukutmonipur reservoir.	32 MLD capacity conventional WTP with the following process: Alum coagulation and flocculation Sedimentation Rapid gravity filtration, Disinfection with chlorination Wash water recovery Sludge drying beds Water quality testing laboratory	The identified land for WTP is 2.5 km from the proposed intake point and belongs to IWD. The coordinates of the proposed WTP location is 22.99777 N and 86.77412 E. The Topography is undulating and ground level of the site and surroundings are about 140m above the mean sea level. The land is connected by an approach road to the nearby villages. As per local enquiries carried

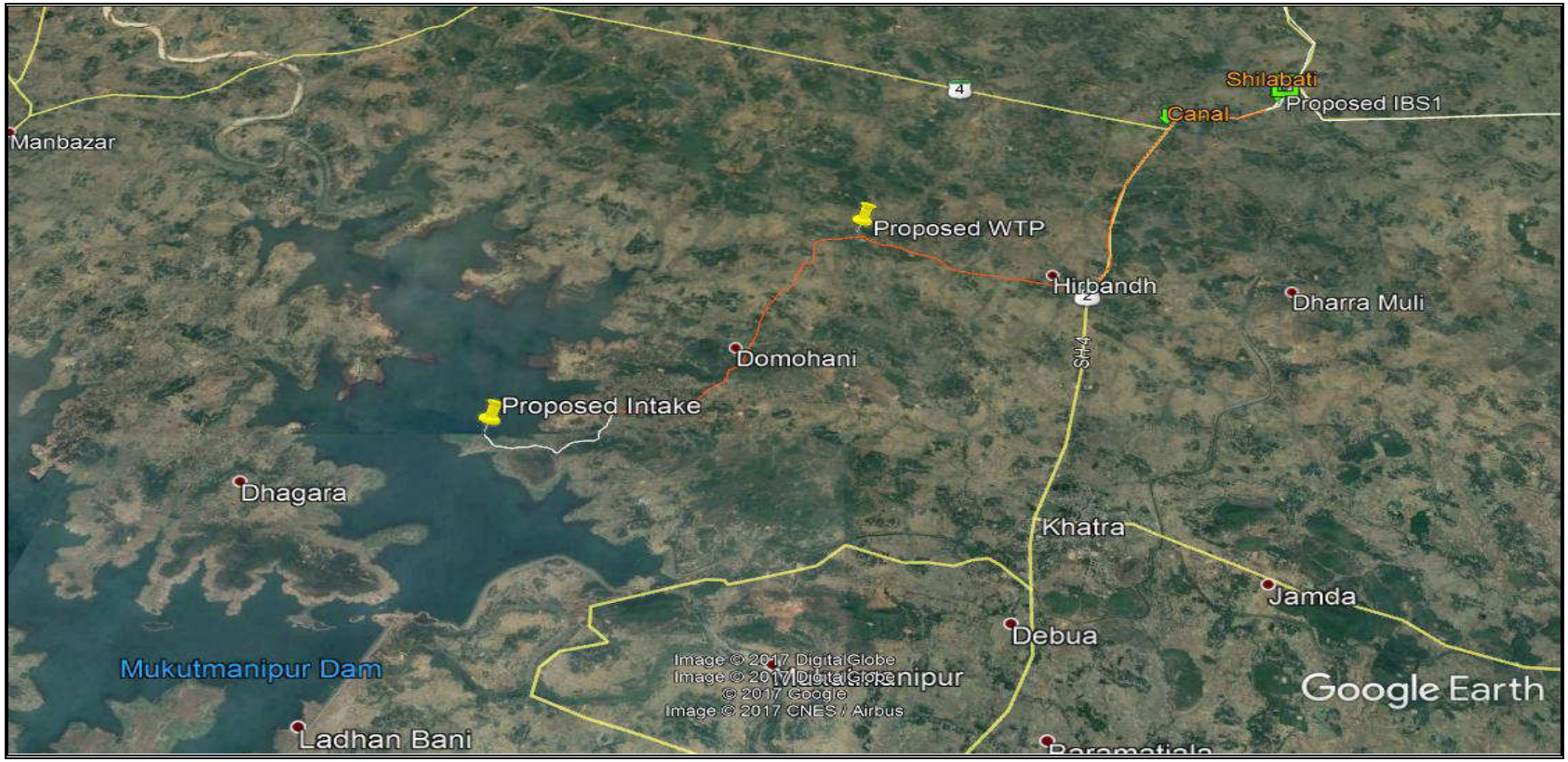
Infrastructure	Function	Description	Location
		Miscellaneous infrastructure (Administrative Building, Laboratory Building, Staff Quarters, Guard Rooms, Internal roads and pathways, Electrical Sub-station). Provision of supervisory control and data acquisition (SCADA) (The operation of the entire Water Treatment plant shall be fully automated with PLC and SCADA system installed in place with provision of manual overriding)	out during field visits, the site is not prone to flooding, and is barren land. The proposed WTP site is required to be developed including proper drainage infrastructure considering the undulating topography
Primary Transmission Main	Primary Transmission main of approximately 21 km to transmit treated water from the WTP to intermediate booster pumping station (IBPS)	The treated water from the WTP will be conveyed to IBPS. Since, the location of the (Intake and) WTP is on one side of the Project area, a single transmission main will be laid with progressively reduced diameters is proposed to feed the proposed IBPS	The Primary transmission main will be laid along the edge of the roads. The rising main is proposed to be laid primarily through open cut method. However, the laying of the rising main through open cut method may not feasible at major road crossings and congested market areas. About 150 m of the Primary transmission main out of total 21 km length is proposed to be laid by trenchless methods in these stretches.
Intermediate Booster Pumping Station	Store treated water from WTP for supply to ground level storage reservoirs (GLSRs)/overhead reservoirs (OHRs) through the pumping main.	Reservoir storage capacity is 4400 kl	Latitude.23.0715 N Longitude. 86.9056 E Average GL 110 m above msl. The identified site of IBPS is at Gobindopur mouza of Indpur block and located on easily accessible by SH 2. The land of IBPS is privately owned land and will be acquired from private owner(s). Overall, there are no notable sensitive

Infrastructure	Function	Description	Location
			environmental features in and around the site.

D. Implementation Schedule

27. The project will be implemented on a design build and operation (DBO) contract. Bids will be invited in October 2017, and the contract will be awarded by April 2018. Construction is likely to start in October 2018, and will take about 24 months. The Operation and Maintenance period is for 3 years.

Figure 1: Proposed Subproject Components and Primary Transmission Main Alignment



Source: Google Earth.

Figure 2: Proposed Surface Water Intake and Water Treatment Plan Locations

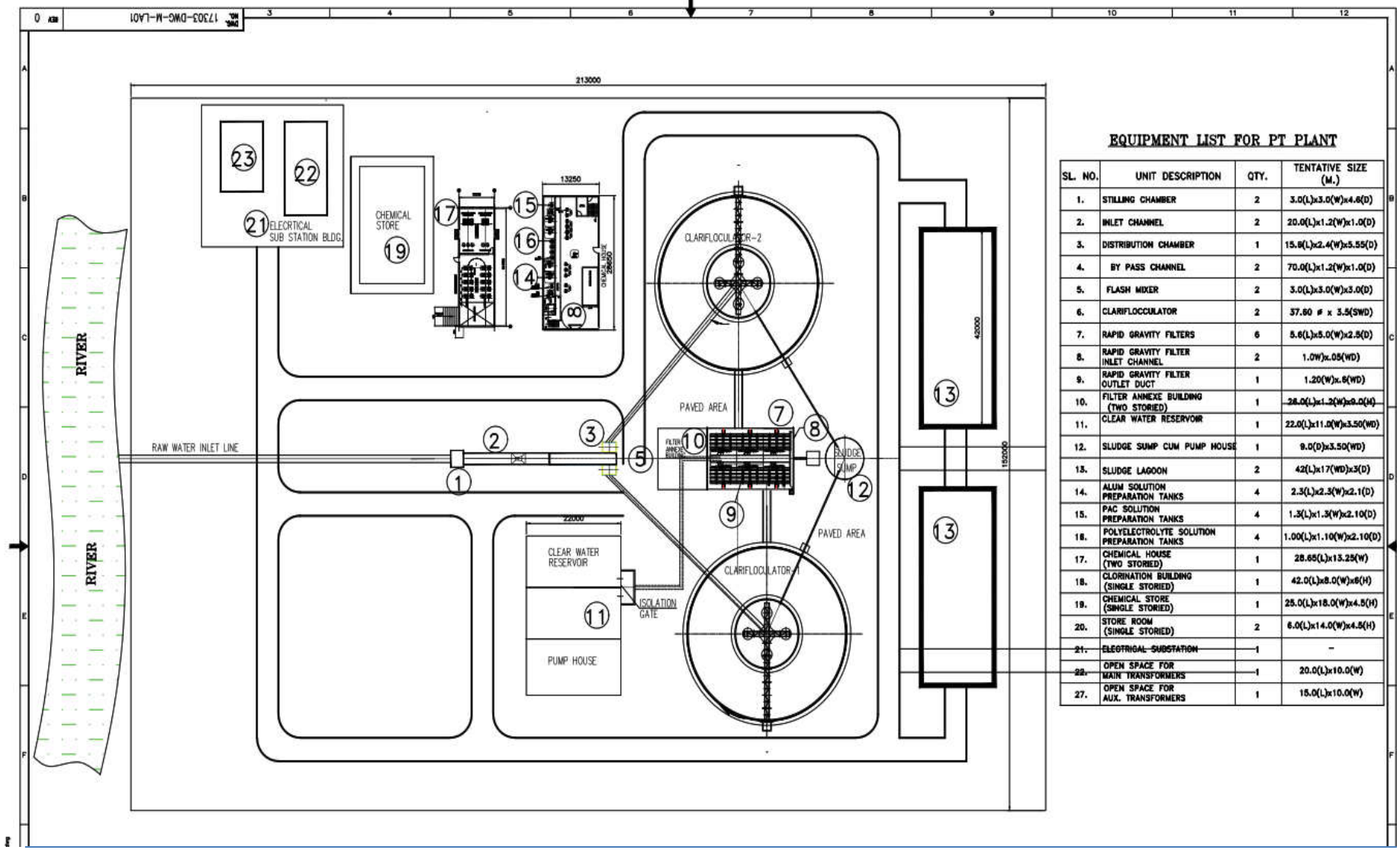
Source: Google Earth.

Figure 3: Photograph of Proposed Mukutmonipur Reservoir Intake Location

Figure 4: Proposed Water Treatment Plant Site

Figure 5: Proposed Intermediate Booster Pumping Station Site at Gobindopur Village

Figure 6: Layout Diagram of Proposed Water Treatment Plan



EQUIPMENT LIST FOR PT PLANT

SL. NO.	UNIT DESCRIPTION	QTY.	TENTATIVE SIZE (M.)
1.	STILLING CHAMBER	2	3.0(L)x3.0(W)x4.6(D)
2.	INLET CHANNEL	2	20.0(L)x1.2(W)x1.0(D)
3.	DISTRIBUTION CHAMBER	1	15.6(L)x2.4(W)x5.55(D)
4.	BY PASS CHANNEL	2	70.0(L)x1.2(W)x1.0(D)
5.	FLASH MIXER	2	3.0(L)x3.0(W)x3.0(D)
6.	CLARIFLOCCULATOR	2	37.60 ø x 3.5(SWD)
7.	RAPID GRAVITY FILTERS	6	5.6(L)x5.0(W)x2.5(D)
8.	RAPID GRAVITY FILTER INLET CHANNEL	2	1.0W)x.05(WD)
9.	RAPID GRAVITY FILTER OUTLET DUCT	1	1.20(W)x.6(WD)
10.	FILTER ANNEXE BUILDING (TWO STORIED)	1	28.0(L)x1.2(W)x9.0(H)
11.	CLEAR WATER RESERVOIR	1	22.0(L)x11.0(W)x3.50(WD)
12.	SLUDGE SUMP CUM PUMP HOUSE	1	9.0(D)x3.50(WD)
13.	SLUDGE LAGOON	2	42(L)x17(WD)x3(D)
14.	ALUM SOLUTION PREPARATION TANKS	4	2.3(L)x2.3(W)x2.1(D)
15.	PAC SOLUTION PREPARATION TANKS	4	1.3(L)x1.3(W)x2.10(D)
16.	POLYELECTROLYTE SOLUTION PREPARATION TANKS	4	1.00(L)x1.10(W)x2.10(D)
17.	CHEMICAL HOUSE (TWO STORIED)	1	28.65(L)x13.25(W)
18.	CLORINATION BUILDING (SINGLE STORIED)	1	42.0(L)x8.0(W)x6(H)
19.	CHEMICAL STORE (SINGLE STORIED)	1	25.0(L)x18.0(W)x4.5(H)
20.	STORE ROOM (SINGLE STORIED)	2	6.0(L)x14.0(W)x4.5(H)
21.	ELECTRICAL SUBSTATION	1	-
22.	OPEN SPACE FOR MAIN TRANSFORMERS	1	20.0(L)x10.0(W)
27.	OPEN SPACE FOR AUX. TRANSFORMERS	1	15.0(L)x10.0(W)

III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

28. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all ADB investments.

29. **Screening and categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:

(i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.
(ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
(iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
(iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all projects will result in insignificant impacts.

30. **Environmental Management Plan.** An environmental management plan (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.

31. **Public Disclosure.** ADB will post the safeguard documents on its website as well as disclose relevant information in accessible manner in local communities:

(i) for environmental category A projects, draft EIA report at least 120 days before Board consideration;
(ii) final or updated EIA and/or IEE upon receipt; and
(iii) environmental monitoring reports submitted by the implementing agency during project implementation upon receipt.

B. National Environmental Laws

32. **Environmental Assessment.** The Government of India EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

33. Category A projects require Environmental Clearance from the central Ministry of Environment, Forest and Climate Change (MOEFCC). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MOEFCC prepares comprehensive terms of reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MOEFCC considers the recommendation of the EAC and provides the Environmental Clearance if appropriate.

34. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the Environmental Clearance based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

35. None of the components of this bulk water supply subproject falls under the ambit of the EIA Notification 2006, and, therefore EIA Study or Environmental Clearance is not required for the subproject.

36. **Applicable Environmental Regulations.** Besides EIA Notification 2006, there are various other acts, rules, policies and regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. The specific regulatory compliance requirements of the subproject are shown in Table 8.

Table 8: Applicable Environmental Regulations

Law	Description	Requirement
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Control of water pollution is achieved through administering conditions imposed in consent issued under to this Act. All pollution potential activities will require consent to establish (CTE) from West Bengal Pollution Control Board (WBPCB) before starting implementation and consent to operate (CTO) before commissioning.	Water treatment plant (WTP) requires CTE and CTO from WBPCB. Application has to be submitted online.[a]
Environment (Protection) Act, 1986 and Central Pollution Control Board (CPCB) Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards	Appendix 2 provides applicable standards for ambient air quality. Appendix 3 provides vehicular emission norms
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Appendix 4 provides applicable noise standards.

Law	Description	Requirement
Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.	- Applicable for equipment and machinery's potential to emit air pollution (including but not limited to diesel generators and vehicles); - CTE and CTP from WBPCB; - Compliance to conditions and emissions standards stipulated in the CTE and CTO.	All relevant forms, prescribed fees and procedures to obtain the CTE and CTO can be found in the WBPCB website.[a]
Direction of West Bengal Department of Environment under the Air Act, 1981 Direction No. EN/3170/T-IV-7 /001/2009 dated: 10 December 2009	- issued based on a study by WBPCB with help of ADB on air pollution from construction activities - lays out norms for control of air pollution from construction activities - prescribes two sets of norms: preventive measures, and practices to be discarded - failure to comply will lead to legal action, stoppage of work etc., -All construction activities under West Bengal Drinking Water Sector Improvement Project (WBDWSIP) shall follow the norms	Appendix 5 provides the pollution control measures indicated in the direction
Municipal Solid Wastes Management Rules, 2016	Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing and disposal.	Solid waste generated at proposed facilities shall be managed and disposed in accordance with the Municipal Solid Waste Management (MSWM) Rules
Construction and Demolition Waste Management Rules, 2016	Rules to manage construction and to waste resulting from construction, remodeling, repair and demolition of any civil structure. Rules define C and D waste as waste comprising of building materials, debris resulting from construction, re-modeling, repair and demolition of any civil structure.	Construction and demolition waste generated from the project construction shall be managed and disposed as per the rules (Appendix 6)
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Appendix 7 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.
Land Acquisition Act of 1894	Private land acquisition is guided by the provisions and procedures in this Act. The District Collector or any other officer designated will function as the Land Acquisition Officer on behalf of the Government. There is a provision for consent award to reduce the time for processing if the land owners are willing to	All the project components are in government or public land. No land acquisition is required as a part of this sub project.

Law	Description	Requirement
	agree on the price fixed by the Land Acquisition Officer.	
West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006	This Act has put restriction on felling of trees in the State unless until permitted by the Tree Officer. Any person desiring to fell a tree shall apply in writing to the tree officer for permission in that behalf. It further defines clauses for planting adequate number of trees, planting in place of fallen/destroyed trees, preservation of trees and adoption of trees.	Tree cutting is required for construction work and laying of rising main. Therefore, prior permission should be obtained
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	The Rules designate areas within a radius of 100 meters (m) and 300 m from the "protected property" as "protected area" and "controlled area" respectively. No development activity (including mining operations and construction) is permitted in the "protected area" and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	There are no protected properties near project area. However, in case of chance finds, the contractors will be required to follow a protocol as defined in the environmental management plan (EMP).

[a] West Bengal Pollution Control Board.

C. Other Permission from Statutory Authorities

37. **Permits for Abstraction.** Abstraction of raw water from surface water sources within the state is accorded by the IWD. The IWD may give permit of only surface water, allocation of the quantum would be accorded by the IWD after scrutiny of various technical aspects.

38. **Permits for Pipe Laying along National and State Highways.** The primary rising main from the WTP to the Clear Water reservoir cum Booster Pumping station has to be laid across the National and State Highway. Necessary permission from Highway Authorities is required to lay the pipe.

39. **ADB Safeguard Policy Statement Requirements.** During the design, construction, and operation of the project the PMU and PIUs will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the PMU and PIUs will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 9: WHO Ambient Air Quality Guidelines

Table 1.1.1: WHO Ambient Air Quality Guidelines[7,8]		
	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 10: World Bank Group's Environment, Health and Safety Noise Level

Table 1.7.1- Noise Level Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

IV. DESCRIPTION OF THE ENVIRONMENT

A. Methodology Used for Baseline Study

40. **Data Collection and Stakeholder Consultations.** Data for this study has been primarily collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed subproject sites.

41. The literature survey broadly covered the following:

(i) Project details, reports, maps, and other documents prepared by technical experts of the PHED, ADB PPTA team;
(ii) Discussions with Technical experts of the PPTA team, municipal authorities, relevant government agencies like WBPCB, etc.;
(iii) Secondary data from previous project reports and published articles; and
(iv) Literature on land use, soil, geology, hydrology, climate, socioeconomic profiles, and other planning documents collected from government agencies and websites.

42. **Ocular Inspection.** Several visits to the project sites were made during IEE preparation period in 2016-2017 to assess the existing environment (physical, biological, and socioeconomic) and gather information with regard to the proposed sites and scale of the proposed project. A separate socioeconomic study was conducted to determine the demographic information, existing service levels, stakeholder needs and priorities.

B. Physical Resources

1. Location, Area and Connectivity

43. Geographically Bankura district is situated between $22^0$38'' North latitudes and $86^0$36'' to $87^0$46'' East longitudes. It is bounded by W and Hugli district to the East, Puruliya to the West, District Barddhaman to the North and Paschim Medinipur to the South. Bankura district is almost triangular in shape with a total area of 6,882 km^2. Its north to south extension is of 112 km and that of east to west is of 120 km.

44. The population of the district is 3,596,674[9] of which male and female were 1,840,504 and 1,755,788 respectively. It is the 3rd least populated district in West Bengal after Alipurduar and Purulia, with Population Density of 523 persons / km2. The district has 22 Panchayet Samitis[10], with 190 Gram Panchayats[11], consisting of 3823 Villages and 6638 habitations. The total number of urban centers is 12, of which 3 are Municipalities (Bankura, Bishnupur and Sonamukhi), and the remaining 9 are Census towns, (Khatra, Ledisol, Jhanti Pahari, Kotulpur, Simlapal, Raipur Bazar, Ghutgarya, Barjora and Beliatore).

45. Average literacy rate of Bankura in 2011 were 70.95 % compared to 63.44% of 2001. If things are looked out at gender wise, male and female literacy were 81.00% and 60.44%

[9] District Census Handbook-2011.
[10] The Panchayat Samiti is the rural local self-government system at the block level. They form the middle level of the Panchayati Raj Institutions in India. It acts as a link between Village Panchayats (Gram Panchayats) and Zila Parishad (District council). Each district is divided into a number of blocks and each block consists of a number of adjoining villages (Gram Panchayat). For each block, again there is a Panchayat Samiti.
[11] Gram Panchayat is the organization of elected members of Gram Sabha of the village. A Gram Sabha consists of members that include every adult of the village or Gram.

respectively. With regards to Sex Ratio in Bankura, it stood at 954 per 1000 male compared to 2001 census figure of 952. The details of Blocks within each Sub-division and the Municipalities are tabled below:

Table 11: Administrative Divisions of Bankura District

	Sub-Division	Block Details	Municipality
1	Bankura Sadar	Bankura-I, Bankura-II, Barjora, Chhatna, Gangajalghati, Mejia, Onda and Saltora	Bankura
2	Khatra	Indpur, Khatra, Hirbandh, Raipur, Sarenga, Ranibundh, Simlapal and Taldangra	-
3	Bishnupur	Indas, Joypur, Patrasayer, Kotulpur, Sonamukhi and Bishnupur	Bishnupur and Sonamukhi

46. The select two blocks Indpur and Taldangra blocks of Bankura District (hereinafter referred to as the Project area). Indpur is located at 23.1667°N and 86.9333°E. It has an average elevation of 118 m (387 ft). Indpur community development block spreads over from the central parts of the district to the western border with Purulia district. It belongs to the uneven lands/ hard ring rock area. Indpur community development block is bounded by Chhatna and Bankura I CD Blocks on the north, Onda and Taldangra CD Blocks on the east, Khatra and Hirbandh CD Blocks on the south and Puncha CD Block, in Purulia district, on the west.

47. Taldangra is located at 23°01′N and 87°07′E. Taldangra community development block is located in the south-eastern part of the district and belongs to the hard rock area. Taldangra community development block is bounded by Onda community development block on the north, Bishnupur community development block and Garhbeta II CD Block, in Paschim Medinipur district, on the east, Simlapal community development block on the south and Khatra and Indpur CD Blocks on the west

48. Total population of select 2 project blocks is 304,415 (rural 304.415 and urban nil) as per 2011 census. Scheduled Castes numbered 102,435 (33.64%) and Scheduled Tribes numbered 35,600 (11.69%) as per 2011 census. The project area does not have any Census town but has 16 Gram Panchayats. Administrative profile of the 2 blocks are given below:

Table 12: Block-Wise Profile of the Project Area

General Information of Block	Project Blocks	
	Indpur	Taldangra
Subdivision	Khatra	Khatra
Block Headquarter	Indpur	Taldangra
Geographical area (km^2)	302.60	349.74
Panchayat Samity	1	1
No. of Gram Panchayats	7 (Bheduasole, Brahmandiha, Brajarajpur, Gourbazar, Hatgram, Indpur and Raghunathpur)	9 (Amdangra, Bibarda, Fulmati, Harmasra, Khalagram, Panchmura, Saltora, Satmouli and Taldangra)
No. of Inhabited Village	198	141
No. of Mouza	222	145
No. of Gram Samsad (Village Councils),	112	109

49. **Road Network and Connectivity**. The National Highway 60 or NH-60 connects NH-5 (At Balasore) to NH-34 (At Morgram). Within Bankura, it runs through Bishnupur, Bankura,

Gangajalghati and Mejia, an approximate distance of 93 km before crossing over to Ranigunj. State Highway-2, 4, 8 and 9 are the major State Highways connecting / interconnecting Bankura, with the rest of the districts. Details of the major [12]National / State Highways within the district and their connectivity as per available information are presented below:

Table 13: Details of Major Roads in Bankura District

	National / State Highway Number	Length (km)		Details of Major Blocks which Passing Through
		Total	In Bankura	
1	NH-60	446	93	Bishnupur, Onda, Bankura, Gangajalghati and Mejia
2	NH-60A	84	33	Bankura-II, Bankura-I
3	State Highway-2	323	117	Saltora, Chhatna, Bankura-II, Chhatna, Indpur to SH-4
4	State Highway-4	466	80	Hirbandh, Khatra to Sarenga
5	State Highway-7	289	-	Bishnupur, Joypur, Kotulpur
6	State Highway-8	292	112	Beliatore, Sonamukhi, Patrasayer and Indua
7	State Highway-9	251	82	Durgapur, Beliatore, Bankura, Onda, Taldangra, Simlapal, Sarenga, Raipur

50. Length of Roads maintained by different agencies in the Indpur and Taldangra Blocks of Bankura for the year 2013-14 are given below:

Table 14: Roads Maintained by Different Agencies in the Indpur and Taldangra Blocks

	Name of Block	Length of Road Maintained by Institutions (km)				Total Length (km)
		PWD	Zilla Parishad	Gram Panchayat	PMGSY	
1	Indpur	41.00	19.40	483.00	48.4	591.80
2	Taldangra	60.00	38.28	433.00	44.9	576.18
Total		**101.00**	**57.68**	**916.00**	**93.3**	**1167.98**

Source: 1) P.W.D. (Roads), Government of West Bengal; 2) Zilla Parishad, Bankura; 3) Panchayat Samity, Bankura; 4) Gram Panchayat, Bankura.

2. Physiography, Topography, Soil and Geology

51. **Physiography.** The district is described as the "connecting link between the plains of Bengal on the east and Chota Nagpur plateau on the west." The areas to the east and north-east are low lying alluvial plains, similar to predominating rice lands of Bengal. To the west the surface gradually rises which gives way to undulating country, interspersed with rocky hillocks. Much of the district is covered with jungles. The regions of the district could be divided into broad three parts viz. 1) the hilly areas to the west, 2) the connecting undulating tract in the middle, and 3) the level alluvial plains to the east. The greater portion of the district consists of a rolling country covered by laterite and alluvium. While metamorphic or gneissose rocks are found to the extreme west, to the east there is a wide plain of recent alluvium. Strong massive runs of hornblendic varieties stretch across the region in tolerably continuous lines, the general strike being nearly east and west. The most characteristic geological feature of the district is the area of laterite and associated rocks of sand and gravel. At some places one finds hard beds of laterite. At other

[12] Public Works Department, Government of West Bengal. Road-State Highway.

places, it is decomposed and reorganized. Locally, the ferruginous rock is called kankar. The calcareous concretions, commonly used as the sources of lime, are known as ghutin. The Gondwana system is represented in the northern portion of the district, south of the Damodar, between Mejia and Biharinath Hill. The beds covered with alluvium contain seams of coal belonging to the Raniganj system.

52. **Topography**. The average elevation of the district from mean sea level is 448 metres. Topographically the district of Bankura is divided into 6 micro regions viz.:

(i) Main Bankura Upland: characterized by undulating terrain with many hills and ridges along the north-western boundary of the district and having a gradual descent from the Chhatonagpur plateau.
(ii) Bankura Upland: continuation from the main Bankura Upland over a small tract in the south-east corner.
(iii) Bankura–Bishnupur Radh Plain: the elevation rises gradually with undulating topography but abruptly in hilly tract towards the west extending between the western hilly tract and eastern alluvial plains. The hillocks ranges in the region from 90 m to 180 m.
(iv) Patrasayer Plain: a fertile plain with a gradual slope towards the south-west located in the north-east part.
(v) Silai Plain: a plain with few undulations in the west extending to the south-central part.
(vi) Middle Kasai Basin: mainly a plain shaped by the Kasai river which flows from north-west to south-east and covers the north-western part of the district.

53. There are three distinct geomorphic units with characteristic morphological assemblages in Bankura. These are:

(i) **The Hilly Terrain in the West**: the terrain consists of crystalline rocks of Archean age, characterized by hillocks, low ridges and valleys. Susunia Hills (493m) and Biharinath Hillas (447.8 m) have the highest surface elevation of the unit. There are other small hills such as Mejhia Karo around Gangajalghati block and in other blocks e.g. Khatra, Ranibundh, Raipur. The average elevation of these hills ranges between 100 – 150m above mean sea level. The entire geomorphic unit is the continuation of Chotonagpur plateau.
(ii) **The Eastern Plain:** the eastern part of the district comprising the blocks of Bishnupur, Kotulpur, Indus etc. is flat land which promotes intense cultivation. The surface elevation of this unit ranges between 10-50m above mean sea level with a gentle slope. At places, the flat land shows dissected topography and is devoid of natural swamps or lakes.
(iii) **The Marginal Undulating Tract:** this is relevant in the central part of the district where hilly terrain of the western part slowly merges into plain alluvial land. This geomorphic unit is favorable for the growth of forest. The morphology of this unit presents a highly dissected topography where the average surface elevation is of the order of 100 m above mean sea level.

54. **Soil**. Soil of Bankura district can be broadly grouped into three principal types (Groundwater Resources Assessment and Management of the Bankura District, CSME, 1993) viz. (1) Red Soil (2) Alluvial Soil and (3) Laterite Soil.

55. Typical red soil has limited distribution in the south central, south-eastern and south western parts of the district around Bishnupur, Kotulpur and Raipur blocks respectively. These are the red-colored sedimentary soils (i.e. formed from residual parent materials) found mainly on laterites supporting Sal vegetation. They are also found along the margins of small hills bare of vegetation. Brown soils form a group within this class which are also sedimentary in nature, mainly derived from sandstone, granite gneiss and schist.

56. The alluvial soils, which have wide distribution in the east-central and south-eastern parts of the district, are grouped according to soil association as Damodar-Rajmahal riverine, Damodar flatlands, Damodar highlands etc. The oldest soil amongst them is unaffected by floods and siltation and shows profile development, whereas the younger or newer alluvial soil, found mostly in the Damodar flatland areas is enriched by silt deposition during floods. Such areas are characterized by high water table, a heavy sub-soil and occurrence of brown concretions at shallow depths.

57. The laterite soils have wide distribution in the south-central to the south-western part of the district. Such soils are distinguished from the red soils by the occurrence of ferruginous concretions in a definite layer, whereas in the red soils they are distributed throughout the profile.

58. According to the textural types, soils of the district can be classified under the following types: (1) sandy (2) sandy loam (3) loam (4) sandy clay loam (5) clay loam (6) clay. clay, clay dominated loam and loamy soils are mostly confident to the flood plains of the Damodar and the Dwarkeswar rivers through sporadic occurrences. This type of occurrences is also seen in other small river valleys. The district as a whole is covered generally by sandy loam.

58. **Geology.** The geology of Bankura district is characterized broadly in four lithounits as under:

(i) Crystalline granite gneiss of Archaean age is exposed in the Western part of the District covering Blocks of Chhatna, Bankura-I and II, Indpur, Khatra, Hirbundh, Gangajalghati, Ranibundh, Sarnga and parts of Saltora and Mejia.
(ii) Sedimentary Sandstone and Shale of lower Gondwana age occupy the northern and north-western parts of the district as small patches, covering parts of Saltora and Mejhia blocks.
(iii) Quaternary alluvium occupies the eastern and south-eastern parts of the district covering Bishnupur, Sonamukhi, Kotulpur, Indus, Joypur and Patrasayer Blocks.
(iv) The marginal tract covering Simlapal, Taldangra, Onda and parts of Barjora and Bishnupur blocks is covered by laterites and Quaternary alluvium underlain by basement rock at shallow depth within 40 m.

3. Climatic Conditions

59. The climate of the State is tropical and humid except in the northern hilly region which is close to the Himalayas. The temperature in the mainland normally varies between 24°C-40°C during summer and 7°C-26°C during the winter. The average rainfall in the State is about 1,750 mm. West Bengal is divided in to six agro-climatic zones namely Hill zone, Tarai zone, Old Alluvial and New Alluvial zones, Laterite zone and Saline coastal zone (Figure 15). Birbhum, Bankura, Puruliya, Paschim Medinipur districts falls under Red Laterite zone and generally undulating, coarse textured, susceptible to erosion, acidic soil.

60. Bankura is generally arid compared to other parts of Bengal. Annual average rainfall in the district is 1400 mm and the temperature varies from a maximum of ≥44°C and minimum of ≤6°C. The climate in the western portion of the district is drier than the eastern regions. From March to May, the hot westerly winds prevail and the day time temperatures are oppressive. The north-westerly winds are frequent during the early part of March (locally called as "Kal Baisakhi") and help to mitigate the excessive heat.

61. The rainy season sets during the month of June and lasts till September, but the climate is pleasant. The rainfall is maintained primarily by cyclonic storms, which originate from the Bay of Bengal, situated to the south-east. The winter sets in November and extends till February and the temperatures during the period are far more pleasant and enjoyable. The rainfall recorded at the various metrological stations, in and around Bankura district during the winter, summer and rainy seasons is tabled below:

Table 15: Rainfall Data Recorded in Various Metrological Stations

	Station	Years recorded	Average Rainfall in Bankura (mm)			
			November to February	March to May	June to October	Average Annual
1	Bankura	43 - 46	50.8	169.7	1207.5	1428.0
2	Bishnupur	21 - 22	50.0	200.9	1234.2	1485.1
3	Gangajalghati	15 - 16	45.2	147.1	1185.7	1378.0
4	Indus	16 - 17	43.2	209.3	1128.8	1381.3
5	Khatra	20 - 21	52.1	159.3	1293.9	1505.3
6	Kotulpur	16 - 17	47.5	172.7	1170.9	1391.1
7	Mejhia	20 - 21	36.3	134.6	1125.7	1296.6
8	Onda	16 - 17	34.8	131.8	1116.3	1282.9
9	Raipur	15 - 16	47.8	203.7	1300.2	1551.7
10	Sonamukhi	15 - 16	51.3	166.6	1119.1	1337.0
Average			**46.0**	**169.7**	**1188.2**	**1403.6**

Source: Metrological stations, in and around Bankura district.

62. **Vulnerability to Earthquakes.** As per the report published by National Institute of Disaster Management (NIDM) in 2013, West Bengal experiences earthquakes at a relatively lower frequency of the seismic hazard zonation map. As per the map of Bureau of Indian Standards West Bengal lies in seismic zones II-IV. Entire Bankura district and the project area falls in Zone III, which is classified as Moderate Damage Risk Zone in India.

63. **Vulnerability to Drought**. As per the report published by National Institute of Disaster Management (NIDM) in 2013, the districts of Bankura, Purulia, Birbhum and parts of Paschim Midnapore have been affected by drought at regular intervals, mainly due to deficient rainfall and adverse soil conditions. Every summer many parts of Purulia, Bankura, Paschim Medinipur, and Birbhum (covering the south-western part of the state) suffer water shortage with respect to the entire state.

4. Surface Water

64. **Rives and River Basin Systems of Bankura**. The drainage basin system of Bankura is controlled primarily by the Damodar, Sali, Dwarekeshwar, Silabati and Kangshabati rivers. All have a south-easterly flow and are almost parallel to each other. A brief discussion on each of the major rivers is outlined below. Further assessment for possible adverse impacts on aquatic species

from construction and operations of the water intake and jetty will conducted during detailed engineering design.

65. **The Damodar river** rises in the Palamu Hills of Chhotanagpur in Jharkhand at about 609 m above mean sea level. After flowing generally in a south-easterly direction for 540 km (240 km in Jharkhand and the rest in West Bengal), it joins the river Hoogly about 50 km below Kolkata. The river's principal tributary, the Barakar, joins it just upstream of the Jharkhand-West Bengal border. The Damodar has a number of tributaries and sub-tributaries, namely, Barakar, Konar, Bokaro, Haharo, Jamunia, Ghari, Guaia, Khadia and Bhera, with Barakar being the prime tributary. The catchment area of the river is about 22,000 km2 of which about 19,000 km^2 are in uplands and 3,000 km^2 in plains which are of deltaic nature. The catchment is irregular in shape and somewhat elongated in the lower reach. The river slope is 1.86 m/km for the first 241 km; 0.57 m/km in the next 167 km and 0.16 m/km in the lowest reach. Due to the particular topography of the catchment area, River Damodar used to inundate annually large tracts of Burdwan, Hoogly and Howrah Districts in the state of West Bengal. To mitigate the recurrent floods, dams were constructed at Tilaiya (on Barakar River In 1953), Konar (on Konar River in 1955), Maithon (on Barakar in 1957) and Panchet (on Damodar in 1959).

66. **The Sali River** is an important tributary of Damodar River that drains the northern part of Bankura district. It originates from a few miles west of Kora hill, halfway between Mejia and Bankura, and flows northwest to south-east and meets the Damodar at Samsar village in Indas Block. The total length of the Sali river is 81 km.

67. **The Dwarekeshwar River.** The largest river flowing through Bankura is the Dwarakeswar River. The river originates from Tilboni hills (445 m), in neighboring Purulia district, entering Bankura near Chhatna. The total length of the river within Bankura is 132 km, and its catchment area is 4430 km2.The Silai (or Shilabati) is the largest tributary of Dwarakeswar and it joins Dwareshwar near Ghatal (in Paschim Mednipur). The two together are known as Rupnarayan River, which flows through Hooghly. The other tributaries of Dwarakeswar River are the Gandheswari, the Kukhra, and the Berai.

68. **The Silabati River (also known as Silai).** The Silabati River (also known as Silai) originates in the terrain of the Chhota Nagpur Plateau (Puncha Block) in Purulia district. It flows in a south-easterly direction through the districts of Bankura and West Midnapore. The length of the river within Bankura is 63 km. There is a small reservoir on the Silabati near Khatra known as Kadam Deuli Dam where a canal from Mukutmanipur-Kangsabati dam meets the river.The major tributaries are Joypanda, Purandar and Chamkakhali.

69. **The Kangsabati River** (also variously known as the Kasai and Cossye) rises from the Chota Nagpur plateau and passes through the districts of Purulia, Bankura and Paschim Medinipur before draining to the Bay of Bengal. After rising at Murguma near Jhalda in the Chota Nagpur plateau in Purulia district, the river passes by Purulia, Khatra and Ranibandh inBankura district, and then enters Paschim Medinipur in the Binpur area. It is joined by Bhairabbanki. At Keshpur the river splits into two. The northern branch flows through the Daspur area as Palarpai and joins the Rupnarayan River. The other branch flows in a south-easterly direction and on joining the Kaliaghai River forms the Haldi River, which flows into the Bay of Bengal at Haldia. The total length of the river within the district is 51 km. Major tributaries are Bhairabanki and Tarafeni.

70. **Characteristics of the rivers.** Though the rivers are seasonal, the river course in itself allows a huge potential for the sub-surface water to be tapped. The extent of availability can be formalized only with requisite geo-hydrological study. While the need to harness the surface water

flows of the rivers can well be understood, it must be appreciated that studies must also involve regarding river water characteristics, particularly of credible importance is the shifting of rivers, which could critically affect any WS Scheme contemplated.

