



NATIONAL MISSION FOR CLEAN GANGA

Ministry of Jal Shakti,

*Department of Water Resources, River Development & Ganga
Rejuvenation, Government of India*

ENVIRONMENTAL AND SOCIAL ASSESSMENT & MANAGEMENT PLAN

Pollution Abatement of Tolly Nullah (Adi Ganga)



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LIST OF ABBREVIATIONS

ASI	---	Archaeological Survey of India
ASP	---	Activated Sludge Process
BDPS	---	Ballygunge Drainage Pumping Station
BOCW	---	Building and Other Construction Workers
BOD	---	Biochemical Oxygen Demand
BSI	---	Botanical Survey of India, Kolkata
CCTV	---	Closed Circuit Television
CESC	---	The Calcutta Electric Supply Corporation Limited
CGWA	---	Central Ground Water Authority
CO	---	Carbon Monoxide
COD	---	Chemical Oxygen Demand
CPCB	---	Central Pollution Control board
CPGRAM	---	Centralized Public Grievance Redress and Monitoring System
CPHEEO	---	Central Public Health & Environmental Engineering Organization
CPR	---	Common Property Resource
CTE	---	Consent to establish
CTO	---	Consent to Operate
DBOT	---	Design Build Operate Transfer
DM	---	District Magistrate
DoWR, RD&GR	---	Department of Water Resources, River Development and Ganga Rejuvenation
DWF	---	Dry Weather Flow
DO	---	Dissolved Oxygen
DoE	---	Department of Environment
DPR	---	Detailed Project Report
DWF	---	Dry Weather flow
EAs	---	Executing Agencies
EHS	---	Environmental, Health and Safety
EIA	---	Environmental Impact Assessment
EKW	---	East Kolkata Wetland
EMP	---	Environment Management Plan
EPA	---	Environment (Protection) Act
ESAMP	---	Environmental & Social Assessment and Management Plan
ESDD	---	Environment and Social Due Diligence
ESMF	---	Environmental and Social Management Framework
ESMP	---	Environmental and Social Management Plan
FAB	---	Fluidized Aerobic Bioreactor

FPU	---	Filter Paper Units
GAP	---	Ganga Action Plan
GBV	---	Gender Based Violence
GHG	---	Green House Gas
GRM	---	Grievance Redress Mechanism
Gol	---	Government of India
HFL	---	Highest Flood Level
ICC	---	Internal Complaint Committee
I&D	---	Interception & Diversion
ILO	---	International Labour Organization
IMD	---	India Meteorological Department
INTACH	---	Indian National Trust for Art and Culture Heritage
IPS	---	Intermediate Pumping Station
KEIIP	---	Kolkata Environmental Improvement Investment Programme
KMA	---	Kolkata Metropolitan Area
KMC	---	Kolkata Municipal Corporation
KMDA	---	Kolkata Metropolitan Development Authority
KMPH	---	Kilometer per hour
LASA	---	Lea Associates South Asia Private Limited
LS	---	Lifting Station
MBR	---	Membrane Bio Reactor
MBBR	---	Moving Bed Bio Reactor
MLD	---	Million Liter per Day
MoEF&CC	---	Ministry of Environment, Forests and Climate Change
MPN	---	Most Probable Number
MPS	---	Main Pumping Station
MSDS	---	Material Safety Data Sheet
MSK	---	Medvedev–Sponheuer–Karnik scale
MT	---	Metric Tonne
NABL	---	National Accreditation Board for Testing and Calibration Laboratories
NAAQS	---	National Ambient Air Quality Standard
NGO	---	Non-Governmental Organization
NGRBA	---	National Ganga River Basin Authority
NGT	---	National Green Tribunal
NMCG	---	National Mission for Clean Ganga
NO ₂	---	Nitrogen Dioxide
NOC	---	No Objection Certificate
NP	---	National Park
NPK	---	Nitrogen Phosphorus & Potassium
NTU	---	Nephelometric Turbidity Unit
OCEMS	---	Online Continuous Effluent Monitoring System
O&M	---	Operation & Maintenance
OP	---	Operational Policy
OSHA	---	Occupational Safety and Health Administration

PAFs	---	Project Affected Families
PF	---	Protected Forest
PM	---	Particulate Matter
PMO	---	Prime Minister's Office
PPE	---	Personal Protective Equipment
PPP	---	Public Private Partnership
PS	---	Pumping Station
RCA	---	Route Cause Analysis
RCC	---	Reinforced Cement Concrete
RF	---	Reserved Forest
RFCTLARR	---	Right to Fair Compensation and Transparency in Land acquisition and Rehabilitation & Resettlement
RPSPM	---	Rajpur Sonarpur Municipality
R&R	---	Rehabilitation and Resettlement
SAFF	---	Submerged Aerobic Fixed Film Reactor
SBR	---	Sequential Batch Reactor
SC	---	Scheduled Caste
SCADA	---	Supervisory Control and Data Acquisition
S & D	---	Sewerage and Drainage
SEIAA	---	State Level Environment Impact Assessment Authority
SMCG	---	State Mission for Clean Ganga
SO ₂	---	Sulphur Dioxide
SOP	---	Standard Operating Procedures
SPCB	---	State Pollution Control Board
SPS	---	Sewage Pumping Station
SC	---	Scheduled Caste
ST	---	Scheduled Tribe
STP	---	Sewage Treatment Plant
STP	---	Sewage Treatment Plant
SWF	---	Storm Water Flow
TDS	---	Total Dissolved Solids
ToR	---	Terms of Reference
TSS	---	Total Suspended Solid
UD&MA	---	Urban Development & Municipal Affairs
ULBs	---	Urban Local Bodies
UASB	---	Upflow Anaerobic Sludge Blanket Reactor
VFD	---	Variable Frequency Drive
WB	---	World Bank
WHO	---	World Health Organization
WLPA	---	Wild Life Protection Act
WLS	---	Wildlife Sanctuary
WSP	---	Waste Stabilization Pond
WRc	---	Water Research Centre
WTP	---	Water Treatment Plant

E. EXECUTIVE SUMMARY

Introduction

The Government of India has given Ganga the status of a “National River” and in exercise of the powers conferred by sub-sections (1) and (3) of Section 3 of the Environment (Protection) Act, 1986, the Central Government constituted the National Ganga River Basin Authority (NGRBA) on 20th February 2009, as a planning, financing, monitoring and coordinating authority for strengthening the collective efforts of the Central and State Governments for effective abatement of pollution and conservation of the Ganga river by adopting a river basin approach with comprehensive planning and management. In this regard, under the pollution abatement programme, NGRBA proposes **“Pollution Abatement of Tolly’s Nullah (Adi Ganga) in the state of West Bengal under National Mission for Clean Ganga (NMCG), following the principles of ESMF of NGRBA”**.

As per the Environmental and Social Management Framework (NGRBA, 2020), the implementation of such river pollution mitigation projects under the NGRBP is anticipated to encounter a variety of environmental and social issues/problems. Therefore, the study of the environment and social aspects is required for analysing the impacts of the proposed project and suggesting the management measures to handle them. Hence, the Environmental and Social Assessment and Management Plan (ESAMP) has been prepared that will provide a clear understanding of the prevailing and expected environmental and social impacts along with their probable causes. The ESAMP has to be followed while designing and implementing the proposed interventions to reduce pollution load of Tolly’s nullah.

Project Description

The project City i.e., Kolkata (formerly Calcutta) is the state capital of West Bengal. Kolkata is situated at 88° 30'E - 22° 33' N, on the Eastern Bank of River Ganga. The governing body of the city of Kolkata is Kolkata Municipal Corporation (KMC), which has been established in 1876 and it administers an area of about 206.08 square kilometres encircling 144 wards and 16 nos. of boroughs. The KMC area is bounded by river Hooghly in the northwest, South 24 Parganas district in the south and southwest, Salt Lake City in the east and North 24 Parganas district in the north. The area falls between north latitudes of 22°28'00” and 22°37'30” and east longitudes 88°17'30” and 88°25'00”.

KMC area has a natural drainage system governed by its physiographic profile, which got disturbed as the city moved towards urbanization and utilization of majority of its open spaces. Further, the unplanned growth of population combined with encroachment of major part of the drains flowing through the city leads to overflowing of rainwater through roads and the adjoining residential colonies.

The total population of the city and the Kolkata Metropolitan Area was estimated at 14.7 million in 2015, making it the third most populous metropolitan area in India. With 24,000 people living per square kilometre in Kolkata, it is also one of the densest megacities in the world.

The study area “Tolly nullah” also called Adi Ganga was excavated by Colonel William Tolly in the year 1773 for the purpose of navigation through it, which however has presently ceased to be a free flowing channel due to siltation, construction of metro piers on the canal bed and rapid dense inhabitation along its bank. The nullah is connected to river Hooghly on one end and Vidyadhari river on its other end. In addition to it,

due to non-functioning Dry Weather Flow (DWF) pumping stations and the penstock gates that were made under GAP phases I & II, Adi Ganga has got extremely polluted, which was earlier suitable for bathing and aquatic life.

In view of the initiatives taken by various government organizations towards eradicating pollution from Tolly Nullah and ultimately river Hooghly, the 15.5 km stretch of the nullah starting from Garia Rail bridge near Khudiram metro station to Daighat (confluence at River Hooghly) has been divided into 6 zones, out of which the proposed STPs will treat dry weather flow generated from zones 2, 3 and 5.

Existing Scenario of Sewerage Facilities

Kolkata Municipal Corporation (KMC) area has a natural system of drainage and is governed by the physiographic profile. In the catchment of Tolly Nullah, flooding and water logging are recurring problems for which a suitable surface drainage system needs to be developed. Due to unplanned growth of population, the major drain flowing through the city has been encroached upon, over and above the construction of metro rail piers on the canal bed of Tolly Nullah has drastically reduced the flow of water through it. All these anthropogenic forces have led to disruption in the drainage system of the city thus, leading to overflowing storm water in the city triggering flooding of residential colonies located along the sides of natural drains during heavy downpour.

Besides encroachment of the nullah bank, municipal waste dumping along with discharging sewage, throwing / collecting ritual waste by the side of nullah is a common practice of the nearby residents. These waste materials get flown away by wind and rain thereby causing siltation and reduction in channel cross-section ultimately leading to reduced discharge in downstream side of Tolly Nullah. Further, in absence of regular cleaning and de-silting, the drainage channel got filled up to a considerable depth rendering acute flooding problem in the adjoining areas during monsoon season. City area has underground sewerage system constructed long back, which has now become outdated and defunct.

The nullah traversing through the middle of KMC area serves as a main drainage channel for the southern part of the city. The predominant flow of Tolly's Nullah is from east to west, i.e., from Garia side to Hastings, however during high tides, it was observed that the river water from Hooghly flows back towards Tolly nullah, resulting into overflow of nullah at some places especially near Kalighat area as informed by KMC officials also during the site reconnaissance survey. The nullah has three tributaries, namely Western Channel (Approx. 2 km long), Keorapukur Khal (Approx. 2 km long) and Chetla Boat Canal (Approx. 2.8 km long). The existing contour or topography of project site shows that present area is very flat with ground level varying from 2.38 m to 6.30 m above mean sea level.

The bank of Tolly's Nullah is not uniformly lined up, the upstream stretch from chainage 0 m to 7713 m has lined bank with partial damage at some places, while the downstream portion of the nullah from chainage 7713 m to 15691 m has irregular earthen bank. There is ample existence of slum areas, livestock farms, cowsheds and daily markets along the bank that directly dispose their waste into the canal. Moreover, lack of social awareness and environmental education amongst the local people has added to worsening of the state of the nullah.

As far as sewerage and drainage network of Tolly nullah is concerned, presently the sewage and storm water flow through the same network and sewage is directly disposed into the nullah without any treatment. There are 74 no. of penstock / sluice gates provided for storm water drainage, some of which

are damaged and dilapidated due to which there is backflow of river Hooghly towards the city during high tide and heavy shower causing inundation at some areas. In most of the places, the sewer lines, pumping mains, pumping stations and their adjoining trunk sewers are either silted up or damaged.

The sewerage network of Tolly nullah basin is divided into two parts - northern catchment area and southern catchment area. The northern catchment area extends from Chetla Boat canal to outfall in Hooghly river. It comprises of 7 pumping stations carrying sewage to Ballygunge Drainage Pumping station (BDPS) finally leading to river Vidyadhari through East Kolkata Wetland. On the other hand, the southern catchment area extending from Garia Rail Bridge to Chetla Boat canal has 15 pumping stations pumping sewage to Keorapukur STP, finally leading to Churial khal. The entire portion of the Tolly nullah starting from its confluence with river Hooghly at Dai ghat to Garia station under the area of Kolkata is divided into 6 zones. The 6 zones include 28 wards coming under KMC and 3 wards under Rajpur Sonarpur Municipality. The sewage from zones I and VI will be treated through East Kolkata Wetland that from zone IV will be taken to Keorapukur STP and zones II, III and V will be catered through new STPs proposed at Brijji road, Bansdroni and Golf Green.

Water Supply: The River Hooghly is the main source of water supply for Kolkata. After drawing water from the river, KMC treats the water at Indira Gandhi Water Treatment Plant (WTP) of capacity 260 million gallons per day at Palta Water Works. Water from this water works is sent to Tallah pumping station for temporary storage and onward distribution to the city.

Necessity of this project

The Tolly nullah being the lifeline of Kolkata Municipal Corporation area carries all types of drainage and municipal wastes from all of its 28 wards along with 3 wards of Rajpur Sonarpur Municipality and finally conveys it to the river Hooghly. With the expansion of the city boundary as well as its population, demand for clean water supply and proper management of the wastewater drainage system has increased manifold. Although there are sewage treatment systems including pumping stations and sewer lines available within the project purview, but there is huge negligence in their operation and maintenance part.

In addition, the establishment of metro rail pillars over the nullah associated with occupancy of the nullah bank with slum dwellers, cowsheds, livestock, religious activities, unplanned solid waste management etc. has extremely hampered its hydraulic property by diminishing its flow. As a result Tolly's Nullah has become a silted-up sewer channel and polluted tributary to the river Hooghly (Ganga).

As per news published in The Telegraph India on 15.06.2021, the Tolly nullah has turned into a sewage canal according to the study carried out by State Pollution Control Board based upon the water samples collected during February 2021. Amongst the entire stretch, Bansdroni section is the most polluted, followed by stretches near Shahid Khudiram Metro station, Karunamoyee and Kudghat¹. The BOD (biochemical oxygen demand) at Bansdroni was found to be 40mg per litre at low tide whereas the limit is 3 mg/l. The amount of dissolved oxygen along the entire stretch of the nullah was found to be nil. These entire unfavourable attribute has led the State Government to take initiative in the direction of pollution alleviation from Tolly nullah, the backbone of the city of south Kolkata.

¹ Source: <https://www.telegraphindia.com/west-bengal/calcutta/tollys-nullah-turned-into-a-sewage-canal-report/cid/1818836>

Proposed Project Activities

The Tolly's nullah developmental proposal has been categorized into following few subheadings:

- Sewerage and drainage network replacement & refurbishment, initially done for the trunk & outfall sewers;
- Construction & development of the existing & new pumping stations;
- Construction of modern Sewage Treatment Plants (STPs) with SBR technology;
- Solid waste management;
- Periodical/ frequent dredging works;
- Restoration & renovation of the lining works of the Nullah;
- Renovation & restoration of the ghats on the bank of Nullah;
- Rehabilitation of slum dwellers & beautification, as necessary;
- Storm water management to control city inundation;
- Fencing over the bridges and both banks along Tolly's Nullah to minimize garbage/ rubbish dumping;
- Public awareness program

Out of above mentioned activities, the assignments that will be taken up on priority basis under the proposed project include:

- Sewerage and drainage network replacement and upgradation for the trunk & outfall sewers;
- Out of total 23 nos. of locations for pumping stations, 7 nos. DWF PS and 5 nos. mini underground PSs have been proposed to be newly constructed;
- Rest 11 nos. of pumping stations will be either civil and/or electromechanically renovated;
- Construction of 3 nos. of SBR technology STPs (10 MLD, 11.6 MLD & 3.5 MLD);
- Rehabilitation and rejuvenation of considerable length of existing pipeline with suitable WRC (Water Research Centre) approved lining technology;
- Laying of new pipeline network wherever necessary through micro-tunnelling technology {22.655 km of new sewer (including 4.587 km of micro-tunnelling work & 1.648 km of covered drain), 0.850 km of RCC U-Trap (Suti Khal) & upgradation/ renovation of 74 nos. of Penstock Gates};
- O&M for 15 Years;

Total 25.10 MLD of new STPs of SBR technology has been planned to be installed in three parts, viz., one at Bansdrani, another at Brijji road and the third one at Golf Green. For the proposed new STPs and the associated pumping stations, SCADA (Supervisory Control and Data Acquisition) & OCEMS (Online continuous Effluent Monitoring System) have been considered with VFD (Variable Frequency Drive) pumps. During the monsoon period, Storm Weather Flow (SWF) of locality will be allowed to be discharged into the Tolly's Nullah through Penstock Gates after their renovation and automation.

Disposal of Treated Effluent: The treated effluent from STP will be used preferably for toilet flushing in the nearest public toilets by providing dual plumbing system. Contractor shall also explore other alternative possibilities of using treated water in various purposes, like gardening in parks, playgrounds, school yards, residential landscape etc., gated communities' commercial establishments and other educational institutions. The treated water can be reused in industries where the requirement of water is more than the available water for production. As per latest NGT standard, BOD of treated water shall be less than 10 mg/l.

As per the AA&ES for Adi Ganga (Tolly Nala) projects, NMCG has mandated 20% re-use of treated wastewater from the project. Further, efforts need to be made by the state government to identify thermal power plants within 50km radius of STP and to tie up with them for the usage of treated

wastewater (as per section 6.2 of relevant Gazette notification of Ministry of Power, GoI, dated Jan 28, 2016 notification). Copy enclosed in **Annexure-12**. Around 6 thermal power plants has been identified within 50km radius from the proposed STPs. A list of the TPPs within 50km radius from the STP site is given below and enclosed in map given in **Annexure-13**.

Septage Management: A comprehensive sewerage network is proposed in the city to cover the entire area with the sewerage system so that sewage flows can be collected in an integrated manner and conveyed to STP for treatment. The proposed sewerage system is designed for 30 years period i.e. 2055. As per DPR, the sewerage zones proposed are covering the entire catchment area of Tolly's Nullah, i.e., 1km on either side. Therefore, STP will have adequate capacity to accept the septage without hampering the functioning of the sewage treatment plant. With view of economic considerations related to distance and transport, addition of Septage has been taken into consideration at all nearby proposed STPs and IPS to maximize catchment and provide suitable management.

Disposal of Sludge: The sludge as collected from biological digestion basins will be diverted to sludge sump, which will be conveyed to centrifuge unit for dewatering. After dewatering the sludge, its weight will be reduced by up to 40-20 %. Around 3511kg /day of sludge will be generated² collectively from three STPs. The dried sludge may be used as manure, soil conditioner, fertilizer in the agricultural field. The Contractor shall prepare appropriate Sludge Management Plan. The necessary safeguard measures associated with the storage and disposal of sludge are provided in the EMP of this report. Suitable site should also be identified by the Contractor within the project premises for the safe storage of sludge. The surplus amount of sludge shall be managed and processed at KMC's solid waste dumping site called Dhapa / Keorapukur that is located 17-20 km away from the proposed site.

Land Requirement for New Constructions

The land available for all the three STPs and a proposed mini-pumping station at Bhowanipore has been tabulated in the table given below:

Details of proposed land parcel (for 3 STPs & 1 pumping station)

Plot No.	Area	Classification	Ownership
Bansdroni STP and pumping station site			
341	2.23 Acre	Sali (vacant dry land)	Earlier Irrigation & Waterways Department, now transferred to KMC
343	0.19 Acre	Doba (water body /man-made low lying waste land now accumulated with wastewater)	Refugee Rehabilitation Department, Govt. of West Bengal
346	0.43 Acre	Sali (vacant dry land)	Refugee Rehabilitation Department, Govt. of West Bengal
Total available land	2.85 Acres		
Brijji road STP and pumping station site			
763 (P), 766 (P), 770 (P), 771(P) & 772(P)	0.7228 Acres	BPAD Township at U block under ward no.110; vacant dry land with bushes and shrubs	Earlier KMDA, now transferred to KMC during December 2019

² Based of TSS & BOD available as per CPHEEO guideline and based on similar experience

Golf Green, Sukhapukur STP			
Premises no. 3 (Por), Russa Road south	0.8 Acres (3190.38m ²)	Kolkata Improvement Trust Scheme No. 118; low lying man-made waste land	Earlier KMDA, now transferred to KMC during July 2017
Mini pumping station at Patuapara, Bhowanipore			
15 A, 17 A	0.014 Acre 11 m X 5.3 m, i.e., 58.3 m ²	Illegal colonization	KMC land

A comparison between the available land for three STP sites and their land requirement is tabulated below:

STP Locations	Capacity of STPs	Area required @600 m ² /MLD	Area available	Remarks
Briji Road STP and Pumping station site	10 MLD	6000 m ² ≈ 1.48 acres	0.7 Acres	Less space available for STP, so STP will be established in 2 tier
Golf Green, Sukhapukur STP	3.5 MLD	2100 m ² ≈ 0.52 acres	0.8 Acres	Sufficient land available
Bansdroni STP and Pumping Station site	11.6 MLD	6960 m ² ≈ 1.72 acres	2.85 Acres (2.23 + 0.19 + 0.43)	2.23 acre plot area will be sufficient for establishing STP and the pumping station, which is a vacant dry land belonging to I&W Deptt.

Displacement and resettlement

There are 5 mini pumping stations, 7 pumping stations and 3 STP sites newly added to the proposed Tolly nullah sewage treatment system. Out of all these, only 1 site, i.e., the proposed mini pumping station besides Madan Pal Lane at Patuapara, Bhowanipore will involve displacement of 8 families. These 8 families will be resettled at a location about 200 m away from the place of displacement in a proposed one bedroom apartment each having 370 ft² area under Banglar Bari Housing Scheme of State Urban Development Agency, UD&MA Department, Government of West Bengal. Both the land parcels belong to KMC.

Implementation Schedule

The completion schedule has been taken as 36 months after sanctioning of the project.

Agency Responsible for execution of O&M Works

Agency responsible for execution of work is Kolkata Municipal Corporation (KMC) which is headed by Executive Officer assisted by other technical staff. Kolkata Municipal Corporation (KMC) shall be the nodal agency for Execution, O&M of the project.

The proposed interventions involve numerous constructions allied to STPs and its appurtenances. The available project staffs of KMC shall be trained for monitoring as well as ensuring compliance to environmental and social safeguard measures associated with construction activities of proposed project.

Cost Estimate

The total **Project Cost** is **Rs. 938.89 Crore for phase I including O&M of 15 years**, which has been submitted for approval and allotment of funds for the project **“Construction of STPs and S&D in Tolly’s Nullah”**. Cost under environmental sanitation and management plan has been worked out as **Rs. 580 Lakhs** as per the DPR, however as per the present ESAMP report, the tentative EMP cost excluding the

parameters covered under DPR, such as noise barrier/ fencing during construction stage, Sludge quality Monitoring, Tree Plantations etc. has been estimated to be around **Rs. 14.20 Lakhs**. The proposed project of Tolly nullah's pollution abatement will be carried out in two phases. The phase II project cost has been projected to be **Rs. 219.63 Crore**.

Approach and Methodology

The Environmental and Social Assessment and Management Plan (ESAMP) has been prepared by M/s. LEA Associates South Asia Private Limited and Detailed Project Report for Pollution Abatement of Tolly's Nullah (Adi Ganga) has been prepared by Kolkata Municipal Corporation (KMC).

The Environmental and Social Management Framework (ESMF of NGRBA, 2020) is intended to identify and assess several environmental and social impacts (both positive and negative) that may result from the proposed river pollution mitigation project "**Pollution Abatement of Tolly's Nullah (Adi Ganga)**" under NGRBP, as well as to provide a corresponding management plan to handle any adverse/negative impacts. The methodology adopted for conducting Environmental and Social Assessment and Management Plan (ESAMP) for the proposed interventions includes:

- ▶ Describe the sub-project and its components;
- ▶ Provide the applicable policies and legal guidelines to the proposed sub-project and include the specific clearances/approvals that have to be obtained by the executive agency/contractor.
- ▶ Describe the baseline environmental and social conditions of the sub-project areas and the proposed project facilities;
- ▶ Carryout public consultations and participation with different stakeholder groups at the local, regional and district level.
- ▶ Identification and analysis of key environmental and social issues viz. presence of any ecologically sensitive areas in the vicinity of the project site, as well as land availability issues (if any)
- ▶ Alternative analysis that were examined in the course of developing the proposed project towards in siting of project location, design, technology adopted, selection of construction techniques and phasing and operating and maintenance procedures.
- ▶ Develop Environmental and Social Management Plan (ESMP) outlining suitable mitigation and monitoring measures to be adopted by the relevant implementing actor;
- ▶ Suggesting suitable institutional arrangement for the implementation of ESAMP at varied levels, this includes man power requirement, training requirements for skills enhancement, organization mechanisms and information dissemination requirements

Project Screening

The project screening was carried out to understand the nature, scale and magnitude of environmental and social impact anticipated by the project. The screening activity was conducted as per the guidelines provided in Environmental and Social Management Framework of NGRBA (NGRBA, 2020) and on the secondary data analysis, field assessments and stakeholder interactions/consultations. Since the project area is located within the heart of the city, it is circumferenced by many squatters, market places, narrow lanes that trigger the proposal to be under moderate risk category, mainly during its construction phase that will last for about 2.5 to 3 years. For this, the technical survey has been conducted by the engineers of

the EA and the length under open cut and trenchless drain line installation has been proposed on technical basis and practical feasibility.

Further, The E&S Screening was carried out based on ESMF guideline, which indicates that the project falls in 'Moderate impact' category. **Please refer Annexure 1** of this report. Based on the initial Environmental screening, Pollution Abatement of Tolly's Nullah (Adi Ganga) Project has been rated under Moderate risk zone because of following reasons:

- ▶ Proposed project components (STP & associated provisions) do not fall under EIA notification 2006, so Environmental Clearance is exempted.
- ▶ The project area not located within Eco-Sensitive Zone of any Protected area/national Park /Eco sensitive zones, Ecological Sensitive Area.
- ▶ Project sites do not fall under Forest Notified area (PF/ RF/ Social Forestry).
- ▶ Proposed land identified for STP construction is government land while desilting work envisaged for trunk sewer line under the project may have slight disturbances to Local people/ encroachments during construction phase. These are identified in patches. Project does not involve relocation, resettlement, or any permanent loss of structure or Livelihood.

Legal Policy and Regulatory Framework

The key applicable legal requirements to the environmental and social aspects of the investments implemented in the project are as follows:

- ▶ Environmental Protection Act, 1986 (an umbrella Act) to protect and improve the overall environment
- ▶ Environmental and Social Management Framework for Namami Gange Programme

The Operational Policies and the guidelines of the World Bank applicable to the project are as follows:

- ▶ Environmental Assessment (OP 4.01) – OP. 4.01 is an Umbrella Policy applicable for all infrastructure projects under Namami Gange Programme. Environment and Social Due Diligence (ESDD) for projects under DBOT/PPP/Hybrid Annuity Mode followed by the preparation of a detailed ESAMP report during the detailed design stage (irrespective of the final design by the Concessionaire/Contractor).
- ▶ The World Bank's Environmental, Health, and Safety (EHS) Guidelines for Water and Sanitation is also applicable for the proposed project. This guideline will provide guidance on EHS issues principally associated with construction, operation and maintenance phases of the sewage collection through a system of pipes, pumps and other associated infrastructure (sewerage) to a centralized storage and/or treatment system.

The project does not require any environmental clearance or forest clearance. At the same time, the project requires to obtain required consents and permissions from competent authorities. The specific requirements are mentioned as under, for which the concessionaire should comply with before initiating the construction:

- ▶ Consent to Establish (CTE) and Consent to Operate (CTO) for the establishment and operation of STP is mandatory to be obtained under Water (Prevention and Control of Pollution) Act 1974 and the Air (Prevention and Control of Pollution) Act 1981 of Government of India,
- ▶ Permission for use of water for construction purposes from irrigation department/CGWA for surface / ground water respectively,
- ▶ Permission for use of electricity from CESC,
- ▶ Permission for using land of Irrigation department / Refugee Rehabilitation department,
- ▶ Permission for solid waste and sludge disposal into landfill site of Dhapa / Keorapukur.
- ▶ Labour license requires to be obtained by the contractor before the start of construction activity.

Baseline Environmental and Social Features

The baseline information forms the basis to analyze for the probable impacts of the proposed project on environmental and social issues. The baseline information pertaining to the physio-chemical, ecological, socio-economic and cultural aspects for the project area has been collated from various secondary sources and available literature. The information on the baseline environmental and social conditions were gathered through primary surveys at strategic locations considering various project components like laying of sewer line, construction of STPs etc.

Physiography & Soil: The Project district comprises a part of lower Ganga Plain. Kolkata region forms a part of the lower deltaic plains of the Ganga Bhagirathi river system. The project area is a typical deltaic flat land with surface elevation ranging between 3.5 to 6m above mean seal level. In Kolkata, several low-lying depressions in the form of marshes, shallow lakes or jheels occur within the city. The major slope of the land is towards south and is covered with younger alluvial soil mainly of silty & clayey loams. Younger levee, deltaic plain, inter distributary marsh, paleo channels and younger levee adjacent to river Hooghly and older levee on both sides of the Tolly's Nullah are the important geomorphological units present in the area. The soil of project site is more of sandy loam content and brown in colour. The analysis results shows that range of pH of soil is moderately basic in nature.

Seismicity: As per seismic hazard map of State of West Bengal, the project area falls in Moderate damage risk seismic zone III and corresponds to MSK intensity VII, within very close vicinity of High Earthquake Damage Risk Zone (Zone-IV) of North and South 24 Parganas districts.

Climate: Predominant climate of the region is a Tropical Wet and Dry Climate. It is characterised by an oppressive hot summer, high humidity for most part of the year and well distributed rainfall during the Southwest monsoon season. The winter season commences from middle of November to the end of February, which is followed by the hot season from March to May. The southwest monsoon season is from June to September. October and the first half of November constitute the post-monsoon season. January is the coldest month with Monthly maximum temperature at 29.8°C and monthly minimum temperature at 10.7°C. May is the hottest month with maximum temperature at 38.8°C and minimum temperature is 25°C.

Air: On-site 24 hrs. Ambient air quality monitoring has been carried out for 2 days at 10 locations in the project area, from 12th May 2022 to 19th May 2022, through NABL accredited Environmental Monitoring Agency. The concentration of SO₂& NO₂ is within the CPCB standard. Higher particulate matter in air quality is probably due to dust emissions from vehicle plying on unpaved road, ongoing construction activities, vehicular pollution etc.

Water: As per SPCB record for River Bhagirathi-Hooghly, the levels of dissolved oxygen is above the minimum standard indicating that the river water is fit for the survival of aquatic life. The BOD load is above the permissible limit (3.0 mg/l) at most of the sampling stations highly contaminated by enteric bacteria. The river water is not fit for recreational purposes and drinking purposes without proper disinfection. As per monitoring of the surface water of Tolly's Nullah, the water quality shows higher level of coliform and reflecting that the water quality is degrading due to excreta pollution from the city area.

Onsite ground water quality has been tested from 10 locations near the project area, which shows all the parameters are within permissible limit. The level of ground water is under safe zone in Tolly's Nullah (as per CGWA). During construction stage contractor has to be ensured not to extract ground water. As per information available from Central Ground Water Authority, Ground water category in the Project District Kolkata is under safe category. Levels of ground water during pre and post monsoon are 12.09 to 19.59 mbgl & 10.72 to 15.42 mbgl respectively.

Biological Environment: The sub project locations at Tolly's Nullah under flat alluvial Gangetic plain and likewise the major forest type of the region is tropical moist deciduous forest. Within 10 km radius of the project site no protected National Park, Wild Life Sanctuary has been identified. Wet land (Sundarbans) has been identified at 63 km from project site in the direction of South East. A Ramsar Site (East Kolkata Wetland) is located at 9km from the project region. The current project is abatement of pollution from Tolly Nullah, this will improve the existing water quality and thus direct –indirect negative impact has not been anticipated.

With respect to project area, the land proposed for the STP& MPS are not falling under forest notified (PF/ RF / Social Forestry Zone). The land use of chosen project site is open land having shrubs and grass grown over the site. The land identified for STPs are government owned land, intra departmental transfer process of land with KMC is under process. As per site investigation and interaction, few trees have been observed in the boundary. As per KMC, it is perceived that boundary trees shall be preserved as periphery green buffer of the proposed STPs. Effort shall be taken by the Contractor to avoid the disturbance of flora and fauna of the region. Trees and shrubs reported on the site are Kikar, *acacia sps.*, *Lantana camara*, *Ageratum conyzoides*, *Mikaniamicrantha*, *Cynodon dactylon*, *Ricinus communis*, *Blumealacera* herb, *Calotropis*, *Chromolarnaodorata* etc.

Land use: All the three identified land pieces for establishing STPs are government land. Kolkata Municipal Corporation (KMC) area has a natural system of drainage and is governed by the physiographic profile. The major land use in the region is built up and there is no significant forest cover. The soil of the area is loam to silty loam. Predominant land uses of the sub project area are majorly built up, marshy or open land. In order to treat waste water going into the Tolly' Nullah, 23 pumping stations have been planned to be established in its catchment region. Out of 23, there will be 12 new pumping stations of which 11 will be on the land having old and rundown pumping / lifting stations, while 1 pumping station will be installed on the land belonging to KMC, but presently colonized by squatters. Other 11 pumping stations out of 23 will be augmentation of the older ones, which do not involve any land requirement. 3 STPs will also be established on new pieces of land, the details of which have already been furnished. The laying / upgradation / de-siltation of sewerage network has been almost planned along the available ROW of existing roads / streets that may have some social impact in terms of traffic disturbance, utility shifting etc. during construction

phase. Therefore, necessary environment and social mitigation measures shall be required to be implemented by Contractor during construction work.

ASI Structure: In project region Tolly' Nullah under Kolkata Municipal Corporation, 5 ASI protected Archaeological site/ Monuments (Metcalf Hall, St. John Church, Currency building, Maghen David Synagogue, Bethel-Synagogue etc.) has been identified, this is located 5-10 km far from the STPs site. Proposed locations of STP and lifting stations are not coming under 300m regulated zone of the ASI structure. No Temple, school are impacted under the project. Contractor as per EMP. should follow adequate EMP implication. During desilting work of trunk sewer, it is suggested, Contractor to take precautionary safety measure.

Social Baseline: Kolkata has total population of 4,496,694 as per the Census 2011. Out of which 2,356,766 (52.42%) are males and 2,139,928 (47.59%) are females. Population of Children with age group of 0-6 in the city of Kolkata is 339,323 which is 7.55 % of total population of Kolkata (M Corp).

Analysis of social groups for the project area has also been done based on concentration of Schedule Caste (SC) and Schedule Tribe (ST) population in project city. As per census 2011, the scheduled caste (SC) population of Kolkata is 241,932 (5.4%) and the scheduled tribe (ST) population is only 10,684 (0.2%).

87.8% of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 12.2% were involved in Marginal activity providing livelihood for less than 6 months. Of 1,795,740 workers engaged in Main Work, 7,413 were cultivators (owner or co-owner) while 8,903 were Agricultural labourers.

Public Consultation

Consultations were carried out with the officials of various departments (KMC& KMDA), stakeholders and Executive Agency. Consultations were carried out with the officials of various government departments including KMDA. The details of consultation and issues discussed have been summarized in Table 6.1.

As per discussion with officials of KMC, it is perceived that people showed willingness about the project and expressed their happiness about the improved sanitation in the city.

Based on the site visits and consultations with the stakeholders, the proposed project is expected to benefit people residing near Tolly's Nullah region, as the wastewater that currently flows untreated into the Hooghly River will be captured, treated and the remainder of the treated effluent will be discharged into the river.

Environmental and Social Impacts and their Mitigations

Though the project envisages environmental and social impacts during construction phase. However, they are temporary in nature and can be mitigated with the proper safeguard measures as suggested in the ESAMP along with effective monitoring during implementation. The project is expected to benefit the city, as the wastewater that is currently generated, flows untreated into the River Ganga/Hooghly. This will be tapped, treated at designated STPs and treated effluent will be utilized for secondary uses, like gardening and street washings between the zones of Moor Avenue to Garia i.e. under Br. X and XI as well as in thermal power plants located within 50 km of the project sites, while the rest unutilized treated water will be allowed to discharge into the Ganga River.

With the establishment of various project components, about 4.4 acres (1.8 Ha) of land is required which has been fulfilled by allotting government land at three different locations for STP and one location for a pumping station. Resettlement and displacement of 8 families are envisaged due to one pumping station proposed at Patuapara, Bhowanipore. Nevertheless, loss of livelihood is not foreseen due to the said displacement as the rehabilitation site is in the same locality. Rather the resettlement plan will improve the living condition of the associated families.

The project is expected to benefit the project area as the wastewater that currently flows untreated into the River Ganga/Hooghly will be diverted to STP for treatment. No untreated water would be discharge.

The STP project will improve the overall surface water quality of the Ganga/Hooghly River. The improvement in Ganga/Hooghly Water Quality will improve primary productivity (phytoplankton/ Zooplanktons) thereby improving the fish population in the river.

The proposed projects for sewerage and sewage treatment schemes at Tolly's Nullah have minimal temporary impacts during construction phase, however due to its development within the heart of a metropolitan city of Kolkata, it may face some congestion issues, traffic disruptions and inconveniences for which reason, it has been considered to be under 'moderate risk' category. Otherwise the major outcomes of the environmental and social assessment suggest:

- The project components are neither located in an eco-sensitive area nor any adjoining eco-sensitive/forest area.
- There is no requirement of acquisition or purchase of any private land in the project.
- The impact assessment also reiterates that the project does not involve any loss of livelihood rather resettlement of the squatters in a more planned settlement area provided by UD&MA under Government of West Bengal.
- The project will not have any impact on the tribal population.

The project components have limited environment and social impacts, which can be mitigated with the adoption of suitable mitigation measures by way of project specific Environmental Management Plan (EMP).

The social assessment clearly defines that the displacement of 8 families will positively impact the people belonging to the families as they will be settled in a planned housing apartment in the area closer to their present habitation area. Hence, their source of livelihood will not get hampered due to the proposed project. However, during desilting work of trunk sewer line and S&D work in the catchment of Tolly's Nullah, some temporary commercial encroachers might get impacted. In such cases, the affected party will be compensated according to the Environment and Social Management Framework (ESMF) guidelines set by the NGRBA.

Moreover, some inconvenience caused to the local public will be temporary in nature. The mitigation plan will be adopted to overcome any inconvenience during the project. The suggestions received from the local will be incorporated during the consultations. For execution of construction work within a scheduled time frame a provision of prior notice to residents and shop-owners will be followed.

Furthermore, the laying of pipelines will be done phase wise, for which suitable length of stretch will be identified to be worked upon and immediately after completion of the work in that stretch, road will be restored. Then further stretch will be taken up for laying of pipeline and subsequently restored. Generally for such congested areas, the contractors use to work during the lean traffic period and avoid peak hours of traffic. During the detailed design phase, contractor needs to come up with a detailed traffic diversion plan and suitable construction plan at such locations which need to be included in the C-ESIA so that the impact is minimized and immediately restored. Necessary EHS measurements will also be taken up with hard barricading.

A public grievance mechanism (as prescribed by ESMF of NGRBA) is to be followed. A social management plan has been developed comprising of mitigation measures to address social issues. The mitigation measures are provided in the SMP, the brief description is as follows:

Construction Stage: 1. Impact on Livelihood: There is minor impact on the livelihood of any permanent residents, shop owners, and any kiosks. It is suggested to compensate according to the Entitlement Matrix suggested in ESMF.

Land Acquisition issues: Land acquisition for a new pumping station on Madan Pal Lane at Patuapara, Bhowanipore will involve displacement of 8 families who will be compensated with an one bed-room flat in the same neighbourhood under Department of Urban Development & Municipal Affairs (UD&MA), Government of West Bengal.

Inconvenience to the public: As the project area is circumferenced by many squatters, market places, narrow lanes, inconveniences may be caused during the construction phase that will last for about 2.5 to 3 years. However, the laying of pipelines will be done phase wise, for which suitable length of stretch will be identified to be worked upon and immediately after completion of the work in that stretch, road will be restored. Then further stretch will be taken up for laying of pipeline and subsequently restored. Work will be conducted during day and night so that peak hours of traffic can be avoided. There will be a minor inconvenience to the public due to construction activities. Advance public notices to be circulated and construction should be completed in the given time limit. Debris should be cleared on time.

Health issues due to dust and noise levels: During the construction stage, a minor inconvenience to the public may happen. This could affect elderly and children, but time duration of impact is very limited and temporary.

Traffic Congestion: Re-route traffic wherever possible.

Health hazardous: Fences/ temporary enclosures should be put around construction sites (even inactive ones, if hazards, like open pits, remain); enclosures should be properly marked with caution signs.

Environmental Management Plan

Construction Stage: 1. Environmental Sensitive areas: There are no environmentally sensitive areas in the project area, no roadside trees will be affected. Air Pollution: Sprinkling of water at regular intervals to control dust especially at places where the soil is stockpiled are suggested. Also the use of low fume emitting and newer generators and vehicles with well-maintained engines and control devices. Noise levels: Noise barriers/sheets all-around construction sites and proper maintenance of construction equipment are provided in the EMP. Contamination of water resources: suggestion to ensure proper

handling and disposing of construction waste at identified refusal sites. Proper stockpiling of excavated soil will be ensured by contractor.

Occupational Health and Safety: During construction stage, sewer cleaning desilting work, pipeline and renovation work, construction of new establishment of STP, excavation etc., would involve construction specific occupational health and safety issues worker and staff. During construction stage, contractor should follow specific standard operating procedures to safeguard the occupation health and safety of worker and staff. EMP has suggested general safety measures for the project. However, during construction stage site specific Safety Health and environmental management plan will be required from the contractor end under supervision of executive agency (KMC).

Operation Stage Proper handling and regular maintenance of operating machines at pumping stations and STP including generators, air diffusers and regular clearing of waste, etc. would leaks in the sewer network system. This would lead additional pollution load to the Ganga/Hooghly River. Therefore, mitigation measures to be followed to prevent the leakage and overflow in the sewer network system and appropriate adequate design measures and slope in the gravity mains to prevent siltation and accumulation of solid waste. Proper management of Sludge from STPs is required to be managed by Contractor under supervision of implementing agency. Effort shall be made to maximize the use of digested sludge as soil manure, fertilizer in farm field, garden etc. Since the project STP site is falling in busy city area, efficient odour management in terms of providing thick green belt around the STP, high fence, continuous aeration /oxygen supply in the tank to avoid anaerobic condition in the tanks are few management measures to be incorporated in the operation phase of the project

Grievance Redress Mechanism

- ▶ NMCG has adopted Government of India's Centralized Public Grievance Redress and Monitoring System (CPGRAM) to record and monitor grievances that come either to NMCG directly or through various ministries/ PMO/ states.
- ▶ NMCG has one GRM officer, who addresses all queries registered on the Centralized Public Grievance Redress and Monitoring System (CP GRAM) portal of NMCG. The nodal officer will reply the applicant and if the matter relates to the SMCGs of Ganga Basin States, the grievances are forwarded to the concerned State with the request to furnish reply direct to the applicants under intimation to NMCG.
- ▶ The GRM officer is supported by one social expert who coordinates with all the SMCGs. At SMCG level, reporting of grievances are being monitored by environmental and social experts.
- ▶ All Executing Agencies have a GRM mechanism at each project site. The project manager and deputy project managers are in-charge of these GRMs. To register grievances, a register has been kept at all project site offices and sometime field team received grievances over mobile phones as well as on WhatsApp messages.
- ▶ To resolve the grievances, project manager from EAs side, contractor's project engineer and his team, work together sorted out at the earliest. If site team is unable to resolve the issue its own, the complaint/matter is brought up to senior management of EA as well as Contractor and discussed in monthly review meetings and escalated to the level of SMCG and NMCG.

- ▶ In continuation, Grievance Redress Committees (GRCs) has also been constituted in some of the basin States. The GRC discusses grievances on weekly basis at their safety meetings³.

District level GRC system is available through District Magistrate's Office and KMDA handles grievances if any. Project specific GRC have to be established by the KMC/KMDA/SMCG in West Bengal.

Labour Management Plan

Contractor shall prepare and submit Labour Influx and Worker's Camp Management Plan to the concerned EA that addresses specific activities that will be undertaken to minimize the impact on the local community, including elements such as worker codes of conduct, workers accommodation facilities, training programs on workers safety, and also to address COVID-19 issues. A Workers' Labour Camp Management Plan addresses specific aspects of the establishment and operation of workers' camp.

Management of COVID-19 Pandemic at the Project Site

Additional measures to address the COVID-19 situation that a systematic approach to planning, recognizing the challenges associated with rapidly changing circumstances shall be prepared by the Contractor. Addressing COVID-19 at a project site is beyond occupational health and safety and is a broader project issue which will require a designated team for documentation and discussed at regular meetings to facilitate adaptive management measures.

Monitoring of COVID-19 pandemic by the Executive Agency (EA)

The Executing Agency (KMC) shall monitor the COVID-19 issues at the project site and will make sure that the Contractor taking adequate precautions to prevent or minimize the outbreak of COVID-19.

Gender Assessment & Development

According to ESMF, the objective of Gender Assessment and Development is to analyse gender issues during the preparation stage of sub projects, design interventions and primary data collection. The gender analysis shall be carried out based on findings from gender specific queries and requirements during data collection and community consultation process. The quantitative and qualitative analysis shall include sex-disaggregated data, issues related to gender disparity, needs, constraints, priorities and understanding of gender-based inequitable risks, benefits and opportunities as well as gender relevant indicators.

Institutional Arrangement for implementing ESAMP

The nodal Ministry for the Namami Gange program is the Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation (DoWR, RD&GR). National Mission for Clean Ganga (NMCG) is the primary implementing agency for the project at the national level. The implementing agencies at the state level are the State Mission for Clean Ganga (SMCGs). At the local level, specific Executing Agencies (EAs) will be there for the implementation of various activities, including infrastructure investments under the Namami Gange program. Kolkata Municipal Corporation (KMC) is the Executive Agency for the proposed development of Sewerage and Sewerage Treatment plant.

³ Draft Report on GBV-GRM in National River Ganga Basin project (NGRBA), June 2019, World Bank

The contractor shall be responsible to implement the EMP primarily in assistance with the Project Executing Agency (KMC). The Environmental Engineer/Specialist from the Contractor and Independent Engineer/ Supervision Consultant shall implement and monitor the compliance of the EMP and all the design drawings of various civil structures shall be implemented after his approval. Also to assist to the respective Project managers to ensure social and environmentally sound and safe construction practices.

The State, local Government will be responsible for Coordination, Monitoring and evaluation of the Environmental Management Plan. It should ensure all the safeguarding plans are in line and acted upon. The Contractor shall report the implementation of the Environment Management Plan to the Environmental Expert and as well as to KMC through monthly reports. Further, a quarterly report is required to be prepared and required to be given to SMCG (State Mission for Clean Ganga) and National Mission for Clean Ganga (NMCG) for the progress made in implementing the Environment Management Plan.

Feedback from the residents can also be taken from time to time to cross check the contractor's report. KMC should make inspection visits at the construction site to check the implementation of Environment Management Plan as per the contract.

EMP Budget

EMP Budget & monitoring cost has been presented in Table 9-3 of total amount of 59,420,000. 580 lakhs EMP Management and monitoring cost has been considered under the DPR (**Table 2-10**). EMP aspects and monitoring which is not included in the DPR are estimated separately in the ESAMP as EMP management cost (such as tree plantation, Sludge quality monitoring, noise barrier/fencing during construction stage etc.), this is estimated to be around Rs. 14, 20,000/-. This environmental budget is a tentative one and a construction specific Environment Management Plan along with the appropriate expenses required to abide by the environmental guidelines prescribed by CPCB will be framed by the construction contractor during detailed designing stage of the STPs.

Item	Location	Season	Year	Total no. of samples	Unit cost (INR)	Total cost (INR)
A. Environmental Monitoring during Construction Stage-						
1. Construction Stage Air, Noise, Soil , Ground Water at 5 location (3 STP and MPS) & Surface Water Quality Upstream, Mid-Stream, Down Stream, HFL,LFL; 10 location out fall location monitoring cost for 4 years has been taken in DPR						6,000,000 (Included in the DPR)
B. Environmental Monitoring during Operation Stage-						
2.Operation Stage monitoring of waste Water Quality Upstream, Mid-Stream, Down Stream, HFL,LFL; 10 location of outlet for 15 years has been taken in DPR						9,000,000 (included in the DPR)
3.Sludge (STP sites) during operation stage	3	2	15	90	6500	5,85,000
C.EMP Management cost						
Parameter	Description				Unit	Amount
4.Dust Suppression	Water sprinkling on excavated material and provision of top cover when transported through vehicles				(included in DPR Lumpsum)	2500000
5.Health & sanitation and Labour camp/construction camp	Creation of Sanitation and water supply at construction camp Sanitation Arrangement at Camp (6)				(included in DPR Lumpsum)	2500000
6. Isolation /fencing of sites near to heavy settlements & traffic areas/ Use of sound barriers or sheets	Lump sum Cost- Rs 70 per KG –GI sheet (including loading , unloading , installation etc.) Approximately 72000 m Sewer line desilting and fresh line & 15,000 sqm STP area involves; perday				Not included in the DPR	4,20,000

		<p>requirement of barricading on active area assumed as 250m; approximately 350 active days requires for installing and shifting barricading from completed to active area.</p> <p>GI sheet of 250 m length & 3 m height will have 750 sqm. and converting to KG (@6kg/sqm)=4500 total weight & total cost of that is 3,15000 (4500*70)</p> <p>Labour cost (assuming 350 days total active days at rate of 300rs)= 105000</p> <p>Total cost of GI installation - 4,20,000</p>			
7. Fly nuisance at STP	Applications of Insecticides	--	--	--	Lumpsum 2,00,000
8. Tree plantation/land scape at STP and IPS	Reduction of noise and odour	Lump sum cost (three STP locations @rs 1800/tree including maintenance 5 year & 75 trees at each STP) + Soft cover 20 % at plant- Lumpsum 2 lakhs + 1 lakhs at existing MPSs			Lumpsum 8,00,000
9. Training/ Awareness generation along with IEC material	Undertake to develop communication strategy, capacity building and training initiatives for all stakeholders such as the SMCGs, EAs, ULBs, NGOs and common citizens			(included in DPR Lumpsum)	500,000
10.CSR					37500000
ESMP Cost included in DPR (sl.no.1,2,4,5,9,10)					58,000,000
EMP Cost Excluded from the DPR (sl.no.3,6,7,8)					1420000
Total budget Cost of EMP implementation (Sum of DPR's ESMP Cost + EMP remaining aspects of ESAMP)					59,420,000

1. INTRODUCTION

The river Ganges traversing along a length of 2525 Km within India originates from Gangotri glacier (4255 metres above mean sea level) on the mountain of Garhwal Himalayas in Uttarakhand and flows upto Ganga Sagar in the Bay of Bengal. During its course, the river touches almost 11 States of India comprising of about 36 Class-I cities and 14 Class-II towns located along its bank, out of which 15 Class-I cities belong to West Bengal.

The river Hooghly, a 260 km long channel of river Ganges has got bifurcated from it about 200 km north of Kolkata at Murshidabad spreads across the flat terrain of West Bengal and Bangladesh before entering into the Bay of Bengal. The upper reaches of the river, often called Bhagirathi is fed by Farakka feeder canal, while at its lower reaches, the flow is enhanced by the rivers Haldi, Ajay, Damodar and Rupnarayan.

Hooghly River is of significant importance since pre-historic times when the Portuguese traders ventured the area, pioneered in commerce and successively attracted other wealthy merchants including French, Dutch and British colonizers. The rich culture, heritage and the land of abundant resources sprawling around the mighty river had fascinated the rich businessmen to flourish and exploit the area. Besides, the river is a fundamental lifeline of the State of West Bengal as it nurtures the people settled there in terms of supplying water for human use, irrigation, industries as well as supporting various river dependent trades.

As per the Indian Journal of Applied Research, a review on the pollution status of river Hooghly states that Ganges has been considered to be sixth most polluted river in the world affecting almost 400 million people who live close to the river. Kolkata, Kanpur and Varanasi are the three leading cities that contribute towards more than half of sewage being discharged into the Ganges every day. In West Bengal, only 49% of total 1,311 million litres a day (MLD) of wastewater is actually treated, which comprises of 47% sewage generated by Kolkata alone. A rapid colonization, urbanization and industrialization at the basin areas of river Hooghly accompanied by the release of sewage and industrial waste along with various agro-chemicals through surface run-off into it may be the probable cause behind it.

The World Bank recognizes that the pollution in River Ganga is primarily a result of inadequate infrastructure, the weak capacity of local water and wastewater utilities in the basin and the poor state of environmental monitoring and regulation. The Government of India (GoI) has received loan assistance from the World Bank for the Mission Clean Ganga related activities under NGRBA Program (later which is included as one of the component of the Namami Gange Programme) at the level of institutional development, operational and implementation support and in four sectors, namely wastewater collection and treatment, industrial pollution control, solid waste management and riverfront development.

NMCG acted as implementation arm of National Ganga River Basin Authority (NGRBA) which was constituted under the provisions of the Environment (Protection) Act (EPA), 1986. NGRBA has since been dissolved with effect from the 07th October 2016, consequent to the constitution of National Council for Rejuvenation, Protection and Management of River Ganga (referred as National Ganga Council) vide Notification No. S.O. 3187(E), dated 07th October 2016 under EPA 1986 and subsequent amendments vide Notification No. S.O. 1793(E), dated the 21st May, 2019 and Notification No. S.O. 3163(E), dated 02nd September, 2019.

The current focus of World Bank funded National Ganga River Basin Projects (NGRBP) under National Mission for Clean Ganga (NMCG) is on six participating States namely Uttarakhand, Uttar Pradesh, Bihar,

Jharkhand, West Bengal and Madhya Pradesh. National Mission for Clean Ganga (NMCG), the implementing wing of Namami Gange Programme has appointed M/s. LEA Associates South Asia Private Limited, New Delhi as a Consulting agency for the preparation of Environmental and Social Assessment & Management Plan for **“Pollution Abatement of Tolly’s Nullah (Adi Ganga) in the state of West Bengal under National Mission for Clean Ganga (NMCG)”**.

1.1 NAMAMI GANGE PROGRAMME

The Government of India launched “Namami Gange” as an integrated conservative mission programme in the year 2015, which is a comprehensive project that has adopted a river-basin approach and given a multi- sectoral mandate to address both water quantity and quality aspects. Under Namami Gange Programme, diverse set of interventions for cleaning and rejuvenation of river Ganga have been taken up. These include pollution abatement activities comprising of sewage, industrial effluent, solid waste management, river front management, aviral dhara, rural sanitation, afforestation, biodiversity conservation, public participation etc. The programme covers short term, medium term and long-term activities. The programme aims at integrating previous and currently ongoing initiatives by enhancing efficiency, extracting synergies and supplementing them with more comprehensive and better coordinated interventions. Namami Gange Programme has been segregated into three different components:

- ▶ **Component 1: Institutional Development:** This component will support to the national, state and municipal governments to strengthen implementation and financing arrangements and develop a framework to improve Ganga River basin management.
- ▶ **Component 2: Infrastructure Development:** Pertains to the initiatives to be undertaken under National Ganga Plan in 5 major sectors i.e., Infrastructure Development (Sewage Treatment, River Front Development, and Industrial Wastewater Treatment & Solid Waste Management), Ecological Sustainability and Research & Development and Communication & Public Outreach.
- ▶ **Component 3: Program communication and management:** NMCG conducts a range of vibrant communication activities ranging from ground-level community engagement exercises, social and traditional media outreach, public debates and lectures, to a flagship mass media campaign.

Presently, NMCG is the designated body to take all necessary decisions and actions for pollution abatement and rejuvenation of River Ganga. Later in 2019, Ministry of Jal Shakti was formed by merging Ministry of Water Resources, River Development & Ganga Rejuvenation as well as Ministry of Drinking Water and Sanitation. Now NMCG, being a part of Department of Water Resources, River Development & Ganga Rejuvenation comes under Ministry of Jal Shakti.

1.2 STRUCTURE OF THE REPORT

This report deals with the Environmental and Social Assessment and Management Plan for the proposed **“Pollution Abatement of Tolly’s Nullah (Adi Ganga) in the state of West Bengal”**. as per the requirement of Environment and Social Management Framework (ESMF) of NGRBA. In line with the requisite of ToR, the present ESAMP has been arranged in the following chapters:

Chapter 1	Introduction This chapter details the background of Ganga Clean-up Initiatives, Namami Gange programme, and various mechanisms to implement the project.
Chapter 2	Project Description

	This chapter provides a brief description of the project including the scenario of existing sewerage infrastructure of the project area, need of the proposed project and various components and/or interventions proposed under the present sewerage project.
Chapter 3	Approach and Methodology This chapter of the report talks about the approach and methodology adopted for conducting environmental and social assessments for the present project in Tolly's Nullah.
Chapter 4	Policy and Legal Guideline This chapter highlights various policy and legal framework of the government of India as well the policies of World Bank applicable to the project, as per the requirements of ESMF of NGRBA
Chapter 5	Baseline Environmental and Social Profile of the Project Area Description of the baseline environmental and social condition including the baseline physical environment, biological environment and socio-cultural conditions of the proposed project area.
Chapter 6	Stakeholder Consultations This chapter of the report details about the consultation processes carried out with the various sections of community and stakeholder groups in and around the project area, as well as the suggestions provided under the consultations is documented.
Chapter 7	Environmental and Social Impacts and Mitigation Measures This chapter provides an assessment of potential environmental and social impacts associated with various stages of the project cycle including design and development phase as well as construction and operation phase. Also some mitigation and management measures have been suggested to counteract such impacts.
Chapter 8	Alternative Analysis This section describes the alternatives considered in the project towards improving the project.
Chapter 9	Environmental Management Plan It includes the steps involved in the identification of anticipated impacts, the description of each mitigation measure with technical details including the type of impact to which it relates and the conditions under which it is required. This chapter also emphasizes on implementation schedule, responsibilities and respective time frame for implementation of ESAMP.
Chapter 10	Conclusions Finally, this chapter concludes the inferences brought out from the environmental and social analysis of the project activities for the proposed sewerage works at Tolly's Nullah. It also highlights the conclusion based on the analysis which shows that the proposed project can be categorized as 'Moderate Impact' intervention.

2 PROJECT DESCRIPTION

2.1 ABOUT THE CITY

The project City i.e., Kolkata (formerly Calcutta) is the state capital of West Bengal. Kolkata is situated on the Eastern Bank of River Ganga. The tail end of river Ganga flows by the side of Kolkata before it reaches Bay of Bengal about 180 Km downstream from Kolkata. The project City Kolkata is situated at the longitude of 88° 30'E - 22° 33' N. The height of the city is 6.4 meters from mean sea level.

The governing body of the city of Kolkata is Kolkata Municipal Corporation (KMC), which has been established in 1876 and it administers an area of about 206.08 square kilometres encircling 144 wards and 16 nos. of boroughs. The KMC area is bounded by river Hooghly in the northwest, South 24 Parganas district in the south and southwest, Salt Lake City in the east and North 24 Parganas district in the north. The area falls between north latitudes of 22°28'00" and 22°37'30" and east longitudes 88°17'30" and 88°25'00".

KMC area has a natural drainage system governed by its physiographic profile, which got disturbed as the city moved towards urbanization and utilization of majority of its open spaces. Further the unplanned growth of population combined with encroachment of major part of the drains flowing through the city leads to overflowing of rainwater through roads and the adjoining residential colonies.

As per ADB's report *Transforming Kolkata, 2019*, the city bears a population of 5.2 million within its official boundaries. The total population of the city and its surrounding suburbs, known as the Kolkata Metropolitan Area, was estimated at 14.7 million in 2015, making it the third most populous metropolitan area in India. With 24,000 people living per square kilometre in Kolkata, it is also one of the densest megacities in the world. The KMC is the local authority to provide the basic services for the citizens, such as supply of drinking water, sewerage, drainage, solid waste management, road maintenance, street lighting, slum development works etc.

The state of West Bengal is situated in eastern India, sharing its borders with Indian states as well as Bangladesh, Bhutan and Nepal. This advantageous location has made Kolkata a traditional market for eastern and north-eastern India, as well as Bhutan, Nepal and Bangladesh. The city is the dominant commercial and financial hub in the state producing 13% of the state's gross domestic product.

As per the City Disaster Management Plan of Kolkata, 2020, the city has a peculiar land form pattern which restricts any compact urban development form around a fixed nucleus and resulted into linear developments. The river Ganges, over centuries has deposited large quantities of alluvial silt along its both banks, forming natural levees of high land suitable for human habitation on both banks. Kolkata has inevitable physical growth pattern with a faster increase of population. The wetlands surrounding the city in the west and south-west are now mostly filled up by urban expansion.

The study area "Tolly nullah" also called Adi Ganga was excavated by Colonel William Tolly in the year 1773 for the purpose of navigation through it, which however has presently ceased to be a free flowing channel due to siltation, construction of metro piers on the canal bed and rapid dense inhabitation along its bank. The nullah is connected to river Hooghly on one end and Vidyadhari river on its other end. In addition to it,

due to non-functioning Dry Weather Flow (DWF) pumping stations and the penstock gates that were made under GAP phases I & II, Adi Ganga has got extremely polluted, which was earlier suitable for bathing and aquatic life.

In view of the initiatives taken by various government organizations towards eradicating pollution from Tolly Nullah and ultimately river Hooghly, the 15.5 km stretch of the nullah has been divided into 6 zones, out of which the proposed STPs will treat dry weather flow generated from zones 2, 3 and 5. The regional setting of Tolly nullah (Adi Ganga) along with the locations of 3 proposed STPs has been shown in **Figure 2-1**.



Figure 2-1: Regional Setting of Tolly's Nullah Project

2.2 EXISTING SCENARIO OF SEWERAGE FACILITIES IN PROJECT CITY

Overview of Existing Sewerage & Sanitation provisions

Kolkata Municipal Corporation (KMC) area has a natural system of drainage and is governed by the physiographic profile. In the catchment of Tolly Nullah, flooding and water logging are recurring problems for which a suitable surface drainage system needs to be developed. Due to unplanned growth of population, the major drain flowing through the city has been encroached upon, over and above the construction of metro rail piers on the canal bed of Tolly Nullah has drastically reduced the flow of water through it. All these anthropogenic forces have led to disruption in the drainage system of the city thus,

leading to overflowing storm water in the city triggering flooding of residential colonies located along the sides of natural drains during heavy downpour.

Besides encroachment of the nullah bank, municipal waste dumping along with discharging sewage, throwing / collecting ritual waste by the side of nullah is a common practice of the nearby residents. These waste materials get flown away by wind and rain thereby causing siltation and reduction in channel cross-section ultimately leading to reduced discharge in downstream side of Tolly Nullah. Further, in absence of regular cleaning and de-silting, the drainage channel got filled up to a considerable depth rendering acute flooding problem in the adjoining areas during monsoon season. City area has underground sewerage system constructed long back, which has now become outdated and defunct.

Tolly Nallah extending from Garia Rail Bridge (near Khudiram Metro station) towards south of Kolkata to DoiGhat (confluence of River Hooghly) at Hastings towards north of Kolkata covers around 15.5 km distance and 33 sq.km of catchment area encompassing 1 km on either side of the nullah⁴. The nullah traversing through the middle of KMC area serves as a main drainage channel for the southern part of the city. The predominant flow of Tolly's Nullah is from east to west, i.e., from Garia side to Hastings, however during high tides, it was observed that the river water from Hooghly flows back towards Tolly nullah, resulting into overflow of nullah at some places especially near Kalighat area as informed by KMC officials also during the site reconnaissance survey. The nullah has three tributaries, namely Western Channel (Approx. 2 km long), Keorapukur Khal (Approx. 2 km long) and Chetla Boat Canal (Approx. 2.8 km long). The existing contour or topography of project site shows that present area is very flat with ground level varying from 2.38 m to 6.30 m above mean sea level. A view of confluence of Tolly nullah with river Hooghly at Doighat and the illegal settlements along the nullah can be seen in **Figure 2-2**.



Figure 2-2: Glimpse of Tolly nullah and river Hooghly (site visit photographs)

Problems prevailing around Tolly nullah:

- ▶ Untreated wastewater received from 28 wards of KMC and 3 wards of Rajpur Sonarpur Municipality (RPSPM). The problems prevailing around Tolly nullah can be seen in **Figure 2-4**.
- ▶ Untreated wastewater comes through Keorapukur khal, Rania Khal, Chetla Boat Canal as well as Western Channel.
- ▶ Existence of slum areas, markets and alleys, unauthorized commercial activities etc. along the bank of nullah that dispose solid waste and sewage into it.

⁴Source: DPR approved by Kolkata Municipal Corporation

- ▶ Also livestock and khatalas along the nullah dispose their waste into it. A glimpse of cowsheds at the nullah bank has been shown in **Figure 2-4**.
- ▶ Residents of adjoining areas and wards also throw their waste including their daily puja waste along the side of the canal.
- ▶ The pillars and piers of metro rail existing on Tolly nullah from chainage 373 m to 7238 m are also obstructing the flow of the canal thereby reducing its cross-sectional area and hydraulic flow as well as creating hindrance in maintenance of the same. The situation has been represented in Figure 2-5.
- ▶ Severely degraded quality of water of Tolly nullah / Adi Ganga with respect to its use for bathing and carrying out rituals.
- ▶ Non-dredging / non-de-siltation of Tolly's Nullah for long period.
- ▶ Lack of environmental and social awareness among the local people.



Figure 2-3: Tolly's Nullah location



Figure 2-4: Cattles, cow sheds and hutments along Tolly nullah

Source: <https://www.telegraphindia.com/my-kolkata/news/cowsheds-back-on-the-banks-of-tollys-nullah-river-course-as-polluted-as-ever/cid/1861664>; published on 21.04.22



Figure 2-5: Metro rail pillars through Tolly nullah

Source: <https://www.telegraphindia.com/my-kolkata/news/cowsheds-back-on-the-banks-of-tollys-nullah-river-course-as-polluted-as-ever/cid/1861664>; published on 21.04.22

<https://www.telegraphindia.com/west-bengal/calcutta/tollys-nullah-turned-into-a-sewage-canal-report/cid/1818836>; published on 15.06.21



Existing condition of the nullah and its tributaries:

- ▶ The basin of Tolly nullah receives water from its 3 tributaries, namely Keorapukur khal, Chetla boat canal and Western channel along with 74 outlets. The connectivity of the nullah together with its three tributaries has been shown in **Figure 2-6**.
- ▶ The width of channel bed and RoW of nullah varies along its length from 10 m at the start to 36 m at its outfall with constrictions at many places due to development of illegal hutments along its bank through the years.
- ▶ The upstream of the nullah has lined bank from chainage 0 m to 7713 m with partial damage at some places, while the downstream portion of the nullah from chainage 7713 m to 15691 m has irregular earthen bank.
- ▶ The nullah bed has a very flat slope ranging from 1 in 10000 to 1 in 15000 and remains almost silted up throughout its length.
- ▶ The high tide combined with heavy rains causes backflow of water from Hooghly river to the nullah, thus causing flooding and inundation in the catchment area mainly at downstream locations, such as Kalighat, Chetla Road area etc. The tidal impact is noticeably weak beyond Bansdroni Bridge.
- ▶ Slums and squatters developed along the side of the nullah pose great cause of concern towards its cleaning as they contribute to the solid and liquid waste that directly goes into the nullah bed and bank.
- ▶ About 74 no. of penstock/ sluice gates have been provided for the storm water drains discharging into the Nullah with an objective to restrict the tidal flow from Nullah to the drains and avoid flooding situations.