71. **Surface Water quality.** Raw water quality tests of Mukutmonipur reservoir was carried out by the Public Health Engineering Department. It is being noted from the water quality test results that all the chemical quality parameters are well within the permissible values,[13] excepting iron. So, only conventional treatment process is adequate to meet potable water standards. No special or tertiary treatment is required.

72. Iron content marginally exceeds the desirable value, but well within the permissible limit (value detected 0.41 mg/L, desirable limit 0.3 mg/L, permissible value 1.0 mg/L). The chlorine added for disinfection (pre and post) will oxidize a portion of the iron present and in the process, it is expected that the iron content will come down within/ closer to the desirable value.

Table 16:Surface Water Quality of Mukutmonipur Reservoir

	Parameters	Unit	Desirable Limit as per BIS 10,500	Permissible Limit as per BIS10,500	Test Results According to Sample Collection Date		
					4/8/2015	2/9/2015	6/9/2015
1	Temperature	˚C	-	-	27	-	-
2	Turbidity	NTU	5	10	95	39.4	37.6
3	pH	-	6.5	8.5	7.6	6.84	6.93
4	TDS	mg/L	500	2000	90	57.6	54.2
5	Alkalinity	mg/L	200	600	34	79.128	74.732
6	Calcium (Ca)	mg/L	75	200	20	-	-
7	Total Hardness (CaCO3)	mg/L	200	600	80	56	60
8	Chloride (Cl)	mg/L	250	1000	52	-	-
9	Iron (Fe)	mg/L	0.3	0.3	0.41	0.09	0.08
10	Residual Chlorine	mg/L	0.2	0.2	Nil	-	-
11	Color	Hazen	5	15	56	-	-
12	Odor	-	-	Nil	Nil	-	-
13	Fluoride (F)	mg/L	1	1.5	UR	-	-
14	Magnesium	mg/L	30	100	8	-	-
15	Sulphate	mg/L	200	400	40	-	-
16	Nitrate	mg/L	45	100	18	-	-
17	Aluminum (Al)	mg/L	0.03	0.2	0.002	-	-
18	Manganese (Mn)	mg/L	0.1	0.3	0.16	-	-
19	Phenolic Compound	mg/L	0.001	0.002	BDL	-	-
20	Coliform Bacteria (CFU/100ml), Max	-	NIL/100ml	-	540	-	300
21	Escherichia Oil	-	NIL/100ml	-	120	-	-
22	Non Feacal Coliform (CFU/100ml), Max	-	NIL/100ml at 37 ^{O}C	-	320	-	-
24	Feacal Coliform MPN/100	-	-	-	-	-	40

Source: PHED.

[13] Drinking Water IS 10500:1991 BIS.

5. Groundwater

73. **Hydro-geology and Ground Water Potential**. The diverse geology of Bankura district controls the hydro-geological condition of the district. According to Central Ground Water Board (CGWB), in areas underlain by hard crystalline and Gondwana rocks, the groundwater occurs under:

(i) Unconfined condition in the weathered residuum down to the depth of about 15 meters below ground level (mbgl), with maximum to 25 mbgl;
(ii) Semi-confined to confined condition in the fractured zones in the depth span of 30-60 mbgl. Resistivity survey shows that in some places a deeper fracture zone is also expected to occur at a depth span of 80-100 mbgl.
(iii) Groundwater in the unconfined condition is generally developed through open wells in the weathered zone and the available discharge can meet the domestic need, but is insufficient for any large-scale development of groundwater. Groundwater from the zone of secondary porosities i.e. weathered zone is developed through bore wells yielding 45-150 lpm.

74. About two thirds of the district is covered by alluvium. Older alluvium and laterites occur in central–southern part of the district. Groundwater exploration carried out in the area indicates that the thickness of the alluvial sediments increases eastward from 36m in the marginal part to 150m in the eastern most part. Potential aquifers exist between 30 and 95 mbgl and the discharge of the wells tapping such aquifers varies from 20 to 124 m^3/hr, with drawdown ranging from 6 to13 m. Depth to water level in the older alluvium varies from 6 to15 mbgl during pre-monsoon period.

75. The dug-wells in the laterites usually dry up in summer, but those wells which have penetrated through the laterites to underlying bedrock are found to also contain water during the summer months.

76. A number of flowing tube wells exists along the banks of the Darakeswar, Joypanda and Silai rivers. These tube wells are 30-70m deep (30-50 m diameter) and free flow discharge of 23-30 lpm These wells are used for small-scale irrigation.

77. Recent alluvium occupies the eastern and north central parts of the district and extends down to a depth of about 300 m bgl. The thickness of the alluvium increases eastwards. Potential granular zones exist in the depth span of 30-270 mbgl, yielding about 80-150 m^3/h with a drawdown between 6 to 10 m. In general, transmissivity of the deeper aquifer ranges from 272 – 806 m^2/day and storability from 1.019 –x 10^{-3} to 2.1 x 10^{-4}.

78. Long-term water level trend analysis from some hydrograph stations shows either falling (between 0.4 to 1.88 m/y) or rising (0.7 to 1.39 m/y) trends in water levels in the pre-monsoon period. During the post-monsoon period, falling (0.05 to 1.34 m/y) and rising (0.03 to 1.11 m/y) trends occur.

79. A detailed study on Groundwater Resources Assessment and Management of the Bankura District, West Bengal was carried out by Center for Study of Man and Environment (CSME, 1990-1993) under Department of Science and Technology, Government of India. The sponsored project revealed that:

(i) Groundwater occurs under unconfined condition in the hard rock areas of the district and the potential aquifers comprise two units viz. a weathered residuum which is 10 to 20 m thick, and an underlying fractured hard rock to a depth of at least 50 m.
(ii) In the laterite and older alluvium, occupying about 30 percent of the district in Onda, Taldangra, Simlapal, Raipur, parts of Bankura, Bishnupur, Sonamukhi block, groundwater occurs under unconfined condition.

80. **Annual rate of water-level fluctuation**. Maximum in Chhatna, Ranibandh, Raipur, Bishnupur, Jaypur, Indus and Kotulpur (4 m to 6 m). There are some patches in Bankura I, Bankura-II, Barjora, Gangajalghati and Khatra, where the fluctuation is between 4 m to 6 m. In the rest of the district the annual water-level fluctuation is 2 m to 4. In central Taldangra water-level fluctuation is negligible.

81. Change of water level at Indpur block it is seen that water level decreases up to 2 m in peak summer and rises up to 1m during rainy season. The reason is due to less infiltration by virtue of being hard rock disposition. Average pre-monsoon water level is 8.20m, post-monsoon water-level is 5.50 m. The water-level condition of Taldangra block is comparatively good. The water-level decreases only from 0.5 m to 1 m during peak summer and rises 1 m during post-monsoon period.

6. Groundwater Quality Status

82. According to CGWB the high concentrations of fluoride and iron in groundwater area serious problem in the district. Groundwater in 10 blocks namely Taldangra, Simlapal, Raipur, Indpur, Bankura II, Saltora, Barjora, Hirabundh, Chhatna and Gangajalghati is affected sporadically by high concentrations of fluoride in groundwater i.e. more than the permissible limit (>1.5 mg/L). This occurs in different hydro-geological formations namely:

(i) In fractured granite at depths of 40 m to 50 m.
(ii) In older alluvium sediments at depths of 40 m to 50 m.

83. In Bankura district, quite high concentrations of iron in groundwater have been found (up to 9.5 mg/L). Though iron content in drinking water may not affect the human system as a simple dietary overload, but in the long run prolonged accumulation of iron in the body may result in homo-chromatosis, a disease in which tissues are damaged. It is generally recognized that concentrations above 0.3mg/L in household water can lead to staining of clothes during washing and may therefore be unsuitable for use.

84. Groundwater in the upper reaches of the district and flanks is of calcium bicarbonate type, while in the lower reaches, the groundwater is of calcium chloride type with relatively high TDS (CSME, 1993).

85. Blocks affected by fluoride contamination. As per the Water Quality Monitoring System, out of the 22 Blocks a total of 17 Blocks have been identified which have had recurrence of fluoride contamination. Pictorial representation of the fluoride affected blocks is presented below where The light blue dots denote fluoride contamination between 1.0–1.5 mg/L, whereas the brown dots denote fluoride contamination beyond 1.5 mg/L.

86. **Sources of Fluoride.** Fluoride in the groundwater is geogenic (A.K.Yadav et al. 2009). Generally, most groundwater sources have higher fluoride concentrations than surface water. The

high concentrations are a result of dissolution of minerals such as fluorite, apatite and biotite from the local bedrock. Low concentrations of calcium also allow increased fluoride concentrations, controlled by precipitation of the mineral fluorite. The geology, chemical weathering and composition of bedrocks/soils/sediments play a major role in fluoride contamination of ground water**.** The Geological Survey of India has also observed that the Precambrian terrain with fractured/shear zones are possible locale for fluoride contamination of groundwater in parts of Purulia[14] and Bankura Districts.

87. Assessment of affected habitations based on 15IMIS Data. Habitation wise water quality data available from the NRDWP site were compiled to get an overview of status of water quality situation with special emphasis on Fluoride concentration. Details of fluoride contamination as reported in the various blocks in 2013-14, 2014-15, 2015-16 and 2016-17 is presented in Appendix 8. The data compiled for last four years (2013-17) is summarized and tabulated below:

Table 17: Compiled Summary of Fluoride Contamination in Bankura, 2013-2017

	Name of Blocks	Number of Samples Tested	Fluoride Concentration				Affected Habitation with Fluoride Concentration	
			> 1.5 (mg/L)		1.0 - 1.5 (mg/L)		>1.5 (mg/L)	1.0 - 1.5 (mg/L)
			No.	%	No.	%		
1	Bankura I	1854	2	0.11	29	1.56	2	18
2	Bankura II	2657	25	0.94	95	3.58	19	53
3	Barjora	2751	18	0.65	35	1.27	13	20
4	Bishnupur	2368	0	0.00	3	0.13	0	3
5	Chhatna	5250	67	1.28	198	3.77	47	137
6	Ganjagalghati	5007	26	0.52	259	5.17	20	107
7	Hirabandh	1684	10	0.59	53	3.15	10	41
8	Indpur	2651	7	0.26	36	1.36	7	27
9	Indus	2077	2	0.10	2	0.10	2	2
10	Jaypur	2054	0	0.00	0	0.00	0	0
11	Khatra	1842	6	0.33	4	0.22	5	4
12	Kotulpur	1737	0	0.00	2	0.12	0	2
13	Mejia	867	4	0.46	61	7.04	4	23
14	Onda	3378	1	0.03	1	0.03	1	1
15	Patrasayer	1704	0	0.00	0	0.00	0	0
16	Raipur	2462	11	0.45	29	1.18	5	22
17	Ranibundh	2104	0	0.00	6	0.29	0	5
18	Saltora	1969	43	2.18	131	6.65	31	59
19	Sarenga	1425	2	0.14	0	0.00	2	0
20	Simlipal	2149	167	7.77	68	3.16	95	57
21	Sonamukhi	1704	1	0.06	0	0.00	1	0
22	Taldangra	3140	21	0.67	33	1.05	12	19
Total		**52834**	**413**	**0.78**	**1046**	**1.98**	**276**	**600**

88. Summing up the last four years' data, as compiled, it has been observed that out of 52834 water samples tested across the 22 blocks, fluoride concentration above 1.5mg/L was observed in 413 samples (0.78%). Total 276 habitations are affected by high fluoride contamination. These

[14] District adjoining Bankura in West Bengal.

[15] Integrated Management Information System as maintained by Ministry of Drinking Water and Sanitation.

samples were tested mainly from tube-wells. Also, an estimated 1046 (1.98%) samples showed fluoride concentration between 1.0 mg/L and 1.5 mg/L.

89. Based on the water quality test results and analysis, it may be inferred that the pattern of fluoride contamination in the district varies from being severely affected to unaffected. A matrix has been framed to separate out the Blocks which are critically affected by fluoride contamination from those which are only moderately affected or unaffected.

90. Based on the analysis, high fluoride concentrations are noted in 10 blocks, namely Bankura II, Barjora, Chhatna, Ganjagalghati, Hirabandh, Mejia, Raipur, Saltora, Simlipal and Taldangra which are considered as severely affected.[16] The blocks, which are moderately affected are Bankura-I, Indpur, Indus, Khatra, Onda, Sarenga and Sonamukhi. The 5 blocks which are unaffected with fluoride contamination are Bishnupur, Joypur, Kotulpur, Patrasayer and Ranibandh.

91. Apart from fluoride, about 68% of the groundwater samples show iron concentration above the permissible drinking water standard (0.3 mg/L). E-Coli and Coliform counts were also present above the permissible limit in samples tested. Details of other quality parameters based on IMIS data (from 2013-2017) is tabled below:

Table 19: Summary of Water Quality Parameters

Year	Samples Tested	Samples with			
		Coliform >[0MPN/100ml]	**E-Coli >** [0MPN/100ml]	**Fe > 0.3** (mg/L)	**Hardness >200** (mg/L)
2013-14	14536	6927	1739	6984	895
	Range	1 –60 MPN/ 100 ml	0.06 –90 MPN/ 100 ml	0.31 – 8.70mg/L	602 – 5001mg/L
2014-15	26807	6236	2010	20091	2451
	Range	0.6 –9.0 MPN/ 100 ml	0.2 –90 MPN/ 100 ml	0.31 – 9.64mg/L	604 – 4700mg/L
2015-16	9383	4876	962	7374	617
	Range	1.0 –9.0 MPN/ 100 ml	0.02 –110 MPN/ 100 ml	0.31 – 9.68mg/L	604 – 1844mg/L
2016-17	2114	722	4	1557	65
	Range	4 –1600 MPN/ 100 ml	2 –17 MPN/ 100 ml	0.31 – 8.65mg/L	68 – 12365mg/L
Total	**52840**	**18761**	**4715**	**36006**	**4028**
Percentage of Samples Tested Positive (%)		**35.5**	**8.92**	**68.1**	**7.6**

7. Air Quality

92. West Bengal State Pollution Control Board (WBPCB) monitors air and noise pollution in the State. WBPCB have monitoring stations located at various places across the state covers major cities, district headquarters and industrial locations. Systematic estimation of the air quality in West Bengal started in the year 1998. In its current phase, the WBPCB monitors the air quality parameters in 12 districts during the period October 2012-December 2016.

[16]The rationale for severely affected blocks has been assessed based on the consideration that the % of samples tested with Fluoride Content > 1.5mg/Liter is more than 0.4%.

93. West Bengal has good air quality in most places for most of the time. Nevertheless, emissions from industrial sources and road traffic affect air quality in the districts. Around 32 per cent of the state population live in these locations. Both large and small urban settlements are affected by poor air quality. The entire state, throughout the year, hardly ever experience non-compliant air quality for any of the air pollutants other than the Particulate Matters. NO_2, the gaseous air pollutant sourced from high temperature industrial burning processes and automobile exhaust emissions, occasionally miss the standard during winter months in the city area.

94. The district wise status of air quality, 2016 trends are reflected for the indicator air quality parameters, namely, PM10, PM2.5, NO2 and SO2, the first three being such air pollutants in which some of the city areas are non-compliant in the State. Air quality scenario of Bankura district is presented in tabular form in Table 20 followed by graphical presentation (Figure 24) of the annual behaviour of the indicator pollutants during year 2016 and the estimated population exposed to such air quality in those districts.

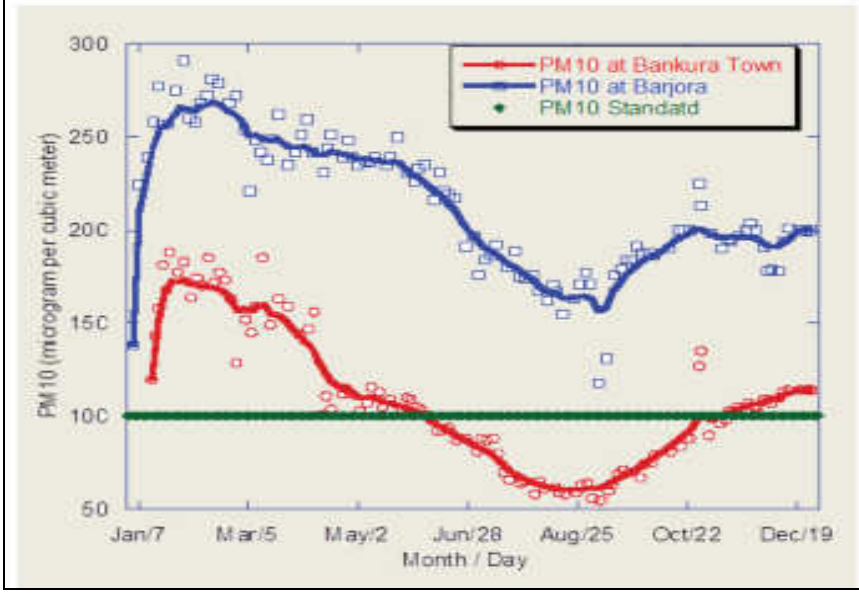
Table 18: Air Quality in Respect of Four Traditional Parameters in Bankura District and Yearly Days of Non-Compliance

Year	PM10 (µg/m³)			PM2.5 (µg/m³)			SO_2 (µg/m³)			NO_2 (µg/m³)		
	Value	Stan-dard	% days of NC	Value	Stan-dard	% days of NC	Value	Stan-dard	% days of NC	Value	Stan-dard	% days of NC
2013	85	60	35	Not Done	40	Not Done	7	50	0	40	40	0
2014	69	60	13	Not Done	40	Not Done	8	50	0	54	40	0
2015	99	60	43	Not Done	40	Not Done	8	50	0	55	40	0

Figure 7: Trend of PM_{10} in Bankura during 2016

District: Bankura

Total Population	3596674
Population affected by air quality	299773
% population affected by air quality	8.33



C. Ecological Resources

95. The eastern portion of the district forms part of the rice plains of West Bengal. The land under rice cultivation contains the usual marsh weeds of Gangetic plain. Aquatic plants and water weeds are found in ponds, ditches and still streams. Around human habitations there are shrub species such as Glycosmis, Polyantha sub-rosa, Clerodendron infortunatum, Solanum torvum, and various other species of the same genus, besides Trema, Streblus and Ficus hispida. The larger trees are papal, banyan, red cotton tree (Bombax malabaricum), mango (Mangifera indica), jiyal (Odina Wodier), Phoenix dactylifera, and Borassus flabellifer. Other plants found include Jatropha gossypifolia, Urena, Heliotropiumand Sida. Forests or scrub jungles contain Wendlandia exserta, Gmelina arborea, Haldina cordifolia, Holarrhena antidysenterica, Wrightia tomentosa, Vitex negundo and Stephegyne parvifolia.

96. The western portion of the district is higher. The uplands either bare or are covered with scrub jungle of Zizyphus and other thorny shrubs. This thorny forest gradually merges into sal (Shorea robusta) forest. Low hills are covered with Miliusa, Schleichera, Diospyros and other trees.

97. Some of the common trees of economic interest found in the district are: Alkushi (Mucuna pruriens), amaltas (Cassia fistula), asan (Terminalia tomentosa), babul (Acacia nilotica), bair (Zizyphus jujuba), bael (Aegle marmelos), bag bherenda (Jatropha curcas), bichuti (Tragia

involucrate), bahera (Terminalia belerica), dhatura (Datura stramonium), dhaman (Cordia macleoidii), gab (Diospyros embyopteris), harra (Terminalia chebula), imli (Tamarindus indica), kuchila (Strychnos nux-vomica), mahua (Bassia latifolia), palas (Butea frondosa), sajina (Moringa pterygosperma), kend (Diospyros melanoxylon), mango, date-palm, nim, papal, banyan, red cotton tree and jiyal.

98. The project area forms part the rice plains of West Bengal. The land under rice cultivation contains the usual marshy weeds of Gangetic plain. Aquatic plants and water weeds are found in ponds, ditches and still streams.

1. Terrestrial Plants at Project Sites

99. There is no such dense vegetation at the project sites. Most are agricultural land. Some scattered small patches of plants were observed in the road side and adjacent area. There is no such endangered or threatened plant has been observed. The common plants are as following:

Table 19: Common Plants at Project Sites

Name of the Family	Name of the Species
Anacordiaceae	*Buchanania lanzan*
	Semicarpu sanacardium
	Odina woodies
Asclepidiaceae	*Calotropis gigantea*
Burseraceae	*Boswella serrata*
Caesalpiniaceae	*Cassia fistula*
Dipterocarpaceae	*Sorear obusta*
Fabaceae	*Butea monosperma*
	Dalbergia latifolia
	Dalbergia sissoo
	Samanea saman
	Albizia lebbeck
Lecythidaceae	*Careya arborea*
Leguminoceae	*Pterocarpus marsupium*
Mimosaceae	*Acacia catechu*
Myrtaceae	*Syzygium cumini*
Palmae	*Phoenix acaulis*
	phoenix dactylifera
	Borassus flabellifer
Poaceae	*Dendrocalamus strictus*
Rhamnaceae	*Ziziphus mauritiana*
	Ziziphus zuzuba
Verbinaceae	*Vitex negunda*
Meliaceae	*Azadirecta indica*
Cornaceae	*Alangium lamarckii*
Moraceae	*Streblus asper*

2. Aquatic Plants

100. The Reservoir, which are primarily rained have very little vegetal growth. The water surface was cleared of all weeds. There were no visible swamps within the study area. There is no such endangered or threatened plant has been observed. The different types of semi aquatic and aquatic plants were observed during the survey, growing are listed below:

Table 20: List of Macrophytes In and Around Intake of the Mukutmonipur Reservoir

Name of the Family	Name of the species
	Algae
Characeae	*Chara* sp.
	Nitella sp.
	Dicot
Najadaceae	*Najas minor*
	Najasindica
Scrophulariaceae	*Limnophilarepens*
	Monocot
Hydrocharitaceae	*Hydrillaverticillata*
	Vallisneriaspiralis
Aponogetonaceae	*Aponogetonundulatus*
Cyperaceae	*Scirpusarticulatus*

3. Phytoplankton and Zooplankton

101. Mukutmonipur reservoir, phytoplankton diversity was greatly concerned at consumer level of reservoir ecosystem. In this reservoir, chiefly contributed classes were Chlorophyceae, Cyanophyceae, Bacillariophyceae, Charophyceae, Xanthophyceae and Dinophyceae. Enormous growth and density of Cyanophyceae was due to the richness of nitrogen and phosphates.

102. The Zooplankton of the Mukutmonipur Reservoir consists of Rotifera, Copepoda, Cladocera, Protozoa andOstracoda. Total 39 genera were recorded which were available in the reservoir during the present study. Of which 12 genera of Rotiera, 12 genera of Copepoda,10 genera of Cladocera, 3 genera of Protozoa and 2 genera of Ostracoda contributed to zooplankton density.

4. Common Fish

103. The studies on fish diversity observed the occurrence of about 36 species. The order Cypriniformes was dominant with 15 species, followed by Siluriformes with 5 species, Channiformes with 4 species, and Mastacembeli-formes and Perciformes with 1 species each. There is no such locally threatened fish species has been observed.

5. Fauna in the Project Area

104. Generally, Rats, Chhachunder, Mongoose, Dogs and Pigs are commonly found near core zone. Snakes and lizards are also common. Different varieties of birds found in core zone are Anjan, Kabutar, Koel, Maina, Sparrows. No endangered species are found near the core zone.

105. Discussion with the DFO and other forest officials of Kanshabati south and Bankura south reveal the fact that the high vegetative growth around the area supports variety of faunal species in the buffer zone. Prominent wild species include wild black napped hare, spotted deer, wild boar, fox squirrel, mongoose in buffer zone. Amongst birds the bulbul, the white-breasted kingfisher, magpie robin, spotted dove and myna are prominent. Amongst reptiles, several poisonous like cobra, viper, krait and non-poisonous snakes (like boa, rat snakes, green whip, Bronze backed tree snake, etc.) are abound in this area. The garden lizard and monitor lizard are also seen. Variety of butterflies (like common grass yellow/ common jezebel) and insects (such as beetles, spiders, red ants, and flies) are spotted in abundance in the study zone.

6. Forest

106. The total geographical area of the district of Bankura is 6882.00 km^2 and the total area of forest of this district is 1,45,006.56 ha (1450.06 km^2) which constitutes 21.5% of total geographical area of the district coverage. A total area of 7305.76 ha has been declared as reserved forests under section 20 of Indian Forest Act. An area of 43643.87 ha of protected forests area has been covered under 438 proposals for declaring as reserved forests.

107. Bankura district forest is pre dominantly Sal and its associated species and plantation forest of Eucalyptus and Akashmoni. Bankura holds one of the best quality of Sal forest in West Bengal particularly at Radhanagar, Sonamukhi and Patrasayer and the entire Bishnpur sub-divisional jurisdiction. Its flora bio-diversity increased substantially over time. From the geographical, socioeconomic and environmental consideration, the district offers lot of scope for development of this activity. In view of Govt. supports for development of this sector, long term potential for development through credit may be estimated at 2500 hect. for next 5 years with annual phasing of 500 ha.

108. The district is covered under the programmes of National Waste Land Development Board. IWDP is being implementation in 7 blocks viz. Indpur, Chhatna, Saltora, Khatra, Hirbundh, G.Ghati and Ranibandh. Various schemes and projects like NREGS,13th Finance Commission, CSS Elephant Project are being implemented to improve the living conditions of the forest fringe area population. Elephant depredation is a very major problem in Bankura in view of very fast growing elephant population and seasonally moving elephant start straying back in Bankura for longer time and the number of residential elephants have also increased significantly. All-out efforts are being made with the help of local forest protection committee to tackle the problem with a human face to mitigate the problem and it is an on-going process.

108. State Government has implemented social forestry project in the district covering roadside, riverside, railway embankment plantation etc. West Bengal forest development corporation, pulpwood development corporation are also working for forest and wasteland development in the district during the past years. Govt. has stressed for biotic plantation distribution of seeding etc. in the district.

109. The total forest area is spread over 27 territorial Range under three forest divisions (Fig. 25). Forest area of Indpur range is 5997.656 Ha (Bankura S division) and that of Taldangra range is 7484.080 ha (Panchyat S.C Div). In forest areas, majority of the population depend on the forest for various purposes like grazing, firewood, collection of Sal leaves and seeds, mushrooms etc. Since the pressure on the forests is high, some minimum amount of forest degradation has almost become unavoidable. However, the Joint Forest Management (JFM) has taken roots in the district and its contribution for greening and conserving the forests of the district is immense. The JFM aims all round development of forest fringe areas.

110. All the proposed project sites are vacant and there is no notable tree cover, except the IBPS site where there are few trees of local species. Some trees required to be cut for laying of primary transmission main. The WTP and other project sites are not in close proximity of reserve forest land. There is sufficient available ROW along the pipe lying routes and no forest area will be affected.

7. Archaeological/Protected Monuments and Other Cultural Properties.

111. There is no notified Archaeological/Protected Monuments and other Cultural properties within project influence area.

D. Economic Development

1. Land Use

112. The distribution of the particular types of land use in Bankura district depends largely on natural factors like the distribution of water and soil. It also depends on the traditional preferences and Government policies of zoning and land use planning decisions. Among food crops, paddy is the most widespread crop. The following table shows the land utilization statistics of the district for the last five years (Table 21).

Table 21: Land Use Characteristics of Bankura District

	Land Use Class	Subclass	Subclass Total (acre)	Class Total (acre)
A.	**Built Up Area**			**177964.10**
	A1.	Urban Settlement	6539.23	
	A2.	Rural Settlement	165937.87	
	A3.	Commercial Area	34.07	
	A4.	Industrial Area	2782.48	
	A5.	Abandoned Airstrip	27.67	
	A6.	Ash Pond	586.69	
	A7.	Archaeological Site	23.53	
	A8.	Area Under Infrastructural Development	271.98	
	A9.	Brick Kiln	541.77	
	A10.	China Clay Quarry	94.15	
	A11.	Coal Mining Area (Active/Disused)	132.03	
	A12.	Eco Tourism	11.38	
	A13.	Gravel/Stone Quarry	720.13	
	A14.	Pebble Querry	200.54	
	A15.	Stone Crushers	60.59	
B.	**Agricultural Land**			**1013534.81**
	B1.	Single Crop	603427.63	
	B2.	Single Crop (Boro)	140.60	
	B3.	Single Crop (Rabi)	739.03	
	B4.	More Than One Crop	403360.30	
	B5.	Vegetables	5867.24	
C.	**Forest**			**357869.85**
	C1	Notified Forest Area (As Per SOI Toposheet 1970's)	305200.22	
	C2.	Plantation	50590.64	
	C3.	Plantation(Under Regeneration)	2078.98	
D.	**Waste Land**			**76454.5**
	D1.	With Scrub	26228.20	
	D2.	Without Scrub	41997.10	
	D3.	Gullied	3214.88	
	D4.	Sandy Area-Riverine	1096.41	
	D5.	Stony Waste/Baren Rocky	3917.92	
E.	**Waterbodies**			**92446.82**
	E1.	**River**	**60767.96**	

	Land Use Class	Subclass	Subclass Total (acre)	Class Total (acre)
	E2.	**Canal**	**3656.71**	
	E3.	**Reservoir/Lakes/Ponds/Tanks**	**28022.15**	
	GRAND TOTAL			**1718270.08**

Source: West Bengal Land Revenue Department.

113. The land use pattern of the district and select 2 blocks are given below (Table 22).

Table 22: Land Use Characteristics of Indpur and Taldangra Blocks

Land Use Category	Indpur Block (Acre)	Taldangra Block (Acre)
Built Up Area	7016.51	7150.80
Agricultural Land	54902.05	42614.33
Forest	9817.01	29697.89
Waste Land	5777.38	4297.19
Water bodies	1840.69	1352.96
Grand Total	**79353.65**	**85113.18**

Source: West Bengal Land Revenue Department.

2. Industry and Agriculture

114. **Agriculture.** In spite of presence of small and marginal farmers, agriculture accounts almost 70 per cent of the district's total income. Due to land reforms, usage of high fertile and hybrid crops, the district has overcome its poor state as was to be in the past. Only 60 to 65 per cent of the total land area of the district is fertile due to availability of sufficient water supply either by canal or deep tube wells. Agricultural land of the district is of three types- Sali, Suna and Tara or Danga. 'Sali' is suitable for growing of aman rice, 'Suna' for various crops like 'aus' kharif, sugarcane, cotton, tobacco, mustard etc. 'Suna' is also used for production of fine kind of rice. Remaining lands of the district is not cultivable due to undulation of land and morum soil.

115. Agriculture in the district is largely dependent of monsoon. Drought constitutes a major hazard in the district. Intermittent gaps of in precipitation and moisture stress during the monsoon gives rise to serious setback in production during the Kharif, which is the main stay of Agriculture in the district. Farmers are working hard to get more production of crop with their limited area of land. Seed farms are working jointly. Fertilizers are available at every village. The main agricultural crop is paddy and it is produced in the 90.0 per cent of the total cultivated area of the district. Wheat, barley, jute and potato are the other important agricultural products of the district.

116. **Agriculture scenario in Indpur Block**. In 2013-14, persons engaged in agriculture in Indpur community development block could be classified as follows: bargadars 2.82%, patta (document) holders 6.88%, small farmers (possessing land between 1 ha and 2 ha) 10.11%, marginal farmers (possessing land up to 1 ha) 25.60% and agricultural labourers 54.59%.In 2013-14, the total area irrigated in Indpur community development block was 6,290 ha, out of which 3,570 ha was by canal water, 850 ha by tank water, 1,800 ha by river lift irrigation, 40 ha by open dug wells and 30 ha by other methods. In 2013-14, Indpur community development block produced 3,573 ton of Aman paddy, the main winter crop, from 1,611 ha, 284 ton of wheat from 128 ha and 182 ton of potatoes from 7 ha. It also produced pulses and mustard.[17]

[17] Wikipedia. Indpur (community development block). References 14. District Statistical Handbook 2014 Bankura.

117. **Agriculture scenario in Taldangra Block**. In 2013-14, persons engaged in agriculture in Taldangra community development block could be classified as follows: bargadars 8.06%, patta (document) holders 17.16%, small farmers (possessing land between 1 and 2 ha) 5.44%, marginal farmers (possessing land up to 1 ha) 16.38% and agricultural labourers 52.97%. In 2013-14, the total area irrigated in Taldangra community development block was 16,984 ha, out of which 12,262 ha was by canal water, 1,435 ha by tank water, 1,300 ha by river lift irrigation, 232 ha by deep tube well, 1,350 ha by shallow tube well, 5 ha by open dug wells and 400 ha by other methods. In 2013-14, Taldangra community development block produced 4,429 ton of Aman paddy, the main winter crop, from 1,922 ha, 4,424 ton of Aus paddy from 1,921 ha, 1,474 ton of Boro paddy from 503 ha, 549 ton of wheat from 329 ha and 40,671,000 ton of potatoes from 879 ha. It also produced pulses and mustard.

3. Horticulture

118. Land utilization pattern reveals that only 59.5 percent of total land is under cultivation. The district has a vast area of cultivable wasteland comprising 2 percent of total geographical area. A part of that is acidic-alkaline or sand cast. These areas offer scope for further development.

119. On the other hand, the agro-climatic condition of the district is suitable for plantation/horticulture. Mulberry and arjun plantation and horticultural crops such as mango, guava, cashew nut, jackfruit, banana, papaya, citrus fruits etc. can be grown in large scale. There is also scope for development of floriculture, medicinal and aromatic plants in the district. Total area under horticultural crops in the district in around 4775 ha and that under mulberry and arjun plantation is 4606 ha.

120. Area of culturable wasteland in the district is 18846 ha, a major part of which can be utilized for the purpose. There are seven seed farms, one Horticultural Research and Development Centre at Taldangra and about two hundred and fifty seed-dealers in the district.
Systematic identification of areas to be covered under plantation/horticulture, getting timely supply of planting materials and other inputs like technical advice, marketing arrangement, market information enabling the farmers to fetch remunerative price are the need of the day. The activity will help marginal and small farmers, to generate employment, improve nutritional standards through development of wasteland and soil conservation by peripheral plantation.
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4. Animal Husbandry

121. In animal husbandry, Bankura district occupies a moderate position in the State. Major problem relating to milk production and meat are shortage of green fodder and inadequate supply of improved breed of animals. By promoting fodder cultivation, encouraging farmers towards crop diversification for fodder cultivation, increasing awareness through exposure visits and conducting health camps, the above problem could be overcome. Dairy development is one of the major economic activities in the district.

5. Fishery

122. Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years, but still due to some unavoidable reasons we regularly find fishes purchased from Andhra Pradesh in most of the district's fish markets. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmonipur.

123. Under Rashtriya Sam Vikas Yojana (RSVY), nearly 81 hectors of pond area have been excavated. The scheme has been implemented through fishermen's groups in a participatory mode. The fishermen's groups have been encouraged to share a small part of the produce with the Primary Schools to make it a part of the mid-day meal. This has created a stake of community at large in the project.

124. As far as activities of fishery sector in Bankura are concerned, fish-breeding industries in Ramsagar and surrounding zone requires special mention. Transaction of about ₹6-7 crores through spawn production of about 50,000 million numbers in 225 to 250 numbers of hatcheries per annum occurs in that zone. About 1500 to 2000 numbers of workers are directly involved in production system and many other enterprises have grown by co-related activities. Spawn purchasers from different parts of India come here every year to purchase various types of spawn.

6. Industry

125. An overwhelming agro-economic base and low urbanization and industrialization characterize the district of Bankura. The district is broadly divided into two regions – the alluvial plains in the east and the undulating tract to the west. Within the district and even within these regions, the villages vary not only in their geographical features but also in their physical forms and composition their economic and social life patterns. Agricultural activities and most its employment and priority is being accord to its development.

126. The mines and minerals play a vital role in the economy of Bankura. Mines and minerals based ventures have already come up on the stretch of land from Bankura to Saltora. In areas like Chhatna, Saltora Khatra, Ranibundh, Bankura to Indpur stretch and Raipur, Taldangra, the prospects for setting up of mines and minerals based industries are, indeed bright subject to environmental clearance.

127. The community development blocks like Bishnupur, Sonamukhi, Patrasayer, Indus, Joypur, Kotulpur have been setting up Agriculture based Industries like rice and oil mills. There is scope for more. The climate is also conducive for food processing ventures.

128. The forest wealth of Khatra and Ranibandh areas has always been remarkable. Various types of medicated trees are available in these forests which are largely exported to neighbouring districts and also outside the State. There are serious scopes to develop industries in connection with the available medicated trees which will generate employment opportunities for local inhabitants. Due to lack of water and undulated alluvial sandy soil, huge lands are remaining vacant which can be upgraded by using modern techniques. The plants which need little water may be planted in these areas. Moreover, new species of herbs and medicinal plants may be planted in the vacant areas and unutilized forest lands.

129. Cottage and Small Scale Industry constitutes a major segment of district's economy. It provides maximum employment opportunity next to agriculture and this accounts nearly 9 per cent of the total income of the district. This field could be developed more by using modern technology and other infrastructure facilities. Effort has been taken up for the improvement designs, marketing assistance and finance etc. specially in case of brass and bell metal craft, conch shell products, fishing hook, pottery and leather products etc. through different development agencies. Rural people of tribal areas are engaged in Babui Rope making and Sal leaf production.

130. The major large scale industrial unit in the district is Mejia Thermal Power Project. It has got All India recognition and is under the management of Damodar Valley Corporation (DVC). The cottage and small scale industry also constitute the major segment of the district's economy. In case of cottage industry, Bankura plays a dominant role in West Bengal. The silk products of Bishnupur are India famous and are also exported internationally. Tassar, Matka, Garad and Cotton Chadars (scarf) are produced in this district. The total products like the Conch shell products of Bishnupur and Bankura (Sadar) Sub-Divisions are famous in this state. The Brass and Bell Metal products, Wood Carved products, Soft Stone products, Clay products are also produced in the district. The Terracotta toys of the district are world famous and are exported to different parts of the country and also exported to different countries outside India

7. Infrastructure

131. **Transport.** The major modes of Transport in Bankura is Road and Rail transport. By road, it is connected to the other districts of West Bengal. By rail, Bankura is served by the South-Eastern division of Indian Railways. The existing railway track passing through the district has a direct connectivity to the important nearby places like Kolkata, Asansol, Kharagpur, Ranchi, Tatanagar and Dhanb.

132. In 2013-14, Indpur community development block had 7 originating/ terminating bus routes. The nearest railway station is 15 km from the community development block headquarters. The Kharagpur-Adra line of South Eastern Railway passes through this CD Block. There is a station at Bheduasole. State Highway 2 (West Bengal) running from Bankura to Malancha (in North 24 Parganas district) passes through this community development block.[18]

133. In 2013-14, Taldangra community development block had 10 originating/ terminating bus routes. The nearest railway station is 25 km from the community development block headquarters. National Highway 14, (old numbering National Highway 60), running from Morgram to Kharagpur, passes through this community development block. State Highway 2 (West Bengal) running from Bankura to Malancha (in North 24 Parganas district) and State Highway 9 (West Bengal) running from Durgapur (in Bardhaman district) to Nayagram (in Paschim Medinipur district) pass through this community development block.