Figure 2-6: Tolly's Nullah and its adjoining wards – The project area

Existing scenario of sewage and drainage systems of Tolly nullah catchment:

- ▶ The drainage basin is divided into two parts – western and southwestern parts draining into Ballygunge Drainage pumping station (BDPS) and Palmer Bridge pumping station via city sewer network, while the south-eastern and southern part is discharged into existing STP at Keorapukur.
- ▶ Currently, the sewage and storm water flows through same network and sewage from all the localities adjoining Tolly nullah is getting directly discharged into it without any treatment.
- ▶ Some of the penstock gates have got damaged and dilapidated.
- ▶ At many places, the sewer lines, pumping mains and pumping stations are either silted up or non-functioning.
- ▶ The pumping stations and their adjoining trunk sewers in most of the places need to be augmented and re-strengthened.
- ▶ The sewer diversion lines made during GAP phase I & II are partially defunct and so currently the sewage is diverted towards storm water drains leading to the nullah.

- ▶ Pumping stations at Rathtala, Bansdroni, Moor Avenue & Naktala are not functioning properly due to broken and disordered sewer lines causing sand boiling condition leading to land settlement in the nearby area.
- ▶ Cross drainage for sewer line at chainage 9034 m near LS – 7, Izzattullah pumping station made during GAP phase – I need replacement with better cross drainage option, like pressurized pipe through trestle bridge etc.

Flow characteristics of the nullah:

The nullah exhibits bi-directional flow pattern towards the river Hooghly as well as also in the opposite direction during high tides. It has also been reported that flows in the Nullah never overtopped except in extreme tidal event (Highest of High 5.34m in 1976) for very high tide combined with extreme high intensity rains. As per the Master plan 2009 also, the channel has sufficient discharge carrying capacity despite construction of metro pillar and metro stations.

Existing sewerage network and sewage pumping stations of Tolly nullah basin:

The sewerage network of Tolly nullah basin is divided into two parts - northern catchment area and southern catchment area. The northern catchment area extends from Chetla Boat canal to outfall in Hooghly river. It comprises of 7 pumping stations carrying sewage to Ballygunge Drainage Pumping station (BDPS) finally leading to river Vidyadhari through East Kolkata Wetland as shown in **Figure 2-7**. On the other hand, the southern catchment area extending from Garia Rail Bridge to Chetla Boat canal has 15 pumping stations pumping sewage to Keorapukur STP, finally leading to Churial khal as shown in **Figure 2-8**. The entire portion of the Tolly nullah starting from its confluence with river Hooghly at Dai ghat to Garia station under the area of Kolkata is divided into 6 zones. The 6 zones include 28 wards coming under KMC and 3 wards under Rajpur Sonarpur Municipality.

In the present situation, most of the pumping stations of the southern catchment of Tolly nullah under Keorapukur STP are defunct and suffering from tremendous sand boiling problem during operation as those were constructed during 1970's.

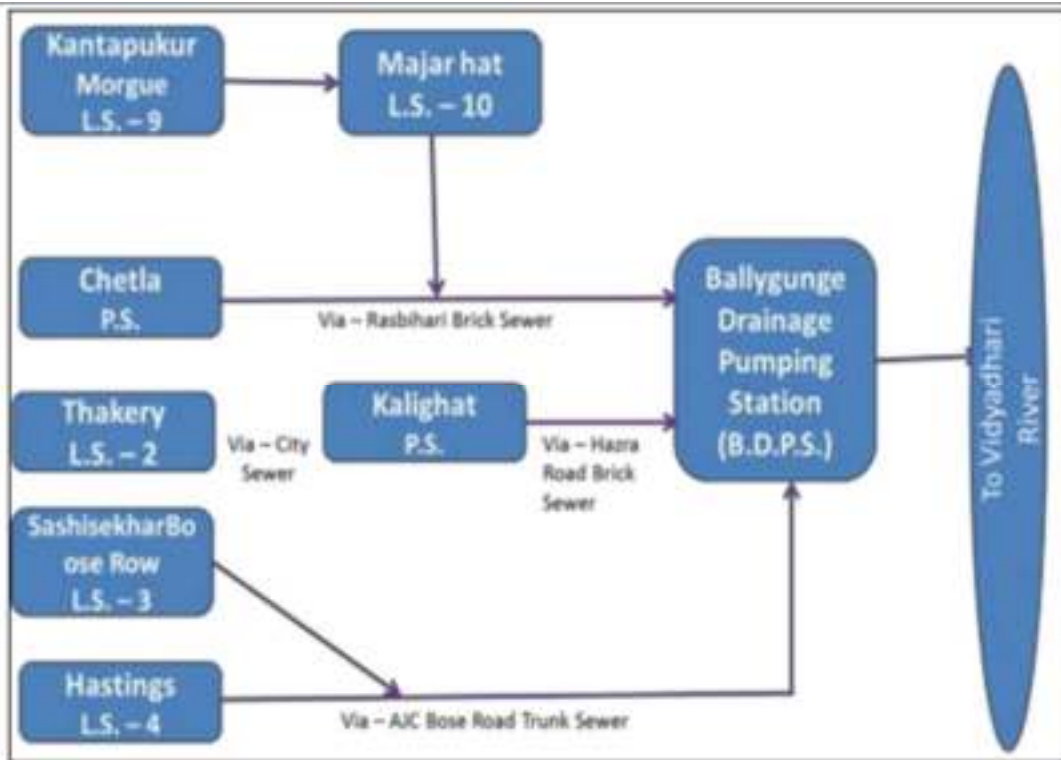


Figure 2-7: Northern catchment of Tolly nullah basin with 7 pumping stations

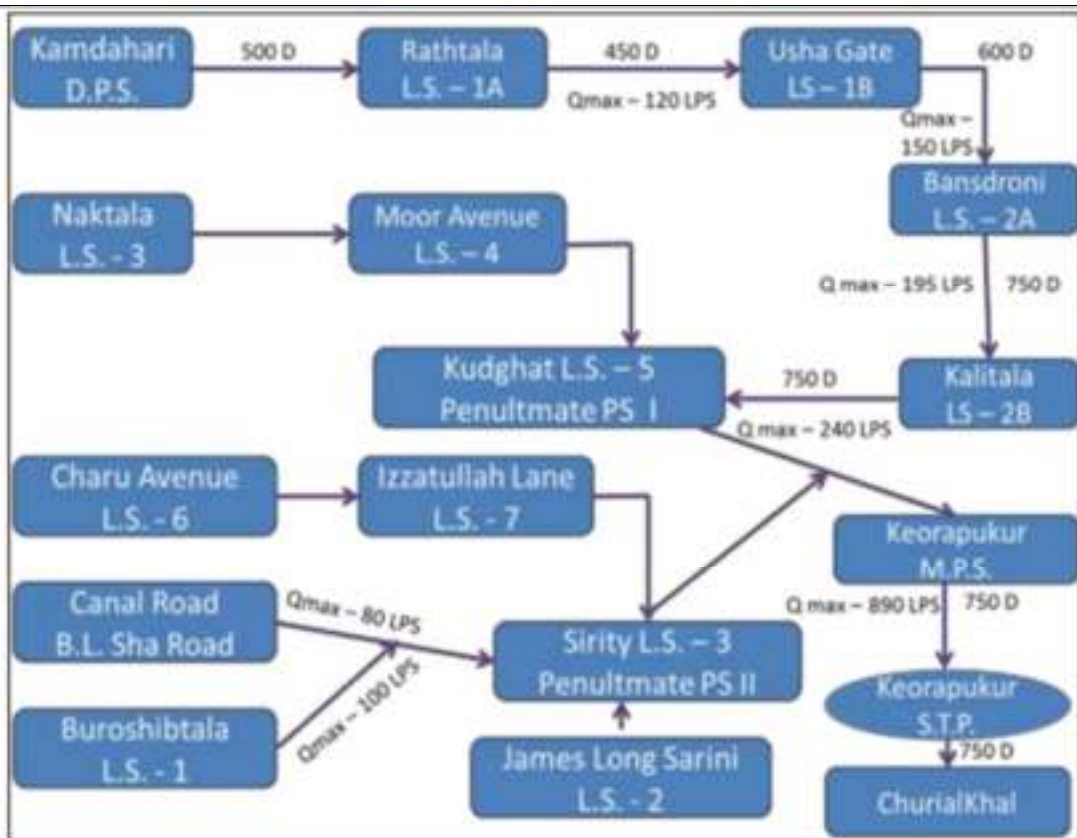


Figure 2-8: Southern catchment of Tolly nullah basin with 15 pumping stations

The catchment area of the existing sewerage network of Tolly nullah has been shown in **Figure 2-9**. The six zones of Tolly nullah stretch are described in the following **Table 2-1** and the ward-wise DWF / sewage generation is tabulated in **Table 2-2**.

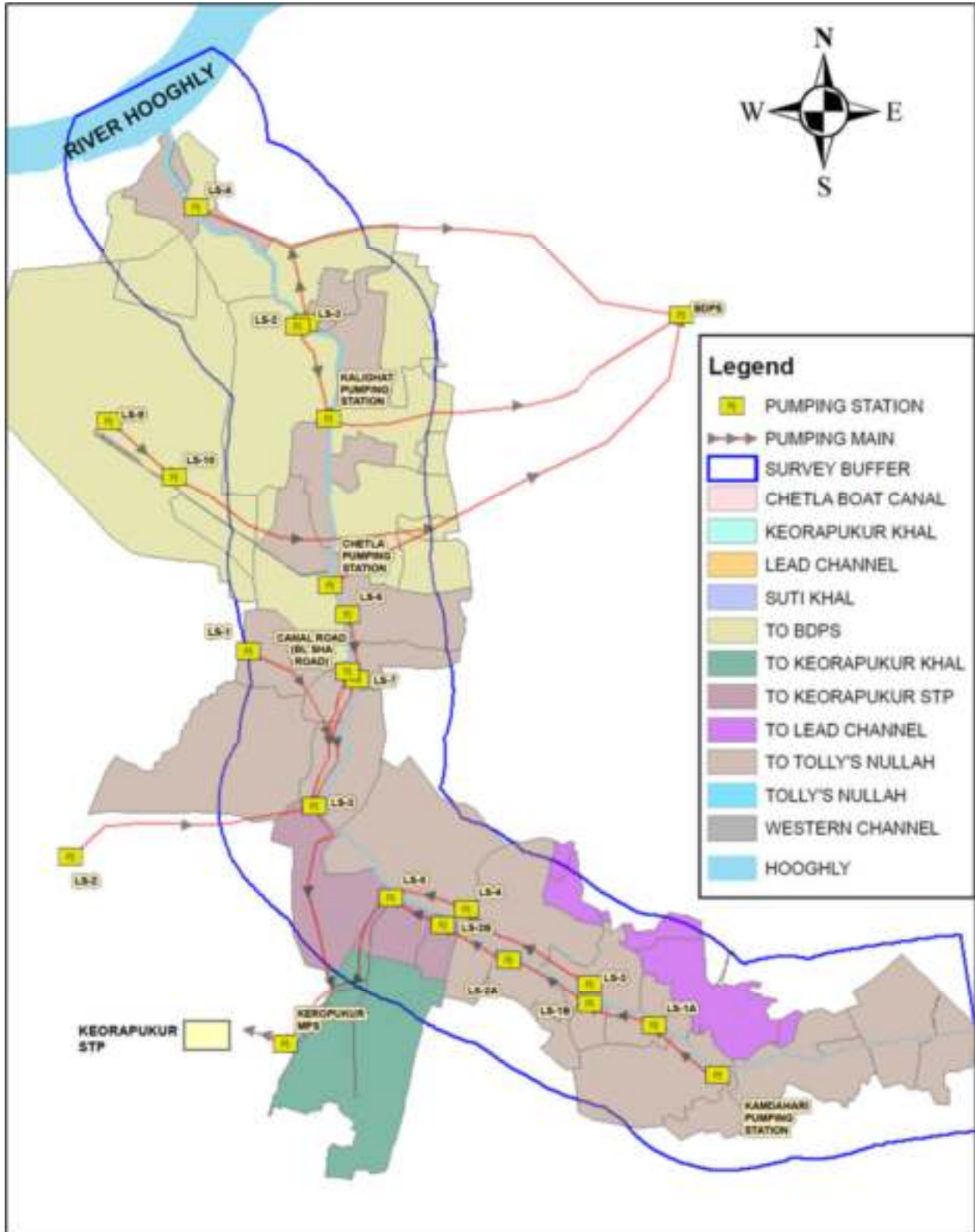


Figure 2-9: Catchment area of existing sewerage network of Tolly nullah

Table 2-1: Zoning nomenclature of Tolly nullah

Zone	Area	Drainage of waste water	Problems	Proposal
I	Rajpur & Sonarpur Municipality (RSPM) of ward 6 & 29	Natural terrain of the area induces flow of water towards Suti khal that ultimately leads to EKW	Solid waste dumping at the point of origin near Garia station; un-sewered area	Construction of covered drain along the Pranabananda Road connecting Suti Khal and EKW
II	KMC area under Naktala pumping station of ward 100 & new area of ward 110 on northern bank of Tolly nullah	10 MLD Brij road STP (new)		New 10 MLD STP at Brij Road and pumping station at Brij road
III	Borough XI of KMC under pumping stations Kamdahari, Rathtala, Usha Gate, Bansdrone and Kalitala	11.6 MLD STP at Bansdrone (new)	Rathtala and Bansdrone pumping stations are defunct	New pumping stations at Rathtala and Bansdrone as well as 11.6 MLD STP at Bansdrone
IV	Borough X, XI & XIII of KMC under pumping stations Moor Avenue, Izzatullah and Canal Road.	Keorapurkur STP	Moor Avenue and Canal Road pumping stations are defunct	New pumping stations at Moor Avenue and Canal Road
V	Charu Avenue Pumping Station	3.5 MLD Golf Green STP (new)		New 3.5 MLD STP at Golf Garden
VI	KMC area from the confluence point of Tolly's Nullah at DaiGhat upto Chetla under pumping stations Hastings, Thackeray, Sashi Sekhar, Kalighat and Chetla	Ballygunge Drainage Pumping Station (BDPS) to EKW	Chetla pumping station is defunct	New pumping station at Chetla

Table 2-2: Ward-wise sewage generation of Tolly nullah

Zone	#	Lifting / pumping station	Ward	Year wise DWF / sewage generation (MLD)		
				2025	2040	2055
II	1	Brij Road Near Shahid Khudiram Metro	6	0.86	1.17	1.48
			29	2.01	2.73	3.45
			110	0.85	0.93	1.02
	2	Naktala LS-3	100	3.38	3.73	4.07
III	3	Bansdrone LS – 2A	112	1.20	1.33	1.45
			113	0.80	0.88	0.96
	4	Kalitala LS2B	113	0.62	0.68	0.75
			114	0.61	0.67	0.74
			111	4.56	5.02	5.49
	6	Rathtala LS - 1A	111	0.56	0.62	0.68
			112	0.04	0.05	0.05
IV	8	Moor Avenue LS-4	112	1.12	1.23	1.34
			98	3.20	3.52	3.85
			97	2.91	3.21	3.50
			95	2.69	2.97	3.24
	9	Canal Road	94	2.95	3.25	3.55
			116	0.86	0.95	1.04
			117	1.13	1.24	1.36
10	Izzatullah LS-7	97	2.00	2.20	2.40	
V	11	Charu Avenue LS-6	89	2.96	3.26	3.50
VI	12	Chetla	81	4.35	4.79	5.23
			82	4.84	5.33	5.83
	13	Kalighat	74	2.80	3.08	3.36
			71	0.87	0.96	1.05
			72	0.48	0.53	0.58
	14	Sashi Sekhar Bose Road LS - 3	73	0.78	0.86	0.94
			74	2.80	3.08	3.36
15	Thackeray Road LS - 2	74	2.80	3.08	3.36	

	16	Hastings LS - 3	75	3.57	3.93	4.30
		Total		55.80	62.21	68.57

In addition to the estimated sewage flows into the pumping stations from the wards of six zones as mentioned in Table 2-2, there are some relay pumping stations in the Tolly nullah catchment which also contribute their flow towards the main pumping stations. Other than that there is direct flow of sewage into the pumping stations. Hence for designing sump and electro-mechanical equipment of the Tolly nullah, some extra flow have been considered, vis a vis, 55.80 MLD has been escalated to 78.83 MLD for year 2025 and subsequently the flow has been approximated to be **86.83 MLD for year 2040 and 94.84 MLD till year 2055.**

Some glimpses of the existing lifting / pumping stations, trestle bridge over Tolly nullah have been shown in **Figure 2-10** that exhibit the present situation of the appurtenances. Most of the old pumping stations require civil as well as elctro-mechanical restoration.



Figure 2-10: Existing lifting / pumping stations of Tolly nullah

As per the DPR, the quality of raw sewage as reported in **Table 2-3** shows that the city sewage system is not functioning with its adequate efficiency and that is why the raw sewage is being directly disposed of into the canals and nullahs connected to the city.

Table 2-3: Raw sewage characteristics

Sr. No.	Parameters	Concentration Values
1	pH	6.5 - 8.5

2	BOD ₅ @ 20 C, mg/L	70 – 160
3	COD, mg/L	180 – 350
4	Total suspended solids, mg/L	80 – 180
5	Total kjeldahl Nitrogen (as N), mg/L	42 - 47
6	Ortho Phosphorus, mg/L	4 - 12
7	Feecal Coliforms MPN/100 ml	10 ⁶ to 10 ⁸



Figure 2-11: Nullah confluence point at Dahi Ghat



Tolly's Nala @ChetlaGhat



Nullah at Tollygunge



Figure 2-12: Tolly's Nullah



Encroachment on the bank

Water Supply:

The river Hooghly is the main source of water supply for Kolkata. After drawing water from the river, KMC treats the water at Indira Gandhi Water Treatment Plant (WTP) of capacity 260 million gallons per day at Palta Water Works. Water from this water works is sent to Nullah pumping station for temporary storage and onward distribution to the city.

2.3 NECESSITY OF THIS PROJECT

The Tolly's Nullah (Adi Ganga), a tributary of river Hooghly flows towards south of Kolkata through its south-west part. The image at Figure 2-13 shows the nullah traverses through the most crowded part of the city and is an important drainage channel with strong tidal influence. Due to presence of old, inefficient and low capacity sewage treatment system, the black water generated from the adjoining area is directly discharged into the storm water drains ultimately leading to Tolly's Nala and river Hooghly. Due to tremendous population growth, infrastructure expansion and increased areas of habitation combined with

defunct sewerage facility, the untreated sewerage disposal has become a critical problem. The course of Tolly nullah through the metropolitan city has been shown in **Figure 2-13**.



Figure 2-13: Tolly Nullah traversing through crowded part of Kolkata

As per news published in The Telegraph India on 15.06.2021, the Tolly nullah has basically turned into a sewage canal according to the study carried out by State Pollution Control Board based upon the water samples collected during February 2021. Amongst the entire stretch, Bansdroni section is the most polluted, followed by stretches near Shahid Khudiram Metro station, Karunamoyee and Kudghat⁵. The BOD (biochemical oxygen demand) at Bansdroni was found to be 40mg per litre at low tide whereas the limit is 3 mg/l. The amount of dissolved oxygen along the entire stretch of the nullah was found to be nil.

Therefore, taking lessons from the past, the Government of India (GoI) has developed a robust and more comprehensive vision for clean-up, conservation and rejuvenation of the river Ganga. This has led to the establishment of the National Ganga River Basin Authority (NGRBA). NGRBA has resolved that “No untreated municipal sewage or industrial effluent will be discharged into Ganga by the year 2020” and accordingly mandate has been given to address both water quantity and quality aspects, by adopting a river-basin approach.

The recent infrastructure expansions in city of Kolkata have affected the physical and environmental health of Tolly’s Nullah. The extension work of metro rail has been setup over the nullah, which has affected the hydraulic property of Nullah. Rapid and unplanned urbanization, particularly in the southern and south-

⁵ Source: <https://www.telegraphindia.com/west-bengal/calcutta/tollys-nullah-turned-into-a-sewage-canal-report/cid/1818836>

western parts of Kolkata, channel bank encroachment, disposal of raw sewage and poor management of solid waste generated from households, livestock and religious activities and above all, lack of maintenance contributed to severe environmental pollution to the Nullah. As a result Tolly's Nullah is a silted-up sewer channel and polluted tributary to the Hooghly (Ganga). This is consequently impacting the river water quality. Hence the abatement of pollution of Tolly's Nullah is important to clean the river Ganga.

Therefore to prevent these drains discharging waste water directly without any treatment, KMC has proposed to construct a systematic sewerage network in the catchment area of Tolly's Nullah to tap the sewer. In addition to this, augmentation of existing defunct pumping station, desilting of existing trunk sewer line, provision of fresh trunk wherever not facilitated in the main stream and connecting all these to 3 STPs are prime scope of the project.

2.4 PROPOSED PROJECT ACTIVITIES

Under Namami Gange program, the objectives is to Intercept and Divert major outfalls of the city and divert the sewer to the Treatment Plant before entering of waste Water into the Tolly's Nullah followed by River Hooghly. To meet sewer tapping requirement a sewerage scheme comprises interception & diversion works, sewage treatment plants (STPs) & augmentations of lifting stations has been proposed. The rate of groundwater infiltration has been adopted as 10% of sewage flow.

The Nullah stretch from Garia Rail Bridge to Dai Ghat (confluence of Tolly's Nullah with Hooghly) has been considered in present study. According to latest DPR, the project area has been envisaged construction of S&D infrastructure in catchment area approximately 1km on either side of Tolly's Nullah and its tributaries. The major components under the project are as below:

The Tolly's nullah developmental proposal has been categorized into following few subheadings:

- Sewerage and drainage network replacement & refurbishment, initially done for the trunk & outfall sewers;
- Construction & development of the existing & new pumping stations;
- Construction of modern Sewage Treatment Plants (STPs) with SBR technology;
- Periodical/ frequent dredging works;
- Restoration & renovation of the lining works of the Nullah;
- Renovation & restoration of the ghats on the bank of Nullah;
- Rehabilitation of slum dwellers & beautification, as necessary;
- Storm water management to control city inundation;
- Fencing over the bridges and both banks along Tolly's Nullah to minimize garbage/ rubbish dumping;
- Public awareness program

Out of above mentioned activities, the assignments that will be taken up on priority basis under the proposed project include:

- Sewerage and drainage network replacement and upgradation for the trunk & outfall sewers;
- Out of total 23 nos. of locations for pumping stations, 7 nos. DWF PS and 5 nos. mini underground PSs have been proposed to be newly constructed;
- Rest 11 nos. of pumping stations will be either civil and/or electromechanically renovated;
- Construction of 3 nos. of SBR technology STPs (10 MLD, 11.6 MLD & 3.5 MLD);

- Rehabilitation and rejuvenation of considerable length of existing pipeline with suitable WRC (Water Research Centre) approved lining technology;
- Laying of new pipeline network wherever necessary through micro-tunnelling technology {22.655 km of new sewer (including 4.587 km of micro-tunnelling work & 1.648 km of covered drain), 0.850 km of RCC U-Trap (Suti Khal) & upgradation/ renovation of 74 nos. of Penstock Gates};
- O&M for 15 Years;

The total amount of DWF estimated to be generated under this scheme from Zone 1 till Zone 6 for the projected ultimate year 2055 will be 81.9 MLD (as given in DPR). Out of this, the DWF expected from zone 1 and 6 is 28.61 MLD, which will be diverted towards the existing East Kolkata Wetland (EKW) and the DWF generating from Zone-4 of 28.34 MLD will be treated at existing Keorapukur STP. For the rest amount, 25.10 MLD of new STP has been planned to be installed in three parts, viz., one at Bansdroni, another at Brijji road and the third one at Golf Garden. For the proposed new STPs and the associated pumping stations, SCADA (Supervisory Control and Data Acquisition) & OCEMS (Online continuous Effluent Monitoring System) have been considered with VFD (Variable Frequency Drive) pumps. During the monsoon period, Storm Weather Flow (SWF) of locality will be allowed to be discharged into the Tolly's Nullah through Penstock Gates after their renovation and automation.

The rest of the activities proposed under Tolly nullah project, like dredging of the nullah, restoration and renovation of lining and ghats of nullah, rehabilitation of slum dwellers and beautification, wherever required has already been started by the State Government as portrayed by **Figure 2-14**. Ghat restoration, renovation and beautification of the existing ghats of Tolly nullah at ward no. 71, 73, 74, 75, 81, 82, 83, 88, 89, 115 & 116 is being carried out in phase-wise manner by KMC. Also waste bins have been installed at various locations by KMC Solid Waste Management Department.



Figure 2-14: Dredging at Tolly Nullah, ghat restoration and rehabilitation of slum dwellers

Besides, storm water pumping stations along with gates at the confluence of Tolly nullah and river to control flooding of the city during high tide have also been proposed to be installed. Fencing over the bridges as well as both banks of Tolly nullah will also be done in phases. In addition, floating garbage arresters, community sanitary latrines and organic composter have been provided at some places and will be installed at concerned areas. Simultaneously public awareness programs along with IEC (Information, Education & Communication) activities have also been started at few places by KMC.

Proposed combined sewer line:

The proposed combined sewer length shall have diameter of min. 25 mm to 250 mm maximum. It is proposed to provide S&D network to cater needs of project area. As per DPR, the sizes of sub trunk main, trunk mains and outfall sewer range from 250 mm to 2500 mm. The total length of gravity sewer system that is to be newly constructed is 22.655 km and pressure main sewer system will be 25.952 km. Out of 22.655 km of gravity sewer system, 18.068 km will be open cut and 4.587 km will be trenchless. All the outfalls are being tapped by either diversion or interception.

Proposed pumping stations:

The **Table 2-4** given below describes about the proposal for laying, augmenting and restoration of the lifting / pumping stations along with the mode of laying pipeline.

Table 2-4: Construction of new pumping stations / augmentations / restoration

Zone	#	Lifting / pumping station	Ward	Mode of pipe laying	Proposed intervention
I		No lifting / pumping stations; unsewered; has natural flow towards Suti khal in north east direction leading to EKW	Rajpur-Sonarpur Municipality	New covered drain	Construction of deep covered drain along the nullah bank connecting Suti Khal and EKW
II	1	Briji Road pumping station near Shahid Khudiram metro station	6	Mostly open cut	Construction of covered drain along the Pranabananda Road connecting Suti Khal and EKW Proposed new PS; New Briji road pumping station with 10 MLD STP
			29		
	2	Naktala pumping station	100	Trenchless	Proposed new PS; Trenchless pipes of higher diameter will replace worn-out pipes from Lakshmi Narayan Colony to proposed pumping station; while on the other side, pipe will be desilted from Bansdrone market to the pumping station with the help of CCTV footage. Direct flow to Tolly nullah will be diverted towards Naktala PS by a new mini underground PS at Naktala
III	3	Bansdrone pumping station	112	Open cut	New pumping station at new location near old one; new sewer of light weight & small dia on nullah bank road & desiltation of existing sewer with CCTV footage; 11.6 MLD STP
			113		
	4	Kalitara pumping station	113	Open cut	Very narrow approach road, so de-siltation of sewer proposed by CCTV monitoring; light weight small dia pipe on nullah bank road to intercept sewage from frontline houses and connect to PS; only augmentation
			114		

	5	Kamdahari pumping station	111	Open cut	Trunk sewer laid by KEIP; de-siltation of rest of the sewers; interception of sewage from frontline houses on the nullah bank road by small dia sewer; only augmentation
	6	Rathtala pumping station	111	Open cut	Proposed new PS; Worn-out sewer to be replaced by RCC sewer; rest restored by de-siltation through CCTV monitoring; small dia conduits on nullah bank to intercept sewage from frontline houses
			112		
	7	Usha Gate pumping station	112	Open cut	KEIP laid larger dia pipe on main road; inner lane of pumping station & inlet sewer need new enhanced dia pipe; Also other sewers will be desilted; proposed small dia sewer on nullah bank road; only augmentation
IV	8	Moor Avenue pumping station	98	Mostly open cut, trenchless 226 m	Proposed new PS; Inlet of PS to be renewed from Netaji Nagar crossing; gradient of sewer to be corrected; major sewers & box drains need de-siltation through CCTV monitoring and insertion of liners; New mini-intermediate pumping station near Kudghat Metro Station to divert flow along Chandi Ghosh Road towards Keorapukur STP by pressure main over Tolly nullah through a proposed trestle bridge near Kudghat New mini-intermediate pumping station near Tapan Sinha Hospital to divert direct flow of sewage from Rishikesh colony by the side of Karunamoyee Bridge towards Keorapukur STP through Chandi Ghosh Road.
			97		
			95		
94					
	9	Canal Road pumping station	116		Proposed new PS; Large dia inlet to the PS, de-silting proposed; MS pressure main will carry sewage from this PS to Siriti pumping station
			117		
	10	Izzatullah pumping station	97		Very narrow approach road, so existing inlet will be desilted with CCTV footage; MS pressure main will carry sewage from Izzatullah PS to Canal road PS through proposed Trestle bridge ; only augmentation
	11	Kudghat pumping station			Only electro-mechanical augmentation
	12	Siriti pumping station			Only civil augmentation
V	13	Charu Avenue pumping station	89	Open cut	Very narrow approach road with thick population; upgradation of inlet conduits of the area; de-siltation of major trunk sewers with CCTV monitoring and insertion of liner; DWF will be carried to 3.5 MLD STP of Golf Green; only augmentation of the PS
VI	14	Chetla pumping station	81	Open cut	Proposed new PS; De-siltation of inlet and other major trunk sewer with the help of CCTV footage; new sewers proposed; DWF from this PS proposed to flow through MS pressure main to Rash Behari Avenue sewer through proposed Trestle bridge on Tolly nullah.
	74				
	16	Sashi Sekhar Bose Row pumping station	71	Open cut	De-siltation of most of the sewers proposed through CCTV footage and insertion of liner; also new sewers to be laid; DWF from this PS will flow towards AJC Bose Road sewer
			72		
			73		

					leading to BDPS through MS pressure main; only augmentation
17	Thackeray Road pumping station	74	Trenchless		Proposed new sewers from area of Orphan Gunge along main road; some sewers to be de-silted with CCTV footage; DWF from this PS pumped to Sashi Shekhar Bose Row pumping station on opposite bank of Tolly nullah through MS pressure main; a trestle bridge proposed for this; only augmentation
18	Hastings pumping station	75	Open cut		Inlet of PS needs upgradation and renewal; also proposed de-siltation of other trunk sewers with CCTV footage and insertion of liners. DWF from this PS pumped to the junction of the Khidderpore Road and AJC Bose Road sewer, ultimately to BDPS through existing MS pressure main; only augmentation

Source: As per KMC DPR, September 2022

Summary of proposed Tolly nullah scheme:

- ▶ Out of 18 pumping stations, there will be 7 new pumping stations at Brijji road (near Shahid Khudiram metro station), Naktala, Bansdroni, Rathtala, Moor Avenue, Canal road and Chetla road.
- ▶ Additional 8 existing pumping stations of Hastings, Sashi Sekhar Bose Road, Thackeray, Kalitala, Usha Gate, Kamdahari, Izzatullah & Charu Avenue have been proposed for their civil and electro-mechanical augmentation.
- ▶ 2 more pumping stations at Kalighat and Siriti will be renovated with respect to their civil work.
- ▶ Further, pumping station at Kudghat will be only considered for electro-mechanical augmentation.
- ▶ 5 new mini underground pumping stations at Naktala Mini, Chandi Ghosh Road, Rishikesh Colony, Shyam Bose Road & Madan Pal Lane
- ▶ Therefore, 23 nos. of pumping stations have been considered under the scope of the proposed project.

Proposed STPs:

Three new STPs at Brijji road, Bansdroni and Golf Green area have been proposed that will treat dry weather flow from zones II, III and V respectively. All these will be based upon Sequential Batch Reactor technology. Besides the three proposed STPs under the present scheme of Tolly nullah, there are other STPs as well as East Kolkata Wetlands catering to the need of treating sewage from the KMC area. The projected capacities of all the existing and proposed STPs within KMC area with respect to years 2040 as well as 2055 have been tabulated in **Table 2-5**.

Table 2-5: Sewage / DWF generation and capacities of STPs within KMC area

Zone	Name of STP	DWF generation projected for year 2040	DWF generation projected for year 2055
I	Existing East Kolkata Wetland (EKW)	3.14 MLD	3.96 MLD
II	Proposed Brijji Road STP	8.6 MLD	10 MLD
III	Proposed Bansdroni STP	10.5 MLD	11.6 MLD
IV	Existing Keorapukur STP (50 MLD)	25.94 MLD	28.34 MLD
V	Proposed Golf Green STP	3.3 MLD	3.5 MLD
VI	Existing East Kolkata Wetland (EKW) through Ballygunge Drainage Pumping Station (BDPS)	22.56 MLD	24.65 MLD

Ongoing STP projects under KEIP (ADB funded)	STP at Rajpur Sonarpur Municipality over Rania Khal to intercept DWF of Western Channel	23 MLD (under construction)
	STP at Bank Plot (MG Road) to intercept DWF from Keorapukur Channel	40 MLD (under construction)
	STP at Joka	45 MLD (under construction)

The locations of lifting / pumping stations, the sewerage and drainage network along with the three STPs have been shown in the google earth image as presented in **Figure 2-15**. The area details of the 3 proposed STP locations along with their site conditions have been discussed in details within this section.



Figure 2-15: Projects S&D network, LS & proposed STPs

Proposed STP at Bansdroni:

Bansdroni STP of 11.6 MLD capacity along with a drainage pumping station has been proposed on a land area of **2.85 acres (11,533.54 sq. m)**. The land document for the acquired land at Bansdroni has been attached as **Annexure 9** to this report. The entire land area belongs to plots 341, 343 and partly 346 of mouza Bansdroni, J.L. No. 45 in ward 113, Borough XI. The land detail is given in **Table 2-6**.

Table 2-6: Land details of Bansdroni STP and pumping station land

Plot No.	Area	Classification	Ownership
341	2.23 Acre	Sali (vacant dry land)	Vested to State; One raiyat in rest area
343	0.19 Acre	Doba (water body / low lying waste land)	Refugee Rehabilitation Department, Govt. of West

		accumulated with waste water)	Bengal
346	0.43 Acre	Sali (vacant dry land)	Refugee Rehabilitation Department, Govt. of West Bengal
Total available land	2.85 Acres		

Land parcels selected for Basdroni STPs sites are contiguous patches of existing government land, only some part of plot no. 341 is not adjoining. The design part will be done so all the major and ancillary facilities shall be accommodated on the total land, without hampering the STP operation and maintenance.

Few photographs depicting the condition and situation of the prevailing land area has been shown in **Figure 2-16**. The proposed site for STP is an abandoned water body, where municipal waste is being dumped from the adjoining area. There are residential apartment on one side of the pond and the other side of the pond encircles a vacant land that is presently used as a playground by the local habitants. The land selected for pumping station is comparatively a high land having some banana trees on one side and an abandoned house at a corner of the land that shall be dismantled and rebuilt as an office cum panel building. The road connectivity to the site is good and convenient.





Figure 2-16: Bansdroni STP and pumping station site

Proposed STP at Brijji road:

0.7228 acre of land allocated for Brijji road pumping station and STP belonged to KMDA that has already been transferred to KMC during December 2019. The land detail is attached as **Annexure 10** to the report. The suggested land belongs to mouza Brijji, J.L. No. 27, R. S. Dag Nos.763 (P), 766 (P), 770 (P), 771(P) & 772(P), P.S. – Jadavpur, District – South 24 Parganas under KMDA BPAD township at block - U beside Tolly nullah. The piece of land is abandoned and unattended with unwanted growth of bushes and shrubs. Also connecting road is available at the proposed site as can be seen in **Figure 2-17**.



Figure 2-17: Brijji road STP and pumping station site

Proposed STP at Golf Green, Sukhapukur:

About **3190.38 sq. m (0.32 Ha) of land** at premises no. 3 (Por), Russa Road South, 1st Lane, Kolkata Improvement Trust Scheme No. 118 has been transferred to KMC on 26th July, 2017 by KMDA for the development of an STP unit as well as drainage pumping station. About 2000.194-sqm land is allotted for STP unit and the rest 1190.186 sqm land is assigned for drainage pumping station. The land detail is attached as **Annexure 11**.



Figure 2-18: Golf Green, Sukhapukur STP and pumping station site

2.5 Displacement of houses / families involved in the project:

There are 5 mini pumping stations, 7 pumping stations and 3 STP sites newly added to the proposed Tolly nullah sewage treatment system. Out of all these, only 1 site, i.e., the proposed mini pumping station besides Madan Pal Lane at Patuapara, Bhowanipore will involve displacement of 8 families. The area involved in the construction work will be about 11 m X 5.3 m, i.e., 58.3 m² (≈ 628 ft²). The details about 8 families are mentioned in the **Table 2-7** given below:

Table 2-7: Details of 8 proposed displaced families

#	Head of family	Age	Address	Family members	Earning members	Monthly income (Rs.)	Educational status
1	Gobinda Mallick	45	15A, Madan Pal Lane, Bhowanipore, Kolkata - 25	5 males +1 female = 6	2 brothers; 100 days contractual labour under KMC in Neetu Enterprise; also gets temporarily involved in cleaning activities within the neighbourhood	7800/- +5200/-; get free ration	2 children studying in Adarsh Hindi High School within the locality
2	Sunita Mullick	50	15A, Madan Pal Lane, Bhowanipore, Kolkata - 25	2 males + 3 females = 5	Work as house maids	10,000/-to 12,000/-; avail free ration	None of the children studying
3	Sandhya Mallick	55	15A, Madan Pal Lane, Bhowanipore, Kolkata - 25	3 males + 3 females = 6	1; house maid	10,000/- + ration	None of the children studying
4	Sabitri Mullick	65	17A, Madan Pal Lane, Bhowanipore, Kolkata - 25	5 males + 2 females = 7	1; 100 days contractual labour under KMC in a private firm; also house workers (undisclosed), cleaning etc.	13,000/- to 14,000/- + ration	2 children studying in nearby Govt. school
5	Komal Mullick	50	17A, Madan Pal Lane, Bhowanipore, Kolkata - 25	5 males + 3 females = 8	1; 100 days contractual labour under KMC in a private firm; also house maids	15,000/- + ration	None of the children studying
6	Gita Dome	55	17A, Madan Pal Lane, Bhowanipore, Kolkata - 25	4 males + 3 females = 7	1 son working as contractual labour; husband retired hospital staff and earns pension; females work as house maids and sweepers	20,000/- + ration	3 children studying in local Govt. school (1 girl in Adarsh Hindi High School and 2 boys in South Suburban Main school).
7	Ratan Mullick	42	17A, Madan Pal Lane, Bhowanipore, Kolkata - 25	5 males + 2 females = 7	2 (Ratan and his son) working as contract labour, sweeper, maid servants, nalla cleaning labour etc.	10,000/- to 12,000/-	2 children studying in South Suburban Main school close to their residence.
8	Dipak Mullick	40	17A, Madan Pal Lane, Bhowanipore, Kolkata - 25	2 males + 1 female = 3	1; 100 days contractual labour under KMC in a private firm; also house maid, sweeper	5500/- against contract	One child studying in local Govt. school

These families are settled within the location since more than 40 years. Some photographs of consultation at the proposed displacement site are given in **Figure 2-19**.



Figure 2-19: Photographs of proposed houses to be displaced

The 8 families have been planned to be resettled at a location about 200 m away from the proposed pumping station site. They will be settled in a proposed one-bedroom apartment each having 370-ft² area under Banglar Bari Housing scheme of State Urban Development Agency, UD&MA Department, Government of West Bengal. The proposed resettlement site has the pumping station that is defunct and will be renovated too. The photographs of the resettlement area are shown in **Figure 2-20**:





Figure 2-20: Photographs of resettlement site within Sashi Sekhar pumping station site

2.6 POPULATION PROJECTIONS

The arithmetic increase method of population growth has been considered for the city of Kolkata under KMC jurisdiction. Manual also states that arithmetic increase method is best suitable for well-settled and established communities. The details of population projection / estimation for 2025 (the base year), 2035, 2040 (intermediate year), 2045 and 2055 (the ultimate design year) are given below in **Table 2-8**.

Table 2-8: Population Projection of project catchment area

Zone Based on Sewage Disposal	Location in the Municipality	Ward	Projected Population				
			2025	2035	2040	2045	2055
1	RPSPM	1	Projection in Zone 1 is not considered as there is no proposed PS and STP at this zone.				
2	RPSPM	6	17986	22293	24447	26600	30908
		29	16725	20731	22733	24736	28741
	KMC	110	30650	32729	33769	34808	36887
		100	28183	30095	31050	32006	33918
3	KMC	112	35804	38232	39446	40661	43089
		113	36987	39496	40750	42004	44513
		113	36987	39496	40750	42004	44513
		114	46310	49431	51022	52592	55733
		111	42702	45598	47046	48494	51390
		111	42702	45598	47046	48494	51390
		112	35804	38232	39446	40661	43089
		112	35804	38232	39446	40661	43089
4	KMC	98	35035	37411	38599	39787	42163
		97	41182	43890	45283	46677	49465
		95	29542	31546	32548	33550	35553
		94	30351	32410	33439	34468	36527
		116	31311	33435	34497	35559	37682
		117	24114	25749	26567	27385	29020

		97	41102	43890	45283	46677	49465
5	KMC	89	24644	26316	27151	27987	29659
6	KMC	81	45855	48965	50520	52075	55186
		82	42913	45823	47279	48734	51644
		74	46601	49762	51342	52922	56083
		71	33061	35304	36425	37546	39789
		72	21178	22614	23333	24051	25487
		73	25979	27741	28622	29503	31265
		74	46601	49762	51342	52922	56083
		75	29750	31768	32777	33785	35803
TOTAL			955783	1026567	1061959	1097351	1168135

❖ RPSPM- Rajpur Sonarpur Municipal authority ❖ KMC- Kolkata Municipal Corporation

Treated Water characteristics: With the objective to prevent untreated wastewater of drains falling into River Ganga via Tolly's Nullah Catchment area and also to achieve the effluent standard norms as set by NGT. Contractor shall be responsible to follow the latest discharge standard as prescribed by NGT in year 2019 for effluent discharge characteristic of treated water from STP. The new NGT Standard for STP treated effluent are discussed in **Table 2-9**.

Table 2-9: Characteristics of treated effluent as prescribed by NGT

Parameters	Standards for treated sewage effluent for disposal into water bodies
Biochemical Oxygen Demand BOD (mg/l)	<10
Chemical Oxygen Demand (COD) (mg/l)	50
Total Suspended Solids TSS (mg/l)	<20
Total Nitrogen (mg/l)	<10
Ammoniacal Nitrogen (mg/l)	<5
Total Phosphorus (mg/l)	1.0
Fecal Coliform MPN/100 ml : Desirable, Permissible	<100, 230

Source: As per Hon'ble NGT Order dt. 30 April 2019

Design Period: As per revised DPR, Sept 2022, Year 2025 has been considered as the base year for design of sewerage & drainage (S&D) system and project design is for next 30 years i.e., year 2055 as per Part A of CPHEEO manual on Sewerage & Sewage Treatment (latest Edition).

2.7 DISPOSAL OF TREATED EFFLUENT:

As per the AA&ES for Adi Ganga (Tolly Nala) projects, NMCG has mandated 20% re-use of treated waste water from the project. 20% of the treated water from the STPs is proposed to be used for gardening and street washings between the zones of Moor Avenue to Garia i.e. under Br. X and XI. for which necessary MoUs will be signed with the local authorities. Further, efforts need to be made by the state government to identify thermal power plants within 50km radius of STP and to tie up with them for the usage of treated waste water (as per section 6.2 of relevant Gazette notification of Ministry of Power, GoI, dated Jan 28, 2016 notification). Copy enclosed in **Annexure-12**. Around 6 thermal power plants has been identified within 50km radius from the proposed STPs. A list of the TPPs within 50km radius from the STP site is given below and enclosed in map given in **Annexure-13**. The rest of the unutilized treated effluent will be discharged to the Adi Ganga to maintain its natural flow.

2.8 Septage Management

A comprehensive sewerage network is proposed in the city to cover the entire area with the sewerage system, so that sewage flows can be collected in an integrated manner and conveyed to STP for treatment. The proposed sewerage system is designed for 30 years period i.e 2055.

As per DPR, Sewerage zone proposed are covering the entire catchment area of Tolly's Nullah (1km either side). Therefore, STP should be designed with adequate capacity to accept the septage without hampering its efficiency. With view of economic considerations related to distance and transport, addition of septage has been taken into consideration at all nearby proposed STPs and IPS with suitable management.

2.9 DISPOSAL OF SLUDGE

The sludge as collected from biological digestion basins is collected into sludge sump and conveyed to centrifuge unit for dewatering the same. Centrifuge feed pumps & Centrifuges will be provided.

Faecal Sludge: With view of economic considerations related to distance and transport, addition of faecal sludge has been taken into consideration at STP with proper management.

Sludge Disposal in proposed STP: In the proposed 3 STPs of 25 MLD (10 MLD, 11.6 MLD, 3.5MLD), the provision of Sludge thickener/ centrifuge has been included. After dewatering the sludge to almost 80% levels, it will then be packed in bags and easily handled /used in many applications on small scale. Around 3500kg /day of sludge is estimated to be generated⁶ collectively from three STPs. The dried sludge may be used as manure, soil conditioner, fertilizer in the agricultural field. Contractor shall be responsible to get the Bio chemical quality check of dried sludge before handling to farmer or using as soil conditioner in nearby area. The sludge disposal standard as per CPHEEO 2016 has been presented in annexure 8. For dewatered septage/sludge agriculture application, it should satisfy the following criteria of Class A Bio solids of USEPA either by lime stabilization, solar drying and or composting.

- A faecal coliform density of less than 1,000 MPN/g total dry solids
- Salmonella sp. density of less than 3 MPN per 4 g of total dry solids (<3 MPN/4 g TS)

The Contractor shall prepare appropriate Sludge Management Plan. Preferably, the dried sludge shall be used as manure, soil conditioner, fertilizer in the agricultural field, Landscape of STP, KMC office, MC offices etc. Suitable site should also be identified by the Contractor within the project premises for the safe storage of sludge. The surplus amount of sludge shall be managed and processed at KMC's solid waste dumping site, i.e., Dhapa landfill site that is located about 15 to 17km from the proposed STP locations. The necessary safeguard measures associated with the storage and disposal of sludge are provided in the EMP, discussed in subsequent chapter.

The contractor will also prepare and submit the sludge management plan with O&M manual before O&M phase and get it approved from SPMG.

⁶ Based on TSS & BOD available as per CPHEEO guideline and based on similar experience

2.10 IMPLEMENTATION SCHEDULE

The completion schedule has been taken as 36 months after sanctioning of the project.

2.11 AGENCY RESPONSIBLE FOR EXECUTION OF O&M WORKS

Agency responsible for execution of work is Kolkata Municipal Corporation (KMC) which is headed by Executive Officer assisted by other technical staff. Kolkata Municipal Corporation (KMC) shall be the nodal agency for Execution as well as O&M of the project.

The proposed interventions involve numerous constructions associated with the three STPs along with pumping stations and other appurtenances. Accordingly, the available project staffs of KMC shall be trained for dedicatedly monitoring as well as ensure compliance of environmental and social safeguard measures during construction activities and O&M phase of the proposed project.

2.12 TOTAL COST

The total **Project Cost** is **Rs. 938.89 Crore for phase I including O&M of 15 years**, which has been submitted for approval and allotment of funds for the project **"Construction of STPs and S&D in Tolly's Nullah"**. **Cost under Environmental sanitation and management plan has been worked out as 580 Lakhs**, Refer Table 2-10. After several technical analysis and review meeting held on 01.09.2022, the proposed project has been revised in September 2022 in consultation with Technical wing of NMCG, SPMG and KMC and it has been planned to be considered under two phases. Referring to the minutes of the aforesaid, the entire pollution abatement of Tolly's Nullah project DPR has been reframed as **Phase-I** – comprising of all sorts of works incurring capital expenditure & **Phase-II** - works comprising of maintenance and upgradation of existing S&D network system including procurement of mechanical equipment.

Components under Phase I: All sorts of capital expenditure related works has been taken up. The entire work under this phase constitute the components, like construction of LS/PSs, new gravity mains, pressure main / forced delivery lines, STPs, penstock gates, box-drains, U- Trap, Electro-mechanical works, installation of OCEMS & SCADA etc. and O&M for 15 Years.

Components under Phase II: The main components in this phase are related to the sewerage and drainage network. The existing sewer lines which may be retained but at present is under huge siltation are considered in this phase to be de-silted with the help of CCTV monitoring. The sewers which are needed to be structurally reinforced are proposed to be provided with suitable liners as deemed fit after complete de-siltation. Apart from this, the modalities of that framework for the future operation and maintenance of the sewers for next 15 years will be decided in due course by SPMG or NMCG. The cost component of this O&M will be considered later after the finalization of the technology. The **phase II cost** of the project is **Rs. 219.63 Crore**. The summary of estimated total project cost for phase I and II for pollution abatement of Tolly nullah is tabulated in **Table 2-10**.

Table 2-10: Comprehensive Cost for S&D and STP work in Tolly's Nullah

Abstract Cost Summary (Phase-I)						
Sl. No.	Items	Quantities	Estimated Cost, Rs. In Lakhs			Remarks
			Civil Work	E&M Work	Total	
1	2	3	4	5	6	7
A	S&D Sector - I & D Works etc.					
1	S&D Network [22.655 KM of new Sewer (including 4.587 KM of Micro-trenching work & 1.648 KM of Covered Drain), 0.850 KM of RCC U-Trap (Soti Khad) & upgradation/ renovation of 74 nos. of Perstock Gates]	23.505 KM	17214.46	1637.76	18852.22	
2	DWF Pumping Stations and Mini Pumping Stations	18 PS + 5 Mini PS	2778.39	12365.60	15143.99	Out of 18, cost for 2 new PS has been considered with STP cost
3	Pressure Main (including 4 nos. of Trestle Bridge)	25.952 KM	5760.99		5760.99	
4	Sewage Treatment Plants (STPs)					
(a)	STP at Beiji Road	10 MLD	1773.53	1305.00	3078.53	Including cost for 1 PS
(b)	STP at Bamdhoni	11.6 MLD	2976.99	1513.80	3590.79	Including cost for 1 PS
(c)	STP at Golf Garden	3.5 MLD	612.70	362.25	974.95	
	Sub Total (A) Basic Capital Cost		30217.06	17184.41	47401.47	
B	Contage					
	Cost of project preparation @ 4%				1896.06	
	Cost of project supervision @ 4%				1896.06	
	Sub Total (B)				3792.12	
C	Items on which no centage is admissible					
C.1	O&M cost for 1st 15 years			26851.20	26851.20	
C.2	Power Connection			858.00	858.00	
C.3	Land Acquisition			Govt. Land	0.00	
C.4	Environmental Sanitation and Management Plan (ESAMP)			580.00	580.00	
	Sub Total (C)				28289.20	
D	Total Cost excluding GST & LWC (A+B+C)				79482.79	
E	GST @ 18% on (A+C.1+C.2)				13519.92	
F	CESS @ 1% on (A+C.1+C.2+E)				886.31	
	Total Cost of Project (Phase-I) including GST & LWC – (D+E+F)				93889.02	

Abstract Cost Summary (Phase-II)

Sl. No.	Items	Quantities	Estimated Cost, Rs. In Lakhs			Remarks
			Civil Work	E&M Work	Total	
1	2	3	4	5	6	7
A	S&D Sector - I & D Works etc.					
i	S&D Network [3.858 KM of De-silting work in existing sewer, 22.610 KM of De-silting with Liner work in existing sewer]	26.468 KM	17269.71	0.00	17269.71	De-silting and Lining work only
	Sub Total (A) Basic Capital Cost		17269.71	0.00	17269.71	
ii	Centage					
	Cost of project preparation @ 4%				690.79	
	Cost of project supervision @ 4%				690.79	
	Sub Total (B)				1381.58	
C	Total Cost excluding GST & LWC (A+B)				18651.29	
D	GST @ 18% on (A)				3108.55	
E	CESS @ 1% on (A+D)				203.78	
	Total Cost of Project (Phase-II) including GST & LWC = (C+D+E)				21963.62	

Source: As per DPR, KMC, September 2022

3 APPROACH AND METHODOLOGY

3.1 METHODOLOGY

The Environmental and Social Management Framework (ESMF of NGRBA, 2020)⁷ is intended to identify and assess several environment and social impacts (both positive and negative) that may result for the proposed river pollution mitigation project “**Pollution Abatement of Tolly’s Nullah (Adi Ganga)**” under NGRBP, as well as to provide a corresponding management plan to handle any adverse/negative impacts. The methodology adopted for conducting Environmental and Social Assessment and Management Plan (ESAMP) for the proposed interventions is given in **Figure 3-1** below.

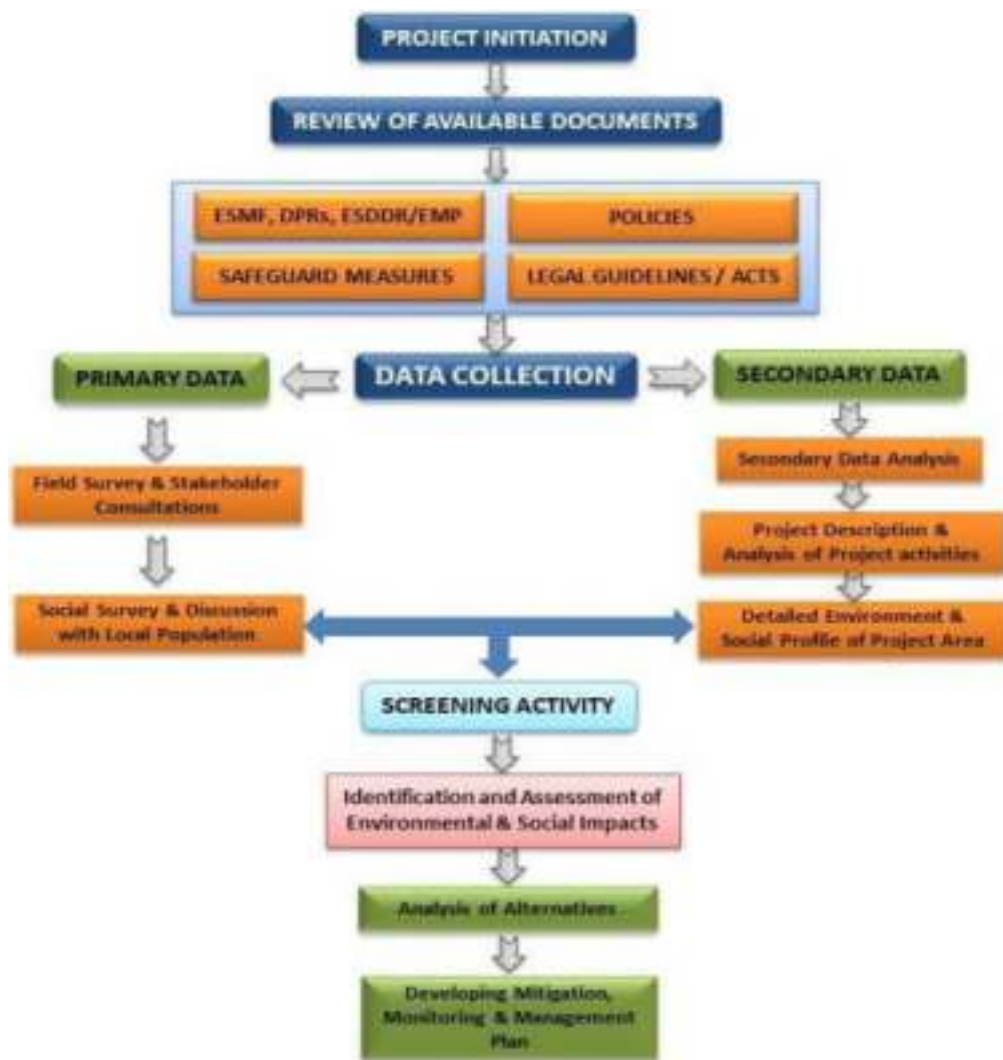


Figure 3-1: Flowchart describing steps adopted for ESAMP preparation

⁷For the Environmental and Social Management Framework (ESMF) –Revised in March 2020
(<https://nmcg.nic.in/Disclosure.aspx>)

The Environmental and Social Assessment and Management Plan (ESAMP) has been prepared by LEA Associates South Asia Private Limited and Detailed Project Report for Sewerage and STP **Pollution Abatement of Tolly's Nullah (Adi Ganga)** has been prepared by Kolkata Municipal Corporation (KMC).

3.2 REVIEW OF AVAILABLE DOCUMENTS AND DATA COLLATION

Review of available documents and collating information from various documents has been assessed to evaluate the possible environmental and social impacts triggered by proposed project. All the available information and data (quantitative and qualitative) regarding the proposed project has been collected mainly from the Detailed Project Report (Revised), Environmental and Social Management Framework (ESMF), consultation with stake-holders and other secondary sources including the water/air/noise monitoring data of Pollution Control Board and from primary tests conducted at site.

3.3 DESCRIBING THE SUB-PROJECT ACTIVITIES

With the help of information and data received from the Detailed Project Report (DPR) and consultations with stakeholders, a brief description and analysis of the project activities has been established. Based on initial understanding for the project, the list of required information has been drafted before conducting the field survey.

3.4 STAKEHOLDER CONSULTATIONS

The key stakeholders including the KMC's Officials in Kolkata were interacted (both formally and informally) during the field visits while preparing the ESAMP. Associated government departments were visited to collect the relevant data and their feedback on the proposed project activities. The proposed mitigation plans which have been adopted/are planning to adopt, suggestions for improvement and any public grievances raised, issues addressal mechanisms are discussed during meetings.

3.5 BASELINE ENVIRONMENTAL AND SOCIAL PROFILE OF PROJECT AREA

With the help of secondary information/data received from the available documents and from the discussions/interactions with key stakeholders and host population, a brief description of the baseline environmental and social profile of the project area has been established.

3.6 SCREENING ACTIVITIES

The project screening has also been carried out to understand the nature, scale and magnitude of potential environmental and social impacts associated with the proposed project. The screening activities have been conducted as per the guidelines provided in Environmental and Social Management Framework of NGRBA (NGRBA, 2020) and on the basis of secondary data analysis, field assessments and stakeholder interactions/consultations.

The screening checklist provided in **Annexure 1** detailed out the impact level of various activities during the construction and operation phases. The criteria included environmental factors such as the presence of eco-sensitive region in and around the project area, clearance of tree cover, improper storage of

excavation spoils, flooding of adjacent areas, elevated noise and dust levels, damage to existing utilities, etc. Social criteria factors such as requirement of land purchase, displacement of tribes, and loss of livelihood and gender issues.

3.7 IDENTIFICATION AND ASSESSMENT OF IMPACTS

Based on the analysis of the data collected from field surveys, stakeholder interactions/ consultations and secondary sources, issues related to the environmental and social sectors were identified. It is envisaged that the project will have few environmental and social impacts. However, they will be temporary and can be mitigated with the proper implementation of safeguard measures suggested in the EMP and SMP designed along with effective monitoring schedule.

3.8 ANALYSIS OF ALTERNATIVES

In consultations with the officials of NMCG/SPMG, implementing agencies, other related agencies as well as in light of the current environmental and social circumstances, appropriate alternatives to be assessed in the process of ESAMP preparation.

The project alternative is evaluated on the basis of site suitability, technology scale, waste management, and other local environmental and social features related to the proposed project area.

3.9 DEVELOPING MANAGEMENT ACTION PLAN

Based on the identified potential environmental and social impacts, an appropriate mitigation / management action plan has been developed. It is recommending suitable measures needed to prevent, minimize, mitigate, or compensate for adverse impacts (if any) and to improve the environmental and social performance. The mitigation plans are suggested for different stages of the project i.e., designing phase, construction phase and, operation and maintenance phase.

3.10 SCOPE OF WORK

Based on the Environmental and Social Screening carried out as part of this assessment using the screening matrix provided in the Environmental and Social Management Framework of NGRBA (refer **Annexure-1**), concludes that the present project for pollution abatement works at Tolly's Nullah, is categorized as 'Moderate Impact' category. The scope of the ESAMP that has been finalized on the basis of project screening and categorization, which are given below:

- ▶ Describe the sub-project and its components;
- ▶ Provided the applicable policies and legal guidelines to the proposed sub-project and include the specific clearances/approvals that have to be obtained by the executive agency/contractor.
- ▶ Describe the baseline environmental and social conditions of the sub-project areas and the proposed project facilities;
- ▶ Carryout public consultations and participation with different stakeholder groups at the local, regional and district level.

- ▶ Identification and analysis of key environmental and social issues viz. presence of any ecologically sensitive areas in the vicinity of the project site, as well as land availability issues(if any) associated with the project;
- ▶ Alternative analysis that was examined in the course of developing the proposed project towards in siting of project location, design, technology adopted, selection of construction techniques and phasing and operating and maintenance procedures.
- ▶ Develop Environmental and Social Management Plan (ESMP) outlining suitable mitigation and monitoring measures to be adopted by the relevant implementing actor;
- ▶ Suggesting suitable institutional arrangement for the implementation of ESAMP at varied levels, this includes man power requirement, skills and training requirements, organization mechanisms and information dissemination requirements.

4 LEGAL POLICY & FRAMEWORK

4.1 APPLICABLE ENVIRONMENTAL LAWS AND REGULATION

The government of India has laid down various policy guidelines, regulations, acts and legislations pertaining to sustenance and protection of environment and its various components. The policy, legal and regulatory requirements that are relevant to the environmental and social aspects of the proposed project shall comply with the policy, legal and regulatory requirements of the Government of India (GoI) respective State Governments and World Banks's safeguard policies. The following are the key regulations in India applicable for various development Projects.

Table 4-1: Summary of Environmental Regulations and Legislations under GOI

Sl.no	Relevant applicable Act & Rules	Objective	Type of activity involved in project	Applicability (Yes/No)	Responsible Agency/Authority
1.	Environment Protection Act, 1986	This is an umbrella Act to protect and improve overall environment. All environmental related act and regulation comes under this.	All construction & operational related activities where environmental regulation and protection is attracted.	Yes	MOEF& CC, SPCB, CPCB
2.	EIA Notification 14th Sep-2006 & amendments thereafter	To ensure and regulate the all-new development work which is listed in EIA Schedule	The proposed project activity like establishment of STP, laying of Sewerage line, I&D work are not listed in EIA schedule.	No	MOEF & CC, SEAA, GOI
3.	The Air (Prevention and Control of Pollution) Act, 1981	To control air Pollution by controlling emission of air pollutants as per the prescribed standards.	Consent to establish (CTE) and consent to operate (CTO) is required from SPCB under section 21 of Air (Prevention and control of Pollution) Act 1981.	Yes	State Pollution Control Board, West Bengal
4.	The Water (Prevention And Control Of Pollution) Act, 1974	To control water Pollution by controlling discharge of pollutants as per the prescribed standards.	Consent to establish (CTE) and Consent to operate (CTO) is required from SPCB under section 25 of this Act.	Yes	State Pollution Control Board, West Bengal
5.	The Noise Pollution (Regulation and Control) Rules, 2000 & amendments.	The standards for noise for day and night have been promulgated by the MoEF&CC for various activities	This act will be applicable for all construction equipment deployed at worksite and in operation.	Yes	State Pollution Control Board, West Bengal
6.	Ancient Monuments and Archaeological Sites and Remains Act, 1958	Conservation of cultural and historical remains of India	No ASI protected monuments identified in the project area. None of the project sites falls under within regulated zone of ASI structure. That is within 100 meters restricted zone and 200 meters	No	Archaeological Dept. GoI, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH).

Sl.no	Relevant applicable Act & Rules	Objective	Type of activity involved in project	Applicability (Yes/No)	Responsible Agency/Authority
			regulated zone.		
7.	Public Liability and Insurance Act, 1991	to provide public insurance liability for the purpose or providing immediate relief to the persons affected by accident occurring while handling any hazardous substances	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions, chlorine etc. as per the CPCB guidelines.	Yes	State Pollution Control Board , West Bengal
8.	The Forest (Conservation) Act, 1980	To regulate the non-forest activity and conservation of Forest of India	None of the project site falls under forest notified PF/RF/Social Forestry zone.	No	State Forest Department & GOI MOEF &CC
9.	Wild Life (Protection) Act, 1972	To protect wildlife through National Parks and Sanctuaries	No Protected area as listed under the act is located within periphery of 5 km of the project site. None of the project activity are envisaged near to protected area (NP, WLS etc.)	No	Chief Wild Life Warden, conservator of Forest GOI
10.	Right to fair compensation and Transparency in land acquisition, Rehabilitation and resettlement Act, 2013	Sets out rules for acquisition/ purchase of land by government	Not applicable	Yes	Revenue Department, State Government
11.	Solid Waste Management Rules, 2016	To manage collection, transportation, Segregation, Treatment, and disposal of solid wastes (other than Hazardous water, plastic Waste, BIO Medical waste)	Applicable for Waste generated from the camp, offices, STP plants	Yes	SPCB, CPCB
12.	Construction and Demolition Waste Management Rules, 2016	To manage collection, transportation, Segregation, Treatment, and disposal of waste arising of Construction and demolition activities	Applicable in construction & demolition activity involved in STP, MPS and S&D work, desilting work.	Yes	SPCB, CPCB
13.	Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016	To manage, store, transport hazardous and other waste	Applicable, in case of using chlorine tonner in disinfection process of treated water in STP; Storage, shipping and handling of chlorine, waste oil etc.	Yes	SPCB, CPCB
14.	Plastic Waste	To manage and safe	Applicable in case of using of	Yes	SPCB, CPCB

Sl.no	Relevant applicable Act & Rules	Objective	Type of activity involved in project	Applicability (Yes/No)	Responsible Agency/Authority
	Management Rules, 2016	segregation, reuse of the plastic waste arriving from the Proposed STP, MPSs	plastic trash bag and sheet (not less than 50m micron thickness); handling and disposal of plastic trash from the STP, MPS to authorized vendor.		

4.2 APPLICABLE SAFEGUARD POLICIES OF WORLD BANK

As the Project is seeking financing from the World Bank and therefore the Bank's Operational Policies pertains to environmental and social safeguards are also applicable to this Project. The Operational Policies of World Bank applicable to the project under Namami Gange programme are as follows:

Table 4-2: Operational Policy of World Bank

S. No.	Word Bank Safeguard Policies	Subject Category	Applicable(Yes / No)	Reason for Applicability
1	OP 4.01	Environmental Assessment	Yes	It is Umbrella Policy, applicable for all infrastructure projects under Namami Gange Programme.
2	OP 4.36	Forestry	No	No Impact; In S&D and STP work of Tolly's Nullah, no diversion of protected Forest (like PF, RF etc.) is envisaged.
3	OP 4.04	Natural Habitats	No	Applicable to protect natural habitats including forest and wild life impacted due to project. In current project, No diversion of protected Area (like NP, WLS etc.) is envisaged.
4	OP 4.12	Involuntary Resettlement	No	Proposed 1.8 ha. land for STPs is Government Land., no impact on private land and structure loss has been envisaged.
5	OP 4.10	Indigenous people	No	To protect the dignity, right and cultural uniqueness of tribes & indigenous people impacted for the project. No tribal population is impacted for the proposed project.
6	OP 7.50	Projects on International Waterways	No	These projects will not add potential pollution of any waterways. It would improve the water quality of notified Ganga National waterways -1

Furthermore, the World Bank's Environmental, Health, and Safety (EHS) Guidelines for Water and Sanitation is also applicable for the proposed project. This guideline will provide guidance on EHS issues; principally occur during the construction, operation and maintenance phases, of the sewage collection through a system of pipes, pumps, and other associated infrastructure (sewerage) to a centralized storage and/or treatment system.