134. **Trade and Commerce.** Due to lack of adequate industries, trade and commerce of the district didn't flourished as other districts of the state. Jhantipahari, Chhatna, Bankura, Onda, Gangajalghati, Beliatore, Ramsagar, Barjora, Asaria, Pakhanna, Maliara, Kotulpur and Patrasayer are the main centres for transaction in paddy and rice. In Sonamukhi, Raipur and Sarenga jute is purchased and sold. Sonamukhi, Indus and Kotulpur are also the important trading centres of the district where potato and sugarcane are purchased and sold.

135. **Electricity and Power:** In Bankura district, the per capita consumption of commercial energy like coal, petroleum and electricity is very low as compared to the adjoining districts. Since last Five Year Plan, the demand of electricity from the rural area has strongly emerged, out of 3,826 numbers of mouza in the district 2,412 mouzas have declared electrified up to 31 March 2000.

136. The existence of Mejhia Thermal Power Plant within the district and other thermal power plants in Durgapur and Kolaghat can be a boon for the proposed industries for Bankura, as transmission-loss can be minimum due to proximity of the district to these power plants. The

[18] Wikipedia. Indpur community development block). References 19. List of State Highways in West Bengal.

electrical grid in the district is well-knit with the existence of two numbers of 132/33/11 KV sub-station and 24 numbers of 33/11 KV sub-station. On the other hand, per capita domestic consumption of electricity is also very low compared to the adjoining districts. Thus, abundance of electricity can be used for setting up of industries in the entire district.197 or 89% of mouzas in Indpur community development block and 141 or 97% of mouzas in Taldangra community development block were electrified by 31 March 2014.

8. Mineral Resources

(i) Coal. The coal mines are situated in Saltora, Mejhia, Barjora and Gangajalghati area. Mejhia itself holds 10 coal mines.
(ii) Copper. The district has a deposit of copper at Damdi, Mukutmanipur, Khatra, Sarong, Nilgiri and Narayanpur. Near Kangsaboti Dam, a 2 km. long ridge of copper has been found.
(iii) Tungsten. It's a rare metal with vast demand in India and other countries. Chhendapathar and Porapahar have the deposit of this metal in the whole state.
(iv) Cayanite. This is another valuable mineral used in heater, high temperature instruments etc. At Balarampur (near Mukutmanipur), a huge amount of deposit (20 km long) has been found.
(v) Cheoline. An excessive deposit of cheoline or china-clay can be found at Jalahari Pahar, Dhatara, Malti, Thakurdungry etc. and in many places of Taldangra police station.
(vi) Mica. Bankura is one of the three districts of West Bengal in which mica is available. Almost 100 numbers of pegmatite have been found in Khatra, Indpur, Bankura Town, Gangajalghati and jhilimily though most of them are in the form of either small shaped sheets or powdered form.

137. Education Bankura district had a literacy rate of 70.26% as per the provisional figures of the Census of India 2011. Bankura Sadar subdivision had a literacy rate of 69.56%, Khatra subdivision 69.79% and Bishnupur subdivision 71.60%.

138. In 2013-14, Indpur community development block had 169 primary schools with 12,400 students, 13 middle schools with 1,741 students, 12 high schools with 7,364 students and 13 higher secondary schools with 10,695 students. Indpur community development block had 1 general college with 2,096 students and 254 institutions for special and non-formal education with 8,297 students. Indpur community development block had 7 mass literacy centers.

139. In 2013-14, Taldangra community development block had 172 primary schools with 12,132 students, 15 middle schools with 2,363 students, 10 high schools with 6,384 students and 15 higher secondary schools with 13,486 students. Taldangra community development block had 1 general college with 2,337 students, 3 professional/technical institution with 486 students and 244 institutions for special and non-formal education with 7,237 students

9. Healthcare in Indpur and Taldangra Blocks

(i) In 2014, Indpur community development block had 1 rural hospital, 3 primary health centers and 1 private nursing home with total 55 beds and 5 doctors. It had 27 family welfare subcenters and 1 family welfare center. 7,120 patients were treated indoor and 211,362 patients were treated outdoor in the hospitals, health centers and subcenters of the community development block.

(ii) In 2014, Taldangra community development block had 1 rural hospital, 4 primary health centers and 1 private nursing home with total 74 beds and 11 doctors. It had 26 family welfare sub centers and 1 family welfare center. 8,207 patients were treated indoor and 300,423 patients were treated outdoor in the hospitals, health centers and subcenters of the community development block.

E. Socio Cultural Resources

1. Demography

140. The population of the district[19] is 3,596,674 of which male and female were 1,840,504 and 1,755,788, respectively. It is the 3rd least populated district in West Bengal after Alipurduar and Purulia, with Population Density of 523 persons/km^2. Average literacy rate of Bankura in 2011 were 70.95 % compared to 63.44% of 2001. If things are looked out at gender wise, male and female literacy were 81.00% and 60.44%, respectively. With regards to Sex Ratio in Bankura, it stood at 954 per 1000 male compared to 2001 census figure of 952.

141. Total population of select 2 project blocks is 304,415 (rural 304.415 and urban nil) as per 2011 census. Scheduled Castes numbered 102,435 (33.64%) and Scheduled Tribes numbered 35,600 (11.69%) as per 2011 census. Main language spoken in the project area is Bengali.

Table 23: Demographic Characteristics

Demographic Parameters	West Bengal State	Bankura District	Indpur Block	Taldangra Block
Total Population (2011)	91,276,115	3,596,674	156,522	147,893
Male	46,809,027	1,838,095	80,556	74,999
Female	44,467,088	1,758,579	75,966	72,894
Geographical area (km^2)	88,752	6,882	116.14	172.73
Total households	20,380,315	765,536	31,668	31312
Decadal Growth rate (2001-11) (%)	13.84	12.64	13.57	14.87
Sex ratio (Per 1000)	950	954	943	972
Population Density, (per km2)	1028	523	512	490
literacy rate (%)	76.26	70.95	67.42	70.87
literacy rate (male) (%)	81.69	81.00	79.87	75.44
literacy rate (female) (%)	70.54	60.44	55.30	55.81
% of urban population (%)	31.87	8.3	0	0
SC Population (%)	23.5	32.65	40.59	26.30
ST Population (%)	5.8	10.25	9.59	13.93
Total workers (%)	38.08	40.77	40.50	42.20
Male workers (%)	57.07	57.17	69.63	67.99
Female workers (%)	18.08	23.62	30.29	13.50
Main workers (%)	28.14	25.48	20.01	23.05
Marginal workers (%)	9.94	15.29	20.49	19.15
Cultivators (%)	14.72	21.12	20.24	21.89
Agricultural Labourers (%)	29.32	44.15	53.53	56.55

[19] District Census Handbook-2011.

Demographic Parameters	West Bengal State	Bankura District	Indpur Block	Taldangra Block
Household industry workers (%)	7.09	4.19	3.31	3.58
Other workers (%)	48.87	30.54	22.92	17.99

Source: Census 2011.

F. History, Culture and Tourism

142. The earliest signs of human habitation in the area was at Dihar. By about 1000 BC chalcolithic people had settled on the north bank of the Dwarakeswar.

143. In later pre-historic times this area was inhabited by various Proto-Australoid and a few Proto-Dravidian tribes. The tribes were spread across different strata of development – food-gathering, hunting, animal-raring and agriculture. Bankura district was part of Rarh in ancient times.

144. From around 7th century AD till around the advent of British rule, for around a millennium, history of Bankura district is identical with the rise and fall of the Hindu Rajas of Bishnupur.

145. Romesh Chunder Dutt wrote in the late 19th century, “The ancient Rajas of Bishnupur trace back their history to a time when Hindus were still reigning in Delhi, and the name of the Musalmans was not yet heard in India. Indeed, they could already count five centuries of rule over the western frontier tracts of Bengal before Bakhtiyar Khilji wrested the province from the Hindus. The Musalman conquest of Bengal, however, made no difference to the Bishnupur princes. these jungle kings were little known to the Musalman rulers of the fertile portions of Bengal, and were never interfered with. For long centuries, therefore, the kings of Bishnupur were supreme within their extensive territories. At a later period of Musalman rule, and when the Mughal power extended and consolidated itself on all sides, a Mughal army sometimes made its appearance near Bishnupur with claims of tribute, and tribute was probably sometimes paid. Nevertheless, the Subahdars of Murshidabad, never had that firm hold over the Rajas of Bishnupur which they had over the closer and more recent Rajaships of Burdwan and Birbhum. As the Burdwan Raj grew in power, the Bishnupur family fell into decay; Maharaja Kirti Chand of Burdwan attacked and added to his zamindari large slices of his neighbour’s territories. The Marathas completed the ruin of the Bishnupur house, which is an impoverished zamindari in the present. day.”

146. The area around Bishnupur was called Mallabhum the core area would cover present day Bankura police station area (excluding Chhatna), Onda, Bishnupur, Kotulpur and Indas. In olden days, the term was used for a much larger area, which probably was the furthest extent of the Bishnupur kingdom. In the north it stretched from Damin-i-koh in Santhal Parganas to Midnapore in the south. It included the eastern part of Bardhaman and parts of Chota Nagpur in the west. Portions of the district appear to have been originally the homes of aboriginal tribes, who were gradually subdued. The Khatra region was Dhalbhum, the Raipur region was Tungbhum, and the Chhatna region was Samantabhum. They were eventually overshadowed by the Malla kings of Bishnupur. There also are references in old scripts to Varahabhumi or Varabhumi (present day Barabhum) on whose borders run Darikesi river, and Sekhara mountain (probably present day Pareshnath).

147. Adi Malla was the founder of the Malla dynasty. Adi Malla ruled in Laugram for 33 years and has been known as the Bagdi Raja. He was succeeded by his son, Jay Malla, who invaded Padampur and captured the fort, then the power-centre. Jay Malla extended his domains and shifted his capital to Bishnupur. The subsequent kings steadily extended their kingdom. Among

the more renowned are: Kalu Malla, the fourth in line, Kau Malla, the sixth in line, Jhau Malla, the seventh in line, and Sur Malla, the eighth in line, who defeated the Raja of Bagri, a place now in northern Midnapore. He was followed by 40 other kings, all of whom were known as Mallas or Mallabaninath, which means lords of Mallabhum or Mallabani. Family records show that they were independent of foreign powers.

148. Bir Hambir, the 49th ruler of the Malla dynasty who flourished around 1586 AD and ruled in 16th-17th century, was a contemporary of the Mughal emperor Akbar. Bir Hambir was both powerful and pious. He was converted to Vaishnavism by Srinivasa. There is mention in two Vaishnava works, Prem-vilasa of Nityananda Das (alias Balaram Das) and Bhakti Ratnakara of Narahari Chakrabarti, about Srinivasa and other bhaktas (devotees) being robbed by Bir Hambir, when they were travelling from Vrindavan to Gaur with a number of Vaishanava manuscripts. However, Bir Hambir was so moved by Srinivasa's reading of Bhagavata that he converted to Vaishnavism and gave Srinivasa a rich endowment of land and money. He introduced the worship of Madan Mohan in Bishnupur.

149. Raghunath Singh, who followed Bir Hambir, was the first Bishnupur Raja to use the Kshatriya title Singh. It is said that he was conferred upon with this title by the Nawab of Murshidabad. Bishnupur kingdom had entered its golden age. With exquisite palaces and temples built during the period that followed Bishnupur was reputed to be the most renowned city in the world, more beautiful than the house of Indra in heaven. However, it has also been recorded that while these royal patrons of Hindu art and religion were busy building temples they had lost much of their independence and sunk to the position of tributary princes. Raghunath Singh built the temples of Shyam Rai, Jor Bangla and Kalachand between 1643 and 1656.

150. Bir Singh built the present fort, the temple of Lalji in 1658, and seven big lakes named Lalbandh, Krishnabandh, Gantatbandh, Jamunabandh, Kalindibandh, Shyambandh and Pokabandh. His queen, Siromani or Chudamani, built the temples of Madan Mohan and Murali Mohan in 1665. He walked up alive all his sons, eighteen in number. The youngest, Durjan, alone escaped, having been kept in hiding by the servants.

151. Durjan Singh built the Madan Mohan temple in 1694. According to family records, the kings of Bishnupur continued to pay tribute to the Muslim rulers but they were free to do things internally. There was no interference by the Muslim rulers in the internal affairs of Bishnupur. This is also confirmed by Muslim historians. The status of the Raja of Bishnupur was that of a tributary prince, exempted from personal attendance at the court at Murshidabad, and represented there by a resident. The Bishnupur Rajas who were at the summit of their fortunes towards the end of the 17th century, started declining in the first half of the 18th century. First, the Maharaja of Burdwan seized the Fatehpur Mahal, and then the Maratha invasions laid waste their country.

152. While they failed to take the fort and pillage the treasury, the Marathas harried the less protected parts of the kingdom. The Maratha chief, Sheobhat, made Bishnupur his headquarters in 1760 during the invasion of Shah Alam. The Marathas fell with their heaviest weight on border principalities such as Bishnupur and Birbhum. Exactions of a hundred sorts reduced the once powerful kingdom to poverty. The tenants fled and the country became desolate.

153. Chaitanya Singh was another pious ruler unfit to face the difficulties. As he was too involved in religious matters he did not have time for administrative matters. He faced internal feuds. Damodar Singh, a cousin of his, tried to gain power. He was able to convince the court at Murshidabad about his capabilities. Initially, Siraj ud-Daulah lent him forces but he was unable to capture Bishnupur. Later, after the British defeated Siraj, Mir Jafar lent him stronger forces. He

succeeded in taking Bishnupur, and Chaitanya Singh escaped to Kolkata with the idol of Madan Gopal, but the British restored the latter to power. However, intrigue and litigation continued for many years. Litigation ruined the Bishnupur Raj family and eventually in 1806, the estate was sold for arrears of land revenue and bought up by the Maharaja of Burdwan.

154. **British Administration.** In the year 1760, Bishnupur was ceded to the British with the rest of Burdwanchakla. The Marathas had laid the country waste and famine of 1770 completed the misery of the kingdom. People swept away, cultivation failed and there was lawlessness everywhere due to lack of powerful administration as once the powerful king had been reduced to the status of a mere zamindar. Making Suri the capital, Bisnupur was united with Birbhum in 1787 but rebellious situation prevailed. Till 1793, Bankura continued to be part of Birbhum, when it was transferred to the Burdwancollectorate.

155. Towards the end of the 18th century, when Bankura was part of Jungle Mahals, certain portions of the district around Raipur were affected by the Chuar rebellion. The disturbances of the Chuars in 1832 in the western part of the district lead to the disbandment of the Jungle Mahals in 1833. Bishnupur was transferred to Burdwan. In 1872, the parganas of Sonamukhi, Indas, Kotulpur, Shergarh and Senpahari were transferred from Manbhum to Burdwan. In 1879, the district acquired its present shape with the thanas (Police Stations) of Khatra and Raipur and the outpost of Simplapal being transferred from Manbhum, and the thanas of Sonamukhi, Kotulpur and Indas being retransferred from Burdwan. However, it was known for some time as West Burdwan and it came to be known as Bankura district from 1881 onwards only. Since then there has been no change either in the physical boundary of the district or in the administration of justice.

156. **Tourist Attractions**. Bankura has gained wide appeal as a popular tourist destination. The district can legitimately take pride in having a wide range of spots attracting tourists for a variety of reasons ranging from Arts and Arcitecture, Terracota temples, dense virgin forests, hills and the scenic spots at Mukutmoipur etc.

157. Bankura district, falling under Eastern Chhotanagpur Plateau, looks like handpicked by Mother Nature and is blessed with old brown hills, murmuring rivers, ancient temples- all bearing testimony to a rich and resourceful culture and tradition.

158. Situated in the western part of the State of West Bengal it comes under the Burdwan division and it forms a part of what is popularly known as Rarh area in Bengal. Bishnupur town deserves a special mention in that the town hosts a good many temples like Madan Mohan temple, Shyam Roy temple and a short distance away at Jairambati the famous temple dedicated to Sarada Devi -Holy Mother for crores of devotees of the Ramakrishna Monastic Order. The town also has its own distinct musical tradition known as Bishnupur Gharana.

159. The hill at Biharinath and at Susunia are spots of natural wonder and ideal for trekking and going foot-loose.

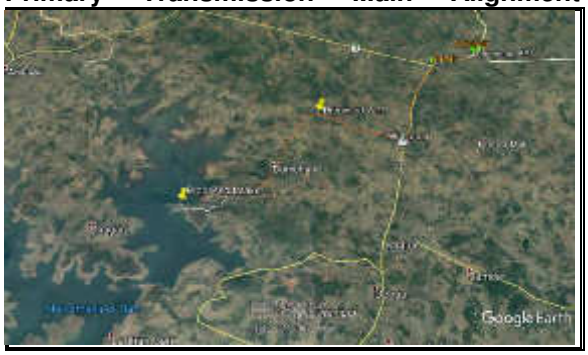
160. Mukutmonipur is situated in the confluence of river Kansabati and Kumari has the second largest earther Dam in India. Hemmed in by hillocks all around, the still waters of the lake offer a hypnotic visual of the azure sky above and is a delight for lovers of nature in its pristine beauty.

G. Subproject Site Environmental Features

161. The table below shows the site environmental features.

Table 26: Site Environmental Features

Infrastructure	Location and Environmental Features	Site Photograph
Head works (Raw water Intake with Fixed Type Jetty with arrangement for housing pumping machineries)	The Raw water source is Mukutmonipur reservoir. It is located at approximately 3.2 kilometer (km) upstream of the confluence of River Kangsabati and River Kumari about 12 km from Khatra town in the district of Bankur. The proposed intake site is located at Satsol Mouza of Khatra block. The coordinates are 22.984015 N latitude and 86.781074° E Longitude. There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake. Mukutmonipur reservoir has abundant water throughout the year even during lean period. Quality of river water is in general of acceptable quality as per IS 10500:2015 specification, which can be used for potable purposes after conventional treatment and disinfection. The Irrigation and Waterways Department (IWD) has already given a permission of drawl of 32 million liters per day (MLD) raw water.	**Proposed Intake location**  **Intake Point - Mukutmonipur Reservoir** 
Water Treatment Plant (WTP)	The identified land for 32 MLD WTP is 2.5km from the proposed intake point and belongs to IWD. The coordinates of the WTP location is 22.99777 N and 86.77412 E. The Topography is undulating and ground level of the site and surroundings are about 140 m above msl. The land is connected by an approach road to the nearby villages. As per local enquiries carried out during field visits, the site is not prone to flooding, and is barren land. The proposed WTP site is required to be developed including proper drainage infrastructure considering the undulating topography	**Water Treatment Plant Location** 

Infrastructure	Location and Environmental Features	Site Photograph
Intermediate Booster Pumping Station	Latitude.23.0715 N Longitude. 86.9056 E Average GL is 110m above msl. Reservoir storage capacity is 4400kl. The identified site of IBPS is located in the Gobindopur mouza of Indpur block and easily accessible by SH 2. The land of IBPS is privately owned land and will be acquired from private owner(s). Overall, there are no notable sensitive environmental features in and around the site.	
Primary Transmission Mains	Primary Transmission main of approximately 21 km is to be laid to transmit treated water from the WTP to IBPS. Since, the location of the (Intake and) WTP is on one side of the Project area, a single transmission main will have laid with progressively reduced diameters is proposed to feed the proposed IBPS. The Primary transmission main will be laid along the edge of the roads. The rising main is proposed to be laid primarily through open cut method. However, the laying of the rising main through open cut method may not feasible at major road crossings and congested market areas. It will also cross Supur main canal and River Silabati. About 150 m of the primary transmission main out of total 21 km length is proposed to be laid by trenchless methods in these stretches. Some trees required to be cut for laying of primary transmission main.	**Primary Transmission Main Alignment**  **Laying of Pipeline has to be done along the Edge of the Road** 

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

162. Potential environmental impacts of the proposed infrastructure components are presented in this section. Mitigation measures to minimize/mitigate negative impacts, if any, are

recommended along with the agency responsible for implementation. Monitoring actions to be conducted during the implementation phase is also recommended to reduce the impact.

163. Screening of potential environmental impacts are categorized into four categories considering subproject phases: location impacts and design impacts (pre-construction phase), construction phase impacts and operations and maintenance phase impacts and mitigation is devised for any negative impacts

(i) **Location Impacts** include impacts associated with site selection and include loss of on-site biophysical array and encroachment either directly or indirectly on adjacent environments. It also includes impacts on people who will lose their livelihood or any other structures by the development of that site.
(ii) **Design Impacts** include impacts arising from Investment Program design, including technology used, scale of operation/throughput, waste production, discharge specifications, pollution sources and ancillary services.
(iii) **Construction Impacts** include impacts caused by site clearing, earthworks, machinery, vehicles and workers. Construction site impacts include erosion, dust, noise, traffic congestion and waste production.
(iv) **O&M Impacts** include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams, and occupational health and safety issues.

164. Screening of environmental impacts has been based on the impact magnitude (negligible/moderate/severe – in the order of increasing degree) and impact duration (temporary/permanent).

165. This section of the IEE reviews possible project-related impacts, in order to identify issues requiring further attention and screen out issues of no relevance. ADB SPS (2009) require that impacts and risks will be analyzed during pre-construction, construction, and operational stages in the context of the project's area of influence.

166. The ADB rapid environmental assessment checklist in http://www.adb.org/documents/guidelines/environmental_assessment/eaguidelines002.asp has been used to screen the project for environmental impacts and to determine the scope of the IEE.

167. In the case of this project (i) most of the individual elements involve straightforward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and some works are located in the reservoir and (iii) being mostly located in an rural area and not falling in any environmentally sensitive zones will not cause direct impact on biodiversity values. The project will be in properties held by the local government and access to the project location is through public rights-of-way and existing roads hence, land acquisition and encroachment on private property will not occur.

A. Pre-Construction Impacts – Design and Location

168. **Design of the Proposed Components**. Technical design of the (i) intake facilities at river; (ii) water treatment plant; (iii) clear water mains, (iv) Intermediate Booster Pumping Stations and other items like flow meters, follows the relevant national planning and design guidelines, focusing

on providing a robust system which is easy to operate, sustainable, efficient and economically viable. Following environmental considerations are included in the project:

(i) Discontinuation of current unsafe and unsustainable groundwater sources and creating a new comprehensive surface water (river) based water supply system;
(ii) Recovering wash water from treatment process to optimise the water use;
(iii) Treatment and reuse of sludge from treatment process;
(iv) Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage;
(v) Reducing the incidence of water borne diseases by providing 100% population with potable water supplies;
(vi) Preparation and implementation of a water quality surveillance program including development of a laboratory as part of the project by DBO contractor to ensure that supplied water meets the drinking water standards;
(vii) Development of laboratory with all necessary environment, health and safety measures and adopting international standard procedures for water quality testing
(viii) Using low-noise and energy efficient pumping systems;
(ix) Installing the noise-producing pumps and motors etc., in enclosed buildings with noise reducing walls, and also maintaining adequate buffer to the nearby inhabited areas; and
(x) Provision of appropriate personal protection equipment to the workers and staff.

169. **Water Source Sustainability**. The source of raw water supply is Mukutmonipur reservoir which has abundant reserve of water throughout the year and principle source of water supply schemes for the Bankura and adjacent Puruliya districts. The proposed Intake is located at Satsol mouza of Khatra block.

170. Mukutmonipur reservoir has abundant flow throughout the year even during lean seasons. WBPHED already has a water supply scheme of 6.09 MLD from Mukutmanipur reservoir commissioned in the year 2008 for supplying water to Khatara and Ranibandh blocks serving approximately 73,600 persons in 72 Mouzas and is performing satisfactorily. The reservoir is also the source of another two proposed surface water based piped water supply schemes of PHED:(i) 27 MLD in Khatra, Hirbandh and Ranibandh blocks of Bankura district and (ii) 65 MLD for Manbazar and Bunduan blocks of adjacent Puruliya district. Based on the Mukutmonipur reservoir data of 2005-15 and considering the lowest water storage during lean season as on 1st June before onset of monsoon: the average water storage calculated is 86,440 million liters per day (MLD). The total ultimate abstraction for the WTP is 32 MLD up to design year 2035, which comprises only 0.03% of the total volume of available water during lean season (February to May). Therefore, the reservoir water is sufficient to meet the demand of the project during lean period. Quality of raw water is, in general, of acceptable quality and that which can be used for potable purposes after conventional treatment and disinfection. This further justifies considering the Mukutmonipur reservoir as the potential sustainable source of raw water. There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake. The IWD has already given a permission of drawl of 32 MLD raw water for drinking water purpose under the Bankura water supply project (Appendix 17).

171. **The Mukutmonipur Reservoir Water Quality and Suitability as Drinking Water Source**. Water quality tests of Mukutmonipur reservoir were carried out by the Public Health Engineering Department. It is noted from the water quality test results that all the chemical quality

parameters are well within the permissible values,[20] except iron. So, only conventional treatment process is adequate to meet potable water standards. No special or tertiary treatment is required. Iron content marginally exceeds the desirable value, but well within the permissible limit (value detected 0.41 mg/L, desirable limit 0.3 mg/L, permissible value 1.0 mg/L). Conventional water treatment and disinfection which is proposed in the project is adequate to make the water usable for drinking purposes. A regular water quality regime needs to be established for checking the raw water quality. The water supplied to the consumers at all times must meet the drinking water standards (Appendix 8).

172. Thus, as presented above, in terms of water availability and quality of water, selected sources are adequate and suitable to meet the project water demand, and there are unlikely to be any issues related source sustainability during the project life cycle.

173. **Use of Chlorine as Disinfectant**. It is proposed to use chlorine at WTP to disinfect the water prior to supply to consumers. There is invariably a safety risk when considerable quantities of chlorine are handled at the WTP. (Chlorine cylinders will be brought by trucks to the site, installed and operated to disinfect the water supplies). Since facilities are located in the urban area, precautions will thus be needed to ensure the safety of both workers and citizens.

174. The average dose of chlorine for pre-chlorination will be about 4mg/L and that for post-chlorination will be about 2 mg/L. With the design capacity of WTP 7.0 mgd, nearly 200 kg of chlorine will be consumed daily. Chlorine cylinders (called tonners of capacity 900 kg) will be procured from nearest manufacturing unit and stored at the site. Tonners sufficient for a month will be stored in the storage; i.e. 12-15 cylinders will be stored at the WTP.

175. To avoid any risk to workers and public, the chlorination facility at the WTP should be designed developed with all appropriate safety features and equipment to meet with any accidental eventuality, which may include:

(i) Chlorine neutralization pit with a lime slurry feeder;
(ii) Chlorine absorption and neutralization facility;
(iii) Proper ventilation, lighting, entry and exit facilities;
(iv) Visible and audible alarm facilities to alert chlorine gas leak;
(v) Facility for isolation in the event of major chlorine leakage;
(vi) Eye wash and shower facility;
(vii) Personal protection and safety equipment for the operators in the chlorine plant (masks, oxygen cylinders, gloves, etc.);
(viii) Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier;
(ix) Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Bengali Languages.

176. **Energy Efficiency**. Owing to almost flat topography of the project area, the water supply system requires pumping (using the electrical energy) to transport and supply water at requisite terminal pressure to the consumers. The raw water from the reservoir intake will be pumped to WTP inlet; within WTP it is mostly gravity flow, but requires energy to operate. From clear water reservoir at the WTP, water will be pumped to IBPS located centrally at Indpur block.

[20] Footnote 17.

177. To optimize the power consumption, the hydraulic design shall follow optimal approach, and the following shall also be considered in design and selection of pumping systems. According to Manual for the Development of Municipal Energy Efficiency Projects in India (jointly developed by Bureau of Energy Efficiency (BEE) and International Finance Corporation in 2008), energy savings, at minimum, of 25% to 40% is possible with appropriate measures. The following measures shall be considered and incorporated into the subproject designs:

(i) Installation of Energy Efficient Motors;
(ii) Efficient Pumping system operation;
(iii) Installation of Variable Frequency Drives (VFDs).

178. **Waste Water and Sludge from Water Treatment Plant - treatment and disposal**. Water treatment process will generate sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton etc.; and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. Following are included in the subproject design to dispose the sludge and back wash:

(i) Provision of recirculation system for backwash water – backwash water from filter beds will be recirculated to WTP inlet and mixed with raw water; this arrangement will minimize wastage of water, which otherwise would have disposed to open drains, and also avoids the pollution of receiving water body
(ii) Provision of sludge drying - accumulated sludge from clariflocculator will be flushed to sludge drying beds, for natural drying.
(iii) Dried sludge will be used as soil conditioner. Periodic testing of dried sludge will be conducted to ensure that it does not contain heavy metals that make it unsuitable for food crops. Tests will be conduct to confirm the concentrations below the following standards. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Municipal Solid Waste Management and Handling Rules, 2000 have been adopted here. The MSWMH Rules stipulate that “In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:

Parameters	**Concentration Not to Exceed**[a] (mg/kg dry basis, except pH value and C/N ratio)
Arsenic	10.00
Cadmium	5.00
Chromium	50.00
Copper	300.00
Lead	100.00
Mercury	0.15
Nickel	50.00
Zinc	1000.00
C/N ratio	20-40
pH	5.5-8.5

[a] Compost (final product) exceeding the above stated concentration limits shall not be used for food crops. However, it may be utilized for purposes other than growing food crops.

179. **Tree Cutting at Selected Project Sites**. The identified WTP and IBPS sites at is having few trees, which need to be cleared for the construction. Following measures need to be implemented to compensate for the loss of tree cover.

(i) Minimize removal of trees by adopting to site condition and with appropriate layout design;
(ii) Obtain prior permission for tree cutting;
(iii) Plant and maintain 5 trees for each tree that is removed.

180. **Development of Water Treatment Plant Site**. The WTP site identified and proposed is near to Mukutmonipur reservoir and belongs to the IWD, Govt. of West Bengal. The Ground level of the site and surroundings 140m above msl. The Topography is undulating. As per local enquiries carried out during field visits, the site is not prone for flooding, and barren land. The vulnerability mapping of the district for flood prone areas also indicates that the site is not prone to flooding. The proposed WTP site is required to be developed including proper drainage infrastructure.

181. **Utilities**. Telephone lines, electric poles and wires, water lines within the proposed project locations may require to be shifted in few cases. To mitigate the adverse impacts due to relocation of the utilities, the contractor, in collaboration with the PHED will (i) identify the locations and operators of these utilities to prevent unnecessary disruption of services during construction phase; and (ii) instruct construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.

182. **Site Selection of Construction Work Camps, Stockpile Areas, Storage Areas, and Disposal Areas**. Priority is to locate these near the project location. However, if it is deemed necessary to locate elsewhere, sites to be considered will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up construction camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals near forest areas, water bodies, or in areas which will inconvenience the community. All locations would be included in the design specifications and on plan drawings. Material stockpiles shall be protected by bunds during the monsoon to arrest the silt laden runoff into rivers/ drains. The subproject is likely to generate soil from excavations, which needs to be disposed safely or utilized locally.

183. **Site Selection of Sources of Materials**. Significant quantities of coarse aggregate and fine aggregate will be required for construction works. Requirement of gravel is limited. Contractor should procure these materials only from the quarries permitted/licensed by Mines and Geology Department. Contractor should, to the maximum extent possible, procure material from existing quarries, and creation of new quarry areas should be avoided as far as possible. If new quarries are required then the contractor will be responsible for obtaining all permissions and clearances, including environmental clearance for mining. It will be the construction contractor's responsibility to verify the suitability of all material sources and to obtain the approval of Department of Mines and Geology and local revenue administration.

B. Construction Impacts

184. Main civil works in the subproject include construction of Intake with Fixed Type Jetty with arrangement for housing pumping machineries, water treatment plant, ground level storage reservoirs, pumping stations, at the identified sites. These works will be confined to sites, and construction will include general activities like site clearance, excavation for foundations, and creation of concrete structures will be one of the major construction activities for this project, as

many of the subproject components will be fixed to concrete plinths and most will be housed in buildings with at least some concrete structural elements. Most such structures will be constructed from reinforced concrete, where steel reinforcing rods and bars are placed and attached by hand to create an interior skeleton for the foundations, walls, columns, plinths, etc., and heavy-duty metal and timber/plywood formwork is bolted around the outside to build a mould into which pre-mixed concrete is poured. Once the concrete has set, the formwork is removed, and the concrete surface is finished by masons by hand if necessary. Some buildings, such as the pump station, facilities, etc., may be constructed from brick work, in which case this work will be done using standard house-building techniques.

185. Most of the technical components of the WTP (intake pump station, intake screens, pre- and post-treatment systems and reverse osmosis racks) comprise a variety of pre-fabricated elements, which are installed on site as ready-made individual units. These will be directly brought from the manufacturers place to the sites lifted into position by crane, affixed to plinths or other installation points, and connected up to pipework and the electricity supply.

186. Since these works are confined to the boundary of identified sites, there is no direct interference of construction work with the surrounding land use. However, construction dust, noise, use of local roads for transportation of construction material, waste, labour camps etc., will have negative impacts, which needs to be avoided or mitigated properly.

187. Subproject also includes laying of approximately 21 km. long Primary Transmission Main pipeline from WTP to Intermediate IBPS. it is proposed to lay the pipeline partly by trenchless technology, especially at the junctions where the pipeline crosses busy roads. In the other sections, it will be laid by open cut method. Appropriate trenchless technology will be adopted by the contractor such as modern micro tunneling with boring pipe jacking technique. Although the main purpose of trenchless here is to lay the pipelines at the sections where it crosses main roads to avoid road closures and traffic disruptions, other important issues such as large scale public inconvenience, safety, and blocking access to properties, business and houses will also be considered while selecting the sections for trenchless approach.

188. Open cut trenching method of pipe laying involves excavation for laying pipes along the roads, placing pipes in the trench, jointing and testing, and refilling with the excavated soil. The trenches will be of 1.5 m – 2.0 m wide and 2 to 3 m depth. Earth work excavation will be undertaken by machine (backhoe excavator) and include danger lighting and using sight rails and barricades at every 100 m., while pipe laying works will include laying pipes at required gradient, fixing collars, elbows, tees, bends and other fittings including conveying the material to work spot and testing for water tightness. Sufficient care will be taken while laying so that existing utilities and cables are not damaged and pipes are not thrown into the trenches or dragged, but carefully laid in the trenches. As trenches are 2-3 m deep, there is risk of collapse of trenches or damage to surrounding buildings. Necessary precautions such as bracing or shoring in the trench will be provided. Once they are laid, pipes will be joined as per specification and then tested for any cracks of leakages. The minimum working hours will be 8 hours daily; the total duration of each stage depends on the soil condition and other local features. About 95% of the excavated soil will be used for refilling the refilling the trench after placing the pipe and therefore residual soil after pipe laying and refilling is not significant.

189. Although pipe laying work involves quite simple techniques of civil work, the invasive nature of excavation and pipeline alignment in the built-up areas will result in impacts to the environment and sensitive receptors such as residents, businesses, and the community in

general. These anticipated impacts are temporary and for short duration, however, needs to be mitigated.

190. Anticipated impacts during the construction phase are discussed below along with appropriate mitigation measures to avoid, minimize or mitigate those impacts to acceptable levels.

191. **Sources of Materials**. Significant amount of sand and coarse aggregate will be required for this project, which will be sourced from quarries. Quarries inevitably cause extensive physical changes; as construction materials are excavated from the ground, leaving large cavities, or leveling hillsides, etc. The physical damage caused by quarries is controlled by allowing them to operate within specific limited areas only, so the damage is restricted in extent and not allowed to spread indiscriminately. New quarries are subject to a rigorous process of environmental assessment to ensure appropriate siting and adequate environmental controls on the operation. It will therefore be important to ensure that construction materials for this project are obtained from government approved licensed quarries only, to ensure these controls are in place. Contractor should avoid new borrow pits / quarries as far as possible, if necessary, all the permissions, including conduct of environmental assessment, and environmental clearance as necessary shall be obtained prior to start of quarrying activity. The contractor should also make a concerted effort to re-use as much excavated material from this project as possible. The construction contractor will be required to:

(i) Obtain construction materials only from government approved quarries with prior approval of PIU
(ii) PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval
(iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each source (quarry/ borrow pit)
(iv) Avoid creation of new borrow areas, quarries etc., for the project; if unavoidable, contractor to obtain all clearances and permissions as required under law, prior to approval by PIU.

192. **Air Quality**. Construction work, especially from earthwork activities, coupled with dry and windy working conditions, material and debris transport, and works along the public roads carrying significant traffic, have high potential to generate dust. Also, emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality. Anticipated impacts include dust and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons. Dust generation from construction work in sites like WTP, IBPS etc., will be mainly during the initial construction phase of earth work. As the site is confined, dust can be effectively controlled with common measures. Dust generation will be significant during pipeline laying along the roads. Increase in dust/ particulate matter in ambient air is detrimental, and may have adverse impacts on people and environment. To mitigate the impacts, construction contractors will be required to:

193. **For All Construction Works**

(i) Comply with the air pollution / dust control measures for construction activities stipulated by the “Direction of West Bengal Department of Environment under the Air Act, 1981 Direction No. EN/3170/T-IV-7 /001/2009 dated: 10 December 2009” (Ref Appendix 6);
(ii) Provide a dust screen around the construction sites at IBPS and WTP work sites;

(iii) Damp down the soil and any stockpiled material on site by water sprinkling;
(iv) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.) when transported by trucks;
(v) Clean wheels and undercarriage of haul trucks prior to leaving construction site/quarry;
(vi) Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water and unloading inside the barricaded area;
(vii) Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition
(viii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by trucks;
(ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site/quarry;
(x) Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water and unloading inside the barricaded area;
(xi) Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition
(xii) Apply water and maintain soils in a visible damp or crusted condition for temporary stabilization;
(xiii) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
(xiv) Cover the soil stocked at the sites with tarpaulins;
(xv) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation;
(xvi) Ensure that all the construction equipment, machinery is fitted with pollution control devises, which are operating correctly, and have a valid pollution under control (PUC) certificate.

194. **For Pipeline Works**

(i) Barricade the construction area using hard barricades (of 2 m height) on both sides
(ii) Initiate site clearance and excavation work only after barricading of the site is done
(iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.,), to the barricaded area
(iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area
(v) Undertake the work section wise: 100 – 200 m section should be demarcated and barricaded
(vi) Conduct work sequentially - excavation, pipe laying, backfilling; conduct pipe testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done.
(vii) Remove the excavated soil of first section to the disposal site; as the work progresses, sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust.
(viii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will generate dust from backfilled section. Road restoration shall be undertaken immediately.

195. **Surface Water Quality**. Run-off from stockpiled materials and chemicals from fuels and lubricants during construction works can contaminate downstream surface water quality of the streams. Project area is flat/undulating and receives considerable rainfall, although mostly confined during the monsoon months. The WTP site is located about 2.5 km from the raw water source. It is important that runoff from the construction areas, which may contain silt and chemical traces do not enter these water bodies. Impact will be temporary, and may not be significant, but needs to be mitigated. Construction contractor will be required to:

(i) All earthworks be conducted during the dry season to prevent the problem of soil run-off during monsoon season;
(ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
(iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;
(iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
(v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
(vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling;
(vii) Dispose any wastes generated by construction activities in designated sites; and
(viii) Conduct surface quality inspection according to the EMP.