4.3 APPLICABLE LAWS AND REGULATIONS - SOCIAL

This section includes the National policies and Acts as detailed under:

73rd Constitution Amendment Act, 1992

- The Act enables participation of Panchayat level institutions in decision-making by broadening the village level functions, supporting implementation of development schemes. The Act provides for involvement of the PRIs especially, the Gram Sabha/ Panchayat during project preparation and implementation. The Panchayats at the village level will be involved for preparation and implementation of the project.

Other legislations applicable to construction activities

Construction stage generally involves equity, safety and public health issues. The construction agencies therefore will be required to comply with laws of the land, which include the following:

- Workmen's Compensation Act 1923 (the Act provides for compensation in case of injury by accident arising out of and during the course of employment);
- 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);
- Employees PF and Miscellaneous Provision Act 1952 (the Act provides for monthly contributions by the employer plus workers);
- Maternity Benefit Act, 1951 (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.);
- Contract Labour (Regulation and Abolition) Act, 1970 (the Act provides for certain welfare measures to be provided by the contractor to contract labour);
- Minimum Wages Act, 1948 (the employer is supposed to pay not less than the Minimum Wages fixed by the Government as per provisions of the Act);
- 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);
- 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);
- Payment of Bonus Act, 1965 (the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages);
- 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);
- Industrial Employment (Standing Orders) Act; 1946 (the Act provides for laying down rules governing the conditions of employment);
- Trade Unions Act, 1926 (the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities);

- Child Labour (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 labour is prohibited in Building and Construction Industry);
- Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 (the inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.);
- 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 employs 10 or more workers are covered under this Act; 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 Factories Act, 1948 (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities);
- Hazardous Wastes (Management and Handling) Rules, 1989 (the Rules govern handling, movement and disposal of hazardous waste); and it's further amendment made thereafter.
- Manufacture, Storage and Import of Hazardous Chemicals Rules 1989, amended 1994 and 2000 (the Rules provide indicative criteria for hazardous chemicals and require occupiers to identify major accident hazards and prepare on-site and off-site emergency plans).

5 ENVIRONMENTAL AND SOCIAL PROFILE OF PROJECT AREAS

This section briefly entails about the baseline environmental and social profile of the study area. The project City i.e. Kolkata is state capital of West Bengal. Kolkata is situated at 88° 30'E - 22° 33' N, on the Eastern Bank of River Ganga. Kolkata Municipal Corporation (KMC) area is bounded by river Hugli in the Northwest, South 24 Parganas district in the south and southwest, Salt Lake City in the east and North 24 Parganas district in the north. The area falls between north latitudes of 22°28'00" and 22°37'30" and east longitudes 88°17'30" and 88°25'00", covering an area of 200.71 and is divided into 144 wards and 16 nos. of boroughs.

5.1 ENVIRONMENTAL PROFILE

5.1.1 Location

The project catchment area for the S&D and STP scheme of Adi Ganga (Tolly's Nullah) is 1 km either side of the Nullah. The project site is plain and falls within Latitude longitude of 22.525 & 88.325. The identified land for STP is government land. No Private land acquisition has been envisaged. The location of proposed STPs (3 no.) in Tolly's Nullah is located from the River Adi-ganga/Tolly'Nullah (100 m away from the Tolly'Nullah). As per DPR and discussion with KMC, the STP has been designed with consideration to River HFL. As per the data furnished by Kolkata Municipal Corporation, the HFL of Adi Ganga at Garia is 3.553 m, whereas the DBL at the same point is 1.529 m. Furthermore, contractor will verify the HFL data and sectional drawing of structures with HFL and finished ground level will be submitted in C-ESA report.

As per Judgment dated 13.07.2017 (OA. No. 200/2014), MC Mehta vs Union of India & Ors, 100 m from the edge of the river would be demarcated as no development zone, thus the site is not falling in the zone, the other clarification and supporting to the same has been presented in (Sitting guideline along the river, OM. Dated 14th Feb 2022, MOEF & CC) and annexed in the report. (Annexure 7). The OM also mentions that river cleaning projects, treatment plan might be established as per NMCG direction, MoJS, India.



Figure 5-1: Project Location STP and S&D locations



Figure 5-2: Proposed STP 1 at Proposed Near Kavi Nazrul Metro Station



Figure 5-3: Proposed STP 2 near to Basdroni Pumping Station



Figure 5-4: Proposed STP 3 at Proposed Golf Green Land

5.1.2 Physiography & Soil

The Project district comprises a part of lower Ganga Plain. Kolkata region forms a part of the lower deltaic plains of the Ganga Bhagirathi River system. The project area is a typical deltaic flat land with surface elevation ranging between 3.5 to 6m above mean sea level. In Kolkata, several low-lying depressions in the form of marshes, shallow lakes or jheels occur within the city. The major slope of the land is towards south and is covered with younger alluvial soil mainly of silty & clayey loams. Younger levee, deltaic plain, inter distributary marsh, paleo channels and younger levee adjacent to river Hooghly and older levee on both sides of the Tolly's Nullah are the important geomorphological units present in the area. Younger alluvial soils mainly silty clay to clay. The existing contour or topography of project site shows that the area is comparatively flat with level of ground varying from approximately 2.38 m to 6.30 m above mean sea level.

The soil of Kolkata city and project region is formed with alluvial deposits by the Ganga, its tributaries and rivers originating from Chhotonagpur plateau and has alternate layers of sand and clay mixed with silt, similar to the soil of Indo-Gangetic plains. Quaternary sediments consisting of clay, silt, various grades of sand and gravel underlie the city. Due to alluvial plain, the pH of level of the soil is neutral to slightly alkaline in reaction with high base saturation. However, soils on low-lying areas are poorly drained, slightly acidic to slightly alkaline in soil reaction with medium base saturation. Soils are low in Nitrogen, medium in Phosphorous and potassium and also susceptible to failure of foundations due to liquefaction.

Table 5-1: Location Soil Sampling

Sl No.	GPS Coordinates	Location of sampling
1	22.543640°; 88.327117°	LS-4, Moor Avenue
2	22.488524°; 88.338371°	LS-3, Naktala
3	22.506111°; 88.341926°	LS-6, Charu Avenue
4	22°30'0.45"N; 88°20'33.97"E	LS-7, Izzazattullah
5	22.532494°; 88.337363°	LS-2, Thackeray Road
6	22.468107°; 88.371560°	LS-1A, Rathtala
7	22.508776°; 88.340289°	Chetla PS
8	22°29'54.97"N; 88°21'3.27"E	STP 3 Proposed Golf Green
9	22°27'56.07"N; 88°23'20.96"E	STP 1- Near Proposed Kavi Nazul Metro Station

To have an overall idea of soil characteristics of the project area, soil samples were collected up to depth of 15 cm for analysing various physical and chemical characteristics. The soil of project site is more of sandy loam content and brown in colour. The analysis results shows that range of pH of soil is moderately basic in nature. Soil has organic matter ranges from 1.8 to 2.8 percentages per weight of the soil, this is slightly lower in concentration which may be due to erosion and flood issue of the region. No contamination of heavy metals has been observed in the samples. The soil has good proportion of NPK.

Table 5-2 : Soil Quality Results of proposed STPs and Lifting Stations Locations

S. No.	Parameters / Physical Characteristics	Units	Results										Test Method
			LS-4, Moor Avenue	LS-3, Naktala	LS-6, Charu Avenue	LS-7, Izzazattullah	LS-2, Thackeray Road	LS-1A, Rathtala	Chetla PS	STP 2- Proposed Police Telecom Dept	STP 3- Proposed Golf Green	STP 1- Near Proposed Kavi Nazul Metro Station	
1	Colour		Brownish Grey	Brown	Greyish Brown	Light Grey	Brown Grey	Grey	Light Grey	Brownish Grey	Brown Grey	Greyish Brown	STRL/STP/SOIL/01
2	Textural class		Sandy Loam	Sandy Loam	Clay	Sandy Loam	Loam	Sandy Loam	Sandy Loam	Sandy Loam	Loam	Sandy Loam	IS27720 (P-4), 1985 (Reaff: 2015)
3	Bulk Density	gm/cm ³	1.08	1.14	1.16	1.22	1.23	1.24	1.23	1.18	1.26	1.34	IS 14765: 2000, RA 2010
4	Water Holding Capacity	%	26	28	29	31	29	30.5	30	29	30	31	STRL/STP/SOIL/01
Particle Size Distribution													
5	Sand	%	47.6	43.2	36.4	41.3	31.4	40.3	43.1	40.4	36.2	37.4	IS27720 (P-4), 1985 (Reaff: 2015)
6	Slit	%	17.3	19.3	24.2	24.2	26.2	17.4	22.6	21.3	22.4	19.2	IS27720 (P-4), 1985 (Reaff: 2015)
7	Clay	%	35.1	37.5	39.4	34.5	42.4	42.3	34.3	38.3	41.4	43.4	IS27720 (P-4), 1985 (Reaff: 2015)
Chemical Characteristics													
8	pH (1:2 Suspension)	-	7.74	7.64	8.12	8.21	7.92	8.15	7.65	7.21	7.47	7.32	IS: 2720 (part-26), 1987 (Reaff: 2011)
9	Electrical Conductivity (1:2)	µmhos/cm	114	123	136	136	126.4	132	142	153	143	143	IS: 14767(2000), RA 2016
10	Organic Matter	%W/W	2.32	1.87	2.18	2.76	2.63	2.76	2.32	2.68	2.87	2.67	STRL/STP/SOIL/01
11	Exchangeable Calcium	mg/kg	9627	10391	8627	9692	10327	11083	10549	10824	12843	9854	IS 2720 (Part 24): 1976, RA 2010
12	Exchangeable Magnesium	mg/kg	7438	6945	6741	7648	7362	7637	6493	6852	7845	5968	IS 2720 (Part 24): 1976, RA 2010
13	Copper	mg/kg	1.82	1.76	2.43	2.17	1.64	2.15	1.63	2.14	1.68	1.48	IS 2720(Part-27): 1977,
14	Nickel	mg/kg	1.61	1.75	1.42	1.16	1.38	1.82	1.45	1.86	2.14	1.84	IS 2720(Part-27):

S. No.	Parameters / Physical Characteristics	Units	Results										Test Method
			LS-4, Moor Avenue	LS-3, Naktala	LS-6, Charu Avenue	LS-7, Izzazattullah	LS-2, Thackeray Road	LS-1A, Rathtala	Chetla PS	STP 2- Proposed Police Telecom Dept	STP 3- Proposed Golf Green	STP 1- Near Proposed Kavi Nazul Metro Station	
													1977,
15	Chromium	mg/kg	13.7	11.8	14.2	14.2	11.2	18.6	17.4	16.5	15.7	17.2	IS 2720(Part-27): 1977,
16	Iron	mg/kg	1931.5	2457.6	1827.6	2045.1	1873.5	2156.3	167.3	1731.6	1843.6	1854.4	IS 2720(Part-27): 1977,
17	Lead	mg/kg	45	52.6	38.6	23.2	23	26.6	18	23.5	19.6	18.8	IS 2720(Part-27): 1977,
18	Sulphate	mg/kg	165.4	187.8	148.3	141.6	141.6	185.5	148.6	146.3	186.5	184.1	IS 2720(Part-27): 1977,
Available Nutrients (Kg/Ha)													
19	Nitrogen (as N)	Kg/Ha	774.3	1143.5	861.8	8273.6	953.6	1258.4	964.8	1165.2	1548.7	1486.3	IS: 10158:1982, RA 2009
20	Phosphorous	Kg/Ha	332.5	295.4	381.4	184.2	274.2	186.4	228.5	232.5	224.5	258.2	IS: 10158:1982, RA 2009
21	Exchangeable Potassium	Kg/Ha	83.3	74.2	78.9	86.2	78.4	83.6	86.3	86.6	84.2	74.8	STRL/STP/SOIL/01

5.1.3 Seismicity

As per seismic hazard map of State of West Bengal, the project area falls in Moderate damage risk seismic zone III and corresponds to MSK intensity VII, within very close vicinity of High Earthquake Damage Risk Zone (Zone-IV) of North and South 24 Parganas districts. As per the Disaster Management Plan of Kolkata 2020, the eastern part of Kolkata (saltlake, new town area) falls under severe hazard level and nearly 50% of the area falls under high to severe hazard level. In consideration to this, due measures should be incorporated in designing of water/waste-water retaining structures. (viz. Sewage lifting Station or Wastewater Treatment Plants, as per provision of the Code).

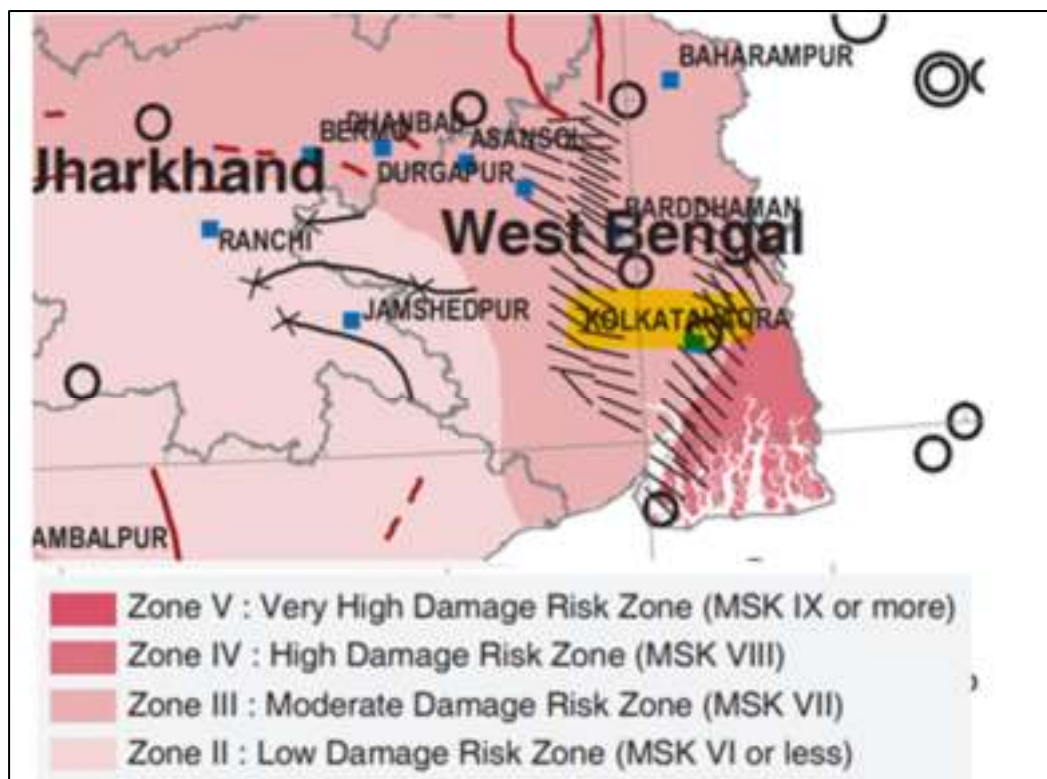


Figure 5-5: Seismic Map of State of West Bengal

5.1.4 Climate

Predominant climate of the region is a Tropical Wet and Dry Climate. It is characterised by an oppressive hot summer, high dampness in the atmosphere nearly all the year round and well distributed rainfall during the southwest monsoon season. The winter season commences by about the middle of November to the end of February which is followed by the hot season from March to May. The Southwest monsoon season is from June to September. October and the first half of November constitute the post-monsoon season.

Region exhibits three distinct season i.e. winter season (from November to February), Summer Season (from March to June) and Monsoon (July to September). January is the coldest month with Monthly maximum temperature at 29.8°C and monthly minimum temperature at 10.7°C. May is the hottest month with maximum temperature at 38.8°C and minimum temperature is 25°C. As per IMD Pune, month wise 30

year record of temperature profile (Daily maximum and Minimum) representative (Kolkata) to the project region has been presented in **Figure 5-6**.

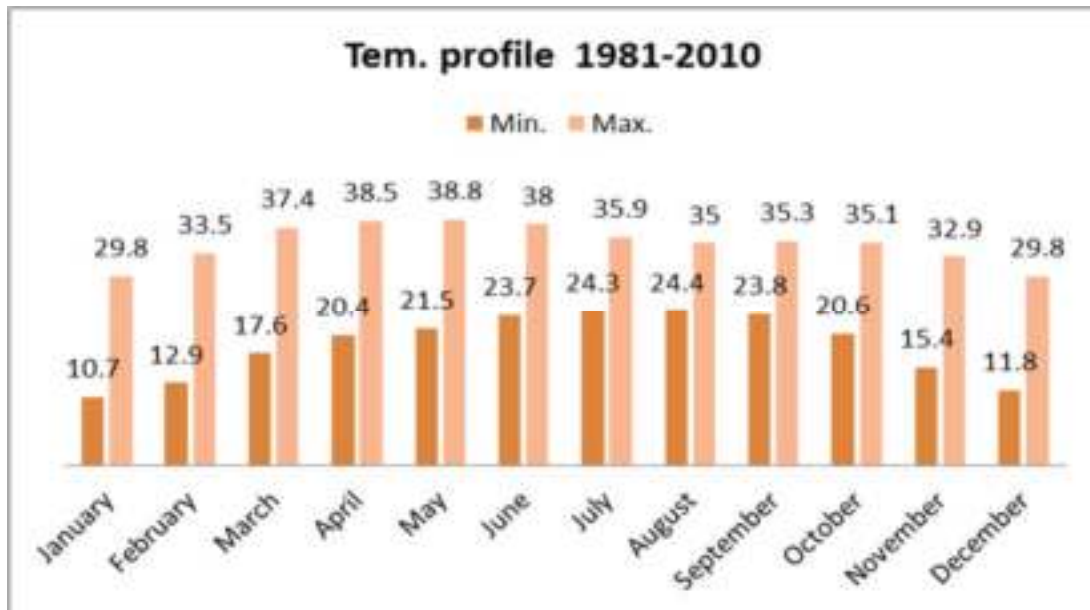


Figure 5-6: Temperature Profile (1981-2010)

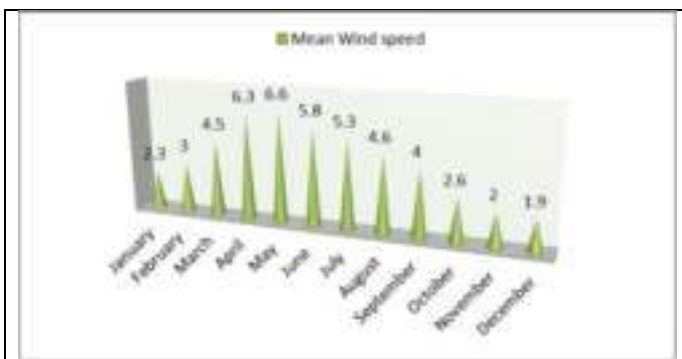


Figure 5-7: Mean wind speed of Project region (1981-2010)

During summer, the wind generally blows from west, northeast or east. The direction and speed is generally variable during monsoon season. Winds are generally high throughout the year; the mean wind velocity is ranges from 2-6 KMPH.

South west monsoon dominate during monsoon season are responsible for rainfall. Kolkata receives an average annual rainfall of 1634.6

mm, of which 75% of the annual rainfall is received during May to September. Monsoon and Post Monsoon season has high relative humidity; this generally decreases in winter months; the range of relative humidity is 72%-84%. As per IMD data on rainfall of the last 5 years, Figure 5-8 shows that July Month of year 2017 had received more rainfall in comparison to the other years. Construction is suggested to be done in the period, which avoids the peak monsoon period (July, August & September). The Contractor shall avoid construction works close to the streams or water bodies during monsoon.

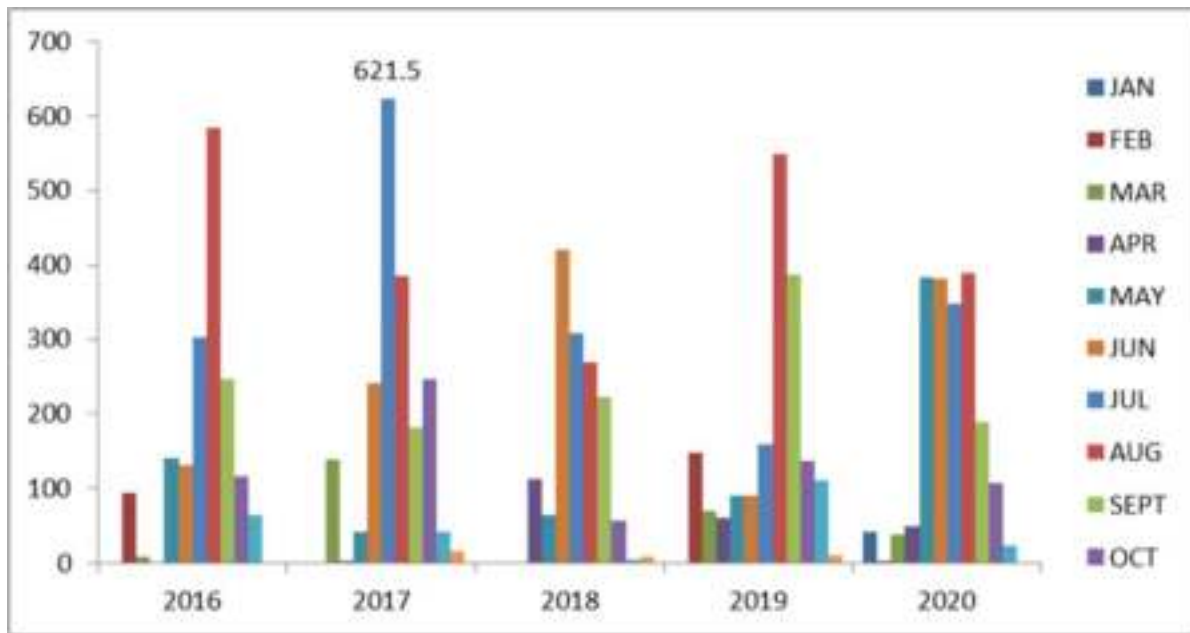


Figure 5-8: Last five years rainfall: Kolkata (2016-2020)

Source: IMD

5.1.5 Air environment

Table 5-3, describes that the annual average concentrations, which violate the prescribed norms at Kolkata. The concerning particulate matter PM10 (Annual standard is 60 ug/m³) mostly contributed by alluvial natural dust. Other sources of PM10 are mostly consisting of road dust, suspended dust and also include anthropogenic construction dust, thermal power dust and secondary aerosols (mostly soluble salts). NO₂ (Annual standard is 40 ug/m³), though below the standard, it depends upon the vehicular population and industrial activities of Kolkata. The SPCB record for Ambient air quality level of Kolkata shows higher level of PM 10 and PM2.5. The gaseous contents observed within prescribed limit of CPCB.

Vehicular pollution, dust from nearby construction activities, unpaved road and industries may cause the variations in PM level. In order to prevent the increase of suspended particulate matter in project location, corresponding measures such water sprinkling, stacking the construction related fine material and soil in covered manner, provision of proper PPEs etc. should be taken care of by contractor during construction stage (other preventive measures are presented in EMP of the Report).

Table 5-3 : National Air Quality Monitoring 2017-19-Kolkata

Year	PM10 ug/m ³	PM2.5 ug/m ³	SO ₂ ug/m ³	NO ₂ ug/m ³	NH ₃ ug/m ³	As ng/m ³	BaP ug/m ³	C ₆ H ₆ ug/m ³	Pbug/m ³	Ni ug/m ³
2017	121.54	70.95	4.52	38.60	23.24	1.81	0.69	2.92	0.15	9.55
2018	124.44	73.57	4.96	38.68	20.74	2.33	0.73	3.03	0.17	11.41
2019	105.10	56.24	8.19	-	42.38	2.53	0.43	-	0.15	13.08
NAAQS ANNUAL AVERAGE	60	40	50	40	100	6	1	5	0.50	20

Source: State of Environment Report – I WEST BENGAL 2021

Primary Ambient air monitoring

On-site 24 hrs. Ambient air quality monitoring has been carried out twice a week at 10 locations in the project area, from 12th May 2022 to 19th May 2022, through NABL accredited Environmental Monitoring Agency.

Table 5-4: Location Air quality level Sampling

Sl No.	GPS Coordinates	Location of sampling
1	22.543640°; 88.327117°	LS-4, Moor Avenue
2	22.488524°; 88.338371°	LS-3, Naktala
3	22.506111°; 88.341926°	LS-6, Charu Avenue
4	22°30'0.45"N; 88°20'33.97"E	LS-7, Izzatullah
5	22.532494°; 88.337363°	LS-2, Thackeray Road
6	22.468107°; 88.371560°	LS-1A, Rathtala
7	22.508776°; 88.340289°	Chetla PS
8	22°29'54.97"N; 88°21'3.27"E	STP 3 Proposed Golf Green
9	22°27'56.07"N; 88°23'20.96"E	STP 1- Near Proposed Kavi Nazul Metro Station

Sampling record shows that all the CPCB's prescribed parameters except Particulate Matter were found within permissible limit (i.e., gaseous pollutants SO_x, NO_x, CO). Particulate Matters (PM₁₀, PM_{2.5}) were found as crossing the permissible limit slightly at all the sampling locations. Higher particulate matter in air quality is probably due to dust emissions from vehicle plying on unpaved road, ongoing construction activities, vehicular pollution etc. Therefore, necessary precautionary measures shall be taken by contractor during construction to avoid degradation of air quality, activities like vehicular movement, handing of concrete material, borrow earth etc., may have dust addition in the air. Dust control mitigation measures like water sprinkling, covering of construction sites with use of green curtain etc. have been taken into the consideration in EMP budget. During operation phase, the dust specific issue will be insignificant. Please refer **Annexure 5** for detail report of Air quality sampling at project sites.

Table 5-5 : Ambient Air Quality Result

S. No	Parameters	Unit	12.05.2022 to 13.05.2022				13.5.2022 to 14.05.2022				14.5.2022 to 15.05.2022		Requirement Permissible limits as per NAAQS/CPCB	Test Method
			LS-4 Moor Avenue	LS-3, Naktala	LS-6, Charu Avenue	LS-7, Izzatullah	LS-2, Thackeray Road	LS-1A, Rathatala	Chetla PS	STP2-Proposed Police Telecom Dept	STP3-Proposed Golf Green	STP1-Near Proposed Kva Nazrul metro station		
1	Particulate Matter, PM 10	µg/m ³	116	121	117	123	114	119	121.5	123.4	118.2	116.7	100	IS:5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	72.5	69.2	74.4	78.2	73.8	68.5	73.6	71.6	74.3	69.3	60	SOP1/STRL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide SO ₂	µg/m ³	21.4	21.2	16.8	17.3	16.4	21.2	20.5	23.4	21.4	21.4	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	µg/m ³	1.42	1.16	1.54	1.45	1.24	1.54	1.43	1.21	1.46	1.25	04 (1 Hourly)	IS:5182 (P-10) : 199,RA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	19.4	21.4	21.5	21.3	23.2	17.2	20.3	18.1	16.1	24.1	80	IS:5182 (P-6) : 2006

Source: primary Survey by Consultant

S. No	Parameters	Unit	16.5.2022 to 17.05.2022		17.05.2022 to 18.05.2022				18.05.2022 to 19.05.2022				Requirement Permissible limits as per NAAQS/CPC B	Test Method
			LS-4 Moor Avenue	LS-3, Naktala	LS-6, Charu Avenue	LS-7, Izzatullah	LS-2, Thackeray Road	LS-1A, Rathatala	Chetla PS	STP2-Proposed Police Telecom Dept	STP3-Proposed Golf Green	STP1- Near Proposed Kvai Nazrul metro station		
1	Particulate Matter, PM 10	µg/m ³	113	115	122	118	125	120	126.1	118.6	124.7	124.1	100	IS:5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	67.3	73.6	71.7	73	71.4	71.3	75.2	67.3	69.4	72.2	60	SOP1/STRL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide SO ₂	µg/m ³	18.2	18.4	13.6	21.1	18.1	15.7	24.2	20.2	23.7	18.2	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	µg/m ³	1.34	1.43	1.42	1.32	1.51	1.35	1.15	1.32	1.26	1.42	04 (1 Hourly)	IS:5182 (P-10) : 199,RA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	21.1	20.9	23.1	17.2	21.6	23.5	17.2	21.5	21.4	22.7	80	IS:5182 (P-6) : 2006

Source: primary Survey by Consultant

5.1.6 Noise Environment

Noise is composed of frequency components of loudness distributed over the audible frequency range. The environmental impact of noise can have several effects varying from annoyance to hearing loss depending on loudness of noise levels. The main objective of the noise level monitoring is to assess the background noise levels in different zones viz. industrial, commercial, residential, and silence zones in and around the proposed project site. Noise pollution prevention and further mitigation measures should be applied where operation phases/construction phases at the stationary source and towards the sensitive receptor. The preferred method for controlling noise from stationary sources is to implement noise control measures at source. **Table 5-6.** Provides the CPCB's prescribed limit for Ambient Noise level within Project site. Project Contractor shall be bound to follow the mentioned standard during construction and operation phase as per EMP of the project.

Table 5-6: Ambient Noise Monitoring Standard (Source: CPCB)

Name of Location	Equivalent Noise Level, Leq (Day*)	Equivalent Noise Level, Leq(Night**)	Test Method
	dB (A)	dB (A)	
Industrial Area	75	70	Project Locations fall within residential zone
Commercial Area	65	55	
Residential Area	55	45	
Silence Zone	50	40	

The noise monitoring locations are taken at 10 locations within the project area. The monitoring was done for 24 hrs. at below mentioned Locations. **Table 5-6.** The monitoring results of day and night shows that it is within CPCB's prescribed limit. Proposed STP and MPS location shows the ambient noise level slightly lower than the prescribed CPCB limit, however during construction stage due to movement of machinery, DG etc. will enhance the ambient level during construction phase. Respective mitigation measures such as barricading (barrier, fencing should be located as close to the source for more effectiveness) at site and avoidance of work during night hours & conducting Ambient monitoring as per EMP, Proper PPEs shall be maintained by the contractor. During operation phase the Pumping station, DGs of STP will be having some augmented noise level due to DG, Pumping machines etc. This will be mitigated through using acoustic enclosure for the DGs and substitute of silence motors or motors will be in enclosed manner etc.. The regular monitoring of the same shall also be done by the contractor during construction and operation phases in line with residential noise level standard.

Table 5-7 : Ambient Noise Monitoring Result at Project Site (24 hrs.)

Name of Location	Date	Equivalent Noise Level, Leq (Day*)	Equivalent Noise Level, Leq (Night**)	Test Method
		dB (A)	dB (A)	
LS-4, Moor, Avenue	12.05.2022	50.2	46.1	IS 9989 : 1981 (RA 2008)
LS-3, Naktala	12.05.2023	51.4	44.7	
LS-6, Charu Avenue	12.05.2024	52	42.6	
LS-7, Izzatullah	12.05.2025	51.5	43.6	

LS-2, Thackeray Road	13.05.2022	51.3	42.8
LS-1A, Rathtala	13.05.2022	52.5	44
Chetla PS	14.05.2022	51.7	43.2
STP2- Proposed Police Telecom Dept	13.05.2022	51.5	43.1
STP3- Proposed Golf Green	14.05.2022	52.9	41.7
STP1-Near Proposed Kavi Nazrul Metro Station	14.05.2022	53	44.1
Limit for Commercial Zone as per the Noise Pollution (Regulation And Control) Rules, 2000		55	45

Source: Primary Survey by Consultant

Note: *Day time means from 6.00 a.m. to 10.00 p.m.

** Night time means from 10.00 p.m. to 6.00 a.m.

5.1.7 Water environment

Major drainage system of the project region is Hooghly River along its western boundary. Other than this, several canals like Bagjola Khal in the north and Beleiaghata and Circular Khal in the central part and Adi-Ganga (a paleo channel), and Tolly nullah in the southern part cover a large area of the city. These khals and nalas cover a large area of the city. Presently, due to population growth and infrastructure expansion all the khals and nalas have been silted. A proper de-siltation is required because these are the main surface water sources inside the city and they can be used for inland water transport.

Ganga is the most significant river in the state. It enters the state of West Bengal from the Rajmahal hill of Jharkhand and flows up to Farakka. The Bhagirathi takes off from the Ganga at a village called Mithipur (Murshidabad district), about two km. north of Jangipur. It flows south ward for about 500 km and ultimately discharges into the Bay of Bengal at Gangasagar. The 280 km stretch of river below Nabadwip is tidal. This tidal reach of the river is known as Hooghly. The Bhagirathi-Hooghly River receives seven tributaries from the west and these are Bansloi, Pagla, Mayurakshee, Ajoy, Damodar, Rupnarayan and Kansai. These rivers together drain an area of about 66000km².

The S&D and STP scheme project is proposed near to Tolly's Nullah (Adiganga River). Adiganga river is tributary of river Hooghly, but due to encroachment, immense population growth, urbanization of the area since British time, the river is now remained in shape of nalla. Major problem of Tolly' Nullah is siltation problem, dumping of solid waste from the nearby, and encroachments (slum, squatters, unauthorized commercial activities etc.). The present stretch of Tolly's Nullah is around 15.5kms with about 33km² catchment area (1km on either side of Tolly's Nullah). The predominant flow of Tolly's Nullah is from east to west (Garia to Hasting) and under strong tidal effect. The Tolly's Nullah flow culminates into River Hooghly. Tolly's Nullah has four tributaries, namely Western Channel (Approx. 2kms long), Keorapukur Khal (Approx. 2kms long), Chetla Boat Canal (Approx. 2.8kms long) and Suti Khal (Approx. 2.5kms long).

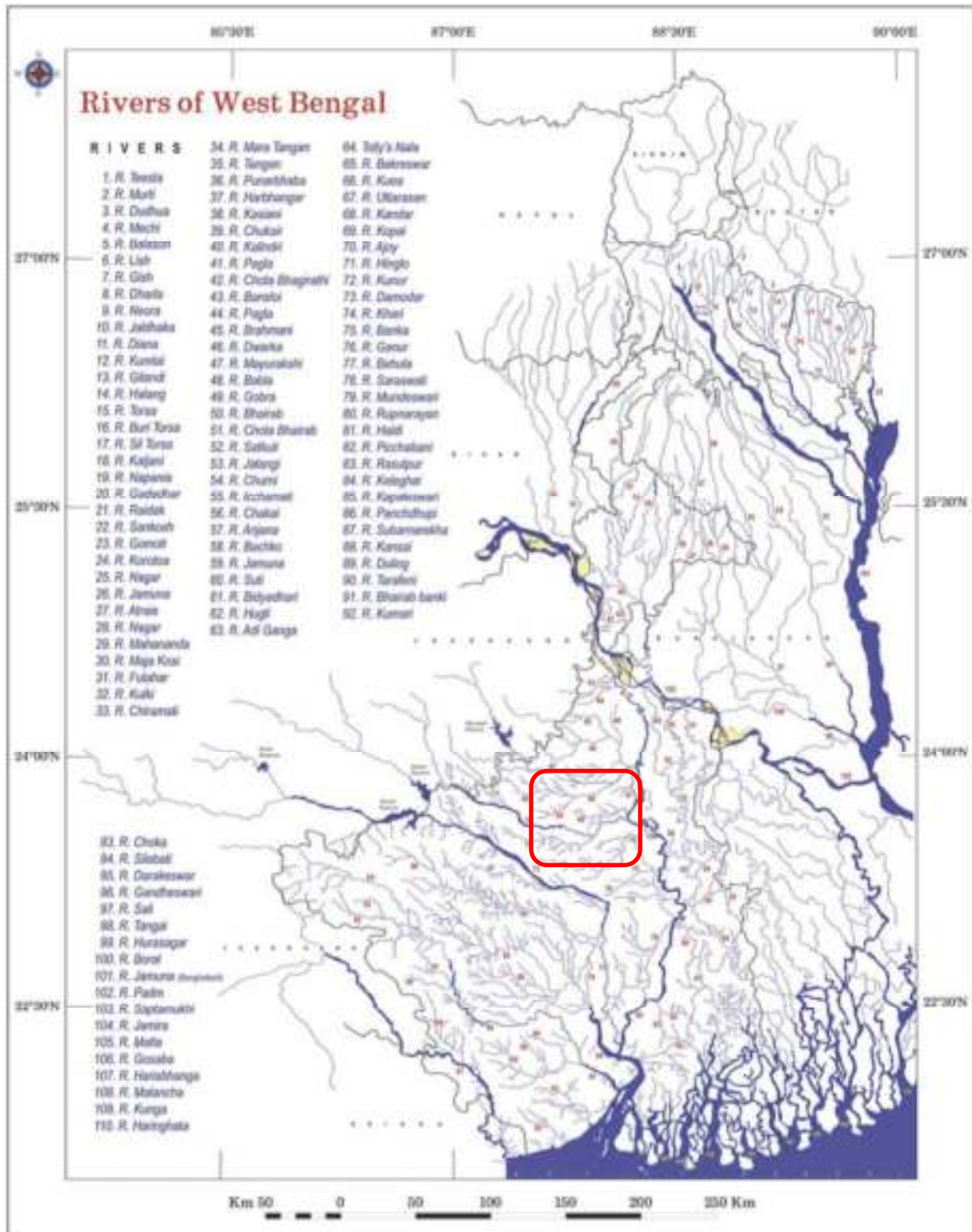


Figure 5-9: Rivers of West Bengal, State of Environment Report – I WEST BENGAL 2021

The water quality of the Bhagirathi-Hooghly River is presented in **Table 5-8**. As per SPCB record, the four significant parameters i.e. Dissolved Oxygen (DO) and Biological Oxygen Demand (BOD), Faecal & Total coliform have been studied for River Bhagirathi-Hooghly. The levels of dissolved oxygen at all the fourteen stations are above the minimum standard indicating that the river water is fit for the survival of aquatic life. The BOD load found above the permissible limit (3.0 mg/l) at most of the sampling stations and the bacterial count shows that the river water is highly contaminated by enteric bacteria. Hence, the river water is not fit for recreational purposes and drinking purposes without proper disinfection. **The highlighted locations as mentioned in Table 5-8 are falling near the Tolly's Nullah Region.** Tolly's Nullah is one of the East Bank drains polluting the Bhagirathi-Hooghly River out of 56 drains/canals carrying wastewater to the Bhagirathi-Hugli River.

Table 5-8 : Water Quality of the Bhagirathi-Hooghly River

Station	Dissolved Oxygen (mg/l.)		Biochemical Oxygen Demand (mg/l.)		Total Coliform Count (MP-N/100ml.)		Faecal Coliform Count (MP-N/100ml.)	
	Apr. 2020	Oct. 2020	Apr. 2020	Oct. 2020	Apr. 2020	Oct. 2020	Apr. 2020	Oct. 2020
Khagra	9.60	5.60	5.50	3.25	9000	110000	7000	49000
Baharampore	6.80	5.30	3.70	3.10	7000	140000	2400	49000
Gorabazar	7.60	5.70	4.00	3.60	11000	63000	6000	49000
Nabadwip	7.70	6.30	2.80	4.15	35000	350000	17000	41000
Tribeni	7.90	5.90	3.00	4.60	170000	160000	92000	92000
PaltaShitalatala	8.50	4.80	3.90	2.45	500000	540000	140000	350000
Palta	7.90	4.90	3.60	1.90	50000	350000	26000	170000
Serampore	6.40	5.30	2.80	3.20	70000	110000	33000	70000
Dakshineswar	5.80	7.00	4.00	5.00	490000	170000	110000	80000
Haora Shibpur	3.90	4.70	1.25	2.30	110000	170000	33000	50000
Garden Reach	5.00	4.80	4.00	2.80	700000	140000	140000	70000
Uluberia	4.00	5.30	1.05	2.80	30000	33000	17000	17000
Diamond Harbour	6.10	5.60	2.70	2.60	70000	27000	790	8000
Patikhali	4.60	5.40	3.33	0.70	NA	3800	NA	1000

Source: State of Environment Report – I WEST BENGAL 2021

The STP and I&D provisions for Tolly's Nullah has been planned to check the further domestic sewage pollution load in the river. Waste water quality of major drains, which are chosen under the project to tap and divert for treatment has been studied and presented in the report (**Table 2-3**). Drains shows BOD ranges from 40-135 mg/l & COD-100-350 Mg/l.

Name of Drain	BOD (mg/l) Jan-Mar- 2020	Faecal Coliform (MPN/1000 ml) Jan-Mar 2020	BOD (mg/l) Mar-Jun- 2020	Faecal Coliform (MPN/1000 ml) Apr-Jun 2020
Tolly Nullah	22.86	1300000	8	800000

Source: SOE, 2020, SPCB

Water quality shows higher level of coliform and reflecting the water quality is degrading due to excreta pollution from the city area and also reflects the poor sanitation facility in the region and resultantly degrading the river water quality. BOD & DO Level shows result within permissible limit.

During construction stage of the project, contractor should ensure the proper sanitation facility to worker on the site to reduce the irregular excreta etc. Preventive measures to be taken during construction stage to reduce the water pollution nearby site are presented in EMP of the Report.

Primary Survey / monitoring of river water quality near to project site at upstream, midstream and downstream point have been tested (refer table below).

Table 5-9: Location of River water Sampling

GPS coordinate	Location of sampling	Mean Sea Level
22°33'2.54"N; 88°19'27.65"E	Confluence point Downstream Tolly Nullah, Near STP	2m
22°31'40.42"N; 88°20'28.46"E	Mid-Stream Tolly Nullah, Near STP	8m
22°28'2.48"N; 88°24'12.99"E	Up Stream Tolly Nullah, Near STP	7m

Water quality shows higher level of coliform and reflecting the water quality is degrading due to excreta pollution from the city area and also reflects the poor sanitation facility in the region and resultantly degrading the river water quality. BOD & DO Levels are also exceeding the tolerance limit. During construction stage of the project, contractor should ensure the proper sanitation facility to worker on the site to reduce the irregular excreta etc. Preventive measures to be taken during construction stage to reduce the water pollution nearby site are presented in EMP of the Report.

Table 5-10 : Surface Water Quality at Tolly's Nullah

S. No.	Parameters	Unit	IS: 2296 - 1992(Class C) Tolerance Limit	Downstream Tolly Nullah, Near STP	Mid-Stream Tolly Nullah, Near STP	Upstream Tolly Nullah, Near STP	Test method
1	pH	-	6.5 -8.5	7.86	7.56	7.72	IS: 3025(Pt-11)1983, RA. 2002
2	Temperature	°C	-	38.8	40.2	39.6	APHA 23 nd Edn.2017-2550 B
3	D.O	mg/l	Minimum -4	3.6	3.4	3.7	IS 3025(Part-38): 2006.
4	BOD	mg/l	30	74.8	82.4	92.2	IS 3025(Part-44):1993, RA

S. No.	Parameters	Unit	IS: 2296 - 1992(Class C) Tolerance Limit	Downstream Tolly Nullah, Near STP	Mid-Stream Tolly Nullah, Near STP	Upstream Tolly Nullah, Near STP	Test method
							2009
5	Color	Hazen°C	300	15	15	15	IS: 3025 (Pt-4) 1983, RA 2017
6	Odour	-	-	Objectionable	Objectionable	Objectionable	IS: 3025(Pt-5)
7	TDS	mg/l	1500	756	786	762	IS 3025(Part-16): 1984, RA 2006
8	TSS	mg/l	-	165	146	176	IS 3025(Part-17)
9	TKN	mg/l		36.8	41.6	36.2	IS: 3025(Pt-34)1988, RA. 2003
10	Ammoniacal Nitrogen	mg/l		<0.1	<0.1	<0.1	IS: 3025(Pt-34)1988, RA. 2003
11	Nitrate (as NO ₃)	mg/l	50	23.4	28.5	31.2	IS: 3025(Pt-34)1988, RA. 2003
12	Free Ammonia	mg/l		<0.1	<0.1	<0.1	IS: 3025(Pt-34)1988, RA. 2003
13	Chlorides (as Cl)	mg/l	600	46.2	41.7	36.8	IS 3025(Part-32): 1988
14	Sulphates (as SO ₄)	mg/l	400	41.4	52.8	43.2	IS 3025(Part-24):1986, RA 2003
15	Fluoride (as F)	mg/l	1.5	0.51	0.45	0.57	APHA 21 st Ed., 4500F(D)
16	Oil & Grease	mg/l	0.1	<0.1	<0.1	<0.1	IS 3025(Part-39):1991, RA 2009
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.005	<0.001	<0.001	<0.001	5530-B,C&E,APHA 23nd 2017
18	Arsenic	mg/l	0.2	<0.1	<0.1	<0.1	3110- B, APHA 23nd Ed. 2017(AAS)
19	Mercury(as Hg)	mg/l	-	<0.001	<0.001	<0.001	3110- B, APHA 23nd Ed.2017
20	Lead (as Pb)	mg/l	0.1	<0.1	<0.1	<0.1	3110- B, APHA 23nd Ed. 2017(AAS)
21	Cadmium (as Cd)	mg/l	0.01	<0.002	<0.002	<0.002	3110- B, APHA 23nd Ed. 2017 (AAS)
22	Chromium (as Cr+6)	mg/l	0.05	<0.1	<0.1	<0.1	IS 3025(Part-52): 200
23	Copper (as	mg/l	1.5	<0.01	<0.01	<0.01	3110- B, APHA

S. No.	Parameters	Unit	IS: 2296 - 1992(Class C) Tolerance Limit	Downstream Tolly Nullah, Near STP	Mid-Stream Tolly Nullah, Near STP	Upstream Tolly Nullah, Near STP	Test method
	Cu)						23nd Ed. 2017 (AAS)
24	Zinc (as Zn)	mg/l	15	0.21	0.26	0.31	3110- B, APHA 23nd Ed. 2017 (AAS)
25	Selenium (as Se)	mg/l	-	<0.1	<0.1	<0.1	IS: 3025 (P- 56)
26	Anionic detergents (as MBAS)	mg/l	1	<0.1	<0.1	<0.1	Annexure K Of IS 13428
27	Iron (as Fe)	mg/l	50	0.19	0.23	0.31	3500-Fe- B, APHA 23nd Ed. 2017
28	Sulphide(as H ₂ S)	mg/l	-	<0.1	<0.1	<0.1	IS-3025 (P-29)
29	Phosphate (as PO ₄)	mg/l	-	5.6	7.8	11.6	APHA 22nd Edn.2012-4500-P C
30	Cyanide (as CN)	mg/l	0.05	<0.1	<0.1	<0.1	4500-CN-B,C & E, APHA 23nd Ed.2017
31	Manganese (as Mn)	mg/l		0.04	0.06	0.08	3110- B, APHA 23nd Ed.2017
32	COD	mg/l	-	268.4	278.2	294.4	IS 3025(Part-58): 2006
33	Total Coli form	MPN/100ml	5000	18500	16800	21600	IS : 1622-1981

Source: primary Survey by Consultant

Ground Water- As per information available from Central Ground Water Authority, Ground water category in the Project District Kolkata is under safe category. Levels of ground water during pre and post monsoon are 12.09 to 19.59 mbgl & 10.72 to 15.42 mbgl respectively. Ground water of the region is soft total hardness less than 150/l), colourless, odourless and slightly neutral in nature. Type of water quality is good and fit for all purposes i.e. domestic, irrigation and industrial.

Onsite water quality has been tested from 10 locations near the project area which shows all the parameters are within permissible limit. The level of ground water is under safe zone in Tolly's Nullah (as per CGWA). During construction stage contractor has to be ensured to avoid or not extract ground water. Uses of treated sewerage water if meets the construction quality should be preferred during construction.

Table 5-11: Ground Water Sampling 1

S. No.	Parameters	Unit	Limit (IS-10500:2012)		LS-4 Results-GW1	LS-3 Results-GW2	LS-6 Results-GW3	LS-7 Results-GW4	LS-2 Results-GW5	Test method
			Desirable Limit	Permissible Limit						

S. No.	Parameters	Unit	Limit (IS-10500:2012)		LS-4	LS-3	LS-6	LS-7	LS-2	Test method
			Desirable Limit	Permissible Limit	Results-GW1	Results-GW2	Results-GW3	Results-GW4	Results-GW5	
1	Color	Hazen	5	15	<5	<5	<5	<5	<5	IS: 3025(Pt-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-8)
4	Turbidity	NTU	1	5	<1	<1	<1	<1	<1	IS 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.61	7.16	7.36	7.62	7.32	IS: 3025(Pt-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	600	186.6	162.2	183.2	163.6	168.4	IS 3025(Part-21)
7	Iron (as Fe)	mg/l	1	No Relaxation	0.56	0.64	0.48	0.53	0.52	3500-Fe- B, APHA 23rd Ed.2017
8	Chlorides (as Cl)	mg/l	250	1000	28.4	25.6	29.4	31.6	26.2	IS 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	0.47	0.56	0.51	0.45	0.47	4500-F-(D), APHA 23 rd Ed2017
10	TDS	mg/l	500	2000	342.3	262.4	254.3	268.2	258.4	IS 3025(Part-16)
11	Calcium(as Ca ²⁺)	mg/l	75	200	26.7	26.7	35.2	26.4	36.2	IS 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	20.2	17.6	28.3	18.3	22.8	3500-Mg B, APHA 23rd Ed2017
13	Sulphate (as SO ₄)	mg/l	200	400	32.5	23.7	26.2	26.3	32.5	IS 3025(Part-24)
14	Nitrate(as NO ₃)	mg/l	45	No Relaxation	16.9	16.2	14.6	18.1	15.3	IS: 3025(Pt-34)
15	Total	mg/l	0.05	No	<0.01	<0.01	<0.01	<0.01	<0.01	3110- B,

S. No.	Parameters	Unit	Limit (IS-10500:2012)		LS-4 Results-GW1	LS-3 Results-GW2	LS-6 Results-GW3	LS-7 Results-GW4	LS-2 Results-GW5	Test method
			Desirable Limit	Permissible Limit						
	Chromium (as Cr)			Relaxation						APHA 23rd Ed.2017
16	Alkalinity as CaCO ₃	mg/l	200	600	172.2	156.4	194.2	174.6	174.8	IS 3025(Part-23)
17	Aluminum (as Al)	mg/l	0.03	0.2	<0.01	<0.01	<0.01	<0.01	<0.01	IS 3025(Part-55)
18	Total Arsenic(as As)	mg/l	0.01	No Relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	3110- B, APHA 23rd Ed2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	<0.05	<0.05	<0.05	<0.05	3110- B, APHA 23rd Ed2017
20	Manganese (as Mn)	mg/l	0.1	0.3	<0.01	<0.01	<0.01	<0.01	<0.01	3110- B, APHA 23rd Ed2017
21	Zinc (as Zn)	mg/l	5	15	0.51	0.63	0.41	0.53	0.53	3110- B, APHA 23rd Ed2017
22	Ammonia (as NH ₃ -N)	mg/l	0.5	No Relaxation	<0.1	<0.1	<0.1	<0.1	<0.1	4500-NH ₃ -B & C, APHA 23 rd ED2017
23	Anionic Detergents (as MBAS)	mg/l	0.2	1	<0.1	<0.1	<0.1	<0.1	<0.1	Annexure K of IS-13428.
24	Boron(as B)	mg/l	0.5	1	0.13	0.18	0.12	0.16	0.16	IS: 3025(Pt-57)
25	Mineral Oil	mg/l	0.5	No Relaxation	<0.1	<0.1	<0.1	<0.1	<0.1	IS 3025(Part-39)
26	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	IS 3025(Part-44)
27	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.002	<0.002	<0.002	<0.002	<0.002	3110- B, APHA 23rd

S. No.	Parameters	Unit	Limit (IS-10500:2012)		LS-4	LS-3	LS-6	LS-7	LS-2	Test method
			Desirable Limit	Permissible Limit	Results-GW1	Results-GW2	Results-GW3	Results-GW4	Results-GW5	
										Ed2017
28	Cyanide(as CN)	mg/l	0.05	No Relaxation	<0.1	<0.1	<0.1	<0.1	<0.1	4500-CN-B,C &E, APHA 23nd Ed2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed2017
30	Mercury(as Hg)	mg/l	0.001	No Relaxation	<0.001	<0.001	<0.001	<0.001	<0.001	3110- B, APHA 23nd Ed.2017
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	<0.02	<0.02	<0.02	<0.02	3110- B, APHA 23nd Ed.2017
32	Residual Free Chlorine	mg/l	0.2	1	<0.2	<0.2	<0.2	<0.2	<0.2	4500-Cl-B, APHA 23nd Ed2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	No Relaxation	No Relaxation	No Relaxation	No Relaxation	3110- B, APHA 23nd Ed.2017
34	Polynuclear Aromatic Hydro Carbons	mg/l	<0.0001	0.0001	No Relaxation	No Relaxation	No Relaxation	No Relaxation	No Relaxation	APHA 6440,23nd Ed.2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	No Relaxation	No Relaxation	No Relaxation	No Relaxation	APHA 6430,23nd Ed.2017
36	Total Coliform	MPN/100 ml	Shall not be detectable in any 100 ml of sample		<1	<1	<1	<1	<1	IS : 1622-1981
37	E. Coli	E.coli/100ml	Shall not be detectable in any 100 ml of sample		Absent	Absent	Absent	Absent	Absent	IS : 1622-1981

Source: primary Survey by Consultant

Table 5-13: Ground Water Sampling 2

S. No.	Parameters	Unit	Limit (IS-10500:2012)		LS-1A	Chetla PS	Proposed Police Telecom Dept	Proposed Golf Green	Near Proposed Kavi Nazrul Metro Station	Test method
			Desirable Limit	Permissible Limit						
1	Color	Hazen	5	15	<5	<5	<5	<5	<5	IS: 3025(Pt-4)
2	Odor	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-8)
4	Turbidity	NTU	1	5	<1	<1	<1	<1	<1	IS 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.41	7.51	7.47	7.61	7.16	IS: 3025(Pt-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	600	168.4	196.2	182.5	185.3	162.8	IS 3025(Part-21)
7	Iron (as Fe)	mg/l	1	No Relaxation	0.51	0.46	0.58	0.61	0.31	3500-Fe- B, APHA 23rd Ed.2017
8	Chlorides (as Cl)	mg/l	250	1000	26.4	31.4	25.8	31.7	36.4	IS 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	0.45	0.51	0.56	0.48	0.61	4500-F-(D), APHA 23 rd Ed2017
10	TDS	mg/l	500	2000	264.8	256.2	264.1	258.4	278.2	IS 3025(Part-16)
11	Calcium(as Ca ²⁺)	mg/l	75	200	28.6	34.6	27.4	37.5	36.8	IS 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	21.4	22.4	17.8	21.4	31.6	3500-Mg B, APHA 23rd Ed2017
13	Sulphate (as SO ₄)	mg/l	200	400	26.3	29.2	34.1	21.4	29.5	IS 3025(Part-24)

S. No.	Parameters	Unit	Limit (IS-10500:2012)		LS-1A	Chetla PS	Proposed Police Telecom Dept	Proposed Golf Green	Near Proposed Kavi Nazrul Metro Station	Test method
			Desirable Limit	Permissible Limit						
14	Nitrate(as NO ₃)	mg/l	45	No Relaxation	14.7	21.4	15.8	15.4	17.5	IS: 3025(Pt -34)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed.2017
16	Alkalinity as CaCO ₃	mg/l	200	600	184.2	164.2	172.6	182.7	172.8	IS 3025(Part-23)
17	Aluminum (as Al)	mg/l	0.03	0.2	<0.01	<0.01	<0.01	<0.01	<0.01	IS 3025(Part-55)
18	Total Arsenic(as As)	mg/l	0.01	No Relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	<0.05	<0.05	<0.05	<0.05	3110- B, APHA 23nd Ed2017
20	Manganese (as Mn)	mg/l	0.1	0.3	<0.01	<0.01	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed2017
21	Zinc (as Zn)	mg/l	5	15	0.52	0.56	0.54	0.54	0.53	3110- B, APHA 23nd Ed2017
22	Ammonia (as NH ₃ -N)	mg/l	0.5	No Relaxation	<0.1	<0.1	<0.1	<0.1	<0.1	4500-NH ₃ -B &C, APHA 23 rd ED2017
23	Anionic Detergents (as MBAS)	mg/l	0.2	1	<0.1	<0.1	<0.1	<0.1	<0.1	Annexure K of IS-13428.
24	Boron(as B)	mg/l	0.5	1	0.21	0.17	0.18	0.18	0.11	IS: 3025(Pt -57)
25	Mineral Oil	mg/l	0.5	No Relaxation	<0.1	<0.1	<0.1	<0.1	<0.1	IS 3025(Pa

S. No.	Parameters	Unit	Limit (IS-10500:2012)		LS-1A	Chetla PS	Proposed Police Telecom Dept	Proposed Golf Green	Near Proposed Kavi Nazrul Metro Station	Test method
			Desirable Limit	Permissible Limit						
				n						rt-39)
26	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	IS 3025(Part-44)
27	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.002	<0.002	<0.002	<0.002	<0.002	3110- B, APHA 23nd Ed2017
28	Cyanide(as CN)	mg/l	0.05	No Relaxation	<0.1	<0.1	<0.1	<0.1	<0.1	4500-CN-B,C &E, APHA 23nd Ed2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed2017
30	Mercury(as Hg)	mg/l	0.001	No Relaxation	<0.001	<0.001	<0.001	<0.001	<0.001	3110- B, APHA 23nd Ed.2017
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	<0.02	<0.02	<0.02	<0.02	3110- B, APHA 23nd Ed.2017
32	Residual Free Chlorine	mg/l	0.2	1	<0.2	<0.2	<0.2	<0.2	<0.2	4500-Cl-B, APHA 23nd Ed2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	No Relaxation	No Relaxation	No Relaxation	No Relaxation	3110- B, APHA 23nd Ed.2017
34	Polynuclear Aromatic Hydro Carbons	mg/l	<0.0001	0.0001	No Relaxation	No Relaxation	No Relaxation	No Relaxation	No Relaxation	APHA 6440,23nd Ed.2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	No Relaxation	No Relaxation	No Relaxation	No Relaxation	APHA 6430,23nd Ed.2017
36	Total Coli	MPN/100	Shall not be		<1	<1	<1	<1	<1	IS :

S. No.	Parameters	Unit	Limit (IS-10500:2012)		LS-1A	Chetla PS	Proposed Police Telecom Dept	Proposed Golf Green	Near Proposed Kavi Nazrul Metro Station	Test method
			Desirable Limit	Permissible Limit						
	form	ml	detectable in any 100 ml of sample							1622-1981
37	E. Coli	E.coli/100ml	Shall not be detectable in any 100 ml of sample		Absent	Absent	Absent	Absent	Absent	IS : 1622-1981

Source: Primary Survey by consultant

5.1.8 Biological environment

Project region Kolkata falls under geographical zone of 8b- Coast east coast of lower Gangetic plain. The District has 0.5% forest cover with respect to its total geographic area. Though the district of Kolkata has no recorded forest area (Table 13), it is home 260 numbers of floral species and 1724 (Insects: 280, Spider: 100, Mollusca: 80, Amphibia: 09, Reptilia: 16, Bird: 130, Mammal: 45) numbers of fauna species.

East Kolkata Wetlands: The Ramsar Site of West Bengal- Out of 38 Ramsar Sites in India, 2 numbers of wetlands has been designated as Ramsar sites in West Bengal, viz. East Kolkata Wetlands and Sundarban wetland. The East Kolkata Wetlands is a natural or near natural wetland which was previously known as the saltwater lakes at the eastern fringes of Kolkata. The East Kolkata Wetlands (22° 25' to 22° 40' North Latitude and 88° 20' to 88° 35'E Longitude) is popular for its waste recycling properties. During 1945, the total area of the wetlands of

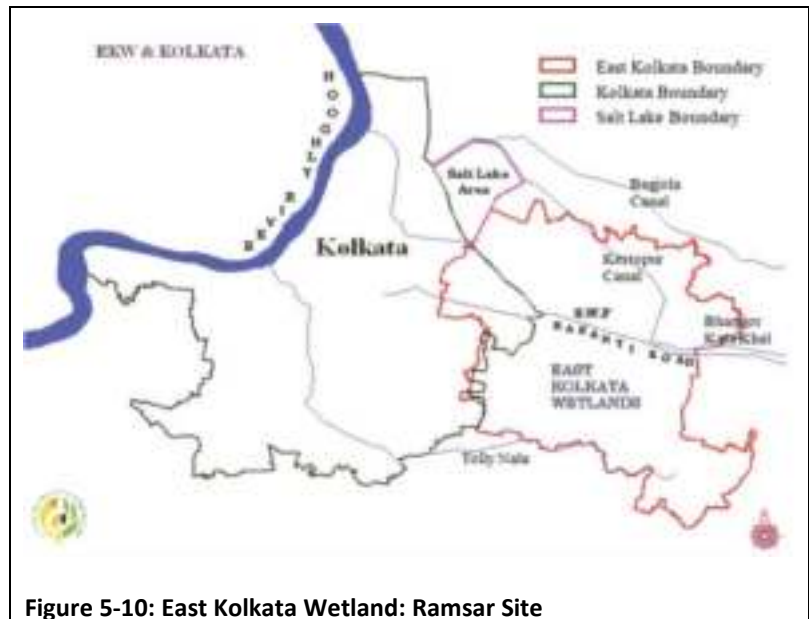


Figure 5-10: East Kolkata Wetland: Ramsar Site

the eastern part of Kolkata was about 8097 ha out of which about 4684 ha has been converted for fish farming with city sewage. Expansion of the city and lack of regulatory control has resulted in the shrinking of these wetlands and the present area of the conservation boundary is about 3905 ha⁸. As per various

⁸ SOE 2020

literatures East Kolkata Wetland plays pivotal role in ecological balance of the Kolkata area by following major ways:

- sewage treatment of 900 MLD wastewater,
- providing fish to the platter of Kolkatans by providing fish in the range of 22000 MT per year in this era of dwindling fish reserve nutrient recovery,
- waste disposal and garbage fed agriculture (150 MT vegetable and 16000 MT paddy per year),
- acting as a carbon sink and keeping the net GHG emission from Kolkata at a lower level,
- reducing urban heat island effect,
- providing livelihood to 50000 people,
- drainage,
- harvesting rainwater in its vast water bodies and recharging the groundwater,
- creating diverse habitats for a wide range of plant and animal species to survive.

As per Biodiversity profile presented by BSI, East Kolkata Wetland region comprises of about 22 species of Ciliates, 42 species of Amoebae, 37 Rotifers, 36 Nematelminths or roundworms, 50 mites species, 32 spiders, 25 species of water flea, 24 varieties of crabs and shrimps, about 55 wingless insects from group Apterygota, 27 dragonflies and damselflies, 92 grasshoppers and crickets, 45 terrestrial bugs, 32 aquatic and semi-aquatic bugs, 50 species of ants, 77 beetles, 75 butterflies, 64 true flies and moths being predominant with highest number of 205 species. In addition, there are 79 varieties of fishes, 22 molluscs, 39 amphibians and reptiles, 87 species of avifauna and 13 mammals. Apart from that East Kolkata Wetland has immense diversity of Flora and Fauna, aves and act as ecological Niche in the region.

East Kolkata Wetland site is located 9 km east wards side from the Tolly's Nullah area. With view of this, it is very significant to improve the Tolly Nallah water quality by commissioning the S&D and STP scheme project to reduce the biological pollution load in the nearby area and subsequently improve the water quality and aquatic biota of the region.

The sub project locations at Tolly's Nullah under flat alluvial Gangetic plain and likewise the major forest type of the region is tropical moist deciduous forest. Within 10 km radius of the project site no protected National Park, Wild Life Sanctuary has been identified. East Kolkata Wet land (Sundarbans) has been identified at 63 km from project site in the direction of South East (refer Figure 5-14)

With respect to project area, the land proposed for the STP& MPS are not falling under forest notified (PF/ RF / Social Forestry Zone). The land use of chosen project site is open land having shrubs and grass grown over the site. The land identified for STPs are government owned land, intra departmental transfer process of land with KMC is under process. As per site investigation and interaction, few trees have been observed in the boundary of the proposed, as per KMC, it is perceived that boundary trees shall be preserved as periphery green buffet of the proposed STPs. Removal of local grass and weeds shall be done at proposed project sites during clearance and grubbing work. No major tree cutting has been envisaged, however in case of felling of trees which are unavoidable to maintain in the landscaping, the necessary approval from Municipal Corporation, Kolkata. During Construction stage, trees located at boundary of the land shall be considered under buffer and landscaping of STP. Effort shall be taken by the Contractor to avoid the

disturbance to flora and Fauna of the region. Trees and shrubs reported on the site are Kikar, *Acacia sp.*, *Lantana camara*, *Ageratum conyzoides*, *Mikania micrantha*, *Cynodon dactylon*, *Ricinus communis*, *Blumea lacera* herb, *Calotropis*, *Chromolarna odorata* etc

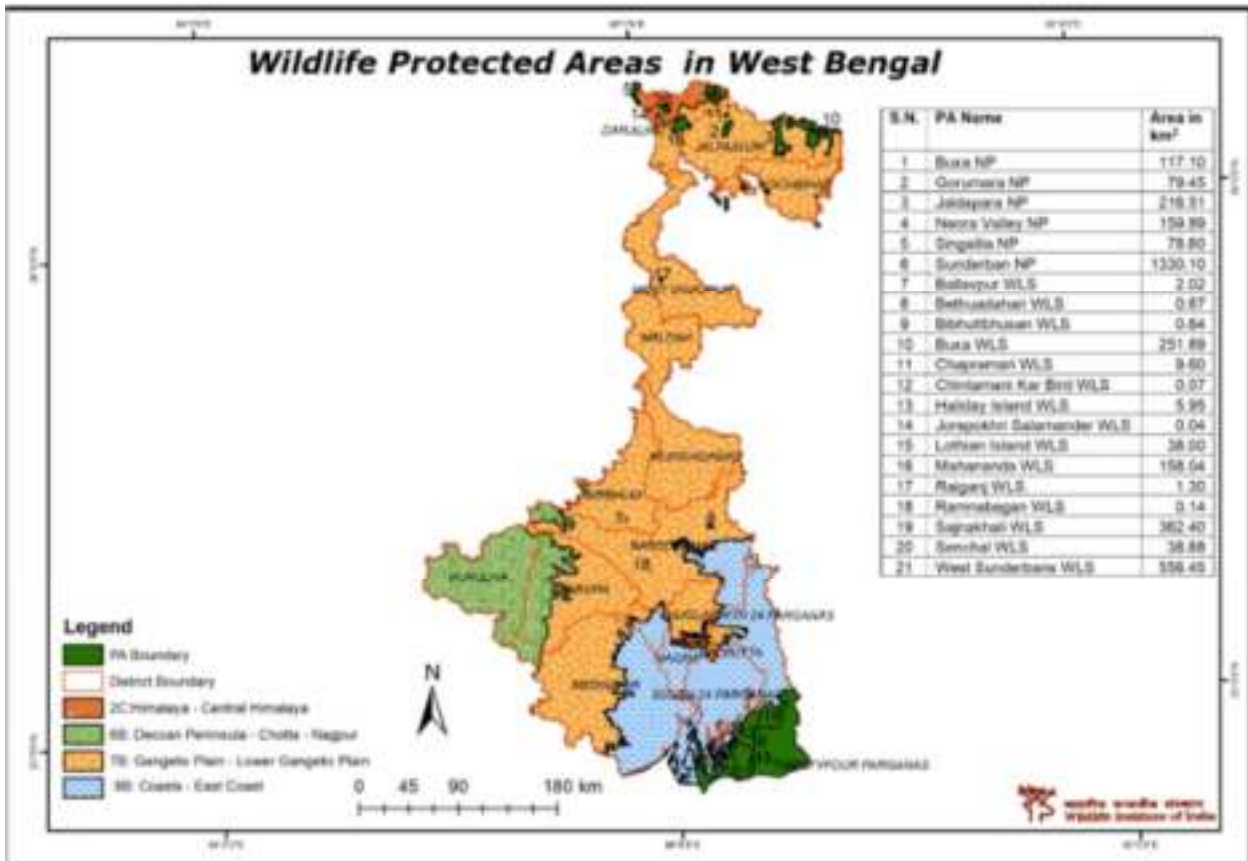


Figure 5-11: common weed at STP 1



Figure 5-12: Mango & Palm tree at periphery of the proposed STP 2



Figure 5-13: Cannabis sativa Shrubs at STP 3 near Golf Green

View of the project site

Major Forest type of the region is mainly tropical moist Deciduous mixed forest. Predominant flora near the project region & district are *Schimawallichii*, *Acacia farnesiana*, *Chromolaena odorata*, *Shorea robusta*, *Madhuca latifolia*, *Madhuca indica*, *Terminalia tomentosa*, *Zizyphus jujube*, *Mangifera indica*, *Azadirachta indica*, *Cassia siamea*, *Artocarpus integrifolia*, *Acacia sp.*, *Cassia sp.*, *Siris*, *Sissoo sp.*, *Chitwan*, *Chilbil*,

Gulmohar, Bamboo, Eucalyptus, Peepal, Banyan tree etc. and shrubs are *Lantana camara*, *Imperata cylindrica*, *Madar*, *Ricinus*, *Cynodon dactylon Pers.* etc.