196. **Pollution of Reservoir Water During Construction.** Construction of intake well in the reservoir, and construction of pipe-supporting bridge may lead to degradation of water quality due to increase in turbidity and chemical contamination from fuels and lubricants used in construction work. Increase in silt content and water turbidity, chemical quality can affect the aquatic life, silting/chocking of spill ways/ canals etc., Though the work is small scale, to ensure that any negative impacts are mitigated, the contractor will be required to:

(i) Select a construction methodology that is least disturbing, and appropriate for the in-situ soil condition, and able to complete the construction work in minimum time
(ii) Schedule the construction works during low flow period and ensure that works is completed during the same period to prior to onset of monsoon
(iii) Erect temporary barriers to form enclosed construction area with least disturbance
(iv) Allow adequate time settle the distributed solids to prior to pumping out water; only clear/clarified water shall be pumped back into the water body/reservoir; any silt laden water should be pumped to a silt pond
(v) Avoid/minimize use of fuels, chemicals and lubricants; ensure no spillage; and have an equipment spill and containment plan and appropriate materials on-site
(vi) Clean up the site after construction; excavated soil, debris, material shall be cleared from the river bed/bank properly
(vii) Conduct water quality inspection according to the Environmental Monitoring Plan (EMP)

197. **Groundwater Quality**. Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. In the project area, groundwater depth is shallow, there are numerous water bodies and ponds, and it also receives high rainfall during the monsoon. Conducting excavation works during non-monsoon season will certainly help, but due to high water table, water may collect in pits as

they are excavated. The water collected in excavated pits will contain silt and disposal of this in drainage channels lead to silting. To avoid this the contractor needs to be implement the following measures:

(i) Create a temporary drainage channel around the work area to arrest the entry of runoff from upper areas into the work area.
(ii) Pump out the water collected in the pits/excavations to a temporary sedimentation pond; dispose of only clarified water into drainage channels/streams after sedimentation in the temporary ponds.
(iii) Consider safety aspects related to pit collapse due to accumulation of water.

198. **Generation of Construction Wastes.** Solid wastes generated from the construction activities are excess excavated earth (spoils), discarded construction materials, cement bags, wood, steel, oils, fuels and other similar items. Domestic solid wastes may also be generated from the workers' camp. Improper waste management could cause odor and vermin problems, pollution and flow obstruction of nearby watercourses and could negatively impact the landscape. Construction waste will be disposed in line with the guideline issued by WB Pollution Control Board . Contractor in consultation with PHED will identify disposal sites for stockpile. Stockpiles shall not be situated such that they obstruct natural water pathways. Stockpiles shall not exceed 2m in height unless otherwise permitted by the Engineer. Generally PHED allows 1.2m height. The following mitigation measures to minimize impacts from waste generation shall be implemented by the contractor:

(i) Prepare and implement a Construction Waste Management Plan
(ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.,
(iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed of two approved designated areas immediately
(iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; site should have located away from residential areas, forests, water bodies and any other sensitive land uses
(v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit at workers' camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market
(vi) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed of in disposal sites approved by WBPCB;
(vii) Prohibit burning of construction and/or domestic waste;
(viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins.
(ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate.

199. **Noise and Vibration Levels**. IBPS site, WTP cum booster pumping station, and primary transmission main laying routes are located predominantly in a rapidly developing areas. All these sites are located close to habitation areas, where there are houses, schools and hospitals, religious places and businesses. The sensitive receptors are the general population in these areas. Increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads for laying of pumping main, operation of construction equipment like

concrete mixers, and the transportation of equipment, materials, and people. Vibration generated from construction activity, for instance from the use of pneumatic drills, will have impact on nearby buildings. This impact is negative but short-term, and reversible by mitigation measures. The construction contractor will be required to:

(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
(ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimise sound impact to surrounding sensitive receptor; and
(iii) Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s.
(iv) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;
(v) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
(vi) 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.

200. **Accessibility**. Excavation along the roads for laying of transmission main pipeline, hauling of construction materials and operation of equipment on-site can cause traffic problems. Roads connecting IBPS and WTP sites are narrow and carry considerable local traffic, mainly comprise bicycles, 2 wheelers, Mini trucks, auto rickshaws, buses etc. Cultivation is predominant in the area and large number of vehicles carrying vegetable produce to market can be seen in the area. Primary main pipeline work will be conducted along roads from WTP to IBPS location, which has potential to create accessibility to issues to surrounding houses and business, and may also affect the traffic movement. Works related to all the remaining components will be confined to the selected sites, therefore there is no direct interference of these works with the traffic and accessibility. Hauling of construction material, equipment, construction waste, etc., to and from the work site may increase the road traffic on local roads, which are not in good condition. This will further inconvenience the local community and road users. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

201. **Hauling (Material, Waste/debris and Equipment) Activities**

(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites
(ii) Schedule transport and hauling activities during non-peak hours;
(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
(iv) Drive vehicles in a considerate manner
(v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

202. **Pipeline Works**

(i) Confine work areas along the roads to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to

this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required

(ii) Leave spaces for access between mounds of soil to maintain access to the houses / properties

(iii) Provide pedestrian access in all the locations; provide wooden/metal planks over the open trenches at each house to maintain the access.

(iv) Inform the affected local population 1-week in advance about the work schedule

(v) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum.

(vi) Keep the site free from all unnecessary obstructions;

(vii) Coordinate with Traffic Police for temporary road diversions, where necessary, and for provision of traffic aids if transportation activities cannot be avoided during peak hours

203. **Socio-Economic – Income**. Only IBPS site is under private ownership, is required to be purchased at market price with the willingness of the land owners to sell their properly for the project. Resettlement and social issues are being studied in a parallel resettlement planning study of this subproject. Blocking of access to the business / livelihood activities, especially during pipeline laying along the roads, may impact the income of households. However, given the alignment of pipeline, trenchless technology for road crossing, and also the measures suggested for ensuring accessibility during pipeline works, no notable impact is envisaged.

204. **Socio-Economic – Employment**. Manpower will be required during the 24-months construction stage. This can result in generation of temporary employment and increase in local revenue. Thus, potential impact is positive and long-term. The construction contractor will be required to:

(i) Employ local labour force as far as possible

(ii) Secure construction materials from local market.

205. **Occupational Health and Safety**. Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

(i) Comply with all national, state and local labour laws (see Appendix 7);

(ii) Develop and implement site-specific occupational health and safety (OHS) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training[21] for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;

[21] 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 to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

(iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
(iv) Provide medical insurance coverage for workers;
(v) Secure all installations from unauthorized intrusion and accident risks;
(vi) Provide health and safety orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
(vii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
(viii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
(ix) Ensure moving equipment is outfitted with audible back-up alarms;
(x) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and
(xi) Disallow worker exposure to noise level greater than 85 dbas for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
(xii) Provide supplies of potable drinking water;
(xiii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances
(xiv) Overall, the contractor should comply with International Finance Corporation's Environment, Health and Safety (EHS) Guidelines[22] on Occupational Health and Safety.

206. **Work within Reservoir.** Since during construction of intake worker should have to work within Reservoir, special precaution particularly using safety equipment and training on swimming and mitigation under emergency situation is necessary**.**

207. **Community Health and Safety**. Pipeline works along the road, and hauling of equipment and vehicles have potential to create safety risks to the community. Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collision with pedestrians. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(i) Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency)
(ii) Enforce strict speed limit (20-30 kmph) for playing on unpaved roads, construction tracks
(iii) Night-time driving will be by exception only, as approved by the PIU to minimise driving risk and disturbance to communities
(iv) Adopt standard and safe practices for micro tunnelling
(v) Temporary traffic control (e.g. flagmen) and signs will be provided where necessary to improve safety and provide directions
(vi) All drivers will undergo safety and training

[22] International Finance Corporation, World Bank Group EHS Guidelines. General EHS Guidelines - 2.0 Occupational Health and Safety.

(vii) Public access to all areas where construction works are on-going will be restricted through the use of barricading and security personnel
(viii) Warning signs, blinkers will be attached to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation
(ix) The period of time when the pipeline trench are left open will be minimized through careful planning
(x) Control dust pollution – implement dust control measures as suggested under air quality section
(xi) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
(xii) Provide road signs and flag persons to warn of on-going trenching activities.

208. **Construction Camps.** Contractor may require to set up construction camps – for temporary storage of construction material (pipes, cement, steel, fixtures, fuel, lubricants etc.), and stocking of surplus soil, and may also include separate living areas for migrant workers. The contractor will however be encouraged to engage local workers as much as possible. Operation of work camps can cause temporary air, noise and water pollution, and may become a source of conflicts, and unhealthy environment if not operated properly. Potential impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(i) As far as possible located the camp site within the work sites (at IBPS and WTP sites); if any camp to be established outside these, then select a camp site away from residential areas (at least 50 m buffer shall be maintained);
(ii) Avoid tree cutting for setting up camp facilities;
(iii) Ensure that a proper compound wall is provided, and erect a wind/dust screen around;
(iv) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas;
(v) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit;
(vi) Provide proper temporary accommodation with proper materials, adequate lighting and ventilation, appropriate facilities for winters and summers; ensure conditions of liveability at work camps are maintained at the highest standards possible at all times;
(vii) Consult PIU before locating project offices, sheds, and construction plants;
(viii) Minimize removal of vegetation and disallow cutting of trees;
(ix) Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers;
(x) Camp shall be provided with proper drainage, there shall not be any water accumulation;
(xi) Provide drinking water, water for other uses, and sanitation facilities for employees;
(xii) Prohibit employees from cutting of trees for firewood; contractor should be provided proper facilities including cooking fuel (oil or gas; fire wood not allowed);
(xiii) Train employees in the storage and handling of materials which can potentially cause soil contamination;
(xiv) Recover used oil and lubricants and reuse or remove from the site;

(xv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for bio-degradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market;
(xvi) Remove all wreckage, rubbish, or temporary structures which are no longer required;
(xvii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site.

C. Operation and Maintenance Impacts

209. Operation and Maintenance of the water supply system will be carried out by Public Health Engineering Department directly or through an external operator. Operation will involve treatment of water in the WTP, disinfection with chlorine, conveying clear water by pumping from booster pumping station to centrally located Intermediate Booster Pumping Station for distribution in their respective zones via distribution system (comprising of overhead tanks and distribution pipes) that will be developed through another subproject under the WBDWSIP.

210. During its operation phase, WTP will treat 7 million gallons (32 million liters) of water every day. The main impact of WTP operation is from (i) generation of wastewater and sludge, (ii) noise from operation of pumps and motors, (iii) chlorine gas leakage risk, and (iv) consumption of electricity. All of these are duly considered in the design of WTP, and various measures such as the following are already incorporated into the project design:

(i) Recirculation and recovery of wastewater including backwash water generated from treatment process - backwash water from filter beds will be sent to a sump, and after allowing adequate time for settlement of solids, clarified water will be pumped back to WTP inlet. This arrangement will avoid pollution and also minimize wastage of water.
(ii) Collection of accumulated sludge, thickening, drying and reuse
(iii) Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage;
(iv) Using low-noise and energy efficient pumping systems;
(v) Installing the noise-producing pumps and motors etc., in enclosed buildings with noise reducing walls, and also maintaining adequate buffer to the nearby inhabited areas;
(vi) Provision of appropriate personal protection equipment to the workers and staff
(vii) Developing chlorine facility with all necessary safety measures.

211. Since backwash water is recovered and recirculated in the WTP, no wastewater will be generated from water treatment process. Water treatment process will generate sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton etc.; and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. In the WTP sludge will collected, thickened and disposed of or reused as soil conditioner. Sludge will be tested periodically for heavy metal concentration.

212. Water supply system will be operated using the standard operating procedures following an operating manual, which will be prepared by the DBO contractor. This will cover all necessary items such as preventive maintenance, periodic maintenance and emergency maintenance,

replacement of pumps, motors, and other electro-mechanical parts as per the design life to optimize energy use and system efficiency etc., Adequate resources – technical and financial, has been taken into consideration in the project design. Manual will also include safety awareness and mock drills for chlorine safety. Thus, considering the design and proposed operational procedures, it is unlikely that there will be any significant negative impacts due to WTP operation.

213. During the system design life (15/30 years for mechanical/civil components) it shall not require major repairs or refurbishments and should operate with little maintenance beyond routine actions required to keep the equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

214. The project is designed to deliver potable water in sufficient quantities to the consumers in their homes with proper terminal pressure. Source water quality data shows that Mukutmonipur reservoir water is suitable for drinking after conventional treatment and disinfection, and WTP has been designed to treat the source water to meet the drinking water standards. The quality of water supplied will be affected by the raw water quality and as well as treatment efficiency at the WTP. To ensure that water delivered to consumers at all times meets the drinking water standards, the following measures are suggested:

(i) Preparation and implementation of a water quality surveillance program including development of a laboratory as part of the project by DBO contractor to ensure that supplied water meets the drinking water standards
(ii) Water quality surveillance program to cover source, WTP and consumer end water quality
(iii) Development of laboratory with all necessary environment, health and safety measures and adopting international standard procedures for water quality testing

215. Recurrence of pipe bursting and leakage problems can be managed by the leak detection and water auditing surveys. PHED will be required to ensure that the leak detection and rectification time is minimized.

216. The residents of the project area will be the major beneficiaries of the improved water supply system, as they will be provided with a constant supply of better quality water, piped into their homes at an appropriate pressure. The project will improve the over-all health condition of the project area by controlling water borne diseases, so people should spend less on healthcare and lose fewer working days due to illness. Their economic status should also improve, as well as their overall health. This should also improve the environment of these areas, should deliver major improvements in individual and community health and well-being.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

217. The active participation of stakeholders including local community, NGOs/CBOs, etc., in all stages of project preparation and implementation is essential for successful implementation of the project. It will ensure that the subprojects are designed, constructed, and operated with utmost

consideration to local needs, ensures community acceptance, and will bring maximum benefits to the people. Public consultation and information disclosure is a must as per the ADB policy.

218. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders of the subproject are: residents, shopkeepers and businesspeople who live and work near sites where facilities will be built (WTP, GLSRs and Primary main pipeline), PHED, Government and utility agencies responsible for provision of various services in project area, and West Bengal Pollution Control Board. Secondary stakeholder is: NGOs and CBOs working in the area, community representatives, beneficiary community in general, government agencies, Government of India and the ADB.

B. Public Consultation

219. The public consultation and disclosure program is a continuous process throughout the project implementation, including project planning, design and construction.

1. Consultation during Project Preparation

220. Institutional consultations were conducted with the project agencies, and Government Departments such as PHED, Block Development Officer, Khatra, Panchyat Samity members, Pollution Control Board, Planning, Health and Sanitation wing officials etc. The subproject proposal is formulated in consultation with the local bodies in the project area to suit their requirements.

221. Focus-group discussions with affected persons and other stakeholders were conducted to learn their views and concerns. A socio-economic household survey has been conducted in the project area, covering sample households, to understand the household characteristics, health status, and the infrastructure service levels, and also the demand for infrastructure services. General public and the people residing along the project activity areas were also consulted during visits to the project sites. Important issues or concerns that were raised by the stakeholders during consultations along with photographs and attendance sheets are provided in Appendix 9. Further a project-level consultation workshop will also be conducted in the project area.

222. It has been observed that people are very happy about the project as the project area currently faces severe water problem due to lack of any potable water supply system due to depletion of groundwater level and fluoride contamination problem. People are very much willing to extend their cooperation as the project will be provide much needed potable water and enhance living standard of the public. There are no negative impacts perceived by the community, however, project team explained the likely issues during construction and proposed EMP to manage the negative impacts. Increasing traffic and disturbance to agricultural vehicle movement (vegetable transport from fields to market) during the work is raised during the meeting, and it was informed that proper care will be taken for movement of construction vehicles including traffic management plan, prior information to people etc., It was also informed no road closures anticipated due to this work, and if needed during the construction phase, alternative access will be provided. These measures are included in the EMP.

2. Consultation during Construction

223. Prior to start of construction, PIU in coordination with the local bodies will conduct information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings will be conducted to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction phase.

C. Information Disclosure

224. Executive summary of the IEE will be translated in Bengali and made available at the offices of PMU, PIU, Block offices, and also displayed on their notice boards. Hard copies of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE in English and Executive Summary in Bengali will be placed in the official website of the PHED, PMU after approval of the IEE by Government and ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

225. Public information campaigns to explain the project details to a wider population will be conducted. Public disclosure meetings will be conducted at key project stages to inform the public of progress and future plans. Prior to start of construction, the PMU/PIU will issue Notification on 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.

226. 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.

VII. GRIEVANCE REDRESS MECHANISM

A. Project Specific Grievance Redress Mechanism

227. A common Grievance Redress Mechanism (GRM) will be in place to redress social, environmental or any other project and/or subproject related grievances. The GRM described below has been developed in consultation with stakeholders. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per project entitlement matrix, and PMU and concerned PIUs will ensure that their grievances are addressed.

228. Affected persons 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 GP office or PMU or PIU office. Careful documentation of the name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area, and how the problem was resolved will be undertaken. PMU / HSGO together with PIU Safeguard Officers will have the joint responsibility for timely grievance redressal on safeguards and gender issues and for registration of grievances, related disclosure, and communication with the aggrieved party.

The affected persons will also be encouraged to seek a complaint registration number through the PIU.

229. The Grievance Redress Mechanism provides an accessible, inclusive, gender-sensitive and culturally appropriate platform for receiving and facilitating resolution of affected persons' grievances related to the project. A two-tier grievance redress mechanism is conceived, one, at project level and another, beyond project level. For the project level GRM, a Grievance Redress Cell will be established at PIU; the safeguards officers of the ESSU PIU, supported by the social safeguards specialist of DSICS will be responsible for conducting periodic community meetings with affected communities to understand their concerns and help them through the process of grievance redressal including translating the complaints into Bengali or English, recording and registering grievances of non-literate affected persons and explaining the process of grievance redress mechanism. All expedient and minor grievances will be resolved at field level; should the PIU fail to resolve any grievance within the stipulated time period, the PMU will be consulted and suggested actions by PMU taken by PIU with SPISC support, within specified time. PIU will also be responsible for follow-through for each grievance, periodic information dissemination to complainants on the status of their grievance and recording their feedback (satisfaction/dissatisfaction and suggestions). In the event that certain grievances cannot be resolved at project level, they will be referred to the District Steering Committee (DSC), which will also act as Grievance Redress Committee (GRC), particularly in matters related to land purchase/acquisition, payment of compensation, environmental pollution etc. Any higher than district level inter-departmental coordination or grievance redress required will be referred to the state level Steering Committee.

230. The GRM aims to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. All grievances – major or minor, will be registered. In case of grievances that are immediate and urgent in the perception of the complainant, the contractor, and supervision personnel from the PIU supported by design, supervision and institutional support consultant (DSISC) will try to successfully resolve them in consultation with the Member, Panchayat and the GP Pradhan. In case of larger issues, they will seek the advice and assistance of the SE PIU. Grievances not redressed through this process within/at the project level within stipulated time period will be referred to the DSC/GRC.

231. The DSC will be set up to monitor project implementation in each district. In its role as a GRC, the DSC will meet every month (if there are pending, registered grievances), determine the merit of each grievance, and resolve grievances within specified time upon receiving the complaint-failing which the grievance will be addressed by the state-level Steering Committee. The Steering Committee will resolve escalated/unresolved grievances received. Grievances remaining unresolved by Steering Committee may be referred by affected persons to appropriate courts of law. The multi-tier GRM for the project is outlined below (Figure 26), each tier having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required. The GRC will continue to function throughout the project duration. The PMU shall issue notifications to concerned PHE Divisions to establish the respective PIU (and field) level GRCs, with details of composition, process of grievance redress to be followed, and time limit for grievance redress at each level.

232. 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.

233. **Composition of Grievance Redress Committee and District Steering Committee**. The DSC, acting as GRC will have District Magistrate (Chairperson), Superintending Engineer, PIU as Member Secretary, Additional Executive Officer, Zilla Parishad, Assistant (Social and Environmental) Safeguard Officers of the Environment and Social Safeguard Units (ESSU) of the PIU, Institutional Support and Capacity Building Officer, PIU, Block Development Officers from respective blocks, and representatives from the affected village panchayat and / or community, if any, eminent citizens, CBOs and NGOs. The DSC/GRC must have a minimum of two women members. In case of any indigenous people impacts in future subprojects, the DSC/GRC must have representation of the affected indigenous people community, including at least one female indigenous person, the chief of the tribe or a member of the tribal council as traditional arbitrator (to ensure that traditional grievance redress systems are integrated) and an NGO working with indigenous people groups.

234. The Steering Committee will include Chief Secretary, as chair, Principal Secretary/Additional Chief Secretary, PHED, Principal Secretary, Panchayat and Rural Development, Principal Secretary, Finance, Principal Secretary, Irrigation and Waterways Development Department, Principal Secretary, Public Works Department, Engineering in Chief, PHED, Member Secretary, and Others as invitees.

235. **Areas of Jurisdiction.** The areas of jurisdiction of the GRC, headed by the District Magistrate will be (i) all locations or sites within the district where subproject facilities are proposed, or (ii) their areas of influence within the District. The Steering Committee will have jurisdictional authority across the state (i.e., areas of influence of subproject facilities beyond district boundaries, if any).

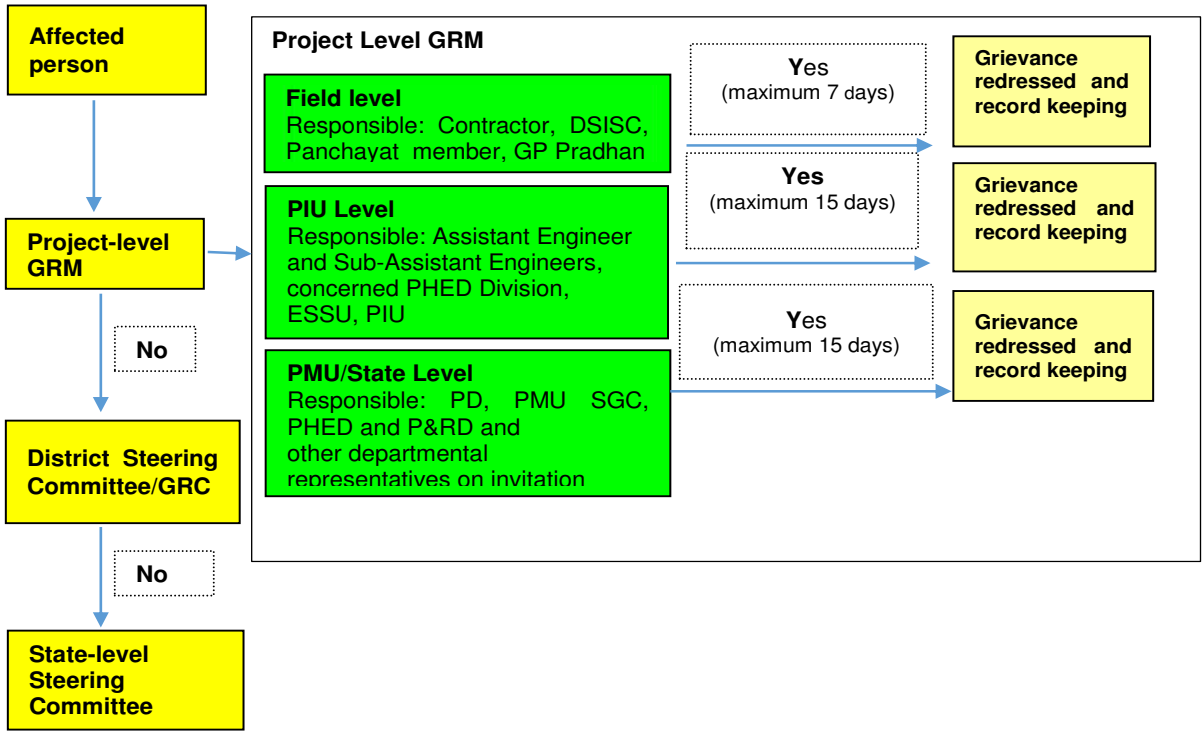
236. **Recordkeeping.** Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected and final outcome will be kept by PIU (with the support of DSISC) and submitted to PMU.

237. **Information Dissemination Methods of the Grievance Redress Mechanism**. The PIU, assisted by SPISC will be responsible for information dissemination to affected persons on grievance redressal procedure. GP/coverage area/affected area-wide public awareness campaigns will ensure that awareness on grievance redress procedures is generated through the consultation and participation plan. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The PIU assistant safeguard officers (environment and social) will be assisted by DSISC safeguards specialists with information/collateral/awareness material etc., and in conducting project awareness campaigns. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per agreed entitlement matrix including. who to contact and when, where/ how to register grievance, various stages of grievance redress process, time likely to be taken for redressal of minor and major grievances, etc. Grievances received and responses provided will be documented and reported back to the affected persons. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PMU and PIU offices, GP/concerned local panchayat notice boards and on the web, as well as reported in the semi-annual environmental and social monitoring reports to be submitted to ADB. A Sample Grievance Registration Form has been attached in Appendix10.

238. **Periodic review and documentation of lessons learned.** The PMU ESC will periodically review the functioning of the GRM and record information on the effectiveness of the mechanism, especially on the PIU's ability to prevent and address grievances.

239. **Costs**. All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the PMU. Cost estimates for grievance redress are included in resettlement cost estimates. The grievance redress process is shown in Figure 26.

Figure 8: Grievance Redress Mechanism



240. **ADB's Accountability Mechanism.** In the event that the established GRM is not in a position to resolve the issue, the affected person also can use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's developing member countries. Before submitting a complaint to the Accountability Mechanism, it is recommended that affected people make a good faith effort to resolve their problems by working with the concerned ADB operations department (in this case, the resident mission). Only after doing that, and if they are still dissatisfied, they could approach the Accountability Mechanism. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

241. An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels.

242. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between MPUDC, project management unit (PMU), project implementing unit (PIU), consultants and contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with. The EMP includes a monitoring program to measure the environmental condition and effectiveness of implementation of the mitigation measures. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries.

243. The contractor will be required to submit to PIU, for review and approval, a site environmental plan (SEP) 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 SEP; and (iv) budget for SEP implementation. No works are allowed to commence prior to approval of SEP.

244. A copy of the EMP/approved SEP will be kept on site during the construction period at all times. The EMP included in the bid and contract documents. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

245. For civil works, the contractor will be required to (i) carry out all of the mitigation and monitoring measures set forth in the approved SEP; and (ii) 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 SEP. The contractor shall allocate budget for compliance with these SEP measures, requirements and actions.

246. The following tables show the potential environmental impacts, proposed mitigation measures and responsible agencies for implementation and monitoring.

Table 24: Design Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Design of water supply system	Source sustainability and efficiency	(i) Discontinuation of current unsafe and unsustainable groundwater sources and creating a new comprehensive surface water (Mukutmonipur reservoir) based water supply system (ii) Recovering wash water from treatment process to optimize the water use (iii) Treatment and reuse of sludge from treatment process (iv) Designing the entire system to maintain optimal flow and terminal pressure, and optimizing the overall energy usage (v) Reducing the incidence of water borne diseases by providing 100% population including urban poor with potable water supplies (vi) Preparation and implementation of a water quality surveillance program including development of a laboratory as part of the project by design, build and operate (DBO) contractor to ensure that supplied water meets the drinking water standards (vii) Development of laboratory with all necessary environment, health and safety measures and adopting international standard procedures for water quality testing (viii) Using low-noise and energy efficient pumping systems (ix) Installing the noise-producing pumps and motors etc., in enclosed buildings with noise reducing walls, and also maintaining adequate buffer to the nearby inhabited areas (x) Provision of appropriate personal protection equipment to the workers and staff (xi) Conduct assessment for possible adverse impacts on aquatic species from construction and operations of the water intake and jetty	DBO Contractor / project implementation unit (PIU)	Project Costs
Chlorine usage as disinfectant at water treatment plant (WTP)	Chlorine handling and application risk – health and safety risk to workers and general public	Provide the following measure at the chlorine application unit: (i) Chlorine neutralization pit with a lime slurry feeder (ii) Chlorine absorption and neutralization facility (iii) Proper ventilation, lighting, entry and exit facilities (iv) Visible and audible alarm facilities to alert chlorine gas leak (v) Facility for isolation in the event of major chlorine leakage (vi) Eye wash and shower facility (vii) Personal protection and safety equipment for the operators in the chlorine plant (masks, oxygen cylinders, gloves, etc.,)	DBO Contractor / PIU	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(viii) Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier (ix) Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Bengali Languages.		
Layout plan of WTP and intermediate booster pumping station (IBPS)	Tree cutting	(i) Minimize removal of trees by adopting to site condition and with appropriate layout design of GLSRs (ii) Obtain prior permission for tree cutting (iii) Plant and maintain 5 trees for each tree that is removed	DBO Contractor / PIU	Project Costs

Table 25: Pre-Construction Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be taken in case of unintentional	Design, build and operate (DBO) Contractor in collaboration with project implementation unit (PIU) and with approval of project management unit (PMU)	(i) List of affected utilities and operators; (ii) Bid document to include requirement for a contingency plan for service interruptions (example provision of water if disruption is more than 24 hours), waste management plan and traffic management plan	Project cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		interruption of services. (iii) Require contractors to prepare spoils (waste) management plan (Appendix 11) and traffic management plan (Appendix 12)			
Construction work camps, stockpile areas, storage areas, and disposal areas.	Conflicts with local community; disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the project location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community.	DBO Contractor to finalize locations in consultation and approval of PIU	(i) List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas. (ii) Written consent of landowner/s (not lessee/s)	Project cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		(v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.			
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water	(i) Obtain construction materials only from government approved quarries with prior approval of PIU; (ii) PIU to review, and ensure that proposed quarry sources have all necessary	DBO Contractor to prepare list of approved quarry sites and sources of materials with the approval of PIU	(i) List of approved quarry sites and sources of materials;	Project cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
	logging, and water pollution.	clearances/permissions in place prior to approval (iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each source (quarry/ borrow pit) (iv) Avoid creation of new borrow areas, quarries etc., for the project; if unavoidable, contractor to obtain all clearances and permissions as required under law prior to approval by PIU			
Consents, permits, clearances, No Objection Certificates (NOCs), etc.	Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions and/or stoppage of works	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to award of civil works. (ii) Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (iii) Acknowledge in writing and provide	PIU and PMC	Incorporated in final design and communicated to contractors.	Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PIU.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		report on compliance all obtained consents, permits, clearance, NOCs, etc. (iv) Include in detailed design drawings and documents all conditions and provisions if necessary			
Asbestos Cement Pipes	Health risk due to exposure to asbestos materials	(i) Obtain details on location of underground asbestos cement pipes (ii) Locate the new piper carefully to avoid encountering asbestos cement pipes (ii) Leave the asbestos cement pipes undisturbed in the ground.	DBO Contractor in coordination with PIU and PMC	(i) Detailed construction drawings showing alignment of asbestos cement pipes	No cost required. Mitigation measures are part of terms of reference (TOR) of PIU and project management design, supervision consultant (PMDSC)

Table 26: Construction Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Environmental management plan (EMP) Implementation Training	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers will be required to undergo training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OHS), core labor laws, applicable environmental laws, etc.	Design, build and operate (DBO) Contractor	Project cost / project management unit (PMU) cost
Air Quality	Emissions from construction vehicles, equipment, and	**For all construction works**	DBO Contractor	Cost for implementation of mitigation

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	(i) Comply with the Direction of West Bengal Department of Environment under the Air Act, 1981 in controlling air pollution from construction activities (ii) Comply with the air pollution / dust control measures for construction activities stipulated by the "Direction of West Bengal Department of Environment under the Air Act, 1981 Direction No. EN/3170/T-IV-7 /001/2009 dated: 10 December 2009" (iii) Damp down the soil and any stockpiled material on site by water sprinkling; (iv) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by trucks; (i) Provide a dust screen around the construction sites at ground level storage reservoir (GLSR) and WTP work sites (iv) Clean wheels and undercarriage of haul trucks prior to leaving construction site/quarry (v) Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water and unloading inside the barricaded area (vi) Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition (vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by trucks; (x) Apply water and maintain soils in a visible damp or crusted condition for temporary stabilization (xi) Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process (xii) Cover the soil stocked at the sites with tarpaulins (xiii) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation (xiv) Ensure that all the construction equipment, machinery is fitted with pollution control devises, which are operating correctly, and have a valid pollution under control (PUC) certificate **<u>Pipeline works</u>**		measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(i) Barricade the construction area using hard barricades (of 2 meter or m height) on both sides and provide dust/wind screen (such geo textile fabric) up to 3 m height (1 m above the hard barricading) (ii) Initiate site clearance and excavation work only after barricading of the site is done (iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.,), to the barricaded area (iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area (v) Undertake the work section wise: 100 – 200 m section should be demarcated and barricaded (vi) Conduct work sequentially - excavation, pipe laying, backfilling; conduct pipe testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done. (vii) Remove the excavated soil of first section to the disposal site; as the work progresses, sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust. (viii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will generate dust from backfilled section. Road restoration shall be undertaken immediately.		
Surface water quality	Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality.	(i) All earthworks be conducted during the dry season to prevent the problem of soil run-off during monsoon season; (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used; (iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; (v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	Ponding of water in the pits/foundation excavations	(vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling (vii) Dispose any wastes generated by construction activities in designated sites; and (viii) Conduct surface quality inspection according to the EMP. (ix) Create a temporary drainage channel around the work area to arrest the entry of runoff from upper areas into the work area (x) Pump out the water collected in the pits/excavations to a temporary sedimentation pond; dispose off only clarified water into drainage channels/streams after sedimentation in the temporary ponds (xi) Consider safety aspects related to pit collapse due to accumulation of water		
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; (ii) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; (iii) Minimize 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; and (iv) Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. (v) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity (vi) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; (vii) 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.	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.
Landscape and aesthetics – waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as	(i) Prepare and implement a Construction Waste Management Plan (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.,	DBO Contractor	Cost for implementation of mitigation measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	(ii) Stockpiles, lubricants, fuels, and other materials should be located away from steep slopes and water bodies; (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed of to approved designated areas immediately; (iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; site should be located away from residential areas, forests, water bodies and any other sensitive land uses (iv) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit at workers' camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market (v) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed of in disposal sites approved by local authorities/WBPCB; (vi) Prohibit burning of construction and/or domestic waste; (vii) Ensure that wastes are not haphazardly dumped thrown within and around the project site and adjacent areas; provide proper collection bins, and create awareness to use the dust bins. (ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate		responsibility of contractor.
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure at specified project location	(i) Prepare a list of affected utilities and operators if any; (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of service	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.
Ecological Resources Terrestrial	Loss of vegetation and tree cover	(i) Minimize removal of vegetation and disallow cutting of trees; (ii) If tree-removal will be required, obtain tree-cutting permit and (iii) Plant 5 native trees for every one that is removed.	DBO Contractor	Cost for implementation of mitigation measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
				responsibility of contractor.
Accessibility	Traffic problems and conflicts near project locations and haul road	**Hauling (material, waste/debris and equipment) activities** (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites (ii) Schedule transport and hauling activities during non-peak hours; (iii) Locate entry and exit points in areas where there is low potential for traffic congestion; (iv) Drive vehicles in a considerate manner (v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. **Pipeline works** (i) Confine work areas along the roads to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required (ii) Leave spaces for access between mounds of soil to maintain access to the houses / properties (iii) Provide pedestrian access in all the locations; provide wooden/metal planks over the open trenches at each house to maintain the access. (iv) Inform the affected local population 1-week in advance about the work schedule (v) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum. (vi) Keep the site free from all unnecessary obstructions; (vii) Coordinate with Traffic Police for temporary road diversions, where necessary, and for provision of traffic aids if transportation activities cannot be avoided during peak hours	Construction Contractor	Cost for implementation of mitigation measures responsibility of contractor.
Socio-Economic - Employment	Generation of temporary employment and	(i) Employ local labor force as far as possible (iii) Comply with labor laws	DBO Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	increase in local revenue			
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Comply with all national, state and local core labor laws (see Appendix 7 of this initial environmental examination or IEE) (ii) Develop and implement site-specific occupational health and safety (OHS) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use personal protective equipment like helmet, gumboot, safety belt, gloves, nose musk and ear plugs; (c) OHS Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; (iii) Provide medical insurance coverage for workers; (iv) Secure all installations from unauthorized intrusion and accident risks; (v) Provide supplies of potable drinking water; (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) Provide health and safety orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; (viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; (x) Ensure moving equipment is outfitted with audible back-up alarms; (xi) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and (xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.		
Asbestos Cement Materials	Health risks associated with asbestos cement pipes	(i) leave asbestos cement pipes in-situ untouched	DBO Contractor	Contractor costs
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	(i) Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency) (ii) Enforce strict speed limit (20-30 kilometer per hour or kmph) for playing on unpaved roads, construction tracks (iii) Night-time haulage will be by exception only, as approved by the PIU to minimize driving risk and disturbance to communities (iv) Adopt standard and safe practices for micro tunneling (vi) Temporary traffic control (e.g. flagmen) and signs will be provided where necessary to improve safety and provide directions (vii) All drivers will undergo safety and training (viii) Public access to all areas where construction works are on-going will be restricted through the use of barricading and security personnel (ix) Warning signs, blinkers will be attached to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation (x) The period of time when the pipeline trench is left open will be minimized through careful planning (xi) Control dust pollution – implement dust control measures as suggested under air quality section (xii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		Provide road signs and flag persons to warn of on-going trenching activities.		
Work Camps and worksites	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants Unsanitary and poor living conditions for workers	(i) As far as possible located the camp site within the work sites (at GLSR and WTP sites); if any camp to be established outside these, then select a camp site away from residential areas (at least 50 m buffer shall be maintained) (ii) Avoid tree cutting for setting up camp facilities (iii) Ensure that a proper compound wall is provided, and erect a wind/dust screen around (iv) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas (v) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit (vi) Provide proper temporary accommodation with proper materials, adequate lighting and ventilation, appropriate facilities for winters and summers; ensure conditions of livability at work camps are maintained at the highest standards possible at all times; (vii) Consult PIU before locating project offices, sheds, and construction plants; (viii) Minimize removal of vegetation and disallow cutting of trees (ix) Ensure good living conditions at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers (x) Camp shall be provided with proper drainage, there shall not be any water accumulation (xi) Provide drinking water, water for other uses, and sanitation facilities for employees (xii) Prohibit employees from cutting of trees for firewood; contractor should be provided proper facilities including cooking fuel (oil or gas; fire wood not allowed)	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(xiii) Train employees in the storage and handling of materials which can potentially cause soil contamination (xiii) Recover used oil and lubricants and reuse or remove from the site (xv) 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 local market (xv) Remove all wreckage, rubbish, or temporary structures which are no longer required (xviii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site		
Chance Finds	There are no protected properties in the subproject sites. However, in case of chance finds, contractors will be required to follow a protocol as defined in the mitigation measures.	(i) Consult Archaeological Survey of India (ASI) or West Bengal State Archaeology Department to obtain an expert assessment of the archaeological potential of the site (ii) Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can be made available. (iii) In case of chance finds, works must be stopped immediately until such time chance finds are cleared by experts	DBO Contractor	Contractor cost
Submission of EMP implementation report	Unsatisfactory compliance to EMP	(i) Appointment of EHS Supervisor to ensure EMP implementation (ii) Timely submission of monitoring reports including pictures	DBO contractor	Contractor cost
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	(i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ii) All excavated roads shall be reinstated to original condition. (iii) All disrupted utilities restored (iv) All affected structures rehabilitated/compensated	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regrassed using the guidelines set out in the revegetation specification that forms part of this document. (vii) The contractor must arrange the cancellation of all temporary services. (viii) Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.		