In terms of fauna, due to having mixed land use, only domestic animals like cow, buffalo, dog, cat, pigs etc. observed. No endangered, vulnerable & schedule –I species as per Wild Life Protection Act has been reported. Amongst Avifauna, few species of birds like crow, sparrow, myna, etc. were noticed. These are of Least Concern and fall within Schedule-IV as per the WLPA-1972⁹. During construction stage under the proposed project sensitization among worker and contractor shall be required to not to disturb any flora and fauna unnecessarily to the project. **(Refer 6 EMP)**

Pollution load from both industrial and sewage affects the aquatic biota of the river. As per secondary information and local consultation, common fish species of the river are *Labeo rohita*, Grass Carp, common carp, *Rita rita*, *Wollago attu*, *Catla catla*, *Puntius sarana*, *Labeo catla*, *Carassius auratus*, *Clarias magur* etc.

Major Avian species of the region are *Ceryle rudis*, *Megalaima lineata*, *Coracias benghalensis*, *Motacilla cinerea*, Common Myna, Greylag Goose (*Anser anser*) , Common Teal (*Anas crecca*) etc.

⁹WLPA- Wildlife (Protection) Act, 1972.

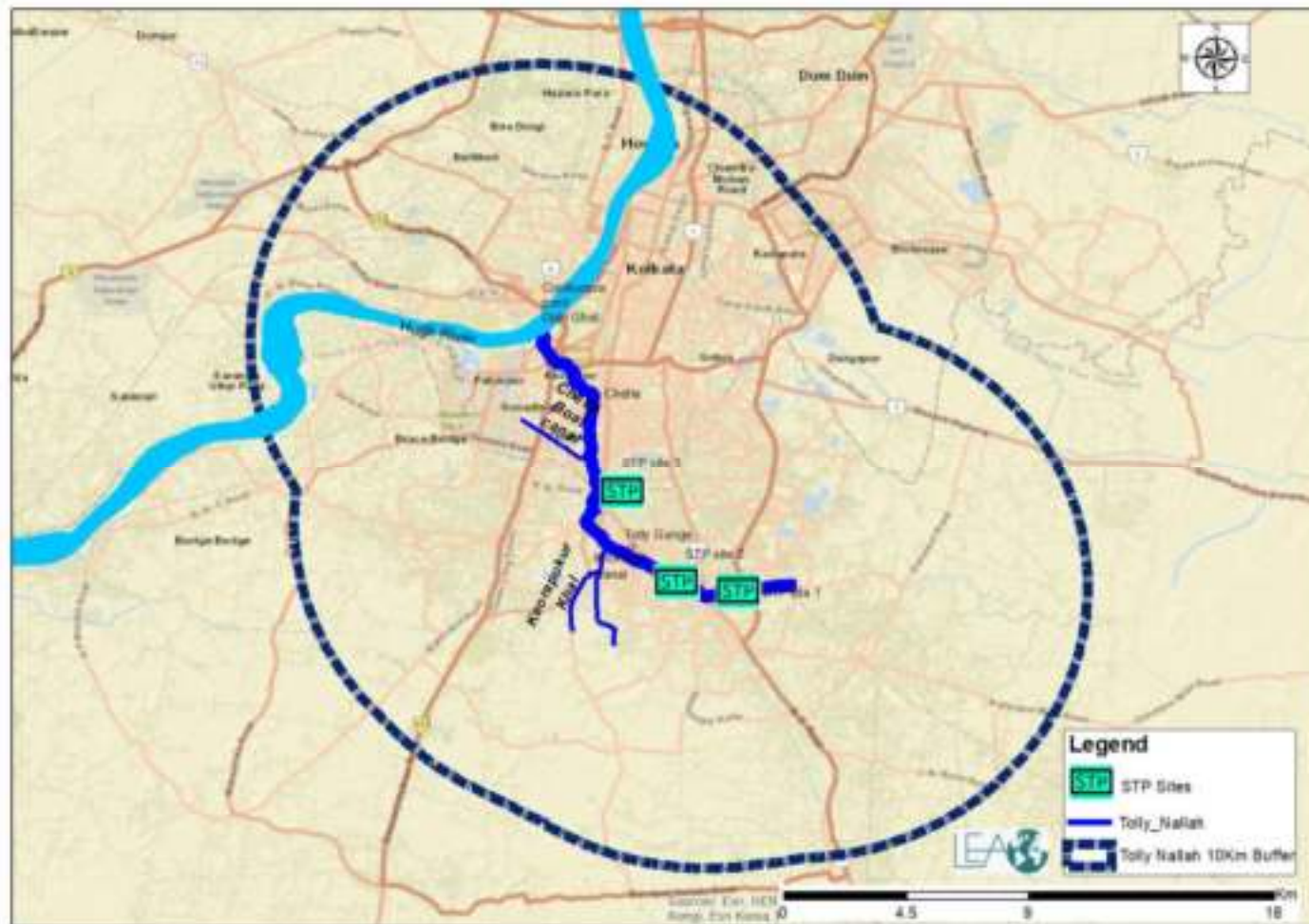


Figure 5-14: 10 km buffer to Project site STPs at Tolly's Nullah Catchment region

5.1.9 Land use profile of the sub project locations

Kolkata Municipal Corporation (KMC) area has a natural system of drainage and is governed by the physiographic profile. **The major land use in the region is built up and there is no significant forest cover.** The soil of the area is loam to silty loam. Predominant land uses of the sub project area are majorly built up and open land. In order to tap wastewater from the households in the Tolly's Nullah catchment region, 3 new STPs, 5 mini underground pumping stations and 7 new additional pumping stations have been proposed along with renovation of existing 11 pumping stations. Interception and diversion work will be almost planned along the available ROW of the existing road/streets, which may have some social impact in terms of disturbance during construction activities. Therefore necessary environmental and social mitigation measures shall be required to be implemented by Contractor during construction work. Each sub project location wise predominant land use is presented in **Table 5-12** below:

Table 5-12: Land Use profile of sub project location

Plot No.	Area	Classification	Ownership
Bansdroni STP and pumping station site			
341	2.23 Acre	Sali (vacant dry land)	Earlier Irrigation & Waterways Department, now transferred to KMC
343	0.19 Acre	Doba (water body / marshy land)	Refugee Rehabilitation Department, Govt. of West Bengal
346	0.43 Acre	Sali (vacant dry land)	Refugee Rehabilitation Department, Govt. of West Bengal
Total available land	2.85 Acres		
Briji road STP and pumping station site			
763 (P), 766 (P), 770 (P), 771(P) & 772(P)	0.7228 Acres	BPAD Township at U block under ward no.110; vacant dry land with bushes and shrubs	Earlier KMDA, now transferred to KMC during December 2019
Golf Green, Sukhapukur STP			
Premises no. 3 (Por), Russa Road south	0.8 Acres (3190.38m²)	Kolkata Improvement Trust Scheme No. 118; low marshy land	Earlier KMDA, now transferred to KMC during July 2017
Mini pumping station at Patuapara, Bhowanipore			
15 A, 17 A	0.014 Acre 11 m X 5.3 m, i.e., 58.3 m²	Illegal colonization	KMC land

As per Information reported from DPR- Tolly's Nullah's KMC

Few Highlights on STP Land

- The newly identified land close to Bansdroni lifting station is open government land belonging to department of Refugee habilitation and Irrigation department. Interdepartmental process of land transfer is underway with KMC.
- Due to vulnerability of flood in in the KMC, the selected land will need proper filling before construction of STP. During monsoon season, water logging is very common in the city, therefore precautionary measure will be required.

- HFL level of River Hooghly will be taken into consideration and similarly cost of flood protection measures will be incorporated in the total project cost. No such cost has been observed in the DPR.
- Since the STP sites are closely located in the habitat area therefore, noise odour control measure such as thick green belt around all the STPs should be mandatory.
- The technologies such MBBR and SBR might be more suitable in the dense region unlike typical waste treatment methods. During BID these consideration should be included.

MPS: The augmentation of existing pumping station has been proposed for 17 LS, while construction of one MPS is envisaged within STP proposed at Navi, therefore no land acquisition & R&R impact has been anticipated.

Sewerage Networking: The rehabilitation, desilting work of existing trunk sewer line has been proposed, additional to this the I&D structure near to LS and connecting STPs has also been proposed. The minor impact due to disturbance to the local public, encroacher has been anticipated during desilting work of trunk sewer line specially closed to the Tolly's Nullah's region. During construction stage, the contractor is suggested to take necessary precautionary measures such as barricading, sensitization to local public and working during lean traffic time, finishing the open trench within day itself and reclaiming the road stretch immediately etc. apart from other safe practices to be adopted as per EMP of BID.

5.1.10 Archaeological Sites

In project region Tolly's Nullah under Kolkata Municipal Corporation, 5 ASI protected Archaeological site/ Monuments (Metcalf hall, St. John Church, Currency building, Maghen David Synagouge, Bethe-el-Synagouge etc.) has been identified, this is located 5-10 km far from the STPs site. However during construction phase, Contractor shall ensure the adequate safety and security along the S&D work. No Temple, school are impacted under the project. Due consideration shall be taken by contractor to provide safety and avoid inconvenience for the common properties of the area such as School, temple, Mosque etc. Adequate EMP implication should be followed by Contractor as per EMP. During desilting work of trunk sewer it is suggested for the contractor to take precautionary safety measure specially where the area is closed to Ghats side of the Tolly's Nullah (Adi-Ganga River).

5.2 SOCIAL PROFILE

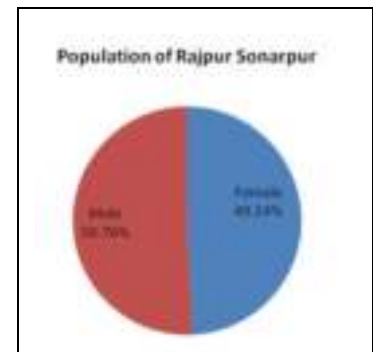
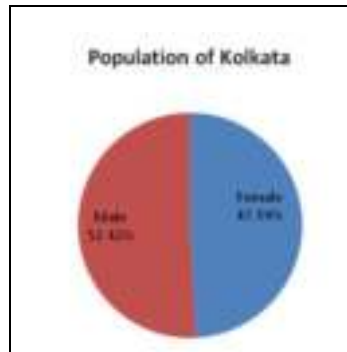
5.2.1 Socio-cultural environment:

Kolkata is the most important cultural centre of India. The city is the birthplace of modern Indian literary and artistic thought and of Indian nationalism, and its citizens have made great efforts to preserve Indian culture and civilization. The blending of Eastern and Western cultural influences over the centuries has stimulated the creation of numerous and diverse organizations that contribute to Kolkata's cultural life. In addition to the universities, the city has Asiatic Society of Bengal, the Bengal Literary Society (Bangiya Sahitya Parishad), the Ramakrishna Mission Institute of Culture, the Academy of Fine Arts, the Birla Academy of Art and Culture, and the Maha Bodhi Society. The gateway to eastern India is famous for its food. Bengali cuisine has evolved over time, but Kolkata still remains an ideal place to experience the cuisine characterized in part by mustard oil and fish.

5.2.2 Population:

Kolkata has total population of 4,496,694 as per the Census 2011.

Out of which 2,356,766 (52.42%) are males and 2,139,928 (47.59%) are females. Whereas total population of Rajpur Sonarpur is 424,368 of which 215,405 (50.76%) are male and 208,963 (49.24%) are Female (As per 2011 Census).



Population of Children with age group of 0-6 in the city of Kolkata is 339,323 which is 7.55 % of total population of Kolkata (M Corp) whereas for Rajpur Sonarpur city the population of age group 0-6 is 35,274 which is 8.31 % of total population. The percentage of population of 0-6 age group in Rajpur Sonarpur city is greater than Kolkata (M Corp).

5.2.3 Schedule Caste and Schedule Tribe Population:

Analysis of social groups for the project area has also been done on the basis of concentration of Schedule Caste (SC) and Schedule Tribe (ST) population in project city. As per census 2011, the scheduled caste (SC) population of Kolkata is 241,932 (5.4%) and the scheduled tribe (ST) population is only 10,684 (0.2%). And in Rajpur Sonarpur city 7865 numbers of total SC population and 1143 numbers of total scheduled tribe (ST) population lives.

5.2.4 Sex Ratio and Literacy rate:

Project city of Kolkata revealed the sex ratio of 908 females per every thousand males. And for Rajpur Sonarpur it is 970 per thousand male persons which is greater than Kolkata. Also as per Census 2011, the Child Sex Ratio of Kolkata is 933 which are greater than Average Sex Ratio (908) of Kolkata Block. In Rajpur Sonarpur Child sex ratio is 945 per 1000 male child under the age of six.

As per 2011 census, the total number of literates in Kolkata was 3,588,137 which constituted 86.31% of the population with male literacy of 88.34% and female literacy of 84.06%. Average literacy rate of Rajpur Sonarpur city is 90.14% of which male and female literacy was 93.23% and 86.96%.

5.2.5 Occupational Structure:

In Kolkata district out of total population 1,795,740 were engaged in work activities. 87.8% of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 12.2% were involved in Marginal activity providing livelihood for less than 6 months. Of 1,795,740 workers engaged in Main Work, 7,413 were cultivators (owner or co-owner) while 8,903 were Agricultural laborers. Whereas out of total population of Rajpur Sonarpur, 166,329 are engaged in working force among which 126,603 are males while 39,726 are females. Total main workers are 136,118 out of which male main workers are 110,661 and female main workers are 25,057. Total marginal workers of Rajpur Sonarpur are 30,211.

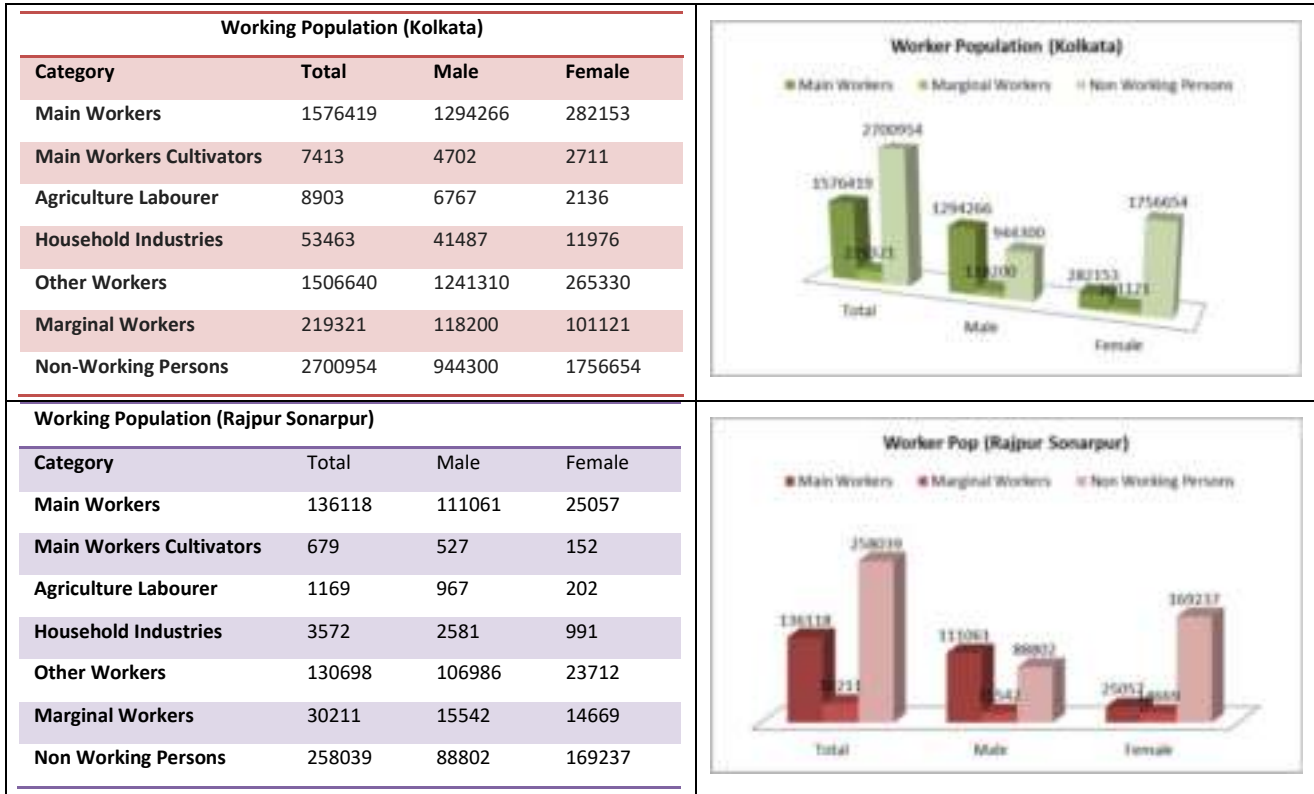


Figure 5-15: Worker Profile of project Municipal region

5.2.6 Slum Population

Total number of slums households in West Bengal is 1.4 million which is 21.9 % of total urban households in the state. According to Census 2011, slum dwellers account for one-third of the total population of Kolkata. There are 2011 registered & 3500 unregistered slums in Kolkata. Total no. of slums in Kolkata city numbers 300,755 in which population of 1,409,721 resides. This is around 31.35% of total population of Kolkata city. Total no. of Slums in Rajpur Sonarpur city numbers 6,997 in which population of 29,573 resides. This is around 6.97% of total population of Rajpur Sonarpur city. Kolkata MC ranks 9th and Rajpur Sonarpur city ranks 36th in percentage of slum population of all the ULBs (Urban local bodies) within KMA (Kolkata metropolitan area).

Impact on Social Profile:

The project areas have been surveyed and the locations selected for development of the entire Tolly Nullah rejuvenation project under Kolkata region are not inhabited by any resident or slum dweller except few squatters along **Madan Pal Lane at the site of penstock gate no.5 (developed by KMWSA during GAP phase II) under the proposed Sashi Sekhar Bose Row drainage pumping station.**

For the fulfilment of the implementation of the proposed project, about eight (8) nos. of families who are presently found to be residing in the above mentioned location surrounding the structure of existing penstock gate at Madan Pal Lane in ward no. 73 are envisaged to be shifted to a proposed nearby rehabilitation location at Sashi Sekhar Bose Row in the campus of the existing drainage pumping station in the same ward without hampering/compromising their livelihood. The project in this regard is planned to consider under 'Affordable Housing Schemes'. Please refer below for the visit pictures of the displacement site.





6 PUBLIC CONSULTATION



Consultations were carried out with the officials of various departments (KMC & KMDA), stakeholders and Executive Agencies. The details of the consultation and issues discussed have been summarized in the table below (Table 6.1).





As per discussion with Officials of KMC, it is perceived that people has showed willingness about the project and expressed their acceptance about the improved sanitation of the city.

Based on the site visits and consultations with the stakeholders, the proposed project is expected to benefit the people residing near Tolly Nullah region, as the wastewater that currently flows untreated into the Hooghly River, will be captured, treated and the remainder of the treated effluent will be discharged into the river.

Table 6-1: Consultation held during ESAMP preparation

#	Date of Consultation	Location	Name of the Officials/Person met	No. of Participants	Discussion Outcomes	Photos
1	16.03. 22 and 9.6.2022	KMDA, Pumping Stations and STPs	<ul style="list-style-type: none"> Shri Parthajoy Bhattacharya, Environment Specialist, WBSPMG Shri Manab Deb, Assistant Engineer KMDA Shri Trishanu Raha, Communication & Public Outreach Coordinator, WBSPM Gravankar Ray, Executive Engineer, Tolly's Nullah Project, KMC Shri Indranil Acharya, Sub Assistant Engineer, Tolly's Nullah Project, KMC 	4	<ul style="list-style-type: none"> Project progress along with the method for selection of location for pumping station and STP was discussed. Initiatives taken to mitigate the environmental and social challenges were also discussed. KMDA assured that the ESAMP will be a part of the bid document for appropriate implementation of E&S safeguards. Communication and outreach campaign is very important due to the densely populated area where the project activity proposes to happen. 	 

#	Date of Consultation	Location	Name of the Officials/Person met	No. of Participants	Discussion Outcomes	Photos
2	17.03.22 and 10.6.22 17.03.22	Dahi Ghat (Confluence point of Tolly Nala with Hooghly River), and STPs, KMDA	<ul style="list-style-type: none"> • Shri Soumitra Bhattacharya, Director General, Tolly's Nullah Project, KMC • Shri Parthajoy Bhattacharya- Environment Specialist, WBSPMG • Shri Frazul Haque, Executive Engineer, Tolly's Nullah Project, KMC • Shri Pravankar Ray, Executive Engineer, Tolly's Nullah Project, KMC • Shri Indranil Acharya, Sub Assistant Engineer, Tolly's Nullah Project, KMC 	12	<ul style="list-style-type: none"> • Aspects of project were disclosed by KMC. • Likely Environmental and social impact due to the construction of STP (Environmental and Social Assessment & Management Plan for Pollution Abatement of Tolly's Nullah) was discussed with KMDA. • The Chief Engineer intimated that the people residing on the banks of Tolly nullah can be temporarily impacted due to construction activities related to sewage outfall, laying of sewer lines and construction of inter-sections. <ul style="list-style-type: none"> (i) The pipeline laying activities in the nullah will temporarily impact the people residing there. (ii) The vehicles which will access construction sites, dumping and storage of construction debris and silt are likely to create disruptions to local communities. (iii) Stacking of silt from nullah and odour may also create discomfort to local community. • All the project facilities [(i) 3 STPs, (ii) 16 existing pump houses, (iii) LS & O&M of 2 existing LS] are proposed within Government land. • Recently for one of the STPs site (Police Telecom) an alternate land has been suggested in Bansdroni under Refugee, Relief & Rehabilitation Department, Kolkata. The land transfer process is under progress. • Ownerships and land use of propose land for STP has been discussed. 	 

#	Date of Consultation	Location	Name of the Officials/Person met	No. of Participants	Discussion Outcomes	Photos
3	17.03.22 and 9.06.22	Local Communities	Community people		<ul style="list-style-type: none"> The various components of the proposed project with respect to the environmental and social aspects were discussed. During the consultation, community claimed that they are residing for years together on the banks of Tolly nullah. They informed that they were already impacted by metro line construction. These people are engaged in daily wage activities. The nullah is filled with solid waste and untreated sewage being disposed in it. The nullah is used for dumping of garbage and sewage water. The stagnant flow is becoming the birthplace of mosquitoes and other harmful insects. Hence, the people have welcomed the project in terms of cleaning the nullah. 	 
4	06.10.22 & 09.10.22	Proposed STP sites at Bansdroni, Briji Road and few pumping stations; Also visited Keorapukur existing STP site	<ul style="list-style-type: none"> Shri Debojit Mondol, Deputy Chief Engineer, Electrical, KMC Shri Frazul Haque, EE, Tolly Nullah Project, KMC Shri Pravankar Ray, EE, Tolly Nullah Project, KMC Shri Shekhar Das, EE (Electrical), KMC Shri Shibaji Chatterjee, AE (Civil), KMC 	7-8 local residents	<ul style="list-style-type: none"> KMC officials showed new proposed Bansdroni STP site which is under Refugee, Relief & Rehabilitation Department, Kolkata. The land transfer process is under progress. At Bansdroni location, the selected land for STP is marshy and presently used for dumping of waste. However, there is a playground in front of the marshy land, which according to the local residents (a local boy's club named Saroj Sangha club) cannot be obstructed by constructing STP. Though as per the KMC officials, some part of it has to be developed into last mile connecting road. They would sort out any interruption with the help of local councillor. 	  
5	09.10.22	Proposed pumping station site at Madan Pal Lane	<ul style="list-style-type: none"> Squatters at Madan Pal Lane, Bhowanipore Shri Uttam Kumar, ward no. 73 councilor 	20-22	<ul style="list-style-type: none"> About 11 families live around the penstock gate no. 5, out of which 8 families are estimated to be displaced. They are satisfied with the rehabilitation scheme facilitated by Government of West Bengal. 	 

7 ANTICIPATED IMPACTS & MITIGATION MEASURES

The process of environmental and social Impact Assessment was accomplished through the review of available documents viz. Detailed Project Reports (DPR), literatures available related project site, site selections etc. Detailed Site visits and field surveys were carried out engaging key experts. The expert during visit interacted with key stakeholders and consultations with host communities.

The finding of site was used to identify and assess the anticipated environmental and social impacts associated with the proposed project as well as helps to develop an Environmental and Social Management Action Plan (ESMAP) with recommended suitable mitigation measures.

An Impact Evaluation Matrix representing without and with implementation of EMP and also subcomponents impacts are discussed in Table 7-4.

7.1 Potential Environmental Impacts and mitigations measures

The proposed S&D, Lift Station, De-silting, Restoration of existing Lift Station and construction of new 3 STPs at Tolly's Nullah would involve Environment and Social issues in three distinct phases:

- ▶ During Designing Stage
- ▶ During the construction phase which would be temporary and short term;
- ▶ During the operation phase which would have long term effects

7.1.1 Design Stage Impacts

All STP, LS & S&D provisions must be designed considering the future population and waste generation rate. Otherwise, the constructed sewer may not carry the waste load, leading to failure and financial loss. The alignment of sewer lines and sewerage pumping stations must be properly planned; else it may lead to both technical and social problems along with environmental issues of backflow creating foul smell and unhygienic conditions.

Seeing the tidal risk in the project catchment region, due consideration for HFL level of river should be considered for all 3 STPs S&D works and Lift Station location. Corresponding filling of earth, high surface level and accordingly cost should be included in the design cost of the project. HFL level of River should be taken into consideration and similarly cost of flood protection measure need to be incorporated in the total project cost. No such cost has been observed in the DPR.

As per the data furnished by Kolkata Municipal Corporation, the HFL of Adi Ganga at Garia is 3.553 m, whereas the DBL at the same point is 1.529 m. Furthermore, contractor will verify the HFL data and sectional drawing of structures with HFL and finished ground level will be submitted in C-ESA report.

Apart from that, owing to encroachment along the nalla, the desilting work of trunk sewer line should be done with prior notice to local public about the project work. Though the desilting work is temporary in nature and construction, time bound.

Addition to this a temporary sludge disposal/ collection site should be demarcated in all STPs and LS. This can be further utilized as per Sludge Management Plan. Since the STP sites are closely located in the

habitat area therefore, noise odour control measure such as thick green belt around the all STPs should be mandatory. The technologies such MBBR and SBR might be more suitable in the dense region unlike typical waste treatment methods. During BID these consideration should be included.

7.1.2 Construction Stage Impacts

The construction activities would generally include earthworks (site clearing and levelling, excavation, foundation, filling, shuttering, compacting), civil construction (Transportation of construction material, equipment etc.,) and E & M installation and commissioning. The impacts of these construction stage activities on the various environmental and social parameters are examined below:

7.1.3 Physical Environment

Air Quality

Based on the field observation and interaction/consultation with stakeholders, it is expected that the levels of dust (PM10 and PM2.5), carbon monoxide (CO), hydrocarbons and NOx (NO & NO₂) is likely to increase during the construction phase mainly because of:

- ▶ Excavation, backfilling, compaction activity and movement of vehicles on un-paved roads (increases dust level)
- ▶ Vehicle exhausts from construction machinery, light and heavy vehicles movement for transportation of pipes and construction material like cement etc. (increases NO₂).
- ▶ Use of portable diesel generators and other fuel fired machinery (increases CO).

Further these construction activities cause temporary deterioration of the air quality which would be localized. A high concentration of PM10 and PM2.5 could also be a leading cause for eye, ear, nose and throat infections and related discomfort. Laying of sewer pipes (mainly to connect with the proposed STPs, LS & S&D structure which is about 72 km approximately) temporary impact on air quality will be anticipated. The D.G sets operate to run digging machinery and to break the paved path, would result in increase in fugitive dust. The suspended particulate matter level is already observed higher than permissible limit in the project city, therefore immediate suppression of dust, water sprinkling, green curtains, stockpiles in covered manner etc. should be practiced at construction sites and camps.

At the proposed STP sites, digging of wells below the ground level for erection of Bio Reactor Tanks, Screening chamber, Pumping point etc. would lead to dust generation. These would be mechanical dug using JCB Machine and manually using local labours.

The ground levelling would be carried out to lay the connecting pipes and other operational instruments. The unloading area earmarked for stocking of Bricks, Cements bags, Concrete, sand, etc would generate fine dust.

Fugitive dust generated by vehicles- carrying construction material like sand, cements and bricks and excess excavated materials.

De-siltation of Nalas, restoration of underground existing sewerage line, etc would generate dust.

Mitigations Measures:

- ▶ Seasonal ambient Air Quality monitoring at the active construction site should be carried out with the help of NABL/MoEF&CC approve laboratory.
- ▶ All the vehicles used for transport of construction material and used for construction activities should have Valid PUC certificate, proper maintenance and service as per the requirement.
- ▶ While digging for sewer lane and sewer piping, dust prevention measures like water sprinkling, shade cloth should install to attenuate dust.
- ▶ All the D.G Sets should have appropriate stack height for proper dispersion of gaseous complying with the CPCB norms. The oil used should be lead free and use of low Sulphur diesel.
- ▶ The vehicles carrying construction materials should be properly covered to prevent dust falling from vehicles during plying.
- ▶ At the stocking yard, loading and unload area temporary fence should be provided. All the workers should be provided with Personal Protection Equipment (PPE).
- ▶ Shade Cloth with help of Scaffolds 3 meters high should be installed all along the STP site to prevent the surrounding residential colony from dust generation.
- ▶ The de-silted soil should be removed in the wet conditions. During transportation they should be properly covered. The de-silted soil should not be stalk piled along the roads, they are very fine dust and could severely effect locals.

Noise Levels:

Noise levels near any construction activity rise due to plying of transport vehicles and use of portable generators, mechanical machinery such as cranes, riveting machines, hammering etc. These activities may occur round the clock and the noise pollution thus created may affect human habitations, particularly during the night time. The increase in noise levels may thus be a major concern at the project site, since it is located in the built up area of the city and close to habitation.

The primary impact of noise level would be mainly on workers operating high noise generating machines, if appropriate control measures are not adopted. Schools and educational institutes may suffer temporarily due to the elevated noise levels. Increase of noise level at night may produce disturbances, causing sleeplessness in people in the vicinity of the site in case construction activity is extended into the night hours. However, these impacts are of temporary in nature, lasting only during the construction period.

Mitigation Measures:

- ▶ Green belt development (30% of the total area) to be carried out with in the STP premises
- ▶ None of the sewerage / drainage systems within KMC area have installed power backup facility / DG sets as there is high priority power supply by CESC, which ensures uninterrupted power supply to the emergency utility services within the heart of the city of Kolkata. Therefore noise emissions in such locations are controlled to a certain extent.
- ▶ Only day time work should be allowed (10 A.M to 6.00 P.M)
- ▶ All the instrument used should have lower sound power level
- ▶ Installation of mufflers on engine exhausts and compressor components.
- ▶ Limiting the hours of operation for hammer, Jackhammer to break the RCC road within the colony by using mobile source operating through settlements.

- ▶ Care should be taken that no employee be exposed to a noise level greater than 85 dB(A) for duration of more than 8 hours per day without hearing protection. No worker should be exposed to a peak sound pressure level of more than 140 dB(A) without using ear protective measures.
- ▶ Periodic medical hearing check should be performed on workers exposed to high noise level.
- ▶ The contractor should comply with the World Bank Group Environmental, Health and Safety General EHS Guidelines for Occupational Health and Safety.

7.1.4 Land Environment:

The proposed STP projects will involve approx. 1.8 Ha of government open Land, which is already earmarked by the implementing agency i.e. Kolkata Municipal Corporation (KMC). The process of transfer of land within government department is under process. An alternative land to the land, which was identified for 15.3 MLD STP at Police telecom has been recognized near Bansdrani Government colony at Bansdrani. The area of land is 2.85 acres, some part of which was under Irrigation & Waterways Department, but now transferred to KMC. While some portion is under Refugee, Relief & Rehabilitation Department, Kolkata, for which inter-departmental transfer procedure is underway. Further, the land parcels for Brij Road STP near Shahid Khudiram metro station as well as Golf Green STP are already under the jurisdiction of KMC.

Moreover, the land for pumping stations also belongs to KMC, where already defunct pumps and motors are there. Out of 23, there is only one new pumping station site proposed at Madan Pal Lane, Patuapara, Bhowanipore which requires displacement of 8 families, though they will be better rehabilitated in a planned housing arrangement provided by Government of West Bengal under Banglar Bari scheme. As a result, no private land acquisition is anticipated due to the Tolly nullah project. Laying of sewerage pipeline for a total designed length of 72 km of sewerage network will be carried out within the RoW of the road. Hence no additional land acquisition or resettlement impact is envisaged. At the same time temporary disruption of community life is foreseen which will be mitigated as per the provision of ESMF. A comparison between the land available for all the three STPs and the land required has been tabulated in the below-mentioned Table.