Table 27: Operation Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
WTP operation – malfunction and effect on efficiency	Public health, safety and environmental impacts	(i) Operate as per the Operational Manual following Standard Operating Procedures as per the WTP design (ii) Undertake preventive and periodic maintenance activities as required (iii) Ensure periodic training to staff in WTP operation, especially in chemical handling and dosing, filter backwash, etc., (iv) replace pumps, motors and other parts as per the operating life prescribed by manufacturer (v) Maintain the mechanical parts as per the maintenance plan to avoid any hazards (vi) Ensure that all safety apparatus at WTP including personal protection equipment are in good condition all times; and are at easily accessible and easily identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations (vii) Ensure that backwash recirculation system and sludge management system are operated as per the manual	DBO Contractor	Operating costs
Check for blockage and leakage problems reducing the water losses	Loss of water, increased demand and inconvenience to consumers and general public	Effectiveness of leak detection and water auditing to reduce the water losses	DBO Contractor	Operating costs
Occupational health and safety	Health, social and economic impacts on the workers	(i) Provide appropriate PPE and training on its proper use and maintenance. (ii) Use fall protection equipment when working at heights. (iii) Maintain work areas to minimize slipping and tripping hazards. (iv) Implement a training program for operators who work with chlorine regarding safe handling practices and emergency response procedures. Prepare escape plans from areas where there might be a chlorine emission. (v) Install safety showers and eye wash stations near the chlorine equipment and other areas where hazardous chemicals are stored or used. (vi) Prohibit eating, smoking, and drinking except in designated areas.	DBO Contractor	Operating costs
Increased in sewage generation	Water pollution, and impacts on public	(i) Sanitation and sewerage/septage facilities needs to be improved/provided in the project area to suit the increased sewage generation	PHED and respective local bodies	To be identified

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	health and environment			

Table 28: Construction Stage Environmental Monitoring Plan

Monitoring field	Monitoring location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Construction disturbances, nuisances, public and worker safety,	All work sites	Implementation of dust control, noise control, traffic management, and safety measures. Site inspection checklist to review implementation is appended at Appendix 13	Weekly during construction	Supervising staff and safeguards specialists	No costs required
Ambient air quality	2 locations (WTP and IBPS sites)	• PM10, PM2.5 NO2, SO2, CO	(i)Once before start of construction. (ii) Quarterly (yearly 4-times) during construction (2-year period considered)	DBO Contractor	Cost for implementation of monitoring measures responsibility of contractor (18 samples x 10000 per sample = 180,000)
Ambient noise	4 locations (Intake, WTP and IBPS sites)	• Day time and night time noise levels	(i) Once before start of construction (ii) Quarterly (yearly 4-times) during construction (2-year period considered)	DBO Contractor	Cost for implementation of monitoring measures responsibility of contractor (36 samples x 1500 per sample = 54,000)
Reservoir water quality	One location (Reservoir intake point)	• pH, TDS, Oil and grease, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity	(i) Once before start of construction (ii)Monthly (yearly 12 times) (2-year construction period considered)	DBO Contractor	Cost for implementation of monitoring measures responsibility of contractor (25 samples x 8000 per sample =200,000)

Table 29: Operation Stage Environmental Monitoring Plan

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Monitoring of quality of water supplied to consumers	Consumer end- random sampling in all zones	pH, Nitrite, Nitrate, Turbidity BOD, Total Alkalinity, Total coliform and Feacal coliform	Monthly once	DBO Contractor / PHED	O&M costs (water quality will be tested at the internal laboratory part of WTP)
Monitoring of quality of reservoir water	Intake location	pH, TDS, Oil and grease, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity pesticides, heavy metals	Monthly once	DBO Contractor/ PHED	O&M costs (water quality will be tested at the internal laboratory part of WTP)
Sludge quality and suitability as manure	WTP	Analysis for concentration of heavy metals and confirm that value is within the following limits (all units are in mg/kg dry basis except pH) • Arsenic - 10.00 • Cadmium - 5.00 • Chromium - 50.00 • Copper - 300.00 • Lead - 100.00 • Mercury - 0.15 • Nickel - 50.00 • Zinc - 1000.00 • PH - 5.5-8.5	Yearly once	DBO Contractor / PHED	O&M costs (testing to be done at an accredited external laboratory)
Chance Finds	Areas protected by ASI or West Bengal State Archaeology Department	Chance finds protocol	Before finalization of detailed design, consult with ASI or West Bengal State Archaeology Department	DBO Contractor	Cost for implementation of monitoring measures responsibility of contractor

B. Implementation Arrangements

247. PHED is the Executing and Implementing Agency for the WBDWSIP, responsible for management, coordination and execution of all activities funded under this sector project. PMU, established within the PHED, will implement the project. PMU will be supported by district level Project Implementation Units (PIUs). PMU will be headed by a project director in the rank of Chief Engineer. Each PIU will be headed by a Superintending Engineer (SE), reporting to the project director. PMU with the support of PIUs will be responsible for planning, implementation, monitoring and supervision, and coordination of all activities under the WBDWSIPPMU will be supported by a Project Management Consultant (PMC) to supervise, monitor and oversee the implementation. Each PIU will be supported by a DSISC.

248. **Safeguards Compliance Responsibilities**. A safeguard and gender cell (SGC) will be established in PMU with the overall responsibility of ensuring compliance with ADB SPS to ensure consistency with PAM. SGC will be headed by a head, safeguards and gender officer (HSGO) and will report to the project director directly. The HSGO will have overall responsibility in implementation of the resettlement framework, EARF, resettlement plans, EMPs, SEMP, GESI action plan, and appropriate monitoring and reporting responsibilities. Key environmental safeguard tasks and responsibilities at the PMU level are as follows:

(i) Ensure subprojects confirms to exclusion criteria and project selection guidelines as stipulated in the EARF;
(ii) Approve subproject environmental category;
(iii) Approve IEEs; ensure that updated IEEs/EMPs reflect final project designs;
(iv) Ensure that EMPs are included in bidding documents and civil works contracts;
(v) Ensure proper implementation of EMPs by contractors;
(vi) Facilitate and ensure compliance with all government rules and regulations regarding site and environmental clearances, as well as any other environmental requirements (e.g. location clearance certificates, environmental clearance certificates), as relevant;
(vii) Oversee public consultation and disclosure;
(viii) Approve quarterly EMP implementation reports;
(ix) Review and approve semi-annual monitoring reports prepared by PMC; and submit to ADB;
(x) Oversee grievances redress process and ensure timely redress;
(xi) Undertake regular review of safeguards related loan covenants, and the compliance in program implementation; and
(xii) Organize periodic capacity building and training programs for WBDWSIP stakeholders, PHED, PMU and PIU staff on safeguards.

249. The SGC will be supported by environmental, social and gender safeguard specialists in the PMC. Key safeguard tasks and responsibilities of Environmental Management Specialist of the PMC on environmental safeguards are as follows:

(i) Review and finalize REA checklist and classify the project;
(ii) Review and confirm project selection/ design; ensure compliance with exclusion criteria and project environmental selection guidelines;
(iii) Review and finalize IEE reports including EMPs prepared/updated by PIUs/DSISCs;
(iv) Oversee public consultation and information disclosure activities; ensure timely disclosure;

(v) Provide advise/support in obtaining government clearance/ approvals;
(vi) Review and confirm that IEEs/EMPs are included in bids and contracts;
(vii) Review and confirm SEMPs prepared by contractor;
(viii) Oversee the implementation of SEMP by contractors and ensure corrective actions, where necessary;
(ix) Review and approve quarterly environmental monitoring reports submitted by PIU/DSISCs;
(x) Conduct site visits of project facilities and work sites to oversee implementation;
(xi) Prepare semi-annual environmental monitoring reports and submit to PMU SGC HSGO;
(xii) Oversee grievance redress process; advise on critical grievance related to environmental issues and concerns; and
(xiii) Organize training and capacity development programs.

250. Project Implementation Unit. At each PIU, an Assistant Engineer will be given additional responsibilities of safeguard tasks and will be designated as Assistant Safeguards Officer. The Safeguard Officer will oversee the safeguards implementation at PIU level, coordinate public consultations, information disclosure, regulatory clearances and approvals, RP implementation, EMP implementation and grievance redressal. Key environmental safeguard tasks and responsibilities of Safeguard Officer are as follows:

(i) Coordinate public consultation and information disclosure;
(ii) Liaise with local offices of regulatory agencies in obtaining clearances /approvals; assist PMU for clearances obtained at state level;
(iii) Review and approve contractors SEMPs;
(iv) Oversee day-to-day implementation of SEMPs by contractors, including compliance with all government rules and regulations;
(v) Take necessary action for obtaining rights of way;
(vi) Ensure continuous public consultation and awareness;
(vii) Coordinate grievance redress process and ensure timely actions by all parties;
(viii) Review monthly contractor's SEMP Monitoring Reports;
(ix) Review and forward quarterly monitoring reports to PMU; and
(x) Inform PMU of unanticipated impacts and formulate corrective action plan; and
(xi) Recommend issuance of work construction work completion certification to the contractor upon verification of satisfactory post-construction clean-up.

251. The PIUs will be assisted by DSISC teams which will include an Environmental Specialist and a Social Safeguards Specialist. Following are the key tasks of Environmental Specialist of DSISC:

(i) Assist PIU in identifying projects/components in compliance with the project exclusion criteria and selection guidelines stipulated in EARF;
(ii) Prepare environmental screening checklists and submit to PMU for categorization; update checklist and category as and when required to reflect project changes, and report to PMU;
(iii) Work closely with PIU and design teams to include environmental considerations in project location, design and technical specifications;
(iv) Identify statutory clearance / permissions / approvals required for subproject; assist PIU in obtaining them;
(v) Assist in including standards/conditions, if any, stipulated in regulatory clearances, consents in the project design;

(vi) Update IEE and EMP to reflect any changes in subproject during detail design / implementation; IEE shall reflect the final project design;
(vii) Lead / assist PIU in public consultation in compliance with the EARF; reflect inputs from public consultation in IEEs, EMPs, and project design;
(viii) Advise/assist PIU in disclosing relevant information on safeguards to stakeholders, affected people etc.;
(ix) Assist / ensure all EMP measures related project design and location and included in the detailed designs;
(x) Integrate EMP into the bid and contract documents (for DBO contracts, include full IEE including EMP in bids);
(xi) Advise contractor in preparation of SEMP as per the final design, prior to start of construction;
(xii) Ensure that all necessary clearances/permission (including those required by Contractor) are in place prior to start of construction;
(xiii) Monitor implementation of SEMP;
(xiv) ensure Contractors including subcontractor's, if any, comply with the measures set forth in the EMP;
(xv) Assist PIU in establishing GRM for the Project:
(xvi) Assist PIU in grievance redress, advise the contractor on appropriate actions on grievances, ensure timely resolution and proper documentation;
(xvii) Identify, if any, non-compliance or unanticipated impacts; initiate corrective actions, report to PMU;
(xviii) Review and approve monthly monitoring reports submitted by Contractor; consolidate and prepare quarterly environmental monitoring reports (EMR) and submit to PMU; and
(xix) Conduct training and capacity building activities (workshops, hands-on trainings, visits etc.,) in EMP implementation.

252. **Civil works contracts and contractors.** IEEs are to be included in bidding and contract documents. The PMU and PIUs will ensure that 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 project sites. The contractor will be required to appoint an Environment, Health and Safety (EHS) supervisor to implement EMP. The EHS Supervisor will update the EMP and submit an SEMP for approval of PIU. Contractors will carry out all environmental mitigation and monitoring measures outlined in EMP, approved SEMP and their contracts. Key responsibilities of the EHS supervisor are:

(i) Prepare SEMP and submit to PIU for approval prior to start of construction;
(ii) Conduct orientation and daily briefing sessions to workers on environment, health and safety;
(iii) Ensure that appropriate worker facilities are provided at the work place and labor camps as per the contractual provisions;
(iv) Records accidents and undertake remedial actions;
(v) Implement SEMP measures and report to PIU/DSISC if any new impacts are surfaced; seek guidance from as required in EMP implementation;
(vi) Conduct environmental monitoring (air, noise etc.,) as per the monitoring plan
(vii) Ensure conduct of water quality surveillance program;

(viii) Prepare monthly EMP monitoring reports and submit to PIU;
(ix) Work closely with PIU safeguard officer and consultants to ensure communities are aware of project-related impacts, mitigation measures and GRM; and
(x) Address any public compliance and grievances effectively and in timely manner.

C. Capacity Building and Training

253. PMU HSGO and PIU SOs will be trained by PMC and DSISC's safeguards experts on safeguards issues related to the project, GESI action plan and GRM. The EARF, RF, IPPF and GESI action plan provided indicative capacity building program which included modules on: (i) introduction and sensitization to ADB SPS on environmental, involuntary resettlement and indigenous people policies and requirements; (ii) project related requirements as provided in the EARF, Resettlement Framework, IPPF and GESI action plan, (iii) review, updating and preparation of the IEEs, SEMPs, Resettlement Plans, DDRs and IPPs (as required) upon the completion of project detailed design; (iii) improved coordination within nodal departments; (iv) monitoring and reporting system; and (v) project GRM. Briefings on safeguards principles, GRM and GESI action plan will also be conducted to the contractors upon their mobilization by PIU Safeguard Officers supported by DSISCs.

254. The following Table 33 presents the outline of capacity building program to ensure EMP implementation. The estimated cost is ₹200,000 (excluding trainings of contractors which will be part of EMP implementation cost during construction) to be covered by the project's capacity building program. The detailed cost and specific modules will be customized for the available skill set after assessing the capabilities of the target participants and the requirements of the project by the Environmental Specialist of PMC.

Table 30: Outline Capacity Building Program on Environmental Management Plan Implementation

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
1. Introduction and Sensitization to Environmental Issues (1 day) - ADB Safeguards Policy Statement - Government of India and West Bengal applicable safeguard laws, regulations and policies including but not limited to core labor standards, OHS, 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 (combined program for all subprojects)	50,000	Included in the overall program cost

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
2. EMP implementation (1/2 day) - EMP mitigation and monitoring measures -Roles and responsibilities - Public relations, - Consultations - Grievance redress - Monitoring and corrective action planning - Reporting and disclosure - Construction site standard operating procedures (SOP) -- Chance find (archeological) protocol - AC pipe protocol - Traffic management plan - Waste management plan - Site clean-up and restoration	All PIU staff, contractor staff and consultants involved in the subproject At PIU	100,000 (Lump sum)	Included in subproject cost estimates
3. Contractors Orientation to Workers (1/2 day) - Environment, health and safety in project construction	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)	50,000	Contractors cost

D. Monitoring and Reporting

255. Immediately after mobilization and prior to commencement of the works, the contractor will submit a compliance report to PIU that all identified pre-construction mitigation measures as detailed in the EMP are undertaken. Contractor should confirm that the staff for EMP implementation (EHS supervisor) is mobilized. PIU will review, and approve the report and permit commencement of works.

256. During construction, results from internal monitoring by the contractor will be reflected in their monthly EMP implementation reports to the PIU. DSC will review and advise contractors for corrective actions if necessary. Quarterly report summarizing compliance and corrective measures taken will be prepared by DSC team at PIU and submitted to PMU (Appendix 14). During operation, the contractor will conduct management and monitoring actions as per the operation stage EMP, and submit to PMU a quarterly report on EMP implementation and compliance.

257. Based on monthly and quarterly reports and measurements, PMU (assisted by PMC) will submit semi-annual Environmental Monitoring Report (EMR). Once concurrence from the ADB is received the report will be disclosed on PHED/PMU websites.

258. ADB will review project performance against the WBDWSIP 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.

259. ADB's monitoring and supervision activities are carried out on an on-going basis until a Project Completion Report (PCR) is issued. ADB issues a PCR within 1-2 years after the project is physically completed and in operation.

E. Environmental Management Plan Implementation Cost

260. Most of the mitigation measures require the contractors to adopt good site practices, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. The costs which are specific to EMP implementation and are not covered elsewhere in the projects are given below.

Table 31: Cost Estimates to Implement the Environmental Management Plan

	Particulars	Stages	Unit	Total No.	Rate (₹)	Cost (₹)	Costs Covered By
A.	**Implementation staff**						
1	Environmental, health and safety (EHS) Supervisor	Construction	per month	24	50,000	1,200,000	Design, build and operate (DBO) contract
	Subtotal (A)					**1,200,000**	
B.	**Mitigation Measures**						
1	Consent for establishments and consent for operation from West Bengal Pollution Control Board (WBPCB)	Pre-construction	Lump sum			200,000	Project costs
2	Provision for tree cutting and compensatory plantation measures (1: 5 ratio replantation)	Construction	Per tree	100	1,000	100,000	DBO contract
3	Traffic management at work sites (Pavement Markings, Channelizing Devices, Arrow Panels and Warning Lights)	Construction	Lump sum	-	-	200,000	DBO contract
	Subtotal (B)					**500,000**	
C.	**Monitoring Measures**						
1	Air quality monitoring	Construction	per sample	18	10,000	180,000	DBO contract
2	Noise levels monitoring	Construction	Per sample	36	1,500	54,000	DBO contract
3	Surface water monitoring	Construction	Per sample	25	8,000	200,000	DBO contract
4	Source water quality, water quality at consumer end, sludge quality	Operation	Lump sum / year	-	-	20,000	DBO Contract
	Subtotal (C)					**454,000**	
D.	**Capacity Building**						

	Particulars	Stages	Unit	Total No.	Rate (₹)	Cost (₹)	Costs Covered By
1.	Training on environmental management plan (EMP) implementation	Pre-construction	lump sum			100,000	PMU
2	Preparation of plans and protocols (traffic management plan, waste (spoils) management plan etc.,	Pre-construction	Lump sum			50,000	DBO contract
5.	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite	Lump sum			50,000	DBO contract
	Subtotal (D)					**200,000**	
	Total (A+B+C+D)				**₹**	**2,354,000**	

Contractor Cos t - ₹ 2,254,000.00
PMU Cost - ₹. 100,000.00
Total - ₹.23,54,000.00

IX. CONCLUSION AND RECOMMENDATIONS

261. The process described in this document has assessed the environmental impacts of all elements of the proposed bulk water supply subproject for Indpur and Taldangra blocks of Bankura district. All potential impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible. Thus, environmental impacts resulting from project design or location were not considered significant.

262. The main design impacts of water supply system in general are due to abstraction of water. The Raw water source is Mukutmonipur reservoir, which has abundant quantity of water throughout the year, even during the lean flow season. The Quality of raw water is good and is suitable for drinking water supply after conventional treatment and disinfection.

263. The subproject components like WTP with booster pumping facilities and raw water intake locations are closely located in the Satsol mouza of Khatra block. Intermediate booster pumping station (IBPS) is located centrally in the Gobindopur mouza of Indpur block. All the facilities are located in rapidly developing areas, which are surrounded by residential and commercial areas. WTP land belongs to the Irrigation and Waterways Department, while the IBPS site is privately owned. Both WTP and IBPS sites are covered with few trees and measures are suggested to minimize, and carryout compensatory tree plantation in a ratio of 1:5. Of the approximately 21 km length of Primary transmission main, an estimated 150m will be laid by trenchless method, especially at sections crossing main roads, congested areas canal and river crossings. The social impacts (access disruptions) due to construction activities are minimal Overall, there are no notable sensitive environmental features in the project sites.

264. Construction activities will be confined to the selected sites, and the interference with the general public and community around is minimal. There will be temporary negative impacts, arising mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.,), mining of construction material, occupational

health and safety aspects. During the construction phase of pipeline work along the public roads, impacts will arise from the construction dust and noise; disturbance to residents, businesses, traffic by the construction work, and from the need to dispose of large quantities of waste soil. The social impacts (access disruptions) due to construction activities are minimal. Trenchless technology is suggested at critical sections where pipeline crosses the main transportation corridors. These are the general impacts of construction in semi-urban, rural and habitation areas, and there are well developed methods of mitigation that are suggested in the EMP.

265. Anticipated impacts of water supply during operation and maintenance will be related to operation of WTP, handling and application of chlorine, operation of pump houses, and repair and maintenance activities. Various provisions have already been made in the design to: recirculate wastewater from WTP; collect, thicken and dispose of sludge; chlorine safety; use energy efficient equipment, etc. Water supply system will be operated using the standard operating procedures following an operating manual, which will be prepared by the DBO contractor. Thus, considering the design and proposed operational procedures, it is unlikely that there will be any significant negative impacts due to operation of water supply system. It is important that proper O&M system as per the SOPs is must. Application and handling of chlorine gas will involve certain risks, and appropriate measures are suggested for safe application including PPEs, awareness programs and mock drills. The DBO Contractor will implement the operation stage EMP. There may be requirement of repairs in pipelines due to leaks and pipe bursts. Proper design and selection of good quality pipe material will mean that leaks are minimal. Leak repair work will be similar to the pipe-laying work.

266. The public participation processes undertaken during project design ensured that stakeholders were engaged during the preparation of the IEE. The planned information disclosure measures and process for carrying out consultation with affected people will facilitate their participation during project implementation.

267. The project's grievance redress mechanism will provide the citizens with a platform for redressal of their grievances, and describes the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance.

268. The EMP will assist the project agencies and DBO contractor in mitigating the environmental impacts, and guide them in the environmentally-sound execution of the proposed project.

269. A copy of the EMP/approved SEP 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 a failure in compliance.

270. Groundwater in these two blocks are contaminated with fluoride and water level is depleting. The project will benefit the general public by contributing to the long-term improvement of water supply system and community livability in the project blocks of Indpur and Taldangra. The potential adverse environmental impacts are mainly related to the construction period, which can be minimized by the mitigating measures and environmentally-sound engineering and construction practices.

271. Therefore, as per ADB SPS, the project is classified as environmental Category B and does not require further environmental impact assessment. However, to conform to government

guidelines WTP requires consent for establish (CTE) and consent for operate (CTO) from West Bengal Pollution Control Board, which shall be obtained prior to invitation of bids.

272. This IEE shall be updated during the detailed design stage to reflect any changes, amendments and will be reviewed and approved by PMU.

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Instructions:
- This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department.
- This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.
- Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: India / West Bengal Drinking Water Sector Improvement Project (WBDWSIP) – Indpur and Taldangra blocks of Bankura District: Bulk Water Supply Subproject

Sector Division: Urban Development

SCREENING QUESTIONS	Yes	No	REMARKS
Water Supply			
A. Project Siting **Is the project area…**			
▪ Densely populated?		√	Project area is not densely populated
▪ Heavy with development activities?		√	Mostly rural area. No heavy development activity is noticed
▪ Adjacent to or within any environmentally sensitive areas?		√	No as such environmental sensitive areas nearby
• Cultural heritage site		√	Few religious places are observed but no cultural heritage site is located nearby the project area
• Protected Area		√	No protected area nearby
• Wetland		√	No designated wetland within the project area
• Mangrove		√	
• Estuarine		√	
• Buffer zone of protected area		√	
• Special area for protecting biodiversity		√	No Special area for protecting biodiversity
• Bay		√	

SCREENING QUESTIONS	Yes	No	REMARKS
B. Potential Environmental Impacts **Will the Project cause…**			
• Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		√	Not expected as per site conditions. Water surveillance program will be included to monitor the raw water quality.
• Impairment of historical/cultural monuments/areas and loss/damage to these sites?		√	No impact expected. No cultural monuments and historical sites near project locations.
• Hazard of land subsidence caused by excessive ground water pumping?		√	Not applicable; subproject does not involve groundwater abstraction. Water from the reservoir to be used and with no risk of land subsidence.
• Social conflicts arising from displacement of communities?		√	Project does not involve land acquisition /displacement. No social conflicts envisaged
• Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		√	Project involves new surface water source development on Mukutmonipur reservoir which has abundant quantity of water throughout the year, even during the lean flow season (February to May). NOC for abstraction of 32 MLD water from the Mukutmanipur dam for this project has been obtained from IWD. There is no ground water abstraction as a part of this sub project.
• Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?		√	Quality of raw water is in general, of acceptable quality and that can be used for potable purposes after conventional treatment and disinfection. Water quality testing should be done before treatment and after treatment.
• Delivery of unsafe water to distribution system?		√	Water will be treated and disinfected prior to supply the water treatment plant will ensure all quality criteria set by CPCB for drinking water standards.
• Inadequate protection of intake works or wells, leading to pollution of water supply?		√	Water quality surveillance program will be included to monitor the raw water quality.
• Over pumping of ground water, leading to salinization and ground subsidence?		√	Not applicable; subproject does not involve groundwater abstraction
• Excessive algal growth in storage reservoir?		√	Regular cleaning of storage tanks will be conducted during operation
• Increase in production of sewage beyond capabilities of community facilities?	√		Sanitation and sewerage system will be improved/developed in the project area
• Inadequate disposal of sludge from water treatment plants?		√	Appropriate provisions for sludge drying and disposal is included in the project

SCREENING QUESTIONS	Yes	No	REMARKS
• Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		√	Adequate buffer is available; all the pumping stations will be located in enclosed buildings with noise control walls to minimize noise propagation. A green belt area will be developed surrounding the boundary wall of the water treatment plant. Trees with thick canopy will be planted in order to reduce the noise levels reaching the nearby surroundings.
• Impairments associated with transmission lines and access roads?	√		Temporary impairments are anticipated along the new transmission line routes during construction stage.
• Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		√	Measures for safe handling, storage and usage of chlorine are included.
• Health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants?		√	Operation and Maintenance recommended by the manufacturers, and the existing norms and guidelines for ensuring the safety of workers will be followed. Measures for safe handling, storage and usage of chlorine are included.
• Dislocation or involuntary resettlement of people		√	There is no resettlement of people for project implementation.
• Social conflicts between construction workers from other areas and community workers?		√	The contractor will be utilizing the local labor force as far as possible; in case if it is unavoidable, labor camps and facilities will be provided appropriately. No conflicts envisaged
• Noise and dust from construction activities?	√		All the construction machineries employed will comply with noise emission standards of Central Pollution Control Board (CPCB). Dust suppression measures such as water sprinkling will be employed
• Increased road traffic due to interference of construction activities?	√		Excavation and laying pipelines along public roads will interfere with the traffic. Construction material transport will increase traffic on the local roads. Proper traffic management and construction planning will be ensured to minimize the interference
• Continuing soil erosion/silt runoff from construction operations?	√		Construction work during monsoon shall be carried out with due care so that silt run off due to construction operation is prevented. No construction will be allowed during rains.
• Delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		√	The Contractor shall prepare an O&M manual for approval of the Employer and training will be given to the staff operating the plant to ensure proper O&M.

SCREENING QUESTIONS	Yes	No	REMARKS
• Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		√	Not envisaged. Online monitoring of process water is proposed as part of the subproject and ensured by the Contractor. Care should be taken during O&M period to ensure that corrosive chemicals are not entered in distribution networks.
• Accidental leakage of chlorine gas?		√	There is risk that inappropriate handling, storage or use of chorine may cause serious accidents due to leakage causing severe health risks. Measures for safe handling, storage and usage of chlorine are included
• Excessive abstraction of water affecting downstream water users?		√	The Mukutmonipur reservoir stores enough water throughout the year the year, and the water abstraction for the project is negligible even during lean seasons and hence extraction will not affect any downstream users.
• Competing uses of water?		√	Project involves new source development. Adequate capacity of raw water is already available.
• Increased sewage flow due to increased water supply	√		Sanitation and sewerage needs to be improved
• Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant	√		Sanitation and sewerage needs to be improved. Additional wastewater and appropriate sludge treatment and disposal facility will be part of this subproject.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes?		√	As per local enquiries carried out during field visits and from the vulnerability mapping of the district for flood prone areas indicate that the subproject components are not located in the flood prone/tropical cyclone areas. Entire Bankura district and the project are a fall in Zone III, which is classified as Moderate Damage Risk Zone in India.
Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?		√	Unlikely, as reservoir contains significant quantities of water; although there will be change in flow due to these events, but may be insignificant. Water quality surveillance program will be included to monitor the raw water quality.
Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		√	No

Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?		√	No

NATIONAL AMBIENT AIR QUALITY STANDARDS

	Pollutants	Time Weighted Average	Concentration in Ambient Air		Method of Measurement
			Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Areas	
1	Sulphur Dioxide (SO_2) microgram per cubic meter ($\mu g/m^3$)	Annual 24 hours	50 80	20 80	Improved West and Geake-Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2) $\mu g/m^3$	Annual 24 hours	40 80	30 80	Modified Jacob and Hochheiser (Na-Arsenite) Chemiluminescence
3	Particulate Matter (Size less than 10 µm) or PM_{10} $\mu g/m^3$	Annual 24 hours	60 100	60 100	Gravimetric -TOEM -Beta attenuation
4	Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$ $\mu g/m^3$	Annual 24 hours	40 60	40 60	Gravimetric -TOEM -Beta attenuation
5	Carbon Monoxide (CO) mg/m^3	8 hours 1 hours	02 04	02 04	Non Dispersive Infra Red (NDIR) Spectroscopy

VEHICLE EXHAUST EMISSION NORMS

1. Passenger Cars

Norms	CO(g/km)	HC+ NOx(g/km)
1991Norms	14.3-27.1	2.0(Only HC)
1996 Norms	8.68-12.40	3.00-4.36
1998Norms	4.34-6.20	1.50-2.18
India stage 2000 norms	2.72	0.97
Bharat stage-II	2.2	0.5
Bharat Stage-III	2.3	0.35 (combined)
Bharat Stage-IV	1.0	0.18 (combined)

2. Heavy Diesel Vehicles

Norms	CO(g/kmhr)	HC (g/kmhr)	NOx (g/kmhr)	PM(g/kmhr)
1991Norms	14	3.5	18	-
1996 Norms	11.2	2.4	14.4	-
India stage 2000 norms	4.5	1.1	8.0	0.36
Bharat stage-II	4.0	1.1	7.0	0.15
Bharat Stage-III	2.1	1.6	5.0	0.10
Bharat Stage-IV	1.5	0.96	3.5	0.02

CO = Carbon Monixide, g/kmhr = grams per kilometer-hour, HC = Hydrocarbons, NOx = oxides of nitrogen, PM = particulates matter.
Source: Central Pollution Control Board

NATIONAL AMBIENT AIR QUALITY STANDARDS IN RESPECT OF NOISE

Area code	Category of Area/Zone	Limit (dBA)	
		Day time	Night time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence zone	50	40

EXTRACT FROM CONSTRUCTION and DEMOLITION MANAGEMENT RULES, 2016

[Published In the Gazette of India, Part-II, Section-3, Sub-section (ii)]
Ministry of Environment, Forest and Climate Change

NOTIFICATION

New Delhi, the 29th March, 2016

G.S.R. 317(E).-Whereas the Municipal Solid Wastes (Management and Handling) Rules, 2000 published vide notification number S.O. 908(E), dated the 25th September, 2000 by the Government of India in the erstwhile Ministry of Environment and Forests, provided a regulatory frame work for management of Municipal Solid Waste generated in the urban area of the country;

And whereas, to make these rules more effective and to improve the collection, segregation, recycling, treatment and disposal of solid waste in an environmentally sound manner, the Central Government reviewed the existing rules and it was considered necessary to revise the existing rules with a emphasis on the roles and accountability of waste generators and various stakeholders, give thrust to segregation, recovery, reuse, recycle at source, address in detail the management of construction and demolition waste.

And whereas, the draft rules, namely, the Solid Waste Management Rules, 2015 with a separate chapter on construction and demolition waste were published by the Central Government in the Ministry of Environment, Forest and Climate Change vide G.S.R. 451 (E), datedthe 3rd June, 2015 inviting objections or suggestions from the public within sixty days from the date of publication of the said notification;

And Whereas, the objections or suggestions received within the stipulated period were duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by sections 6, 25 of the Environment (Protection) Act, 1986 (29 of 1986), and in supersession of the Municipal Solid Wastes (Management and Handling) Rules, 2000, except as respect things done or omitted to be done before such supersession, the Central Government hereby notifies the following rules for Management of Construction and Demolition Waste –

1. **Short title and commencement.**-(1) These rules shall be called the Construction and Demolition Waste Management Rules, 2016.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. **Application.**-The rules shall apply to every waste resulting from construction, re-modeling, repair and demolition of any civil structure of individual or organisation or authority who generates construction and demolition waste such as building materials, debris, rubble.

3. **Definitions** –(1) In these rules, unless the context otherwise requires,-

(a) " ACT' means the Environment (Protection) Act, 1986 (29 of 1986);

(b) **"construction"** means the process of erecting of building or built facility or other structure, or

building of infrastructure including alteration in these entities.;

(c) **"construction and demolition waste"** means the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure;

(d) **"de-construction"** means a planned selective demolition in which salvage, re-use and recycling of the demolished structure is maximized;

(e) **"demolition"** means breaking down or tearing down buildings and other structures either manually or using mechanical force (by various equipment) or by implosion using explosives.

(f) **"form" means a Form annexed to these rules;**

(g) **"local authority"** means an urban local authority with different nomenclature such as municipal corporation, municipality, nagarpalika, nagarnigam, nagarpanchayat, municipal council including notified area committee and not limited to or any other local authority constituted under the relevant statutes such as gram panchayat, where the management of construction and demolition waste is entrusted to such agency;

(h) **" schedule"** means a schedule annexed to these rules;

(i) **"service provider'** means authorities who provide services like water, sewerage, electricity, telephone, roads, drainage etc. often generate construction and demolition waste during their activities, which includes excavation, demolition and civil work;

(j) **"waste generator" means any person or association of persons** or institution, residential and commercial establishments including Indian Railways, Airport, Port and Harbour and Defence establishments who undertakes construction of or demolition of any civil structure which generate construction and demolition waste.

(2) Words and expressions used but not defined herein shall have the same meaning defined in the ACT.

(4) Duties of the waste generator -

(1) Every waste generator shall prima-facie be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority in consonance with these rules.

(2) The generator shall ensure that other waste (such as solid waste) does not get mixed with this waste and is stored and disposed separately.

(3) Waste generators who generate more than 20 tons or more in one day or 300 tons per project in a month shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar and shall submit waste management plan and get appropriate approvals from the local authority before starting construction or demolition or remodeling work and keep the concerned

authorities informed regarding the relevant activities from the planning stage to the implementation stage and this should be on project to project basis.

(4) Every waste generator shall keep the construction and demolition waste within the premise or get the waste deposited at collection centre so made by the local body or handover it to the authorised processing facilities of construction and demolition waste; and ensure that there is no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains.

(5) Every waste generator shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities; Waste generators who generate more than 20 tons or more in one day or 300 tons per project in a month shall have to pay for the processing and disposal of construction and demolition waste generated by them, apart from the payment for storage, collection and transportation. The rate shall be fixed by the concerned local authority or any other authority designated by the State Government.

(5) Duties of service provider and their contractors -

(1) The service providers shall prepare within six months from the date of notification of these rules, a comprehensive waste management plan covering segregation, storage, collection, reuse, recycling, transportation and disposal of construction and demolition waste generated within their jurisdiction.

(2) The service providers shall remove all construction and demolition waste and clean the area every day, if possible, or depending upon the duration of the work, the quantity and type of waste generated, appropriate storage and collection, a reasonable timeframe shall be worked out in consultation with the concerned local authority.

(3) In case of the service providers have no logistics support to carry out the work specified in sub-rules (1) and (2) , they shall tie up with the authorised agencies for removal of construction and demolition waste and pay the relevant charges as notified by the local authority.

(6) Duties of local authority-The local authority shall,-

(1) issue detailed directions with regard to proper management of construction and demolition waste within its jurisdiction in accordance with the provisions of these rules and the local authority shall seek detailed plan or undertaking as applicable, from generator of construction and demolition waste;

(2) chalk out stages, methodology and equipment, material involved in the overall activity and final clean up after completion of the construction and demolition ;

(3c) seek assistance from concerned authorities for safe disposal of construction and demolition waste contaminated with industrial hazardous or toxic material or nuclear waste if any;

(4) shall make arrangements and place appropriate containers for collection of waste and shall remove at regular intervals or when they are filled, either through own resources or by appointing private operators;

(5) shall get the collected waste transported to appropriate sites for processing and disposal either through own resources or by appointing private operators;

(6) shall give appropriate incentives to generator for salvaging, processing and or recycling preferably in-situ;

(7) shall examine and sanction the waste management plan of the generators within a period of one month or from the date of approval of building plan, whichever is earlier from the date of its submission;

(8) shall keep track of the generation of construction and demolition waste within its jurisdiction and establish a data base and update once in a year;

(9) shall device appropriate measures in consultation with expert institutions for management of construction and demolition waste generated including processing facility and for using the recycled products in the best possible manner;

(10) shall create a sustained system of information, education and communication for construction and demolition waste through collaboration with expert institutions and civil societies and also disseminate through their own website;

(11) shall make provision for giving incentives for use of material made out of construction and demolition waste in the construction activity including in non-structural concrete, paving blocks, lower layers of road pavements, colony and rural roads.

(7) Criteria for storage, processing or recycling facilities for construction and demolition waste and application of construction and demolition waste and its products-

(1) The site for storage and processing or recycling facilities for construction and demolition waste shall be selected as per the criteria given in **Schedule I**;

(2) The operator of the facility as specified in sub- rules (1) shall apply in **Form I** for authorization from State Pollution Control Board or Pollution Control Committee.

(3) The operator of the facility shall submit the annual report to the State Pollution Control Board in **Form II.**

(3) Application of materials made from construction and demolition waste in operation of sanitary landfill shall be as per the criteria given in **Schedule II.**

(8) Duties of State Pollution Control Board or Pollution Control Committee-

(1) State Pollution Control Board or Pollution Control Committee shall monitor the implementation of these rules by the concerned local bodies and the competent authorities and the annual report shall be sent to the Central Pollution Control Board and the State Government or Union Territory or any other State level nodal agency identified by the State Government or Union Territory administration for generating State level comprehensive data. Such reports shall also contain the comments and suggestions of the State Pollution Control Board or Pollution Control Committee with respect to any comments or changes required;

(2) State Pollution Control Board or Pollution Control Committee shall grant authorization to construction and demolition waste processing facility in **Form-III** as specified under these rules after examining the application received in **Form I**;

(3) State Pollution Control Board or Pollution Control Committee shall prepare annual report in **Form IV** with special emphasis on the implementation status of compliance of these rules and forward report to Central Pollution Control Board before the 31st July for each financial year.

(9) Duties of State Government or Union Territory Administration-

(1) The Secretary in-charge of development in the State Government or Union territory administration shall prepare their policy document with respect to management of construction and demolition of waste in accordance with the provisions of these rules within one year from date of final notification of these rules.

(2) The concerned department in the State Government dealing with land shall be responsible for providing suitable sites for setting up of the storage, processing and recycling facilities for construction and demolition waste.

(3) The Town and Country planning Department shall incorporate the site in the approved land use plan so that there is no disturbance to the processing facility on a long term basis.

(4) Procurement of materials made from construction and demolition waste shall be made mandatory to a certain percentage (say 10-20%) in municipal and Government contracts subject to strict quality control.

(10) Duties of the Central Pollution Control Board - (1) The Central Pollution Control Board shall,-

(a) prepare operational guidelines related to environmental management of construction and demolition waste management;

(b) analyze and collate the data received from the State Pollution Control Boards or Pollution Control Committee to review these rules from time to time;

(c) coordinate with all the State Pollution Control Board and Pollution Control Committees for any matter related to development of environmental standards;

(d) forward annual compliance report to Central Government before the 30th August for each financial year based on reports given by State Pollution Control Boards of Pollution Control Committees.

(11) Duties of Bureau of Indian Standards and Indian Roads Congress -The Bureau of Indian Standards and Indian Roads Congress shall be responsible for preparation of code of practices and standards for use of recycled materials and products of construction and demolition waste in respect of construction activities and the role of Indian Road Congress shall be specific to the standards and practices pertaining to construction of roads.

Schedule III
Timeframe for Planning and Implementation
[See Rule 13]

Sl. No.	Compliance Criteria	Cities with population of 01 million and above	Cities with population of 0.5-01 million	Cities with population of less than 0.5 million
1	Formulation of policy by State Government	12 months	12 months	12 months
2	Identification of sites for collection and processing facility	18 months	18 months	18 months
3	Commissioning and implementation of the facility	18 months	24 months	36 months
4	Monitoring by SPCBs	3 times a year – once in 4 months	2 times a year – once in 6 months	2 times a year – once in 6 months

The time Schedule is effective from the date of notification of these rules.

FORM – I
See [Rule 7 (2)]
Application for obtaining authorisation

To,
The Member Secretary

_____Name of the local authority or Name of the agency appointed by the municipal authority :

Correspondence address Telephone No. Fax No.	
Nodal Officer and designation (Officer authorized by the competent authority or agency responsible for operation of processing or recycling or disposal facility)	
Authorisation applied for (Please tick mark)	Setting up of processing or recycling facility of construction and demolition waste
Detailed proposal of construction and demolition waste processing or recycling facility to include the following Location of site approved and allotted by the Competent Authority. Average quantity (in tons per day) and composition of construction and demolition waste to be handled	

DEPARTMENT OF ENVIRONMENT'S DIRECTION UNDER AIR ACT, 1981 FOR CONTROL OF AIR POLLUTION FROM CONSTRUCTION ACTIVITIES IN WEST BENGAL

Department of Environment
Government of West Bengal
Writers' Buildings, "G" Block, (2nd. Floor),
Kolkata-700 001.

No. EN/3170/T-IV-7/001/2009 Dated: December 10th, 2009.

DIRECTION

WHEREAS, Department of Environment, Govt. of West Bengal is entrusted to look after the execution of the different environmental laws within the territorial jurisdiction of West Bengal and also responsible for maintaining pollution free environment and also responsible for restraining different environment hazardous activities which are causing serious impact on human beings, other living creatures, plant, micro-organism, property or the environment ;

AND WHEREAS, Department of Environment has already taken different steps for controlling air pollution in the atmosphere generated from the different sources i.e. industrial source, vehicular source and burning of bio-mass;

AND WHEREAS, Department of Environment in exercising the power conferred under section 19 of the Air (Prevention & Control of Pollution) Act, 1981, has already declared entire West Bengal as `Air Pollution Control Area';

AND WHEREAS, West Bengal Pollution Control Board conducted a study with the help of the Asian Development Bank and it is revealed that the contribution of the construction activities is one of the source of air pollution in Kolkata and its surroundings ;

AND WHEREAS, it is further revealed that burning of old tyres in hot mix plant as a fuel during construction and repairs of road for melting coal tar contributes significant obnoxious element into the air which cause a serious problem of the human beings ;

HENCE, in view of the above and in consultation with the West Bengal Pollution Control Board and in exercise of the power conferred under Air (Prevention & Control of Pollution) Act, 1981 and Environment (Protection) Act, 1986, all the municipalities, local authorities and all other concerned Govt. Departments within the State of West Bengal, are now directed to take immediate steps to implement the following norms which need to be strictly followed by the developers, contractors or any other infrastructure developers ;

-

- Preventive measures need to be taken: -

a) Wrap construction area/buildings with geotextile fabric, installing dust barriers, or other actions, as appropriate for the location,
b) Apply water and maintain soils in a visible damp or crusted condition for temporary stabilization,
c) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
d) Limit vehicle speeds to 15 mph on the work site.
e) Clean wheels and undercarriage of haul trucks prior to leaving construction site.
f) Apply and maintain dust suppressant on haul routes.
g) Apply a cover or screen to stockpiles and stabilize stockpiles at completion of activity by water and maintain a dust palliative to all outer surfaces of the stockpiles;
h) Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition where loaders, support equipment and vehicles will operate;
i) Stabilize adjacent disturbed soils following paving activities with immediate landscaping activity or installation of vegetative or rock cover.
j) Maintain dust control during working hours and clean track out from paved surfaces at the end of the work shift/day. Track out must now extend 50 feet or more and must be cleaned daily, at the minimum.
k) Stabilize sloping surfaces using soil binders until vegetation or ground cover can effectively stabilize the slope,
l) Disposal of debris in consultation with the local authorities following proper environmental management practice.
m) During construction work, including cutting of marbles, ambient noise level should not exceed more than 65 dB(A).

Local Police Station is also directed to render all necessary help to the Local Authorities to implement the aforementioned direction in a befitting manner.

This order will take effect from 01-01-2010 through out the State of West Bengal.

By Order,
Sd/-
(M. L. Meena)
Principal Secretary to the Govt. of West Bengal.
Department of Environment.

SALIENT FEATURES OF MAJOR LABOR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN CONSTRUCTION OF CIVIL WORKS

(i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.

(ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days' wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.

(iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are: (a) Pension or family pension on retirement or death as the case may be; (b) deposit linked insurance on the death in harness of the worker; (c) payment of PF accumulation on retirement/death etc.

(iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.

(v) Contract Labour (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor.

(vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employment.

(vii) Payment of Wages Act, 1936 - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.

(viii) Equal Remuneration Act, 1979 - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training and promotions etc.

(ix) Payment of Bonus Act, 1965 - The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33 % of wages and maximum of 20 % of wages to employees drawing ₹3,500/- per month or less. The bonus to be paid to employees getting ₹2,500/- per month or above up to ₹3,500/- per month shall be worked out by taking wages as ₹2,500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of the Act.

(x) Industrial Disputes Act, 1947 - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

(xi) Industrial Employment (Standing Orders) Act, 1946 - It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the employer on matters provided in the Act and get the same certified by the designated Authority.

(xii) Trade Unions Act, 1926 - The Act lays down the procedure for registration of trade unions of workmen and employees. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(xiii) Child Labor (Prohibition and Regulation) Act, 1986 - The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labor is prohibited in Building and Construction Industry.

(xiv) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 - The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.

(xv) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 - All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay Cess at rate not exceeding 2% of the cost of construction as may be notified by the Government. The employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for workers near the workplace etc. The employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

DRINKING WATER STANDARDS

No.	Substance or characteristic	Requirement Desirable limit	Undesirable effect outside the desirable	Permissible limit in the absence of alternate Source	Remarks
Essential Characteristic					
1.	Color Hazen Units, Max	5	Above 5, consumer acceptance decreases	25	Extended to 25 only if toxic Substance are not suspect in absence of alternate sources
2.	Odor	Unobjectionable	-	-	a) test cold and when heated b) test are several dilutions
3.	Taste	Agreeable	-	-	Test to be conducted only after safely has been established
4.	Turbidity (NTU) Max	5	Above 5, consumer acceptance decreases	10	-
5.	pH value	6.5 to 8.5	Beyond this range the water will after the mucous membrane and/or water supply system	No relaxation	-
6.	Total Hardness (mg/L) CaCO3	300	Encrustation in water supply structure and adverse effects on domestic use	600	-
7.	Iron (mg/L, Fe) Max	0.3	Beyond this limit taste/appearance are affected; has adverse effects on domestic uses and water supply structure and promotes iron bacteria	1.0	-
8.	Chlorides 250 (mg/L, Cl) Max	250	Beyond effects outside the desirable limit	1000	-
9.	Residual free Chlorine (mg/L), Max	0.2	-	-	To be applicable only when water is chlorinated. Tested at customer end. When protection against viral infection is required, it should be min. 0.5 mg/L.
Desirable Characteristics					
10.	Dissolved solids mg/L. Max	500	Beyond this, palatability decreases and may cause gastrointestinal irritation.	2000	-
11.	Calcium (mg/L, Ca) Max.	75	Encrustation in water supply structure and adverse effects on domestic use.	200	-
12.	Magnesium (mg/L, Mg) Max	30	Encrustation in water supply structure and adverse effects on domestic use.	100	-
13.	Copper (mg/L, Cu) Max	0.05	Astringent taste dis coloration and corrosion of pipes fittings and utensils will be caused beyond this.	1.5	-
14.	Manganese (mg/L, Mn) Max	0.1	Beyond this limit taste/appearance are	0.3	-

			affected, has adverse effect on domestic use and water supply structure		
15.	Sulphate (mg/L, SO4) Max.	200	Beyond this causes gastro intestinal irritation when magnesium or sodium are present	400	May be extended up to 400 provided magnesium (as Mg) does not exceed 30
16.	Nitrate (mg/L, NO3) Max.	45	Beyond this methaemoglobinemia takes place.	100	-
17.	Fluoride (mg/L, F) Max.	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis.	1.5	-
18.	Phenolic Compounds (mg/L C6H5OH) Max.	0.001	Beyond this, it may cause objectionable taste and odor	0.002	-
19.	Mercury (mg/L Hg) Max	0.001	Beyond this the water becomes toxic	No Relaxation.	To be tested when pollution is suspected
20	Cadmium (mg/L, Cd) Max	0.01	Beyond this the water becomes toxic	No Relaxation.	To be tested when pollution is suspected
21.	Selenium (mg/L, Se) Max	0.01	Beyond this the water becomes toxic.	No Relaxation.	To be tested when pollution is suspected
22.	Arsenic (mg/L, As) Max.	0.01	Beyond this the water becomes toxic	No Relaxation	To be tested when pollution is suspected
23.	Cyanide	0.05	Beyond this the water becomes toxic	No Relaxation	To be tested when pollution is suspected
24.	Lead (mg/L Pb) Max.	0.05	Beyond this the water becomes toxic	No Relaxation	To be tested when pollution is suspected
25.	Zinc (mg/L, Zn) Max.	5	Beyond this limit it can cause astringent taste and an opalescence in water	15	To be tested when pollution is suspected
26.	Anionic detergents (mg/L, MBAS) Max	0.2	Beyond this limit it can cause a light froth in water	1.0	To be tested when pollution is suspected
27.	Chromium (mg/L, Cr6+	0.05	May be carcinogenic above this limit	-	-
28.	Polynuclear Aromatic Hydrocarbons (mg/L, PAH) Max	-	May be carcinogenic	-	-
29.	Mineral oil (mg/L)	0.01	Beyond this limit, undesirable taste and odor after chlorination takes place	0.03	To be tested when pollution is suspected
30.	Pesticides (mg/L) max	Absent	Toxic	0.001	-
Radioactive materials					
31.	Alpha emitters Bq/L Max	-	-	0.1	-
32.	Beta emitters Pci/L Max	-	-	1.0	-
33.	Alkalinity (mg/L,) Max	200	Beyond this limit, taste becomes unpleasant	600	-
34.	Aluminum (mg/L, Al) Max	0.03	Cumulative effect is reported to cause dementia	0.2	
35.	Boron (mg/L) Max	1.0	-	5.0	-

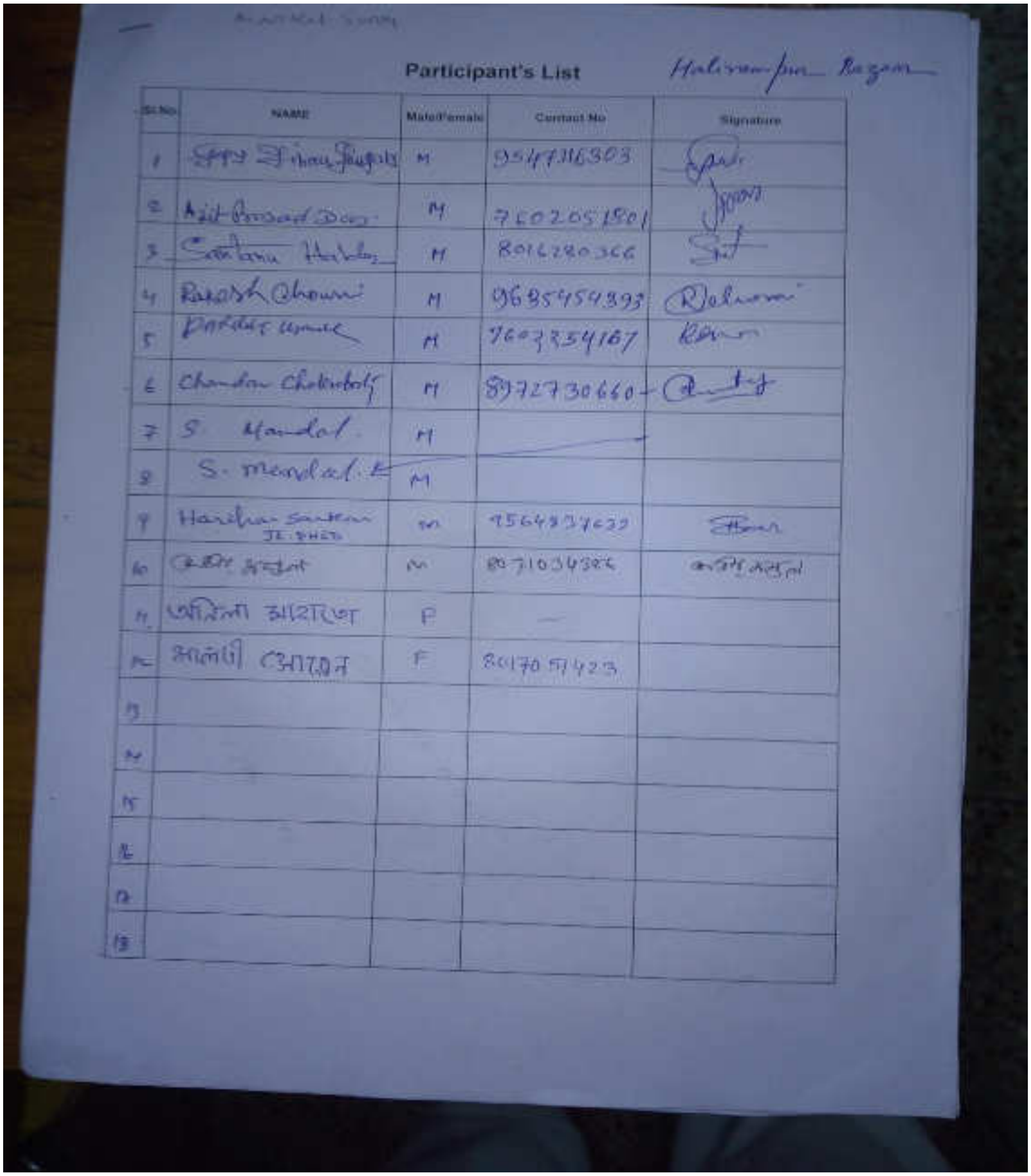
SUMMARY OF PUBLIC CONSULTATION

Date	Place	No. of Participants	Key Issues Discussed	Photographs
28.08.17	**Bheduasole Gram Panchayat Office**	Male :23 Female : 29 Total : 52 **Key Participants :** 1.Officials Asian Development Bank headed by Ms. Neeta Pokhrel 2. Superintend Engineer, Executive Engineer, Asst. Engineer & Sub Asst. Engineers of PHED Bankura Division 3. Pradhan and other Gram Panchayat Members of Bheduasole Gram Panchayat headed by the Panchayat Pradhan	Public Health & Engineering Dept. Of West Bengal Govt. with the Financial support of Asian Development Bank Is going to undertake a Water Supply Project in selected Districts of West Bengal. The project has been named as West Bengal Drinking Water Sector Improvement Project (WBDWSIP). Treated Surface Water will be supplied to every households of the project area through separate pipe connection. The Project aims to provide 70 liters per capita per day of potable water through metered household connections on a 24/7 basis to each household. PHED district offices will be responsible for operating, maintaining and monitoring the bulk water systems, whereas the Gram Panchayat (GP) will operate and maintain the distribution network. The Zilla Parishad (ZP), administrative body at the district level, and Panchayat Samiti (PS), administrative body at the block level, will be involved in coordinating, technical support and monitoring role at the district and block level, respectively. Affordability of water tax has been a pertinent question raised both by the Gram Panchayat members and the community - however almost all agreed to pay the water charges if they get the facility of household water connections. They agreed that it will help in reducing time taken for water collection as well health expenditures. The Gram Panchayat members expressed concern regarding the adequacy/sufficiency of OHRs per Garm Panchayat; it was clarified by PHED personnel present during the consultation that as per the command zone/area it covers most of the part and the rest will be covered by nearby OHRs of other Zone.	

Date	Place	No. of Participants	Key Issues Discussed	Photographs
			On-time completion of the project was another concern of the Panchayat Members and it was told that the project work will not take longer than 3 years. Creating job opportunities was the other question of the Gram Panchayat Members – it was mentioned that the existing PHE workers will be given first preference, further if there is requirement, then workers from the local community can be employed during the construction phase.	

Date	Place	Proposed Work	No. of Participants	Concerns / Issues Discussed	Photographs
	Mouza: Hatirampur	Laying of 19.5 km Transmission Line from Water Treatment Plant to Intermediate Pumping Station at Gobindapur	Male: 10 Female: 2 Total : 12	Benefits and Importance of Treated Surface Water were discussed. Door step water connection will be a great relief for the village women as it will reduce their Time Poverty. The participants were said that if they face any problem related to supply of water, they can inform the Gram Panchayat Office. In the question of affordability, the respondents said that, If all the people get better service then everyone will gladly pay the water tariff. Local tube wells are checked periodically through Panchayats and health dept. officials. But due to High Concentration of Iron it tastes poor. During Construction Phase access to road side shops will be assured through adequate measures. Steps will be taken to control traffic congestion during pipe laying work in market areas	 

Date	Place	Proposed work	Participants no	Concerns / Issues discussed	Photographs
	Village: Supur	Laying of 19.5 km Transmission Line from Water Treatment Plant to Intermediate Pumping Station at Gobindapur	Male: 15 Female: 3 Total : 18	Local people were found aware about the upcoming water supply project in their area. Role of ADB and PHED were discussed with them. It was suggested by the participants that, door step Water Connection to be provided to each household without any prejudice and local influence and no partiality or preferences should be allowed in this context. How the Arsenic / Fluoride contaminates the Ground Water was discussed with them. It was mentioned that, why treated surface water is safer than ground water in all respects. The participants were informed that, during construction phase any grievances will be mitigated on priority basis. It was said by the participants that, local people will extend their full support for successful implementation of the project.	 



Participant's List Haliram-pur Bagan

Sl.No	NAME	Male/Female	Contact No	Signature
1	[illegible]	M	9547316303	[illegible]
2	Ajit Prasad Das	M	7602051801	[illegible]
3	Santanu Haldar	M	8016280366	[illegible]
4	Rakesh Chowni	M	9635454393	[illegible]
5	[illegible]	M	7602354167	[illegible]
6	Chandan Chakraborty	M	8972730660	[illegible]
7	S. Mandal	M		
8	S. Mandal	M		
9	Harihar Santra JE BHED	M	9564337633	[illegible]
10	[illegible]	M	8071034366	[illegible]
11	[illegible]	F	—	
12	[illegible]	F	8017057423	
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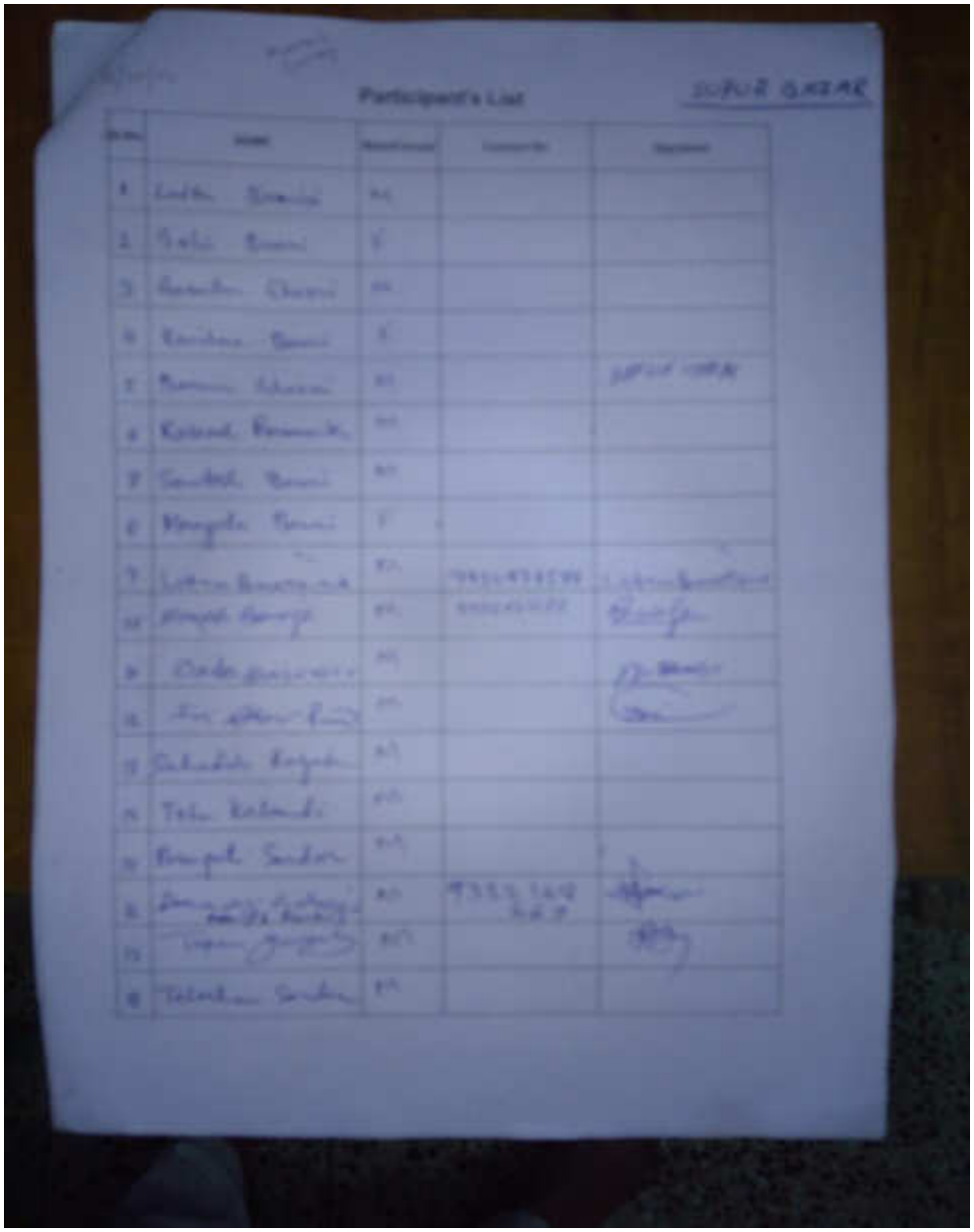


Participant's List

Date	Place	Participants	Key Issues Discussed	Photographs
29 August 2017	Proposed site of Intermediate Booster Pumping Station **Gram Panchayat** : Bheduasole **Block:** Indpur **Mouza:** Gobindapur	Land Sellers (7) ADB Officials (2) PHED Engineers of Bankura Division (2) Consultant (1)	Consultation with the land sellers revealed that, they are aware about the side effects of consuming untreated ground water. Local tube wells are checked periodically through Panchayats and health dept. officials. Yet, the quality of the water is not satisfactory due to various reasons like high concentration of iron, salinity and poor taste. Upon consultation, all the land sellers said that, they are willing to sell their parcel of land at Govt. Price. They have not been forced rather they are happy for having the opportunity to be a part of the project. The proposed land is laid vacant for several years, they do not have any income from the land. Cultivation was done this year after several years due to better monsoon. It is a rain-fed plot. All the land sellers have their own livelihood and a permanent place to live so they will not suffer if they are being compensated at actual Govt. Price of the land. It was further added that, the amount they will receive from the Govt. will enable them to secure their future They assure their full co-operation in land purchase process.	 

PHOTOGRAPHS OF STAKEHOLDER CONSULTATIONS

SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Bengali and English)

The _____Project welcomes complaints, suggestions, queries, and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

Date	Place of registration	Project Town Project:			
Contact information/personal details					
Name		Gender	* Male * Female	Age	
Home address					
Place					
Phone no.					
E-mail					
Complaint/suggestion/comment/question Please provide the details (who, what, where, and how) of your grievance below: If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of official registering grievance)	
Mode of communication: Note/letter E-mail Verbal/telephonic	
Reviewed by: (Names/positions of officials reviewing grievance)	
Action taken:	
Whether action taken disclosed:	Yes No
Means of disclosure:	

SAMPLE OUTLINE SPOILS (CONSTRUCTION WASTE) MANAGEMENT PLAN

- The Spoil Management Plan should be site specific and be part of the monthly Construction Management Plan.
- The contractor, in consultation with the PIU, has to find out appropriate location/s for the disposal of the excess soil generated. The spoils should be deposited only at these sites.
- Further precautions need to be taken in case of the contaminated spoils
- The vehicle carrying the spoil should be covered properly.
- The spoils generating from each site should be removed on the same day or immediately after the work is complete. The site / road should be restored to the original condition.

I. Spoils information

The spoil information contains the details like a) The type / material, b) Potential contamination by that type, c) Expected volume (site / component specific), d) Spoil Classification etc.

II. Spoils management

The Spoil Management section gives the details of a) Transportation of spoil b) disposal site details c) Precautions taken d) Volume of contaminated spoil, if present, d) Suggested reuse of disposal of the spoil

III. Documentation

The volume of spoil generated (site specific, date wise), site disposed, reuse / disposal details should be documented properly.

SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles for TMP around the Water Pipes Construction Sites

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

(i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
(ii) protection of work crews from hazards associated with moving traffic;
(iii) mitigation of the adverse impact on road capacity and delays to the road users;
(iv) maintenance of access to adjoining properties; and
(v) addressing issues that may delay the project.

B. Operating Policies for TMP

2. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

(i) Make traffic safety and temporary traffic control an integral and high-priority element of project from planning through design, construction, and maintenance.
(ii) Inhibit traffic movement as little as possible.
(iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
(iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
(v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
(vi) Train all persons that select, place, and maintain temporary traffic control devices.
(vii) Keep the public well informed.
(viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

3. **Figure A13.2 to Figure A13.12** illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

C. Analyze the Impact Due to Street Closure

4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) approval from the ULB/Public Works Department (PWD) to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, PWD, etc., regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
(iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
(iv) determining if additional traffic control or temporary improvements are needed along the detour route;
(v) considering how access will be provided to the worksite;

(vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and

(vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

5. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the detour street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

Figure A13.1: Policy Steps for the TMP

D. Public awareness and notifications

6. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for

this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

7. The PIU will also conduct an awareness campaign to educate the public about the following issues:

(i) traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
(ii) defensive driving behaviour along the work zones; and
(iii) reduced speeds enforced at the work zones and traffic diversions.

8. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centres. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

(i) explain why the brochure was prepared, along with a brief description of the project;
(ii) advise the public to expect the unexpected;
(iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
(iv) educate the public about the safe road user behaviour to emulate at the work zones;
(v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and
(vi) indicate the office hours of relevant offices.

E. Install traffic control devices at the work zones and traffic diversion routes

10. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- Warning Lights

11. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal

roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

12**.** **Figure A13.2 to Figure A13.6** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

- Work on shoulder or parking lane
- Shoulder or parking lane closed on divided road
- Work in Travel lane
- Lane closure on road with low volume
- Street closure with detour

13. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

14. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flagggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

16. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

Figure A13.2 and A13.3: Work on Shoulder or Parking Lane and Shoulder or Parking Lane Closed on Divided Road

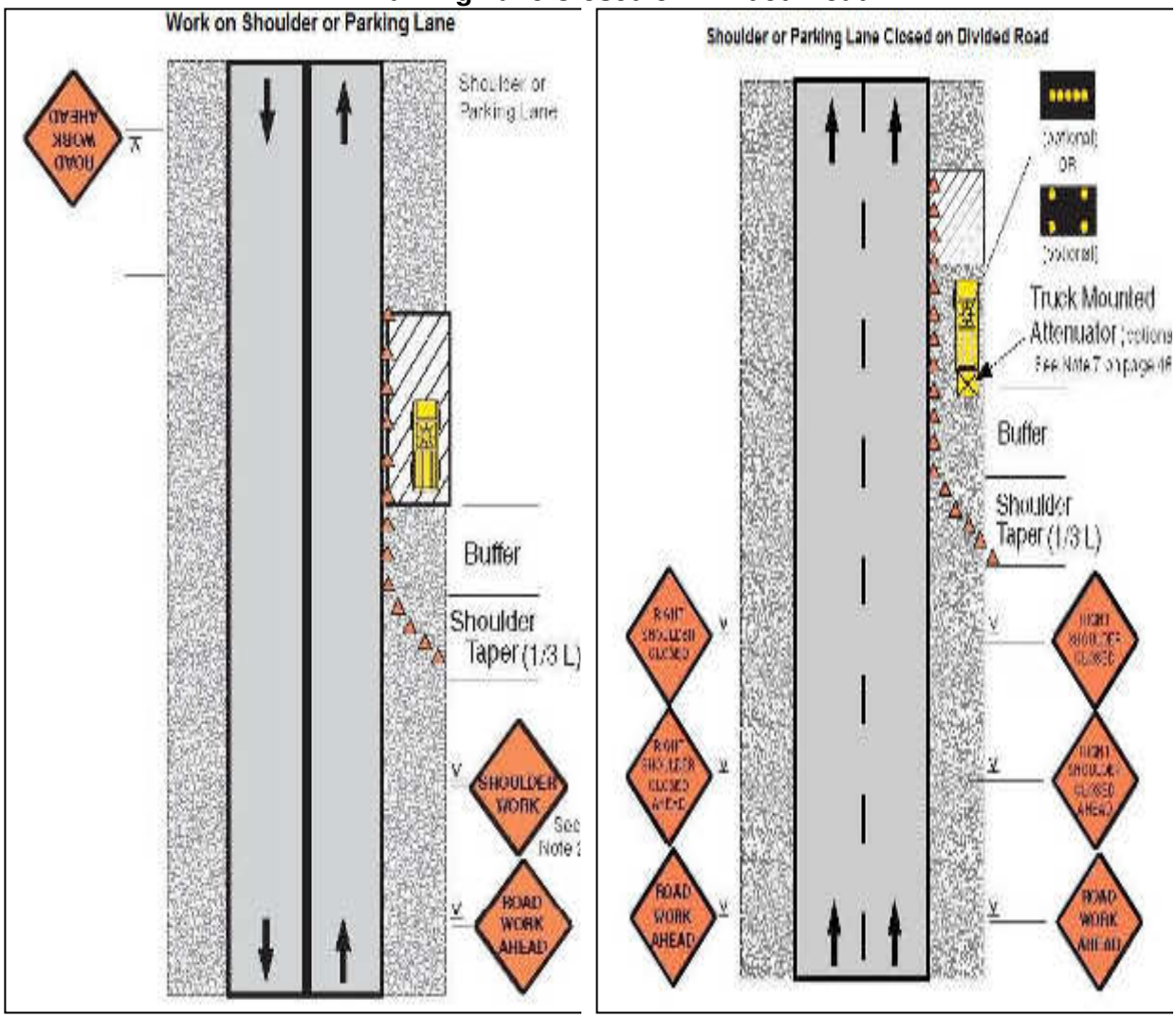


Figure A13.4 and A13.5: Work in Travel lane and Lane Closure on Road with Low Volume

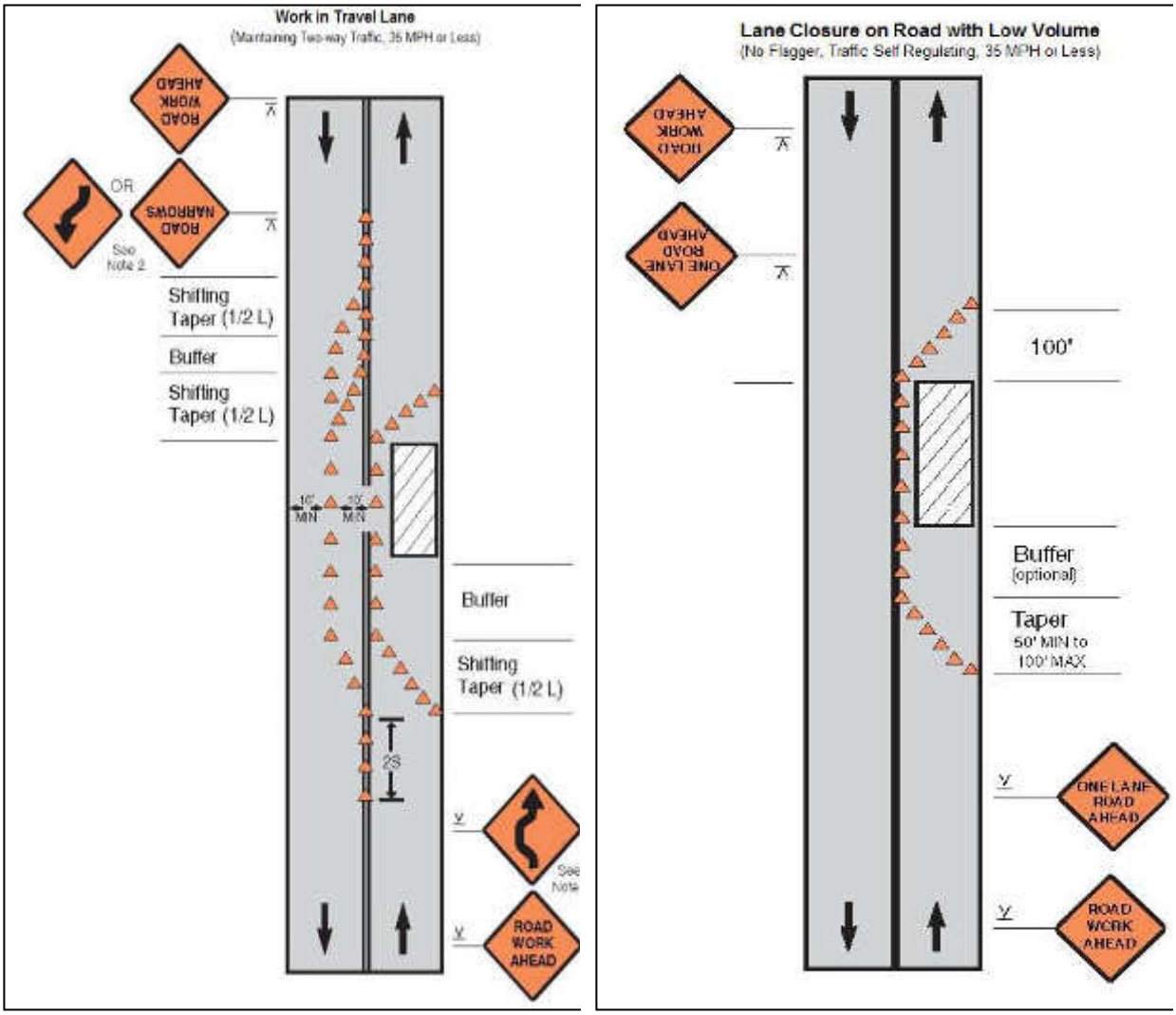
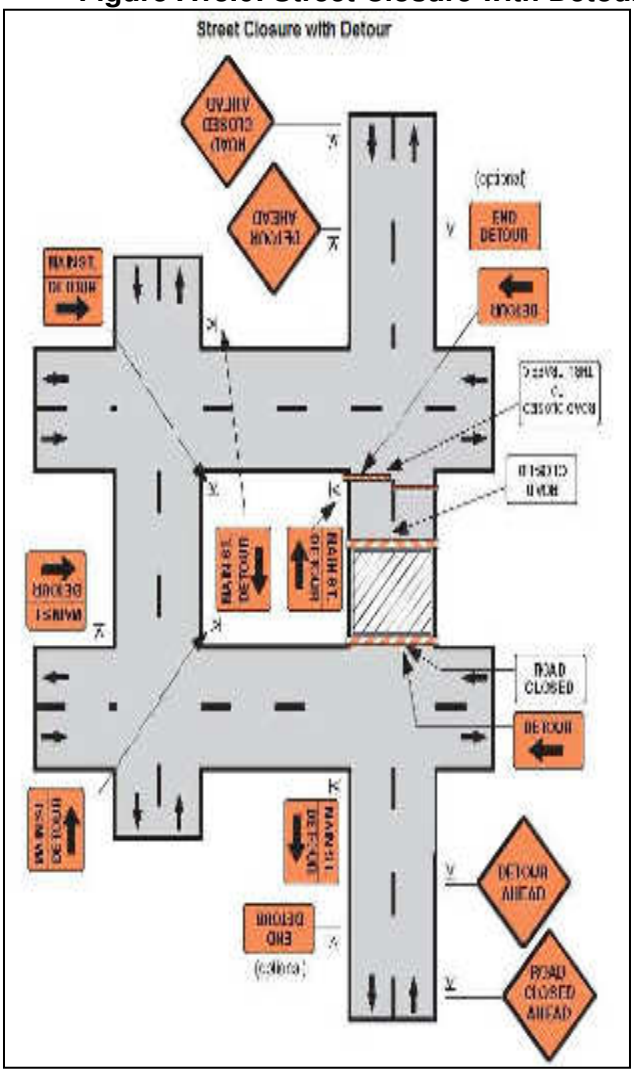


Figure A13.6: Street Closure with Detour



SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

NAME: _____ DATE: _____
TITLE: _____ DMA: _____
LOCATION: _____ GROUP: _____

WEATHER:

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Monitoring Items	Compliance
Compliance marked as Yes / No / Not applicable (NA) / Partially Implemented (PI)	
EHS supervisor appointed by contractor and available on site	
Construction site management plan (spoils, safety, schedule, equipment etc.,) prepared	
Traffic management plan prepared	
Dust is under control	
Excavated soil properly placed within minimum space	
Construction area is confined; no traffic/pedestrian entry observed	
Surplus soil/debris/waste is disposed without delay	
Construction material (sand/gravel/aggregate) brought to site as and when required only	
Tarpaulins used to cover sand and other loose material when transported by vehicles	
After unloading , wheels and undercarriage of vehicles cleaned prior to leaving the site	
No AC pipes disturbed/removed during excavation	
No chance finds encountered during excavation	
Work is planned in consultation with traffic police	
Work is not being conducted during heavy traffic	
Work at a stretch is completed within a day (excavation, pipe laying and backfilling)	
Pipe trenches are not kept open unduly	
Road is not completely closed; work is conducted on edge; at least one line is kept open	
Road is closed; alternative route provided and public informed, information board provided	
Pedestrian access to houses is not blocked due to pipe laying	
Spaces left in between trenches for access	
Wooden planks/metal sheets provided across trench for pedestrian	
No public/unauthorized entry observed in work site	
Children safety measures (barricades, security) in place at works in residential areas	
Prior public information provided about the work, schedule and disturbances	
Caution/warning board provided on site	
Guards with red flag provided during work at busy roads	
Workers using appropriate PPE (boots, gloves, helmets, ear muffs etc.)	
Workers conducting or near heavy noise work is provided with ear muffs	
Contractor is following standard and safe construction practices	
Deep excavation is conducted with land slip/protection measures	
First aid facilities are available on site and workers informed	
Drinking water provided at the site	
Toilet facility provided at the site	

Monitoring Items	Compliance
Separate toilet facility is provided for women workers	
Workers camps are maintained cleanly	
Adequate toilet and bath facilities provided	
Contractor employed local workers as far as possible	
Workers camp set up with the permission of PIU	
Adequate housing provided	
Sufficient water provided for drinking/washing/bath	
No noisy work is conducted in the nights	
Local people informed of noisy work	
No blasting activity conducted	
Pneumatic drills or other equipment creating vibration is not used near old/risky buildings	

Signature

_____

Sign off

_____ _____

Name **Name**
Position **Position**

SAMPLE SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT TEMPLATE

1. Introduction

- Overall project description and objectives
- Environmental category as per ADB Safeguard Policy Statement, 2009
- Environmental category of each subproject as per national laws and regulations
- Project Safeguards Team

Name	Designation/Office	Email Address	Contact Number
1. PMU			
2. PIUs			
3. Consultants			

- Overall project and sub-project progress and status

- Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

Package Number	Components/List of Works	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed/O&M)[a]	Contract Status (specify if under bidding or contract awarded)	If On-going Construction	
				%Physical Progress	Expected Completion Date

[a] If on-going construction, include %physical progress and expected date of completion.

2. Compliance Status With National/State/Local Statutory Environmental Requirements[a]

Package No.	Subproject Name	Statutory Environmental Requirements[b]	Status of Compliance[c]	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per

						Environment Clearance, Consent/Permit to Establish[d]

[a] All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the "remarks" column.
[b] Specify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.)
[c] Specify if obtained, submitted and awaiting approval, application not yet submitted
[d] *Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.*

3. Compliance Status With Environmental Loan Covenants

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

4. Compliance Status With the Environmental Management Plan (Refer to EMP Tables In Approved IEE/S)

- Confirm if IEE/s require contractors to submit site-specific EMP/construction EMPs. If not, describe the methodology of monitoring each package under implementation.

Package-wise Implementation Status

Package Number	Components	Design Status (Preliminary Design Stage/Detailed Design Completed)	Final IEE based on Detailed Design				Site-specific EMP (or Construction EMP) approved by Project Director? (Yes/No)	Remarks
			Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission)	Disclosed on project website (Provide Link)	Final IEE provided to Contractor/s (Yes/No)		

- Identify the role/s of Safeguards Team including schedule of on-site verification of reports submitted by consultants and contractors.
- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.
- Include as appendix all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors.

- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below

- Provide the monitoring results as per the parameters outlined in the approved EMP (or site-specific EMP/construction EMP when applicable).
- In addition to the table on EMP implementation, the main text of the report should discuss in details the following items:

  (i) **Grievance Redress Mechanism.** Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).

  (ii) **Complaints Received during the Reporting Period.** Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).

    - Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
    - Identify muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads.
    - Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these were intact following heavy rain;
    - Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area.
    - Confirm spill kits on site and site procedure for handling emergencies.
    - Identify any chemical stored on site and provide information on storage condition. Attach photograph.
    - Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
    - Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
    - Provide information on barricades, signages, and on-site boards. Provide photographs.
    - Provide information on Checking if there are any activities being under taken out of working hours and how that is being managed.

Summary of Environmental Monitoring Activities (for the Reporting Period)[a]

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						
Construction Phase						
Operational Phase						

[a] Attach Laboratory Results and Sampling Map/Locations.

Overall Compliance with CEMP/ EMP

No.	Sub-Project Name	EMP/ CEMP Part of Contract Documents (Y/N)	CEMP/ EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

5. Approach and Methodology for Environmental Monitoring of the Project

- Brief description on the approach and methodology used for environmental monitoring of each sub-project

6. Monitoring of Environmental Impacts on Project Surroundings (Ambient Air, Water Quality and Noise Levels)

- Brief discussion on the basis for monitoring
- Indicate type and location of environmental parameters to be monitored
- Indicate the method of monitoring and equipment to be used
- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements

As a minimum the results should be presented as per the tables below.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Government Standards)		
			PM10 µg/m3	SO2 µg/m3	NO2 µg/m3

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)		
			PM10 µg/m3	SO2 µg/m3	NO2 µg/m3

Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters (Government Standards)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Site No.	Date of Sampling	Site Location	Parameters (Monitoring Results)

			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	LA_{eq} (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	LA_{eq} (dBA) (Monitoring Results)	
			Day Time	Night Time

7. Summary of Key Issues and Remedial Actions

- Summary of follow up time-bound actions to be taken within a set timeframe.

8. Appendixes

- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- Other

KANGSABATI RESERVOIR (MUKUTMONIPUR RESERVOIR) DATA, JUNE TO OCTOBER

Kangsabati Reservoir Data for the year 2005(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.05	397.75	16617	NIL
02.06.05	397.75	16617	NIL
03.06.05	397.75	16617	NIL
04.06.05	397.75	16617	NIL
05.06.05	397.75	16617	NIL
06.06.05	397.75	16617	NIL
07.06.05	397.70	16515	NIL
08.06.05	397.70	16515	NIL
09.06.05	397.70	16515	NIL
10.06.05	397.70	16515	NIL
11.06.05	397.70	16515	NIL
12.06.05	397.70	16515	NIL
13.06.05	397.70	16515	NIL
14.06.05	397.70	16515	NIL
15.06.05	397.70	16515	NIL
16.06.05	397.70	16515	NIL
17.06.05	397.70	16515	NIL
18.06.05	397.70	16515	NIL
19.06.05	397.70	16515	NIL
20.06.05	397.70	16515	NIL
21.06.05	397.70	16515	NIL
22.06.05	397.70	16515	NIL
23.06.05	397.70	16515	NIL
24.06.05	397.80	16719	604
25.06.05	397.85	17221	302
26.06.05	397.90	17523	302
27.06.05	398.30	18731	1208
28.06.05	398.55	21464	2733
29.06.05	398.85	22263	1833
30.06.05	399.30	24773	1550

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.05	399.65	28096	3323
02.07.05	399.95	29909	1814
03.07.05	400.20	32085	3396
04.07.05	400.30	32935	508
05.07.05	400.30	32933	NIL
06.07.05	400.40	33920	927
07.07.05	400.50	34861	927
08.07.05	400.55	35311	464
09.07.05	400.60	35774	463
10.07.05	400.60	35774	NIL
11.07.05	400.70	36701	927
12.07.05	400.80	37629	928
13.07.05	400.95	39019	1390
14.07.05	401.20	41337	2318
15.07.05	401.45	43655	2318
16.07.05	401.85	47364	3709
17.07.05	402.30	51536	4172
18.07.05	402.70	55245	3709
19.07.05	402.80	56172	927
20.07.05	402.90	57099	927
21.07.05	403.15	59461	1391
22.07.05	403.25	60344	1854
23.07.05	403.45	62198	1854
24.07.05	403.90	63589	1391
25.07.05	403.85	65907	2318
26.07.05	404.10	68225	2318
27.07.05	404.55	72397	4172
28.07.05	405.20	78423	6026
29.07.05	406.00	85841	7418
30.07.05	406.60	91404	5563
31.07.05	407.10	96043	4639

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.05	407.70	101602	5562
02.08.05	408.20	106238	4636
03.08.05	408.70	110874	4636
04.08.05	411.00	136358	25484
05.08.05	414.30	167248	30890
06.08.05	414.40	182022	14774
07.08.05	415.05	190753	8731
08.08.05	415.30	194110	3357
09.08.05	415.45	196125	2015
10.08.05	415.70	199483	3358
11.08.05	415.50	196797	680
12.08.05	414.80	187395	NIL
13.08.05	414.10	177993	2623
14.08.05	413.50	167248	2329
15.08.05	412.59	156804	3057
16.08.05	412.00	149789	6566
17.08.05	411.60	144417	7653
18.08.05	410.80	133672	2210
19.08.05	409.90	122000	964
20.08.05	409.00	113258	3308
21.08.05	410.00	122327	20988
22.08.05	411.10	137701	27298
23.08.05	411.00	136958	10910
24.08.05	410.60	130986	6199
25.08.05	411.40	141730	12380
26.08.05	412.25	151802	10072
27.08.05	412.70	155189	7387
28.08.05	413.10	164562	5373
29.08.05	413.30	167248	2686
30.08.05	413.50	169334	2686
31.08.05	413.70	172621	2687

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.05	413.75	173292	671
02.09.05	413.75	173292	NIL
03.09.05	413.75	173292	NIL
04.09.05	413.85	174635	1343
05.09.05	413.85	174635	NIL
06.09.05	413.95	175978	1343
07.09.05	414.00	176650	672
08.09.05	414.10	177993	1343
09.09.05	414.25	180008	2015
10.09.05	414.30	180679	671
11.09.05	414.35	181351	672
12.09.05	414.05	177322	946
13.09.05	413.45	169258	4523
14.09.05	413.80	173964	9055
15.09.05	414.50	183366	9402
16.09.05	415.10	191424	8058
17.09.05	415.50	197797	5373
18.09.05	416.10	206855	8058
19.09.05	417.60	225001	20146
20.09.05	418.60	238432	13432
21.09.05	419.15	245819	7587
22.09.05	419.45	249848	4029
23.09.05	419.65	252534	2686
24.09.05	419.80	254549	2015
25.09.05	419.95	256563	2014
26.09.05	420.05	258169	1608
27.09.05	420.10	259104	935
28.09.05	419.80	254549	1454
29.09.05	419.00	243804	3429
30.09.05	418.20	233059	4326

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.05	417.30	219628	1652
02.10.05	416.10	203895	31
03.10.05	415.30	193110	3782
04.10.05	414.30	180679	980
05.10.05	413.30	167248	719
06.10.05	412.30	153818	1021
07.10.05	411.30	140387	232
08.10.05	410.35	127627	378
09.10.05	409.20	115530	272
10.10.05	409.10	114583	76
11.10.05	409.20	115510	NIL
12.10.05	409.20	115510	NIL
13.10.05	409.20	115510	NIL
14.10.05	409.20	115510	NIL
15.10.05	409.20	115510	NIL
16.10.05	409.30	116437	927
17.10.05	409.40	117364	927
18.10.05	409.40	117364	NIL
19.10.05	409.80	123073	3703
20.10.05	414.75	185723	65650
21.10.05	419.30	2438004	57081
22.10.05	420.80	272186	28382
23.10.05	422.00	294614	22428
24.10.05	423.00	313903	18583
25.10.05	423.65	325452	12149
26.10.05	424.10	333862	8410
27.10.05	424.40	339460	5597
28.10.05	424.60	343207	3738
29.10.05	424.80	346945	3738
30.10.05	425.00	350685	3738
31.10.05	425.10	352552	1869

15/02/17
Assistant Engineer
Sub-Division Officer
K.L.B. Sub-Division-II
Mukutmonipur, Bankura

14/2/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

Pg-1

Kangsabati Reservoir Data for the year 2006(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.06	401.10	40410	NIL
02.06.06	401.10	40410	NIL
03.06.06	401.10	40410	NIL
04.06.06	401.10	40410	NIL
05.06.06	401.30	42265	1855
06.06.06	401.90	47828	5563
07.06.06	404.00	67298	19470
08.06.06	406.80	93258	25960
09.06.06	407.40	98821	5563
10.06.06	407.45	99284	463
11.06.06	407.60	100675	1391
12.06.06	407.70	101602	927
13.06.06	407.75	102066	464
14.06.06	407.75	102066	NIL
15.06.06	407.75	102066	NIL
16.06.06	407.80	102530	464
17.06.06	407.85	102993	463
18.06.06	407.90	103457	464
19.06.06	407.90	103457	NIL
20.06.06	407.95	103920	463
21.06.06	408.00	104384	464
22.06.06	408.10	105311	927
23.06.06	408.15	105775	464
24.06.06	408.20	106238	463
25.06.06	408.25	106702	464
26.06.06	408.30	107166	464
27.06.06	408.35	107629	463
28.06.06	408.45	108556	927
29.06.06	408.85	112265	3709
30.06.06	408.95	113192	927

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.06	409.00	28096	464
02.07.06	409.10	29909	927
03.07.06	409.20	32065	927
04.07.06	409.30	32993	927
05.07.06	409.40	32993	927
06.07.06	409.45	33920	463
07.07.06	409.50	34847	464
08.07.06	409.55	35311	463
09.07.06	409.60	35774	464
10.07.06	409.90	35774	2781
11.07.06	411.30	36701	18388
12.07.06	412.80	37629	20146
13.07.06	414.30	39019	30146
14.07.06	415.35	42337	14403
15.07.06	417.70	43855	35562
16.07.06	421.35	47364	56122
17.07.06	423.90	51596	47658
18.07.06	425.20	55245	24297
19.07.06	426.05	56172	15886
20.07.06	426.40	57099	9541
21.07.06	427.40	58490	18690
22.07.06	428.20	60344	14951
23.07.06	428.90	62198	13083
24.07.06	429.25	63589	6542
25.07.06	429.40	65907	6291
26.07.06	429.20	68225	4408
27.07.06	429.00	425441	8012
28.07.06	429.00	425441	13140
29.07.06	428.80	421703	9380
30.07.06	429.85	441328	28330
31.07.06	431.65	4484371	50012

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.06	432.65	508759	35352
02.08.06	433.05	518514	22911
03.08.06	433.35	525881	20999
04.08.06	433.40	527051	15299
05.08.06	433.40	527051	14073
06.08.06	433.25	523392	9595
07.08.06	433.05	518514	9102
08.08.06	432.90	514856	10420
09.08.06	432.40	502662	1892
10.08.06	431.90	490468	1849
11.08.06	431.45	479404	3050
12.08.06	431.05	469438	4352
13.08.06	430.65	460983	4267
14.08.06	430.10	446570	525
15.08.06	430.55	457564	14296
16.08.06	430.95	467300	9795
17.08.06	431.45	479454	12194
18.08.06	432.10	495347	15853
19.08.06	433.10	519734	24388
20.08.06	434.05	542962	23168
21.08.06	434.95	564853	32019
22.08.06	435.10	568511	23929
23.08.06	435.20	570960	22763
24.08.06	435.85	586802	36322
25.08.06	435.50	578266	20046
26.08.06	435.35	574608	10241
27.08.06	436.20	596557	21949
28.08.06	436.05	591679	22275
29.08.06	435.15	569730	9697
30.08.06	434.60	556017	10130
31.08.06	435.50	578266	26829

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.06	463.30	537776	24256
02.09.06	435.45	561435	12818
03.09.06	435.35	594118	6876
04.09.06	435.45	561435	13377
05.09.06	437.10	617287	33912
06.09.06	436.30	597776	20710
07.09.06	436.40	600215	14699
08.09.06	436.35	598996	11234
09.09.06	436.25	596557	11749
10.09.06	436.30	597776	15358
11.09.06	436.30	597776	14128
12.09.06	436.15	594118	10447
13.09.06	436.00	590460	10412
14.09.06	435.70	583144	6685
15.09.06	435.35	574608	5653
16.09.06	435.00	565072	5578
17.09.06	434.60	556317	4898
18.09.06	434.20	546362	4303
19.09.06	433.75	535587	3156
20.09.06	433.40	527051	5538
21.09.06	433.50	529496	14301
22.09.06	436.40	600215	78073
23.09.06	437.85	635578	71262
24.09.06	437.05	616067	32486
25.09.06	437.80	634358	30408
26.09.06	438.35	647772	21625
27.09.06	438.50	651431	15015
28.09.06	437.00	614848	4663
29.09.06	437.15	618506	6338
30.09.06	437.40	624603	6097

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.06	437.90	636797	12194
02.10.06	438.20	644114	7317
03.10.06	438.45	650211	6097
04.10.06	438.60	653869	3658
05.10.06	438.60	653869	4486
06.10.06	438.55	652650	5854
07.10.06	438.50	651431	5891
08.10.06	438.35	647772	4156
09.10.06	438.10	641675	3027
10.10.06	437.85	635578	3044
11.10.06	437.50	627042	4010
12.10.06	437.00	614848	2189
13.10.06	436.50	602654	3079
14.10.06	436.00	590460	3125
15.10.06	435.50	578266	3179
16.10.06	435.00	566072	3065
17.10.06	434.45	552859	3897
18.10.06	433.85	538025	738
19.10.06	433.55	530709	3029
20.10.06	433.00	517295	218
21.10.06	432.40	502662	656
22.10.06	431.90	490468	1224
23.10.06	431.40	478274	1054
24.10.06	430.85	464861	713
25.10.06	430.25	450228	550
26.10.06	429.55	435721	766
27.10.06	429.10	427310	2537
28.10.06	428.70	419834	2649
29.10.06	428.65	418900	777
30.10.06	428.65	418900	NIL
31.10.06	428.65	418900	NIL

14/02/17
Assistant Engineer
Sub-Division Officer
K.L.B. Sub-Division-II
Mukutmonipur, Bankura

14/2/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

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Kangsabati Reservoir Data for the year 2007(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.07	395.40	2417	94
02.06.07	395.40	2417	94
03.06.07	395.40	2417	94
04.06.07	395.40	2417	94
05.06.07	395.40	2417	94
06.06.07	395.40	2417	94
07.06.07	395.40	2417	94
08.06.07	395.40	2417	94
09.06.07	395.40	2417	94
10.06.07	395.40	2417	94
11.06.07	395.40	2417	94
12.06.07	395.40	2417	94
13.06.07	395.40	2417	94
14.06.07	395.40	2417	94
15.06.07	395.40	2417	94
16.06.07	395.40	2417	43
17.06.07	395.40	2417	NIL
18.06.07	395.40	2417	NIL
19.06.07	395.40	2417	NIL
20.06.07	395.45	2719	302
21.06.07	395.45	2719	NIL
22.06.07	395.60	3625	906
23.06.07	395.80	4834	1209
24.06.07	396.00	6042	1208
25.06.07	396.05	6344	302
26.06.07	396.15	6948	604
27.06.07	396.20	7251	303
28.06.07	396.25	7553	302
29.06.07	396.35	8157	604
30.06.07	396.50	9064	907

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.07	396.60	9668	604
02.07.07	396.65	9970	302
03.07.07	396.70	10272	302
04.07.07	396.75	10574	302
05.07.07	397.15	12991	2417
06.07.07	421.55	286204	273213
07.07.07	429.70	438524	152320
08.07.07	431.70	485591	47067
09.07.07	432.65	508759	23168
10.07.07	433.15	520953	12194
11.07.07	433.30	524612	3659
12.07.07	433.40	527051	2439
13.07.07	433.65	533148	6097
14.07.07	433.75	535587	2439
15.07.07	433.85	538026	2439
16.07.07	434.25	547781	9755
17.07.07	434.20	546562	31423
18.07.07	433.00	517295	11107
19.07.07	431.85	489249	312
20.07.07	432.40	502662	14813
21.07.07	433.00	517295	18589
22.07.07	433.20	522173	8937
23.07.07	433.40	527051	11537
24.07.07	433.70	534367	14474
25.07.07	434.70	558756	33003
26.07.07	435.20	570950	19051
27.07.07	435.20	570950	20036
28.07.07	434.20	546562	10146
29.07.07	433.45	528270	10813
30.07.07	433.55	530709	17501
31.07.07	433.70	534367	8780

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.07	433.70	534367	7673
02.08.07	433.70	534367	7111
03.08.07	434.70	558756	32008
04.08.07	435.00	566072	18138
05.08.07	435.00	566072	11420
06.08.07	434.75	559975	5461
07.08.07	434.40	551439	5306
08.08.07	434.00	541684	5267
09.08.07	433.70	534367	7747
10.08.07	433.45	528270	7430
11.08.07	433.15	520953	7621
12.08.07	432.60	507540	1449
13.08.07	433.50	429490	36855
14.08.07	435.05	567291	51971
15.08.07	435.05	567291	30032
16.08.07	434.25	547781	14653
17.08.07	433.20	522173	8113
18.08.07	436.00	590460	77570
19.08.07	438.70	656308	304491
20.08.07	434.40	551439	111565
21.08.07	433.35	525831	33402
22.08.07	432.90	514856	16929
23.08.07	432.40	502662	6816
24.08.07	432.70	509979	9793
25.08.07	433.05	518514	8576
26.08.07	433.40	527051	8537
27.08.07	433.75	535587	8536
28.08.07	434.15	545342	9755
29.08.07	434.35	550220	9380
30.08.07	434.25	547781	7681
31.08.07	434.00	541684	7962

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.07	433.65	533148	6185
02.09.07	433.10	519734	1641
03.09.07	432.70	509979	5336
04.09.07	432.10	495346	448
05.09.07	431.75	486810	6566
06.09.07	431.65	484371	12594
07.09.07	431.60	483152	13905
08.09.07	431.55	481932	13898
09.09.07	431.60	483152	16338
10.09.07	431.55	481932	13898
11.09.07	431.30	475835	8995
12.09.07	431.55	481932	21887
13.09.07	431.25	474616	7760
14.09.07	431.35	477055	17491
15.09.07	431.15	472177	10165
16.09.07	431.25	474616	14816
17.09.07	431.30	475835	5688
18.09.07	431.35	477055	5240
19.09.07	431.30	475835	2800
20.09.07	431.40	478274	2712
21.09.07	431.40	478274	
22.09.07	431.55	481932	3658
23.09.07	431.70	485591	3659
24.09.07	434.95	564853	79262
25.09.07	436.55	603873	89783
26.09.07	437.00	614848	95850
27.09.07	436.60	605093	61734
28.09.07	436.80	609970	41602
29.09.07	437.65	630700	25584
30.09.07	438.45	650211	19511

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.07	438.80	658747	15119
02.10.07	438.95	662406	12443
03.10.07	439.00	663625	14101
04.10.07	439.00	663625	15074
05.10.07	438.85	659967	11567
06.10.07	438.40	648992	4244
07.10.07	438.20	644114	10407
08.10.07	437.80	634358	5453
09.10.07	437.40	624603	5484
10.10.07	437.00	614848	5397
11.10.07	436.50	602654	3242
12.10.07	436.00	590460	3195
13.10.07	435.45	577047	2043
14.10.07	434.90	563633	2046
15.10.07	434.45	552659	3731
16.10.07	434.00	541684	3077
17.10.07	434.00	541684	2766
18.10.07	434.00	541684	NIL
19.10.07	434.00	541684	NIL
20.10.07	434.00	541684	NIL
21.10.07	434.00	541684	NIL
22.10.07	434.00	541684	NIL
23.10.07	434.00	541684	NIL
24.10.07	434.00	541684	NIL
25.10.07	434.00	541684	NIL
26.10.07	434.00	541684	NIL
27.10.07	434.00	541684	NIL
28.10.07	434.00	541684	NIL
29.10.07	434.00	541684	NIL
30.10.07	434.00	541684	NIL
31.10.07	434.00	541684	NIL

13/02/17
Assistant Engineer
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K.L.B. Sub-Division-II
Mukutmonipur, Bankura

14/2/17
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Kangsabati Canals Divn.-II
Khatra Bankura

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Kangsabati Reservoir Data for the year 2008(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.08	402.90	57009	NIL
02.06.08	402.90	57009	NIL
03.06.08	402.90	57009	NIL
04.06.08	402.90	57009	NIL
05.06.08	402.90	57009	NIL
06.06.08	402.90	57009	NIL
07.06.12	402.90	57009	NIL
08.06.08	402.90	57009	NIL
09.06.08	402.90	57009	NIL
10.06.08	402.90	57009	NIL
11.06.08	402.90	57009	NIL
12.06.08	402.90	57009	NIL
13.06.08	402.90	57009	NIL
14.06.08	403.10	58953	1854
15.06.08	403.40	61735	2782
16.06.08	403.50	62662	927
17.06.08	404.20	69152	6490
18.06.08	410.00	122927	53775
19.06.08	419.65	252534	129607
20.06.08	421.40	283400	30866
21.06.08	422.20	298352	14952
22.06.08	422.90	311434	13082
23.06.08	423.30	318910	7476
24.06.08	423.50	322648	3738
25.06.08	423.70	326386	3738
26.06.08	423.85	329190	2804
27.06.08	424	331993	2803
28.06.08	424.05	332928	935
29.06.08	424.7	345076	12148
30.06.08	425.5	360028	14952

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.08	425.95	368438	8471
02.07.08	426.25	374045	5607
03.07.08	426.50	378717	4672
04.07.08	426.70	382455	3738
05.07.08	427.05	388996	6541
06.07.08	427.55	398341	9345
07.07.08	429.05	426376	28035
08.07.08	430.05	445350	18974
09.07.08	430.70	461203	15853
10.07.08	434.50	553878	92675
11.07.08	435.00	566072	26193
12.07.08	434.45	552659	7416
13.07.08	433.75	535587	3133
14.07.08	433.25	523392	8076
15.07.08	432.70	509979	6688
16.07.08	433.10	519734	29835
17.07.08	432.70	509979	10325
18.07.08	432.50	505101	15078
19.07.08	432.80	512417	27294
20.07.08	433.85	538026	45815
21.07.08	433.90	539245	21594
22.07.08	433.50	529490	10571
23.07.08	432.90	514856	5545
24.07.08	433.00	517295	22549
25.07.08	434.10	544123	47128
26.07.08	434.10	544123	22451
27.07.08	433.7	534367	13790
28.07.08	433.25	523392	12418
29.07.08	432.7	509979	12797
30.07.08	432.80	512417	14822
31.07.08	433.00	517295	17008

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.08	433.25	523392	18717
02.08.08	433.25	525831	15974
03.08.08	433.40	527051	13934
04.08.08	433.30	524612	10357
05.08.08	432.95	516076	5150
06.8.08	432.70	509979	8654
07.08.08	432.25	499004	2949
08.08.08	432.05	494126	8236
09.08.08	431.75	486810	6468
10.08.08	431.30	475835	3574
11.08.08	431.25	474616	12599
12.08.08	431.30	475835	13577
13.08.08	431.75	486810	20174
14.08.08	431.95	491688	15253
15.08.08	432.60	507540	26661
16.08.08	433.50	529489	32448
17.08.08	433.80	536806	17858
18.08.08	433.85	538026	11789
19.08.08	433.80	536806	11788
20.08.08	434.35	550220	17017
21.08.08	435.70	583144	42142
22.08.08	435.15	569731	14850
23.08.08	434.40	549000	8709
24.08.08	433.25	523392	3265
25.08.08	433.25	523392	4764
26.08.08	433.40	527051	3659
27.08.08	433.4	527051	NIL
28.08.08	433.3	524612	5724
29.08.08	433	517295	4891
30.08.08	432.75	511198	6916
31.08.08	432.50	505101	7050

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.08	432.10	495346	3328
02.09.08	431.75	486810	4833
03.09.08	431.35	477055	3639
04.09.08	431.00	468519	4959
05.09.08	430.60	458764	3919
06.9.08	430.40	453886	8769
07.09.08	430.05	445350	6249
08.09.08	429.65	437590	4374
09.09.08	429.10	427310	3757
10.09.08	428.60	417965	5492
11.09.08	428.30	412358	9184
12.09.08	427.85	403948	2741
13.09.08	427.45	396472	3341
14.09.08	427.50	397407	5941
15.09.08	427.50	397407	4120
16.09.08	427.70	401144	7867
17.09.08	428.35	413293	15755
18.09.08	429.70	438524	25675
19.09.08	431.65	484371	45847
20.09.08	432.85	513637	29266
21.09.08	433.40	527051	13414
22.09.08	433.70	534367	7316
23.09.08	434.00	541684	7317
24.09.08	434.50	553878	12194
25.09.08	435.50	578266	24388
26.09.08	436.60	605093	33491
27.09.08	437.2	619726	24557
28.09.08	437.15	618506	12083
29.09.08	436.95	613629	8762
30.09.08	436.6	605093	5147

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.08	436.25	596557	5130
02.10.08	435.80	585582	2933
03.10.08	435.35	574608	2976
04.10.08	434.95	564853	4235
05.10.08	434.45	552659	1742
06.10.08	434.45	552659	7436
07.10.08	434.45	552659	NIL
08.10.08	434.50	553878	1219
09.10.08	434.60	556317	2439
10.10.08	434.65	557536	1219
11.10.08	434.65	557536	NIL
12.10.08	434.65	557536	NIL
13.09.08	434.65	557536	NIL
14.10.08	434.60	556317	976
15.10.08	434.45	552659	1975
16.10.08	434.15	545342	4023
17.10.08	433.65	533148	2654
18.10.08	433.15	520953	102
19.10.08	432.75	511198	791
20.10.08	432.15	496565	NIL
21.10.08	431.55	481932	313
22.10.08	430.95	463700	348
23.10.08	430.35	452667	366
24.10.08	429.70	438524	798
25.10.08	428.95	424507	951
26.10.08	428.15	409555	NIL
27.10.08	428.00	406751	5629
28.10.08	427.95	405817	297
29.10.08	427.80	403013	358
30.10.08	427.65	400210	656
31.10.08	427.65	400210	247

13/2/17
Assistant Engineer
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K.L.B. Sub-Division-II
Mukutmonipur, Bankura

14/2/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

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Kangsabati Reservoir Data for the year 2009(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.09	398.10	18731	NIL
02.06.09	398.10	18731	NIL
03.06.09	398.10	18731	NIL
04.06.09	398.10	18731	NIL
05.06.09	398.10	18731	NIL
06.06.09	398.10	18731	NIL
07.06.09	398.10	18731	NIL
08.06.09	398.10	18731	NIL
09.06.09	398.10	18731	NIL
10.06.09	398.10	18731	NIL
11.06.09	398.10	18731	NIL
12.06.09	398.10	18731	NIL
13.06.09	398.10	18731	NIL
14.06.09	398.10	18731	NIL
15.06.09	398.10	18731	NIL
16.06.09	398.10	18731	NIL
17.06.09	398.10	18731	NIL
18.06.09	398.10	18731	NIL
19.06.09	398.10	18731	NIL
20.06.09	398.10	18731	NIL
21.06.09	398.10	18731	NIL
22.06.09	398.10	18731	NIL
23.06.09	398.10	18731	NIL
24.06.09	398.10	18731	NIL
25.06.09	398.10	18731	NIL
26.06.09	398.10	18731	NIL
27.06.09	398.10	18731	NIL
28.06.09	398.10	18731	NIL
29.06.09	398.10	18731	NIL
30.06.09	398.10	18731	NIL

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.09	398.10	18731	NIL
02.07.09	398.10	18731	NIL
03.07.09	398.10	18731	NIL
04.07.09	398.10	18731	NIL
05.07.09	398.10	18731	NIL
06.07.09	398.10	18731	NIL
07.07.09	398.30	19940	1209
08.07.09	398.60	21753	1813
09.07.09	398.70	22356	603
10.07.09	398.85	23262	906
11.07.09	398.90	23564	302
12.07.09	399.35	26283	2719
13.07.09	400.00	30211	3928
14.07.09	400.40	33920	3709
15.07.09	400.55	35311	1391
16.07.09	400.70	36701	1390
17.07.09	400.85	38092	1391
18.07.09	401.00	39483	1391
19.07.09	401.50	39948	465
20.07.09	401.20	41337	1389
21.07.09	401.35	42728	1391
22.07.09	401.60	45046	2318
23.07.09	401.80	46901	1855
24.07.09	402.00	48755	1854
25.07.09	402.15	50146	1391
26.07.09	402.25	51073	927
27.07.09	402.60	54318	3245
28.07.09	403.10	58953	4635
29.07.09	403.70	64516	5563
30.07.09	404.05	67761	3245
31.07.09	404.25	69616	1855

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.09	404.40	71006.00	1390.00
02.08.09	404.55	72397.00	1391.00
03.08.09	404.90	75642.00	3245.00
04.08.09	405.70	83059.00	7417.00
05.08.09	407.00	95112.00	12053.00
06.08.09	407.70	101602.00	6490.00
07.08.09	408.20	106238.00	4636.00
08.08.09	408.80	111801.00	5563.00
09.08.09	409.95	122463.00	10662.00
10.08.09	411.05	137030.00	14567.00
11.08.09	411.60	143745.00	6715.00
12.08.09	412.00	149789.00	6044.00
13.08.09	412.15	151804.00	2015.00
14.08.09	412.90	161876.00	10072.00
15.08.09	413.85	174635.00	12759.00
16.08.09	414.30	180679.00	6044.00
17.08.09	414.90	188738.00	8059.00
18.08.09	415.30	194110.00	5372.00
19.08.09	415.60	198139.00	4029.00
20.08.09	415.85	201497.00	3358.00
21.08.09	416.25	206869.00	5372.00
22.08.09	416.75	213585.00	6716.00
23.08.09	417.10	218285.00	4700.00
24.08.09	417.50	223658.00	5373.00
25.08.09	418.30	234402.00	10744.00
26.08.09	419.60	251863.00	17461.00
27.08.09	420.70	270317.00	18454.00
28.08.09	421.80	290876.00	20559.00
29.08.09	423.55	323583.00	32707.00
30.08.09	425.00	350683.00	27100.00
31.08.09	425.60	361896.00	11213.00

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.09	425.90	367503	5607.00
02.09.09	426.10	371241	3738.00
03.09.09	426.20	373110	1869.00
04.09.09	426.30	374979	1869.00
05.09.09	426.45	377783	2804.00
06.09.09	427.15	390865	13082.00
07.09.09	436.15	594118	203253
08.09.09	436.35	598996	68050.00
09.09.09	433.90	539245	26311.00
10.09.09	432.70	509979	23008.00
11.09.09	433.30	524612	21017.00
12.09.09	433.70	534367	9755.00
13.09.09	434.00	541684	7317.00
14.09.09	434.20	546562	5533.00
15.09.09	434.35	550220	4707.00
16.09.09	434.25	547781	4080.00
17.09.09	434.10	544123	4899.00
18.09.09	433.90	539245	3824.00
19.09.09	433.75	535587	5410.00
20.09.09	433.70	534367	7895.00
21.09.09	433.65	533148	8032.00
22.09.09	433.35	525831	4039.00
23.09.09	433.10	519734	4692.00
24.09.09	432.75	511198	2717.00
25.09.09	432.35	501443	3298.00
26.09.09	432.00	492907	4564.00
27.09.09	431.60	483152	3304.00
28.09.09	431.05	469738	492.00
29.09.09	430.60	458764	3055.00
30.09.09	430.05	445350	555.00

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.09	429.65	437590	6268
02.10.09	429.05	426376	2780
03.10.09	428.60	417965	5027
04.10.09	428.10	408620	3903
05.10.09	428.00	406751	11331
06.10.09	428.00	406751	9443
07.10.09	428.10	408620	6399
08.10.09	428.40	414227	13383
09.10.09	428.35	413293	7574
10.10.09	428.45	415161	6654
11.10.09	428.45	415161	4971
12.10.09	428.40	414227	4080
13.10.09	428.30	412358	3140
14.10.09	428.10	408620	1258
15.10.09	427.90	404882	1241
16.10.09	427.85	403948	2022
17.10.09	427.60	399275	606
18.10.09	427.15	390865	697
19.10.09	426.75	383390	2110
20.10.09	426.35	375914	2160
21.10.09	425.75	364700	1523
22.10.09	425.15	353486	2234
23.10.09	424.45	340404	459
24.10.09	423.75	327321	491
25.10.09	423.10	315172	1330
26.10.09	422.45	303024	1282
27.10.09	421.95	293680	884
28.10.09	421.25	280597	NIL
29.10.09	420.45	265645	NIL
30.10.09	419.70	253206	1585
31.10.09	418.80	241118	1813

12/02/17
Assistant Engineer
Sub-Division Officer
K.L.B. Sub-Division-II
Mukutmonipur, Bankura

14/2/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

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Kangsabati Reservoir Data for the year 2010(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.10	399.60	27794	NIL
02.06.10	399.60	27794	NIL
03.06.10	399.60	27794	NIL
04.06.10	399.60	27794	NIL
05.06.10	399.60	27794	NIL
06.06.10	399.60	27794	NIL
07.06.10	399.60	27794	NIL
08.06.10	399.60	27794	NIL
09.06.10	399.60	27794	NIL
10.06.10	399.60	27794	NIL
11.06.10	399.60	27794	NIL
12.06.10	399.60	27794	NIL
13.06.10	399.60	27794	NIL
14.06.10	399.60	27794	NIL
15.06.10	399.60	27794	NIL
16.06.10	399.60	27794	NIL
17.06.10	399.60	27794	NIL
18.06.10	399.60	27794	NIL
19.06.10	399.70	28398	604
20.06.10	399.70	28398	NIL
21.06.10	399.80	29003	605
22.06.10	399.80	29003	NIL
23.06.10	399.90	29609	606
24.06.10	399.90	29609	NIL
25.06.10	399.90	29609	NIL
26.06.10	399.90	29609	NIL
27.06.10	399.95	29909	302
28.06.10	399.95	29909	NIL
29.06.10	399.95	29909	NIL
30.06.10	400.00	30211	302

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.10	400.00	30211.00	NIL
02.07.10	400.00	30211.00	NIL
03.07.10	400.00	30211.00	NIL
04.07.10	400.00	30211.00	NIL
05.07.10	400.00	30211.00	NIL
06.07.10	400.00	30211.00	NIL
07.07.10	400.00	30211.00	NIL
08.07.10	400.00	30211.00	NIL
09.07.10	400.00	30211.00	NIL
10.07.10	400.00	30211.00	NIL
11.07.10	400.00	30211.00	NIL
12.07.10	400.05	30675.00	464.00
13.07.10	400.10	31138.00	463.00
14.07.10	400.10	31138.00	NIL
15.07.10	400.10	31138.00	NIL
16.07.10	400.10	31138.00	NIL
17.07.10	400.10	31138.00	NIL
18.07.10	400.10	31138.00	NIL
19.07.10	400.10	31138.00	NIL
20.07.10	400.10	31138.00	NIL
21.07.10	400.10	31138.00	NIL
22.07.10	400.10	31138.00	NIL
23.07.10	400.10	31138.00	NIL
24.07.10	400.10	31138.00	NIL
25.07.10	400.10	31138.00	NIL
26.07.10	400.40	33920.00	2782.00
27.07.10	400.6	35774.00	1854.00
28.07.10	400.65	36238.00	464.00
29.07.10	400.65	36238.00	
30.07.10	400.80	37629.00	1391.00
31.07.10	400.80	37629.00	1391.00

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.10	400.90	38556	927
02.08.10	400.95	39020	464
03.08.10	401.20	41337	2317
04.08.10	401.35	42728	1391
05.08.10	401.50	44119	1391
06.8.10	401.70	45973	1854
07.08.10	401.95	48291	2318
08.08.10	402.15	50146	1855
09.08.10	402.30	51536	1390
10.08.10	402.40	52463	997
11.08.10	402.50	53390	927
12.08.10	402.50	53390	NIL
13.08.10	402.50	53390	NIL
14.08.10	402.55	53854	464
15.08.10	402.90	57098	3244
16.08.10	403.05	58489	1391
17.08.10	403.05	58489	NIL
18.08.10	403.20	59880	1391
19.08.10	403.40	61734	1854
20.08.10	403.40	61734	NIL
21.08.10	403.45	62198	464
22.08.10	403.55	63125	927
23.08.10	404.00	68225	5100
24.08.10	404.30	70079	1854
25.08.10	404.40	71006	927
26.08.10	404.95	76105	5099
27.08.10	405.4	80277	4172
28.08.10	405.65	82595	2318
29.08.10	405.8	83986	1391
30.08.10	405.95	85377	1391
31.08.10	406.10	86768	1391

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.10	406.25	88159.00	1391
02.09.10	406.35	89086.00	927
03.09.10	406.50	90477.00	1391
04.09.10	406.60	91404.00	927
05.09.10	406.60	91404.00	NIL
06.9.10	406.60	91404.00	NIL
07.09.10	406.60	91404.00	NIL
08.09.10	406.85	93722.00	2318
09.09.10	407.00	95113.00	1391
10.09.10	407.20	96967.00	1854
11.09.10	407.30	97894.00	927
12.09.10	407.45	99285.00	1391
13.09.10	407.55	100212.00	927
14.09.10	407.60	100675.00	464
15.09.10	407.65	101139.00	464
16.09.10	407.95	103921.00	2782
17.09.10	408.15	105775.00	1854
18.09.10	408.35	107629.00	1854
19.09.10	408.70	110874.00	3245
20.09.10	409.00	113656.00	2782
21.09.10	409.35	116901.00	3245
22.09.10	409.90	122001.00	5100
23.09.10	410.20	125614.00	3613
24.09.10	410.45	128972.00	3358
25.09.10	410.75	133001.00	4029
26.09.10	411.00	136359.00	3358
27.09.10	411.2	139045.00	2686
28.09.10	411.3	140388.00	1343
29.09.10	411.35	141060.00	672
30.09.10	411.35	141060.00	NIL

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.10	411.35	141060	NIL
02.10.10	411.35	141060	NIL
03.10.10	411.35	141060	NIL
04.10.10	411.40	141730	670
05.10.10	411.40	141730	NIL
06.10.10	411.60	144417	2687
07.10.10	411.80	147103	2687
08.10.10	411.95	149116	2014
09.10.10	412.00	149788	672
10.10.10	412.05	150460	672
11.10.10	412.10	151132	672
12.10.10	411.20	139044	NIL
13.09.10	410.35	127628	2302
14.10.10	409.55	117829	4290
15.10.10	408.25	106702	3238
16.10.10	406.90	94185	NIL
17.10.10	405.80	83987	211
18.10.10	406.40	89550	10293
19.10.10	406.50	90477	927
20.10.10	406.55	90941	464
21.10.10	406.60	90404	463
22.10.10	406.75	92795	1391
23.10.10	406.95	94649	1854
24.10.10	407.10	96039	1390
25.10.10	407.20	96966	927
26.10.10	407.25	97430	464
27.10.10	407.25	97430	NIL
28.10.10	407.25	97430	NIL
29.10.10	407.25	97430	NIL
30.10.10	407.25	97430	NIL
31.10.10	407.25	97430	NIL

13/02/17
Assistant Engineer
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K.L.B. Sub-Division-II
Mukutmonipur, Bankura

14/2/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

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Kangsabati Reservoir Data for the year 2011(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.11	403.25	60422	NIL
02.06.11	403.25	60422	NIL
03.06.11	403.25	60422	NIL
04.06.11	403.25	60422	NIL
05.06.11	403.25	60422	NIL
06.06.11	403.25	60422	NIL
07.06.11	403.25	60422	NIL
08.06.11	403.25	60422	NIL
09.06.11	403.25	60422	NIL
10.06.11	403.25	60422	NIL
11.06.11	403.25	60422	NIL
12.06.11	403.25	60422	NIL
13.06.11	403.25	60422	NIL
14.06.11	403.25	60422	NIL
15.06.11	403.25	60422	NIL
16.06.11	403.25	60422	NIL
17.06.11	403.40	61735	1313
18.06.11	404.90	75642	13907
19.06.11	413.40	168591	92949
20.06.11	419.40	249176	80585
21.06.11	420.90	274071	24895
22.06.11	421.35	282466	8395
23.06.11	421.65	288073	5607
24.06.11	421.85	291811	3738
25.06.11	421.95	293679	1868
26.06.11	422.15	297417	3738
27.06.11	423.2	317041	19624
28.06.11	425.25	355355	38314
29.06.11	426.65	381521	26166
30.06.11	427.75	402079	20558

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.11	428.10	408620.00	6541.00
02.07.11	428.40	414227.00	5607.00
03.07.11	428.70	419834.00	5607.00
04.07.11	429.20	429179.00	9345.00
05.07.11	429.70	438524.00	9345.00
06.07.11	430.10	446570.00	8046.00
07.07.11	430.35	452667.00	6097.00
08.07.11	430.60	458764.00	6097.00
09.07.11	430.90	466080.00	7316.00
10.07.11	431.10	470958.00	4878.00
11.07.11	431.15	472177.00	1219.00
12.07.11	431.20	473397.00	1220.00
13.07.11	431.25	474616.00	1219.00
14.07.11	431.30	475836.00	1220.00
15.07.11	431.35	477055.00	1219.00
16.07.11	431.40	478175.00	1220.00
17.07.11	431.45	479499.00	1219.00
18.07.11	431.50	480713.00	1219.00
19.07.11	431.55	481932.00	1219.00
20.07.11	431.20	473397.00	895.00
21.07.11	430.75	462422.00	1763.00
22.07.11	431.50	480713.00	26352.00
23.07.11	434.15	545342.00	72781.00
24.07.11	434.55	555097.00	21462.00
25.07.11	434.45	552659.00	9468.00
26.07.11	434.10	544123.00	5399.00
27.07.11	433.7	534367.00	2800.00
28.07.11	433.35	525831.00	3189.00
29.07.11	432.85	513637.00	1133.00
30.07.11	432.30	500223.00	NIL
31.07.11	431.80	488029.00	375.00

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.11	431.30	475835	NIL
02.08.11	430.95	467300	4650
03.08.11	430.80	463641	10646
04.08.11	430.70	461203	12088
05.08.11	430.40	453886	7123
06.8.10	429.90	442262	2756
07.08.11	429.70	438524	10618
08.08.11	429.90	442262	18154
09.08.11	432.30	500223	68177
10.08.11	433.50	529490	36463
11.08.11	433.85	538026	18641
12.08.11	435.35	574608	49160
13.08.11	435.95	589241	58071
14.08.11	434.80	561194	44421
15.08.11	433.75	535587	23423
16.08.11	433.00	517295	8834
17.08.11	432.90	514856	14648
18.08.11	432.70	509979	25113
19.08.11	432.50	505101	24980
20.08.11	432.85	513637	42745
21.08.11	432.60	507540	20589
22.08.11	432.70	509979	13179
23.08.11	432.90	514856	6623
24.08.11	433.10	519734	4878
25.08.11	433.50	529489	9755
26.08.11	433.85	538026	8537
27.08.11	434.1	544123	6097
28.08.11	434.45	552659	8536
29.08.11	434.75	559975	7316
30.08.11	435.05	567291	7316
31.08.11	435.25	572169	4878

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.11	435.40	575827.00	3658
02.09.11	435.65	581924.00	11813
03.09.11	435.70	583144.00	13078
04.09.11	435.75	584363.00	13947
05.09.11	435.75	584363.00	12728
06.9.11	435.65	581924.00	10936
07.09.11	435.50	578266.00	9574
08.09.11	435.50	578266.00	13230
09.09.11	435.60	580705.00	15515
10.09.11	436.90	612409.00	95234
11.09.11	435.35	574608.00	45496
12.09.11	434.00	541684.00	158588
13.09.11	433.90	539245.00	14231
14.09.11	433.80	536806.00	9826
15.09.11	433.70	534367.00	9627
16.09.11	433.80	536806.00	13979
17.09.11	434.20	546562.00	21316
18.09.11	434.30	549000.00	21536
19.09.11	434.20	546562.00	26359
20.09.11	434.15	545342.00	48514
21.09.11	433.80	536806.00	21501
22.09.11	433.35	525831.00	15014
23.09.11	433.60	531928.00	40803
24.09.11	434.35	550220.00	66463
25.09.11	433.85	538026.00	31803
26.09.11	434.10	544123.00	19818
27.09.11	434.25	547781.00	11728
28.09.11	434.25	547781.00	8088
29.09.11	434.20	546562.00	6468
30.09.11	434.20	546562.00	5018

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.11	434.20	546562	4741
02.10.11	434.15	545542	3716
03.10.11	434.20	546562	2408
04.10.11	434.25	547781	1219
05.10.11	434.30	549000	1219
06.10.11	434.35	550219	1219
07.10.11	434.40	551438	1219
08.10.11	434.45	552657	1905
09.10.11	434.50	553876	1905
10.10.11	434.60	556317	3127
11.10.11	434.65	557536	4663
12.10.11	434.35	550220	2504
13.09.11	433.90	539245	1001
14.10.11	433.50	529490	3349
15.10.11	433.00	517295	1146
16.10.11	432.55	506320	2028
17.10.11	432.05	494126	802
18.10.11	431.45	479494	NIL
19.10.11	430.90	466080	NIL
20.10.11	430.35	452667	NIL
21.10.11	429.80	440393	1498
22.10.11	429.20	429179	2572
23.10.11	428.60	417965	2418
24.10.11	428.00	406751	2420
25.10.11	427.50	397406	4097
26.10.11	427.00	388062	3970
27.10.11	426.60	380586	4180
28.10.11	426.15	372176	1826
29.10.11	425.70	363765	1495
30.10.11	425.60	361896	1880
31.10.11	425.60	361896	1211

Assistant Engineer
Sub-Division Officer
K.L.B. Sub-Division-II
Mukutmonipur, Bankura

14/2/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

Kangsabati Reservoir Data for the year 2012(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.12	402.40	52463	NIL
02.06.12	402.20	50609	NIL
03.06.12	402.00	48755	NIL
04.06.12	401.85	47364	85
05.06.12	401.70	45973	85
06.06.12	401.50	44119	NIL
07.06.12	401.40	43192	NIL
08.06.12	401.40	43192	NIL
09.06.12	401.40	43192	NIL
10.06.12	401.40	43192	NIL
11.06.12	401.35	42728	NIL
12.06.12	401.35	42728	NIL
13.06.12	401.35	42728	NIL
14.06.12	401.35	42728	NIL
15.06.12	401.35	42728	NIL
16.06.12	401.35	42728	NIL
17.06.12	401.35	42728	NIL
18.06.12	401.35	42728	NIL
19.06.12	401.40	43192	464
20.06.12	401.60	45046	1854
21.06.12	401.80	46900	1854
22.06.12	402.20	50609	3709
23.06.12	402.40	52463	1854
24.06.12	402.65	54781	2318
25.06.12	402.90	57099	2318
26.06.12	403.10	58953	1854
27.06.12	403.2	59880	927
28.06.12	403.2	59880	NIL
29.06.12	403.2	59880	NIL
30.06.12	403.20	59880	NIL

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.12	403.50	62662.00	2782.00
02.07.12	403.65	64053.00	1391.00
03.07.12	403.65	64053.00	NIL
04.07.12	403.70	64516.00	463.00
05.07.12	403.75	64980.00	464.00
06.07.12	403.90	66371.00	1391.00
07.07.12	404.20	69152.00	2781.00
08.07.12	404.40	71006.00	1054.00
09.07.12	404.60	72860.00	1854.00
10.07.12	404.90	75642.00	2782.00
11.07.12	405.20	78423.00	2781.00
12.07.12	405.30	79350.00	927.00
13.07.12	405.40	80278.00	928.00
14.07.12	405.50	81205.00	927.00
15.07.12	405.65	82596.00	1391.00
16.07.12	405.00	85841.00	3245.00
17.07.12	406.25	88159.00	2318.00
18.07.12	406.65	90940.00	2781.00
19.07.12	406.80	93258.00	2318.00
20.07.12	407.80	102530.00	9272.00
21.07.12	409.20	115510.00	12980.00
22.07.12	409.95	122463.00	6953.00
23.07.12	410.50	129643.00	7180.00
24.07.12	410.60	130986.00	1343.00
25.07.12	410.75	133000.00	2014.00
26.07.12	410.85	134343.00	1343.00
27.07.12	411.00	136358.00	2015.00
28.07.12	411.35	141059.00	4701.00
29.07.12	411.75	146431.00	5382.00
30.07.12	412.10	151132.00	4701.00
31.07.12	412.40	155161.00	4029.00

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.12	413.25	166577	11416
02.08.12	413.85	174635	8058
03.08.12	414.15	178665	4030
04.08.12	415.10	191424	12759
05.08.12	416.15	205527	14103
06.8.12	417.15	218957	13430
07.08.12	418.00	230373	11416
08.08.12	418.95	243132	12759
09.08.12	419.85	255220	12088
10.08.12	420.50	266579	11359
11.08.12	420.85	273120	6541
12.08.12	421.95	293678	20558
13.08.12	423.10	315172	22656
14.08.12	423.80	328255	13997
15.08.12	425.10	355552	32506
16.08.12	425.95	368438	27718
17.08.12	426.15	372176	15128
18.08.12	427.35	394603	33426
19.08.12	427.55	398341	16281
20.08.12	427.45	396472	11512
21.08.12	427.40	395538	11876
22.08.12	427.50	397407	14986
23.08.12	427.88	398341	14220
24.08.12	427.35	394603	9564
25.08.12	427.35	394603	13236
26.08.12	427.45	396472	15105
27.08.12	427.4	395538	12336
28.08.12	427.3	393669	11385
29.08.12	427.05	388996	7769
30.08.12	426.80	384324	6730
31.08.12	426.50	378717	5731

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.12	426.50	378717.00	2449
02.09.12	426.55	379651.00	934
03.09.12	426.65	381520.00	1869
04.09.12	426.85	385258.00	3738
05.09.12	427.35	394603.00	9345
06.9.12	428.85	422638.00	28035
07.09.12	431.55	481932.00	59294
08.09.12	433.50	529490.00	50338
09.09.12	434.20	546562.00	21098
10.09.12	434.50	553878.00	12305
11.09.12	435.35	553878.00	19988
12.09.12	433.90	539244.00	12274
13.09.12	433.25	523392.00	5648
14.09.12	432.70	509979.00	6447
15.09.12	432.05	494126.00	4493
16.09.12	432.35	501443.00	11913
17.09.12	433.05	518514.00	17071
18.09.12	434.40	551439.00	32925
19.09.12	434.30	549000.00	11677
20.09.12	433.55	530708.00	2740
21.09.12	432.90	514856.00	4864
22.09.12	433.30	524611.00	14438
23.09.12	433.80	536805.00	12194
24.09.12	434.40	551439.00	14634
25.09.12	434.50	553878.00	11056
26.09.12	434.40	551439.00	8065
27.09.12	434.15	545342.00	5245
28.09.12	433.7	534367.00	2388
29.09.12	433.2	522173.00	1384
30.09.12	432.8	512417.00	3714

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.12	432.25	499004	379
02.10.12	431.75	486810	1434
03.10.12	431.25	474616	1552
04.10.12	430.75	462422	1410
05.10.12	430.25	450228	1468
06.10.12	429.70	438524	2044
07.10.12	429.15	428245	3429
08.10.12	428.60	417965	3260
09.10.12	428.05	407686	3447
10.10.12	427.50	397407	3387
11.10.12	426.95	387127	3055
12.10.12	426.40	376848	2625
13.09.12	425.80	365634	1670
14.10.12	425.20	354421	1757
15.10.12	424.60	343207	1873
16.10.12	424.00	331993	2034
17.10.12	423.40	320779	19
18.10.12	423.00	313303	2268
19.10.12	422.50	303959	1215
20.10.12	422.05	295550	1245
21.10.12	421.75	289942	557
22.10.12	421.50	285269	NIL
23.10.12	421.30	281531	816
24.10.12	421.10	277793	804
25.10.12	420.85	273122	NIL
26.10.12	420.60	268449	NIL
27.10.12	420.40	264711	712
28.10.12	420.10	259104	NIL
29.10.12	419.80	254549	1013
30.10.12	419.50	250520	1561
31.10.12	419.20	246490	763

12/02/17
Assistant Engineer
Sub-Division Officer
K.L.B. Sub-Division-II
Mukutmonipur, Bankura

14/2/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

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Kangsabati Reservoir Data for the year 2013(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.13	418.80	241118	67154
02.06.13	420.20	260973	19885
03.06.13	420.60	268448	7475
04.06.13	420.90	274055	5607
05.06.13	421.00	275924	1869
06.06.13	421.00	275924	NIL
07.06.13	421.00	275924	NIL
08.06.13	421.00	275924	NIL
09.06.13	421.00	275924	NIL
10.06.13	399.60	275924	NIL
11.06.13	421.20	279662	3738
12.06.13	421.30	281531	1869
13.06.13	421.35	282465	934
14.06.13	421.45	284334	1869
15.06.13	421.55	286203	1869
16.06.13	421.60	287138	935
17.06.13	421.65	288072	934
18.06.13	421.75	289941	1869
19.06.13	421.95	293679	3738
20.06.13	422.05	295548	1869
21.06.13	422.40	302090	6542
22.06.13	422.85	310500	8410
23.06.13	423.15	316106	5606
24.06.13	423.30	318910	2804
25.06.13	423.50	322648	3738
26.06.13	423.95	331059	8411
27.06.13	424.2	335731	4672
28.06.13	424.35	338534	2803
29.06.13	424.45	340403	1869
30.06.13	424.65	344141	3738

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.13	425.30	356290.00	12149.00
02.07.13	425.75	364700.00	8410.00
03.07.13	426.00	369372.00	4672.00
04.07.13	426.15	372175.00	2803.00
05.07.13	426.35	375913.00	3738.00
06.07.13	426.40	376848.00	935.00
07.07.13	426.50	378717.00	1869.00
08.07.13	426.50	378717.00	NIL
09.07.13	426.50	378717.00	NIL
10.07.13	426.50	378717.00	NIL
11.07.13	426.50	378717.00	NIL
12.07.13	426.50	378717.00	NIL
13.07.13	426.55	379651.00	934.00
14.07.13	426.60	380586.00	935.00
15.07.13	426.65	381520.00	934.00
16.07.13	426.70	382455.00	935.00
17.07.13	426.70	382455.00	NIL
18.07.13	426.75	383389.00	934.00
19.07.13	426.80	384324.00	935.00
20.07.13	426.80	384324.00	NIL
21.07.13	426.85	385259.00	935.00
22.07.13	426.95	387127.00	1868.00
23.07.13	426.75	383390.00	1233.00
24.07.13	426.45	377783.00	4303.00
25.07.13	425.95	368437.00	2316.00
26.07.13	425.60	361896.00	6030.00
27.07.13	425.4	358159.00	7242.00
28.07.13	425.5	360027.00	12448.00
29.07.13	425.75	364700.00	16219.00
30.07.13	427.95	405816.00	47956.00
31.07.13	429.45	433852.00	32350.00

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.13	430.45	455106	25448
02.08.13	430.95	467300	18097
03.08.13	431.10	470958	10561
04.08.13	431.15	472177	9023
05.08.13	431.00	468519	4334
06.8.13	430.75	462422	3364
07.08.13	430.35	452667	1290
08.08.13	430.20	449009	5918
09.08.13	430.50	456325	17402
10.08.13	430.80	463641	15882
11.08.13	430.80	463641	6944
12.08.13	430.90	466080	6375
13.08.13	431.00	468519	5735
14.08.13	431.20	473397	7926
15.08.13	431.25	474616	4273
16.08.13	431.25	474616	3056
17.08.13	431.30	475835	4275
18.08.13	431.65	484371	11596
19.08.13	432.20	497785	16484
20.08.13	432.75	511198	18819
21.08.13	433.80	536806	42963
22.08.13	437.85	635578	155773
23.08.13	436.75	608751	74903
24.08.13	435.00	566072	22387
25.08.13	434.10	544123	10273
26.08.13	433.65	533148	5363
27.08.13	433.75	535587	8481
28.08.13	433.85	538026	8764
29.08.13	434.25	547781	17753
30.08.13	434.70	558756	18933
31.08.13	434.95	564853	13777

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.13	434.95	564853.00	9788
02.09.13	434.70	558756.00	4009
03.09.13	434.60	556317.00	7625
04.09.13	434.65	557536.00	11271
05.09.13	434.60	556317.00	8863
06.9.13	433.80	536806.00	3699
07.09.13	433.00	517295.00	2272
08.09.13	432.55	506320.00	1958
09.09.13	432.40	502662.00	4404
10.09.13	432.35	501443.00	5847
11.09.13	432.35	501443.00	2806
12.09.13	432.50	505101.00	3658
13.09.13	432.60	507540.00	2439
14.09.13	432.70	509979.00	2439
15.09.13	432.80	512417.00	2438
16.09.13	433.00	517295.00	4878
17.09.13	433.15	520953.00	3658
18.09.13	433.25	523392.00	2439
19.09.13	433.40	527051.00	3659
20.09.13	433.95	540464.00	13431
21.09.13	434.35	550220.00	9756
22.09.13	434.85	562414.00	12194
23.09.13	435.30	573388.00	10974
24.09.13	435.55	579485.00	6604
25.09.13	435.35	574608.00	4582
26.09.13	435.20	570950.00	6732
27.09.13	435.05	567291.00	8296
28.09.13	434.9	563633.00	8326
29.09.13	435.15	569730.00	18069
30.09.13	436.05	591679.00	33953

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.13	436.30	597776	25889
02.10.13	436.40	600215	26798
03.10.13	437.90	636792	63713
04.10.13	438.00	639236	42812
05.10.13	437.00	614848	12028
06.10.13	436.15	594118	3720
07.10.13	435.60	580705	7867
08.10.13	434.95	564853	5264
09.10.13	434.45	552659	2507
10.10.13	434.50	553878	10877
11.10.13	434.40	551439	8221
12.10.13	434.00	541684	928
13.09.13	433.75	535587	4455
14.10.13	439.40	673381	165248
15.10.13	438.30	646553	58459
16.10.13	437.65	630700	18200
17.10.13	437.45	625823	11206
18.10.13	437.30	622164	10615
19.10.13	437.15	618506	10586
20.10.13	436.75	608751	4459
21.10.13	436.30	597776	5149
22.10.13	436.40	600215	10858
23.10.13	436.15	594118	8080
24.10.13	435.60	580705	5443
25.10.13	435.10	568511	4484
26.10.13	435.15	569730	23058
27.10.13	438.20	644114	100240
28.10.13	437.95	638017	22995
29.10.13	437.25	620945	11201
30.10.13	437.40	624603	10555
31.10.13	437.60	629481	8864

13/02/17
Assistant Engineer
Sub-Division Officer
K.L.B. Sub-Division-II
Mukutmonipur, Bankura

14/2/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

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Kangsabati Reservoir Data for the year 2014(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.14	415.05	190751	192
02.06.14	415.05	190751	NIL
03.06.14	415.05	190751	NIL
04.06.14	415.05	190751	NIL
05.06.14	415.00	190081	NIL
06.06.14	415.00	190081	NIL
07.06.14	415.00	190081	NIL
08.06.14	415.00	190081	NIL
09.06.14	414.95	189409	NIL
10.06.14	414.95	189409	NIL
11.06.14	414.90	188738	NIL
12.06.14	414.90	188738	NIL
13.06.14	414.85	188066	NIL
14.06.14	414.85	188066	NIL
15.06.14	414.85	188066	NIL
16.06.14	414.85	188066	NIL
17.06.14	414.85	188066	NIL
18.06.14	414.85	188066	NIL
19.06.14	414.85	188066	NIL
20.06.14	414.85	188066	NIL
21.06.14	414.85	188066	NIL
22.06.14	414.85	188066	NIL
23.06.14	414.95	189409	1343
24.06.14	414.05	190752	1343
25.06.14	415.05	190752	NIL
26.06.14	415.05	190752	NIL
27.06.14	415.05	190752	NIL
28.06.14	415.05	190752	NIL
29.06.14	415.05	190752	NIL
30.06.14	415.05	190752	NIL

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.14	415.05	190752.00	NIL
02.07.14	415.05	190752.00	NIL
03.07.14	415.10	191423.00	671.00
04.07.14	415.25	193439.00	2016.00
05.07.14	415.35	194781.00	1343.00
06.07.14	415.65	198811.00	4029.00
07.07.14	415.70	199483.00	672.00
08.07.14	415.85	201497.00	2014.00
09.07.14	415.90	202169.00	672.00
10.07.14	415.95	202840.00	671.00
11.07.14	416.05	204183.00	1343.00
12.07.14	416.05	204183.00	NIL
13.07.14	416.20	206198.00	2015.00
14.07.14	416.25	206869.00	671.00
15.07.14	416.35	208212.00	1343.00
16.07.14	416.45	209555.00	1343.00
17.07.14	416.50	210227.00	672.00
18.07.14	416.55	210898.00	672.00
19.07.14	416.65	212242.00	1343.00
20.07.14	416.85	214928.00	2686.00
21.07.14	417.00	216942.00	2015.00
22.07.14	417.15	218957.00	2015.00
23.07.14	417.25	220300.00	1343.00
24.07.14	417.40	222314.00	2014.00
25.07.14	417.55	224329.00	2015.00
26.07.14	417.65	225672.00	1343.00
27.07.14	417.75	227015.00	1343.00
28.07.14	417.85	228358.00	1343.00
29.07.14	417.95	229701.00	1343.00
30.07.14	418.15	232388.00	2687.00
31.07.14	418.35	235074.00	2686.00

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.14	418.65	239103	4029
02.08.14	418.95	243132	4029
03.08.14	419.20	246490	3,358
04.08.14	419.45	249848	3,358
05.08.14	419.60	251863	2,015
06.08.14	419.95	256563	4,700
07.08.14	420.20	260973	4,410
08.08.14	420.40	264711	3,738
09.08.14	420.85	273122	8,411
10.08.14	421.55	286204	13,082
11.08.14	422.40	302090	15,886
12.08.14	422.80	309565	7,475
13.08.14	422.65	306762	4,949
14.08.14	422.40	302090	5,961
15.08.14	422.50	303958	12,076
16.08.14	422.45	303024	9078
17.08.14	422.35	301155	8495
18.08.14	422.35	301155	10,396
19.08.14	422.15	297417	7556
20.08.14	421.85	291810	6025
21.08.14	421.35	282465	3090
22.08.14	420.90	274055	4583
23.08.14	420.50	266579	5464
24.08.14	420.00	257235	3635
25.08.14	419.45	249848	5463
26.08.14	418.90	242461	5425
27.08.14	418.4	235745	5884
28.08.14	417.9	229030	5655
29.08.14	417.35	221643	4787
30.08.14	416.75	213584	4253
31.08.14	416.15	205526	4234

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.14	415.55	197468.00	4000
02.09.14	415.75	200154.00	4343
03.09.14	416.25	206869.00	6715
04.09.13	416.70	212913.00	6044
05.09.13	416.90	215599.00	2686
06.09.14	417.10	218285.00	2686
07.09.14	417.20	219628.00	1343
08.09.14	417.35	221643.00	2015
09.09.14	417.60	225001.00	3358.00
10.09.14	417.75	227015.00	2014.00
11.09.14	417.88	228358.00	1343.00
12.09.14	417.90	229030.00	672.00
13.09.14	417.95	229701.00	671.00
14.09.14	418.10	231716.00	2015.00
15.09.14	418.30	234402.00	2686.00
16.09.14	418.50	237088.00	2686.00
17.09.14	418.75	240446.00	3358.00
18.09.14	418.95	243132.00	2686.00
19.09.14	419.10	245147.00	2015.00
20.09.14	419.20	246490.00	1343.00
21.09.14	419.25	247162.00	672.00
22.09.14	419.55	251191.00	4029.00
23.09.14	420.70	270317.00	19126.00
24.09.14	421.20	279662.00	9345.00
25.09.14	421.60	287138.00	7476.00
26.09.14	421.80	290876.00	3738.00
27.09.14	421.95	293679.00	2803.00
28.09.14	422.05	295548.00	1869.00
29.09.14	422.1	296483.00	935.00
30.09.14	422.15	297418.00	935.00
31.08.14	416.15	205526	4234

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.14	422.05	295548	NIL
02.10.14	421.70	289007	902
03.10.14	421.20	279662	591
04.10.14	420.65	269383	725
05.10.14	420.10	259104	731
06.10.14	419.45	249848	1780
07.10.14	418.70	239775	1932
08.10.14	417.85	228358	1303
09.10.14	417.05	217613	1811
10.10.14	416.20	206198	1028
11.10.14	415.30	194110	550
12.10.14	414.50	183365	1763
13.09.14	413.65	171949	1061
14.10.14	412.90	161876	2345
15.10.14	412.00	149789	261
16.10.14	411.15	138373	715
17.10.14	410.65	131657	2711
18.10.14	410.45	128971	5030
19.10.14	410.20	125613	2878
20.10.14	410.00	122927	1894
21.10.14	409.80	121073	2696
22.10.14	409.30	116437	NIL
23.10.14	408.95	113192	1243
24.10.14	408.60	109947	1195
25.10.14	408.25	106702	1147
26.10.14	407.95	103920	1528
27.10.14	408.15	105775	2412
28.10.14	408.25	106702	927
29.10.14	408.35	107629	927
30.10.14	408.40	108093	464
31.10.14	408.40	108093	

13/02/17
Assistant Engineer
Sub-Division Officer
K.L.B. Sub-Division-II
Mukutmonipur, Bankura

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14/2/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

Kangsabati Reservoir Data for the year 2015(June to October)

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.06.15	403.55	63126	
02.06.15	403.55	63126	
03.06.15	403.55	63126	
04.06.15	403.55	63126	
05.06.15	403.55	63126	NIL
06.06.15	403.55	63126	NIL
07.06.15	403.55	63126	NIL
08.06.15	403.55	63126	NIL
09.06.15	403.55	63126	NIL
10.06.15	403.55	63126	NIL
11.06.15	403.55	63126	NIL
12.06.15	403.55	63126	NIL
13.06.15	403.55	63126	NIL
14.06.15	403.55	63126	NIL
15.06.15	403.55	63126	NIL
16.06.15	403.55	63126	NIL
17.06.15	403.55	63126	NIL
18.06.15	403.55	63126	NIL
19.06.15	403.55	63126	NIL
20.06.15	403.55	63126	NIL
21.06.15	403.55	63126	NIL
22.06.15	403.55	63126	NIL
23.06.15	403.55	63126	NIL
24.06.15	403.55	63126	NIL
25.06.15	403.55	63126	NIL
26.06.15	403.55	63126	NIL
27.06.15	403.55	63126	NIL
28.06.15	403.65	64053	927
29.06.15	403.75	64980	927
30.06.15	403.85	65907	927

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.07.15	403.95	66834.00	927.00
02.07.15	404.05	67761.00	927.00
03.07.15	404.25	69616.00	1854.00
04.07.15	404.40	71006.00	1391.00
05.07.15	404.55	72397.00	1391.00
06.07.15	404.85	75179.00	2781.00
07.07.15	405.40	80278.00	5099.00
08.07.15	407.25	97430.00	17152.00
09.07.15	409.30	116437.00	19007.00
10.07.15	410.35	127628.00	11191.00
11.07.15	414.00	176650.00	49022.00
12.07.15	415.50	196796.00	20146.00
13.07.15	416.00	203512.00	6715.00
14.07.15	416.40	208884.00	5372.00
15.07.15	416.70	212913.00	4029.00
16.07.15	416.95	216271.00	3358.00
17.07.15	417.25	220300.00	4029.00
18.07.15	417.75	227015.00	6715.00
19.07.15	419.15	245818.00	18803.00
20.07.15	419.85	255220.00	9402.00
21.07.15	420.65	269383.00	14163.00
22.07.15	421.65	288073.00	18690.00
23.07.15	422.20	298352.00	10279.00
24.07.15	422.55	304893.00	8621.00
25.07.15	423.05	314238.00	9345.00
26.07.15	423.10	315172.00	9487.00
27.07.15	423.25	317976.00	13095.00
28.07.15	425.00	350683.00	43320.00
29.07.15	432.7	509979.00	196405.00
30.07.15	431.50	480713.00	27027.00
31.07.15	430.05	445350.00	3119.00

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.08.15	429.20	429179	9164
02.08.15	431.45	479493	71027
03.08.15	433.20	522173	64347
04.08.15	433.95	540464	33187
05.08.15	433.95	540464	10514
06.8.15	433.70	534367	4391
07.08.15	432.90	514856	251
08.08.15	432.00	4,92,907	1001
09.08.15	431.05	469738	826
10.08.15	430.05	445350	1726
11.08.15	428.70	419834	2658
12.08.15	427.40	395538	569
13.08.15	426.45	377782	7514
14.08.15	422.50	360027	2959
15.08.15	424.70	345076	547
16.08.15	424.30	337600	3276
17.08.15	423.85	329189	4791
18.08.15	423.25	317976	2125
19.08.15	422.70	307696	3218
20.08.15	422.30	300221	6035
21.08.15	421.90	292745	5888
22.08.15	421.60	287138	7222
23.08.15	421.10	277793	3134
24.08.15	420.55	267514	2614
25.08.15	419.85	255220	581
26.08.15	419.20	246490	2684
27.08.15	418.8	241118	6517
28.08.15	418.65	239103	5037
29.08.15	418.55	237760	5403
30.08.15	418.40	235745	2152
31.08.15	418.85	237088	1615

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.09.15	418.80	241118.00	4030.00
02.09.15	419.20	246490.00	5372.00
03.09.15	419.50	250519.00	4029.00
04.09.15	419.65	252534.00	2015.00
05.09.15	419.75	253877.00	1343.00
06.9.15	419.85	255220.00	1343.00
07.09.15	419.90	255891.00	671.00
08.09.15	420.00	257235.00	1343.00
09.09.15	420.05	258169.00	934.00
10.09.15	420.10	259103.00	934.00
11.09.15	421.10	259103.00	NIL
12.09.15	419.40	249176.00	1711.00
13.09.15	418.50	237088.00	757.00
14.09.15	417.70	226344.00	2216.00
15.09.15	416.90	215599.00	2440.00
16.09.15	416.00	203512.00	1296.00
17.09.15	415.20	192767.00	2727.00
18.09.15	414.30	180679.00	1292.00
19.09.15	413.35	167920.00	387.00
20.09.15	412.40	155161.00	419.00
21.09.15	411.45	142402.00	267.00
22.09.15	410.50	129643.00	295.00
23.09.15	409.65	119682.00	245.00
24.09.15	409.30	116437.00	4125.00
25.09.15	409.70	120146.00	3838.00
26.09.15	409.85	121537.00	1391.00
27.09.15	409.95	122464.00	927.00
28.09.15	410.00	122927.00	463.00
29.09.15	410.05	123599.00	672.00
30.09.15	410.05	123599.00	NIL

Date	Reservoir Level (ft.)	Live Storage (Acft)	Inflow (Acft)
01.10.15	410.05	123599	NILL
02.10.15	410.05	123599	NILL
03.10.15	410.05	123599	NILL
04.10.15	410.05	123599	NILL
05.10.15	410.05	123599	NILL
06.10.15	410.05	123599	NILL
07.10.15	410.05	123599	NILL
08.10.15	410.05	123599	NILL
09.10.15	410.05	123599	NILL
10.10.15	410.05	123599	NILL
11.10.15	410.05	123599	NILL
12.10.15	410.05	123599	NILL
13.09.15	410.05	123599	NILL
14.10.15	410.05	123599	NILL
15.10.15	410.05	123599	NILL
16.10.15	409.10	114583	1001
17.10.15	408.50	109020	1027
18.10.15	408.15	105775	561
19.10.15	407.50	99748	451
20.10.15	406.85	93722	694
21.10.15	406.30	88622	921
22.10.15	406.70	92331	4014
23.10.15	406.80	93258	927
24.10.15	406.85	93722	464
25.10.15	406.85	93722	NILL
26.10.15	406.85	93722	NILL
27.10.15	406.85	93722	NILL
28.10.15	406.85	93722	NILL
29.10.15	406.85	93722	NILL
30.10.15	406.85	93722	NILL
31.10.15	406.85	93722	NILL

13/12/17
Assistant Engineer
Sub-Division Officer
K.L.B. Sub-Division-II
Mukutmonipur, Bankura

19/12/17
Executive Engineer
Kangsabati Canals Divn.-II
Khatra Bankura

PERMISSION OF IRRIGATION and WATERWAYS DEPARTMENT FOR DRAWAL OF 32 MLD RAW WATER FROM MUKUTMONIPUR RESERVOIR

e-mail to PHE O/L

Government of West Bengal
Irrigation & Waterways Department
Jalasampad Bhawan, Salt Lake, Kolkata - 700 091
Ph & Fax- 033 2321 5211, email: ds-works@wbiwd.gov.in

Memo No. 263-I
I-4M-02/2015(Pt.)

Dated: 22/06/2017

From:- Sri B. Mukhopadhyay
Deputy Secretary to the
Government of West Bengal

To:- The Engineer-in-Chief,
Public Health Engineering Department.
Government of West Bengal
N.S.Building, 6th floor,
1, K.S. Roy Road, Kolkata-700001.

Sub : Permission of Irrigation & Waterways Department for drawal of 32 MLD of raw water from Mukutmonipur reservoir for drinking water purpose under the Bankura Water Supply Project (Phase-II) of PHE Department.

Ref: His D.O. letter No. PHE/EIC/209/2017-18 dated 15.06.2017

Sir,

This department earlier accorded 'No Objection' to PHE department, GoWB for drawal of 100 MLD of raw water from Mukutmonipur reservoir through a RCC intake well within the reservoir area at Mouza- Jamdah, Block- Manbazar-I, Dist.- Purulia to cater the need of drinking water of the people of the northern portion of Purulia district. It is understood that out of allocated 100 MLD of raw water, at present 68 MLD is the requirement for phase-I work of the aforesaid JICA assisted drinking water supply project of PHE department for Purulia. It is proposed vide D.O. letter under reference to utilize the balance 32 MLD out of total allocation of 100 MLD for their Bankura Water Supply Project (Phase-II).

In view of above, I am directed to convey the 'No Objection' of this department towards drawal of 32 MLD of raw water out of above mentioned 100 MLD allocation through the already existing intake structure stated above. All other conditions, stated in department's approval letter no. 270-I/I-4M-48/12 dated 10.06.15 will be applicable for this proposed drawal of 32 MLD of raw water.

Yours faithfully,

(B.Mukhopadhyay)
Deputy Secretary to the
Government of West Bengal