Table 7-1: Details on Land

STP Locations	Capacity of STPs	Area required @600 m ² /MLD ¹⁰	Area available	Remarks
Brij Road STP and Pumping station site	10 MLD	6000 m ² ≈ 1.48 acres	0.7 Acres	Less space available for STP, so STP will be established in 2 tier
Golf Green, Sukhapukur STP	3.5 MLD	2100 m ² ≈ 0.52 acres	0.8 Acres	Sufficient land available
Bansdrani STP and Pumping Station site	11.6 MLD	6960 m ² ≈ 1.72 acres	2.85 Acres (2.23 + 0.19 + 0.43)	2.23 acre plot area will be sufficient for establishing STP and the pumping station, which is a vacant dry land belonging to I&W Deptt.

¹⁰ Compendium of Sewage Treatment Technologies, NRCD-MOEF 2009

It is suggested that for establishing Bansdroni STP, the available land area of 2.23 acres may be explored as the area required for it is approximately 1.72 acres. The land earlier belonged to Irrigation and Waterways Department has now been transferred to KMC.

On the other hand for the proposed 10 MLD STP at Brijji Road, the available land of 0.7 acre is insufficient. A 10 MLD capacity aerobic system STP will require a minimum of 1.48 acres of land for development in single tier. However the concessionaire may opt for 2 tier construction on the same patch of land. For this, they will undergo soil stability, structural stability and other related tests for ensuring good safety practices. An important engineering requirement in such cases is the need to ensure headroom of 4.5 m in between the top of sidewall of the bottom tank and the roof of the upper tank because electrical utilities are involved (Source: https://cpheeo.gov.in/upload/uploadfiles/files/engineering_chapter5.pdf).

Based upon the soil investigation report, if the land is found suitable just for filling then engineering filling work (like mixture of Morrum and other earth material) can be taken up at least 300mm above the HFL. If the soil is found very loose then contractor may need to go for deep foundation or pile foundation works based on the load bearing capacity of the proposed STP/SPS structures.

At present the soil test report for the proposed construction site at Bansdroni has already been conducted by Jadavpur University. The recommendation of the Soil Test report is given below and the report is Annexed (Annexure 15). The detailed design need to consider the requirement of foundation based on such report. Soil test for the proposed Golf Garden (Sukhapukur) STP land will be carried out before detailed designing and recommendations thereof will be followed.

Recommendations of Soil Test Report for the Bansdroni Site (By Civil Engineering Department Jadavpur University):

- ✓ From the subsoil exploration it is observed that sub-soil below the top fill consists of soft / firm silty clay / clayey silt down to a maximum depth of 5.00m below G.L. followed by layer of loose / medium / dense silty sand / silty clay / clayey silt down to termination depth of 25.45m.
- ✓ It is, therefore, suggested to adopt shallow foundations for one to two storied buildings, if required, at the proposed site. Bearing capacity of such foundations of different sizes is given in Table 3 of the report.
- ✓ For the pump house well foundation of diameter 12m x depth 11m may be constructed at the site. Safe bearing of such foundation is given in section 5.2 of the report;
- ✓ Bored Cast-in-situ pile foundation resting at a depth of 20.0m with Cut – Off level 5.00m B.G.L. may be adopted, if required, to take superstructure load. Bearing capacity of such piles recommended to take superstructure load with (Shaft length 15.00m) has been given in Table 4 of the report.
- ✓ Proper care should be taken during sinking to maintain verticality of the well foundation. Further, dewatering should be done to lower the ground water level below the founding level of well during construction of bottom plug and the raft at the base of the well;
- ✓ Adequate precautions during constructions of piles should be taken in order to prevent collapse of the walls of the boreholes. For this bentonite slurry is to be used and proper

schedule of construction should be maintained. Boreholes should be cleaned properly after lowering the reinforcement and before concreting the piles.

- ✓ Pile load tests should be conducted as per IS. Code of practice. Integrity tests should also be done to check the continuity of piles.
- ✓ All stability criteria should be checked as per BIS code of practice.

Mitigation Measures:

- ▶ Out of 1.8 hectare land, about 30% of the land at each three STP should be earmarked for green belt development.
- ▶ The top 15 cm soil will be removed and will be stored within the site at earmarked location and will be properly preserve.
- ▶ This top soil will be spread in the landscape area and tree plantation area
- ▶ To prevent soil, land pollution, all loading and unloading area, storage of hazardous chemicals, identified area used for storage of sludge will be paved.
- ▶ To prevent land pollution due to road tar (hazardous substance), which would be generated when road cutting operation would take place for laying of sewer line. The bitumen should be back filled or disposed of to the designated landfill site.

7.1.5 Water Environment

The natural water bodies/drainage channels of the project area are likely to be affected in the following ways:

- ▶ By wastewater from construction activities – This would mostly contain suspended impurities. Other pollutants, which may find their way to it, are likely to be in insignificant concentrations and may be safely disregarded.
- ▶ Flooding is likely during monsoon as drainage paths could be obstructed by the excessive debris.
- ▶ If adequate arrangements are not made to ensure proper drainage of wastewater from the construction sites, such water may form stagnant pools, which might promote breeding of mosquitoes and create generally unsanitary conditions.
- ▶ Soil erosion may be caused by the exposure of loosen soil to rain and wind during site clearance, earth moving and excavation activity. This may result in sedimentation of surface drainage networks.
- ▶ Due to the diversion of sewer lines during the desilting/rehabilitation/replacement works, to be carried out for the existing sewers.
- ▶ The above wastes are likely to be discharged to the nearby surface drains and would hence temporarily increase the pollution load of the drains/nallas.

Mitigation Measures:

- ▶ All the digging and lying of sewer lane should be planned as per the schedule of monsoon. No sewer work or diversion of sewer land should be done during monsoon season. This would prevent local flooding.
- ▶ To prevent sedimentation of soil, contouring and minimizing length and steepness of slope should be considered.

- ▶ Mulching to stabilize exposed area and lining steep channel and slopes.
- ▶ Silt Trap, bund to be used at active sites closed to Nalla area.
- ▶ No construction work to be done during monsoon season and before onset of monsoon, monsoon preparedness plan to be submitted by the contractor and adhere to implementation of the same.
- ▶ HFL level of River has been taken into consideration while the level of construction, however as per reported from KMC more earth filling shall be done on the demarcated site to avoid flood and inundation.
- ▶ The stockpiles, construction material to be kept at least 50 m far from the water body.
- ▶ The construction camp location should be identified within the site or in consultation with KMDA, the preference should be far from the local water body and nalla area.

7.1.6 Ecological Environment

The project site does not involve any forestland and ecologically sensitive areas. Thus, there will be no significant impact on the ecology of the area. Minimal tree cutting is required within the premises of proposed STP locations; however minimum criteria of plantation will be maintained as per the EHS guidelines. The trees reported on the site are marked at boundary of STP site, that will be taken in green buffer/ landscaping part of the site.

In tree plantation, effort shall be done by the contractor to plant more native trees in buffer and landscaping.

The STP project will improve overall surface water quality of Ganga River by treating all the effluent through major nallas before it is discharge into Ganga River. The improvement in Ganga Water Quality will improve the primary productivity (phytoplankton/ Zooplanktons) thereby improving the fish population in the river.

This improved aquatic ecological system will provide suitable/better feeding and breeding ground for Ganga River fish population. This would help in conservation and would lead to overall improve in Fresh water aquatic ecosystem. Thus, the STP Project will have overall positive impact on river Ecosystem and fish population.

7.1.7 Social Environment

Since the project area is located within the heart of a metropolitan city, it is encircled by many busy locale, squatters, market places, narrow lanes. It is therefore expected that during the construction phase of the project, the local inhabitant may face certain inconveniences in terms of traffic congestion, temporary disorganization of the local vendors etc. To assess the amount of social impact, a technical survey has been conducted by the engineers of the EA to decide upon the length of open cut and trenchless drain line installation so that minimum impact is caused to the local people.

Moreover, the laying of pipelines will be done phase wise, for which suitable length of stretch will be identified to be worked upon and immediately after completion of the work in that stretch, road will be restored. Then further stretch will be taken up for laying of pipeline and subsequently restored. Generally for such congested areas, the contractors use to work during the lean traffic period and avoid peak hours

of traffic. During the detailed design phase, contractor needs to come up with a detailed traffic diversion plan and suitable construction plan at such locations which need to be included in the C-ESIA so that the impact is minimized and immediately restored. Necessary EHS measurements will also be taken up with hard barricading. The project pipeline, desilting works are planned over existing pipeline and maintenance of the same. The construction specific management measures, such as effectively scheduling the network job, fencing around the site, community health etc. shall be undertaken during implementation of the project with the help of construction specific EMP.

In addition, contractor has to provide a detailed traffic management plan, other safety precautions, barricading etc. while conducting the open cut works. However, during the detailed design phase, there are possibilities of reduction of open cut and increase in trenchless methods. Such detailed design, traffic diversion and other safety measures will be included in the C-ESIA to be prepared by contractor. Each of the STP sites and SPS are required to follow necessary OSH guidelines. Also it is suggested to have separate safety officers at each of such sites.

In addition, during the detailed design stage, KMC needs to engage an NGO to make the detailed survey for assessing actual number of affected families to whom necessary compensations need to be awarded.

7.1.8 Management and Disposal of Excavated Material during construction

The proposed project will have lot of construction involved and as such if the management and disposal of excavated material is not properly done, it will impose a problem to local people and residents. This would be a temporary impact but a mitigation measure for this has been suggested. Digging and backfilling of trench for laying sewer lines may render topsoil losing. Soils of the construction area may be contaminated by wastewater. This contamination may be due to:

- ▶ Alteration of chemical make-up of the soils, increased acidity/alkalinity
- ▶ Pressure of pathogens and other organic material in the excavated material

These impacts will be minor and limited to the construction phase only. No major impact on soil quality is anticipated.

Occupational Health and Safety

During construction stage, sewer cleaning desilting work, pipeline work and renovation work of existing MPS/ LS and construction of new establishment of STP, excavation etc., construction specific occupational health and safety impact is anticipated on the worker and staff under the project. During construction stage, contractor should follow specific Standard Operating Procedures (SOP) for safeguard the occupation health and safety of worker and staff. Key risk hazard during construction & operation phases would be

- ▶ Mechanical hazards (trips/falls/tight workspace etc.)
- ▶ Asphyxiation hazards (suffocation, loss of senses, fainting spells etc.)
- ▶ Exposure to microbial/biological hazards, rodents/snakes
- ▶ Personal hygiene hazards (skin, eyes, clothes, sanitation etc.)

- ▶ Aggressive environmental conditions (high temperature/humidity, foul odour etc.)

The following broad management measure to safeguard the occupational health should be followed during construction as well as included in the EMP, Safety Health plan of the project from contractor end:

The Contractor is liable to develop a project specific Environmental health and safety management Plan. The contractor shall ensure that the following aspects are included and implemented on site, complying with the provisions given in ESMF:

- Appropriate training to be imparted to construction labourers regarding health and safety aspects. Contractor shall provide the workers with PPEs and they shall be encouraged to consistently use the PPEs.
- Proper civil work schedule shall be in place and be included as part of EMP.
- Properly insulated electrical works shall be provided at respective STPs and in construction sites elsewhere.
- Integration of adequate safety aspects (Protection rails along walk ways at height) in STP.
- Adhering to the monitoring and reporting of the environment Management Measure applicable to the construction stage wise.
- All open excavations must be covered before closing for the day- big gaping holes in the middle of congested locations are not acceptable
- To avoid the trip/falls, the safe practices like labeling, clear identification, proper barricading, adequate lighting, appropriate PPEs to be maintained at site.
- Toe boards should be available at almost all locations for SPS (Sewerage Pumping Stations) to avoid trip/fall hazards.
- Gas analysers with proper calibration must be facilitated at desilting, sewer cleaning work on priority basis.
- A Construction **Permit to Work** must be in place to avoid electrical, mechanical and chemical hazards during specific work/ maintenance.
- Traffic diversion, signage, providing of a signman/traffic warden during peak time etc. is necessary at some locations (e.g., trunk sewer cleaning) to avoid accidents/collisions etc/- proper lighting will be essential.
- During construction stage excavation safety in general- this includes barricading, diversion signage, ladders for escape of persons working, safe escape area, shoring, electrical hazards and others are required to be attended regularly by contractor
- Camp site should have maintained First Aid and register incorporating cases reported during the work should be incorporated.
- Accident reporting mechanism at active site to be adopted and each case wise route cause analysis (RCA by 5 Why, 3 Why technique) to be done by safety staff and senior engineer of the contractor.
- Ventilate the sewer line by opening two or three manholes on both the sides where work is to be carried out. This is more important when adequate blowers for ventilating sewers are not available. The manholes should be opened at least one hour before start of operations. The opened manholes should be properly fenced to prevent any person, especially children, accidentally falling into the sewer. Dummy covers with BRC welded fabric can be used.
- Use Gas masks when men have to enter into the sewer line.
- SOP for working at confined space and at height should be prepared and approved by KMC.

Health and safety

- In order to have emergency care at construction site and avoid any mis-happening, Contractor shall tie-up with nearest hospital (at least- 2nos.) for emergency health care services. On any health issues at site, the workers can get the treatment in normal circumstances as well any emergency.
- An Initial Health screening along with screening at regular interval (in every 6 months) should be provided for all workers and staff during construction and operation phases..
- Health condition will also be checked before mobilizing the labour at site.
- Biomedical waste emanated from the construction site shall be managed as per BMW Rule 2016 and amendments
- Provisions of First Aid services, having trained health care service provider at site
- Ambulance should be deputed at active construction site, STP site, network laying in congested area etc..
- Contractor shall be responsible for providing safe Drinking water facility for workers and ensure regular drinking water quality monitoring (RO plant) at labour camps as well as construction sites.
- All provision such as separate toilet for male and female workers, proper sanitation , bio toilet to provided at construction camp and construction sites as per BOCW act & Factory Act 1948
- Labour camp will be provided with sanitation, drinking water, medical, food and space for recreation activities after work.
- Proper disposal of wastes generated from the camp and construction activity will be followed to maintain the general hygiene in the area.

7.1.9 Operation Stage Impacts

Water Environment:

Water resources in the project area would be the most positively benefited by the sanitation project since sewage will now be routed to the STPs. Therefore proper operation and maintenance mechanism must be followed for efficient working of the system. During maintenance work periodically flushing to remove accumulated sediments at other impurities accumulated in pipe need to be removed. The environmental implication of pipe flushing is discharge of flushing water which may have high suspended solids, residual chlorine, and other contaminants etc. these can harm surface water. The uncontrolled discharge of domestic water into aquatic system can result in increase in microbial load, chemical contamination, oxygen depletion, turbidity, and eutrophication, etc. if problem in STP occurs. The probably environmental impacts related to water during operation stage may include unpredictable events such as:

- ▶ Temporary flooding of adjacent areas due to accidental leakages/bursts, blockages and backloging of sewer lines.
- ▶ Water pollution and possibility of mixing with water supply line due to leakages/ overflows from the sewer lines
- ▶ Impairment of receiving water quality in surface/sub-surface source due to inadequate /inefficient sewage treatment process.

Mitigation Measures:

- ▶ Discharge of flushed water into municipal sewerage system with adequate capacity
- ▶ Discharge of treated effluent after water quality assessment meeting the NGT Standards.
- ▶ Final effluent discharge into trunk Nala after residual chlorine is less than 0.5 ppm
- ▶ No untreated water from STP should be discharge into drains
- ▶ Reuse of Treated sewage water where ever possible.

Noise and Air Quality:

Improper handling and irregular maintenance of operating machines including pumps, generators, air diffusers, etc. may lead to increased noise pollution during operation activity. The odour generated from the waste water treatment plant can be nuisance to the community and settlements if located adjacent. Bio aerosol from the STPs can cause diseases is not treated properly, the release of chlorine could affect the locals if not properly regulated.

Mitigation measures:

- ▶ Since the proposed STP sites are located near habitation area, strict safeguard measures have to be adopted to reduce the noise and odour problems.
- ▶ A buffer zone will be created by planting three tier green belt along the periphery of the STP premises. This would act as caution wall between the STP and nearby community.
- ▶ The wall of appropriate height should be erected outside STP area to attenuate noise and smell problem to some extent.
- ▶ Though there are no D.G sets in most of the pumping station locations, still if any required to be installed then that should be equipped with acoustic enclosure and thickly padded for attenuation of vibration.
- ▶ Air blowers, pumps and motors will also be installed with acoustic enclosures and vibration mounts
- ▶ The stack height of the D.G sets should comply with the CtO condition or should be three meter higher from nearby building.
- ▶ Appropriate PPEs to be provided to laborers working continuously close to pumping station, DG area etc.
- ▶ Contractor shall ensure the ambient noise level of the STP/ MPS area shall be within Residential, Institutional area standard i.e. 55dBA during day time (7AM to 10PM) and 45dBA during night time (10PM-7AM)

Leakages and Overflow:

The leakages and flow in the sewer networking system can result in soil, ground water and surface water pollution. If the ground water depth is less in the sewer. This would result in mixing of sewer water with ground water due to water seepages. Overflow condition in the sewer network occurs, when there is excess volume of waste water generated or there is blockade in sewer lane. It also happens when there is a heavy rain. The overflow in sewer line will happen when there is excess amount of wastewater generated, heavy rains, power loss, STP components malfunctioning, or blockages. Mitigation measures need to be adopted to overcome the leakages and overflows. They are as follows:

Mitigation measures:

- ▶ There should be separate network for sewer and storm water network. This would prevent overflow of sewer line during monsoon season.
- ▶ Wherever possible avoid sewer line on heavy traffic road this would help in easy management during malfunctioning.
- ▶ When ground water depth is less, there should be limit to the depth of sewer lane. Based on the CGWB report for Project city Kolkata, the water table during pre- monsoon season varies between 12.09 mbgl to 19.59 mbgl and post monsoon depth varies between 10.73 mbgl to 15.42 mbgl. Hence during laying of sewer line, water depth should be accounted.
- ▶ There should be adequate slope in the gravity mains to prevent siltation and accumulation of solid and hydrogen sulfide generation.
- ▶ The entire manhole should have appropriate cover which can withstand load and incase the cover breaks, it is easily replaceable.
- ▶ The pumping station should have Power back to have continuous operation during power failure. They should be regularly maintained, to prevent IPS failure.
- ▶ There should be routine maintenance program which should comply with “The World Bank Group Environmental, Health and Safety Guideline for Water and Sanitation”.
- ▶ The agency should keep log book and record all the grey area were frequent overflow/ sewer leakage happens. This would save time and smooth functioning of the STP and Sewage system.
- ▶ Sludge storage system should be incorporated in the LS/ STP premises.

Aquatic Environment

Due to the leakage and overflow in the sewer network system creates the pollution load to the Hooghly river water and leads to deteriorate the water quality and to create the reduction of fish population in the river.

Mitigation measures:

- ▶ Measures to be followed to prevent the leakage and overflow in the sewer network system.
- ▶ Appropriate adequate design measures and slope in the gravity mains to prevent siltation and accumulation of solid waste

Sludge and other solid waste

The solid waste i.e. sludge and solids generated at pumping station, screening chamber, cleaning of drainage and sewer collection system, etc. would be menace to the locals. If not collected it would choke the storm water network, and also can be potent disease vector. The sludge generated from the STP units during operation phase if not processed, handled properly, and would result in contamination of land, ground and surface water. Once dried, the fine dust components may be carried by wind to adjacent area. It would also generate foul smell and would cause inconvenience to the locals:

Mitigation Measures:

- ▶ The solid waste generated during sewer line cleaning should be collected and removed from potential site simultaneously. In most of the cases it has been seen, that they are left for two to three day to get dry, but are dangerous and would pose health issues to the locals. Due to vehicles movement they get stuck to the vehicle tires and are spread on roads. They can even reach the storm water drains.

- ▶ The plastic, racks, wood, cloth which are screened at screening chamber of the STP should be collected and disposed of to the identified land fill site (Dhapa Land fill site, KMC) or / Keorapukur site active dumping site identified by the municipal corporation.
- ▶ The sludge generated from the STP should be collected, stored and should be processed within the site for dewatering adopting suitable technique. This dried sludge should be stocked within the site on paved/ concrete ground to prevent land contamination and washed off during rains. The operator needs to prepare sludge management plan in consultation with the locals, Municipal Corporation, etc. If the sludge is used by the farmers, it should be confirmed that it complies with the macro-nutrient, micro-nutrient, pH level needed for plant growth.
- ▶ LS and STPs should have provisions for collection of extra sludge and reuse / disposal to the identified dump site.
- ▶ The works engaged in sludge handling and treatment, if generated from STPs or sewer line should have safety training program for safe handling, personal hygiene practices so as to minimize exposure to pathogens and vectors.
- ▶ Use of vacuum trucks or tugs for removal of fecal sludge instead of manual methods.
- ▶ There should be provision of PPE, showers and cloth changing areas for workers and technicians
- ▶ Sludge to be checked as per CPHEEO manual for its organic matter and avoidance the heavy metal contaminations.
- ▶ Effective sludge management plan to be followed by contractor throughout the project operation phase.
- ▶ Sludge manure to be used as soil conditioner, fertilizer within garden, community parks of STPs, MPS, KMDA offices and other community parks of the Tolly Nullah region, Kolkata.
- ▶ In addition, the contractor will also prepare and submit the sludge management plan with O&M manual before O&M phase and get it approved from SPMG.

Hazardous chemical handling and exposure

During STPs operation, chemicals like Chlorine, Aluminium hydroxide, Ferric hydroxide, etc. are used to disinfect treated water from microbial load, settle suspended solid etc. These chemicals are hazardous to the individual who are handling them regularly. If they are not treated and proper concentration is not maintained they may affect the individual, pollute surface water, soil and can be suspended in air as fumes. The other hazardous chemical generated are for the STP operation like waste oil generated from the D.G set maintenance, D.G sets oil storage, etc. During handling these Hazardous chemicals and to prevent them from exposure following mitigation measures need to be followed:

Mitigation Measures

- ▶ The waste oil generated from the D.G sets should be stored in close container and should be handed over to government approved recyclers.
- ▶ The D.G sets oil should be stored away from electric circuit, on paved floor and under close premises. It should be stored at one corner.
- ▶ The chlorination dose to disinfect the sewage and sludge should be well regulated as per the norms.
- ▶ The storage of chlorine, Aluminum hydroxide, Ferric hydroxide should be safely stored away from public place. The entry and exit into the storage room should be restricted.

- ▶ The storage of chlorine and other chemical should be packaged in plastic bags that are stored in sturdy cartons or drums in dry places.
- ▶ The tool and equipment used for handling one chemical should not be used to handle other chemicals. If not possible, the tool and equipment should be thoroughly washed, cleaned and dried before used for other chemicals.
- ▶ The storage area should be in close containers properly, cover opened or damaged packaging, store chemicals away from doors and windows, ensure that there are no roof leaks, open or broken windows, or leaks from water pipes, hoses, or the sprinkler system;
- ▶ Ensure that floors are sloped to keep water drained away, store chemicals on shelves or pallets to keep containers off the floor, always use waterproof covers on packaging, exercise particular caution to prevent water contact with stored chemicals any time water is used for cleanup of floor areas near stored packages and it should be ensured that water will not back up from faulty or clogged floor drains.
- ▶ All precaution should be taken to avoid mixing of chemicals by adopting following means
- ▶ Separate incompatible substances; avoid storing containers of liquids above containers of other incompatible substances.
- ▶ Do not mix old chemicals with fresh chemical, even if they are of the same type
- ▶ Consider separate, designated tools for each chemical. Handle only one chemical at a time and make sure that tools used with one substance are not used with another unless all residues are removed.
- ▶ Use separate, designated containers for cleanup of spilled materials to avoid inadvertent mixing of spilled substances. Consult your local hazardous waste disposal facility for more detailed information on proper waste disposal; and
- ▶ Make chemical storage area housekeeping a priority. Don't allow rags, trash, debris, or other materials to clutter hazardous material storage area. Keep combustible and flammable substances away.
- ▶ Provision of emergency alarm system at site for chlorine leakage. In the design chlorine absorption system in case of leakage should be provided at CCT point.
- ▶ Bathing shower should be provided at the chlorination units.

All Employees who handle chemicals should consult the chemical manufacturer's safety instructions as well as the Material Safety Data Sheets (MSDSs) for guidance on the appropriate personal protective equipment (PPE) necessary to protect your employees. Use basic PPE including, as a minimum, chemical goggles and liquid impervious gloves, and boots for any chemical handling activities.

Bio-Medical waste management

As per the Biomedical waste management rule 2016, all the liquid waste need to be treated with 1 to 2 % Hypochlorite or to have an ETP, Floor washing etc should be pre-treated onsite using 1 - 2% Sodium Hypochlorite or connected to ETP.

For a network and STP scheme, it is easier to tap only those hospitals which have installed the suitable treatment measures. But since the project is an I&D scheme, therefore controlling the mixing of untreated liquid waste from hospitals (if any) is difficult.

However, there are seven Common Bio-Medical Waste Treatment Facilities (CBWTFs) established in West Bengal which are in operation and one such new facility has been set up in Bankura District, will be functional shortly. Locations of such CBWTF are given in **Annexure-14**. The nearest CBWTF facility to the project site is run by M/s Genentech Environ Management Pvt. Ltd. located at Amtala, Dist.- 24 Parganas (S), PIN- 743503. As per the BMW rule, 2016 amended in 2018 and 2019 all these hospitals, laboratories need to tie up with any of such CBWTF facility for treatment of Bio-Medical waste as a statutory requirement.

The water quality of drains as given in Section 5.1.7 under Water Environment of chapter 5 does not indicate any such presence of bio-medical waste.

As part of the detailed design contractor need to measure the water quality of the inlet points and may include doing bio-assay test to slightly modify the STP design.

Occupational health and safety -Chance of accidents & injuries

The employee working in the STPs operation and maintenance work would be subjected to injuries and health hazard if precaution at work place is not taken. In the STP system and at MPS locations there are work areas which are under ground or at elevation, there are open trenches, slippery walkways, electrical circuits, heavy equipment, storage tanks, wet wells, digesters, and pumping stations, etc. Even methane, H₂S gas is generated from anaerobic bio-digestion of sewage. This may result to fire and explosions.

The workers, staff and operators of sludge collection vehicles, can be exposed to the many pathogens contained in sewage. Workers may also be exposed to endotoxins, which are produced within a microorganism from sewage pipeline and from STP malfunctioning. This could affect the health of workers, if PPE and precaution are not properly taken. The workers while working at such location, the operator should adopt following mitigation measures.

Mitigation Measures:

There will be a provision of agreement with at least 2 hospitals in nearby areas, where the labourers can get the treatment in normal circumstances as well as during any emergency. Further, a six-monthly health check-up of all workers (during construction as well operation) will be mandatory. A list of various tests to be done be also prepared and included in the ESIA-MP.

- ▶ Safe drinking water for labourers will be ensured and as far as possible the contractor should arrange for dispenser bottled mineral water for the workers.

- ▶ Health and OHS Policy will be circulated and publicized amongst workers, contractor personnel, employees etc. especially on National Safety Day, where each employee is officially handed over a copy of the policy along with the taking of the safety pledge.



- ▶ Critical tasks, like underground laying of sewerage network, cleaning of lines, lifting of drain covers, excavation etc. which have hazard/injury potential will be firstly shortlisted and basic HAZID/RA (qualitative) will be carried out.
- ▶ As protective measures there should be railing around all process tanks, bio-reactors, SBR tanks, Sludge Ponds and at location where work is at height or underground wells.
- ▶ The entry and exit to outsiders should be restricted.
- ▶ The workers should use fall protection equipment's when working at height
- ▶ All the maintenance work should minimize slipping and tripping hazard
- ▶ Use proper techniques for trenching and shoring
- ▶ There should be well established traffic circular plan, demarcated parking area, rest area, etc.
- ▶ When installing or repairing sewerage line adjacent to roadways, implement procedures and traffic controls measure on road. Prior to start of work, the work zone should be earmarked through sign board, traffic diversion signals, etc.
- ▶ Safety training program for works, safe handling and personal hygiene practices to minimize exposure to pathogens and vectors.
- ▶ Preliminary health check-up of the workers will be carried out at an interval of 6 months.
- ▶ Use of vacuum trucks or tugs for removals of fecal sludge instead of manual removals
- ▶ Encourage workers at wastewater facilities to wash hands frequently.
- ▶ Effective Accident reporting mechanism to be adopted at O&M level. The record of the same should be maintained regularly by contractor.
- ▶ Gas detection process should be adopted, for underground works.
- ▶ Underground lighting with 12Volt to 24-volt lighting system should be used in case of underground sewerage repairs work.
- ▶ Proper ventilation system, oxygen supply system, escape rope, etc should be provided.

Some basic hygiene practices to be followed by workers cleaning the existing sewer lines:

- ▶ Washing hands before eating or drinking as well as after using toilet
- ▶ Keep open sores, cuts, and wounds covered with clean, dry bandages
- ▶ Avoid touching face, mouth, eyes, nose, or open sores and cuts while handling human waste or sewage
- ▶ Use waterproof gloves to prevent cuts and contact with human waste or sewage
- ▶ Wear rubber boots at the worksite and during transport of human waste or sewage
- ▶ smoke or chew tobacco or gum while handling human waste or sewage is strictly prohibited
- ▶ Workers should be vaccinated with Tetanus, polio, typhoid fever, Hepatitis A and Hepatitis B vaccines.

7.2 Potential Social Impacts and Mitigation Measures

Based on the surveys, interviews with the key stakeholders, interaction with the coordinating agencies, a screening checklist was prepared to identify the social issues associated with the project during construction phase. The proposed project will only influence social sector during construction phase. During the construction phase, the impacts identified below would be temporary and short term.

Impacts on Human Health

One of the potential impacts of the proposed sub-projects will be on the air quality due to the dust generated during excavation. The amount of dust generated will depend upon the level of digging and the prevailing weather conditions and can have an adverse impact on the health of the persons residing or working near the project sites. Since the area has more of residential land use, the number of people who will be affected is more. Residential population includes more vulnerable groups such as elderly and children.

Mitigation Measure: Acoustic enclosures or hoardings can be constructed at the proposed sites

Our mitigation plan involves the erection of temporary enclosures around construction sites. These barriers will help entrap some of the dust that is brought up in digging. They will also provide safety benefits, to be detailed below. Water sprinkling will be undertaken as well, according to the contractors

Traffic Congestion

Due to the construction of STPS which take place on the vacant lands in the city peripheries, there will not be much disturbance in the traffic movement. However, some inconvenience may occur during the construction activities to the nearby residential area.

During desilting work of existing sewer line and S&D work connecting to LS and STP will involves temporary disturbance to local traffic and residents. Appropriate mitigation measure to avoid traffic congestion and safe work practices shall be adopted by the contractor.

Mitigation Measure: Re-route traffic whenever possible and employing traffic police to manage the traffic movement.

Traffic must be re-routed to facilitate ease of movement. Proper signage should provide detailed information on the dates and duration of road closures and which detours will be available, ideally well in advance of actual construction so residents can plan accordingly.

Temporary fencing /barricading along with cautionary signage's to be adopted at all active work fronts having construction of STP, desilting work & S&D.

Impact on Livelihood:

The excavation will lead to road blockage and as a result the residential/commercial establishments and vendors will have some trouble in operating their business on daily basis. But there will be no loss of livelihood. No Ambulatory vendors are located near the STP sites. So overall, no loss of livelihood has been reported during the survey and Consultation with the stakeholders.

During desilting work of trunk sewer line and S&D work near to Tolly's Nullah, temporary disruption in the movement of residential and shop owners are envisaged.

Mitigation Measure:

Sewer constructions will invariably lead to road closures, which will adversely affect shops on those streets. The first priority is for the contractor to take the necessary measures to ensure that pedestrians always have access to shops, vendors, etc. For mobile vendors, this may include adjusting the location of the cart, etc. to a similar location in the immediate vicinity of the original location for the duration of the project. Projects should also proceed on schedule so as to minimize disruption. Additionally, clean-up of debris and clearance of blockages should commence immediately after project completion so as to remove any potential obstacles that might prevent customers from accessing businesses or other disruptions.

In the event that the contractor, despite best efforts, is unable to avoid blockages of the roads and/or disruption of local businesses, some assistance is necessary. The ESMF currently mandates assistances only in the case of permanent livelihood loss or displacement and provides no provisions for temporary livelihood loss. Additionally, no regulation, policy, guideline, etc. exists which can provide precedent or guidance in this instance ESMF clearly states that mobile/ambulatory hawkers: fruit cart vendors, etc. who can easily relocate fall into this category. These vendors are most eligible for a temporary relocation just outside the construction area, and will thus not be eligible for compensation as is the case for this proposed project.

However, if during the construction of the project, the temporary disruption on livelihood due to the proposed project, should be supported through compensation or resettlement assistance as per the provisions of the ESMF.

Other social disturbances and mitigations

Contractor, while preparing for construction specific ESIA-MP will conduct detailed survey of the roads, lanes and the locality where laying of pipelines have to be carried out. The pipe laying and opening of the road will be done within ROW in small stretches and restored back immediately so that the dug-out soil can be refilled. Any displacement of temporary hawkers, vendors will be effective only during small duration of time and they can further resettle back to the location, once the laying is complete. As far as possible, loss of livelihood and displacement will be avoided to the least possible extent.

The project span of 2 to 3 years has been kept taking into consideration the work lag during monsoon months. Otherwise the construction work would have been completed in about 18 months. The KMDA officials assured the work involving road excavation continues for 24 hours in a day. Also wherever excavation is not possible, they have decided to go for trenchless laying of pipes.

Impact on Existing Utilities

The road opening activities may damage the underground water pipelines or electricity poles in the vicinity of the site for the proposed sub-projects. This will lead to water supply interruptions, disruption in electricity supply and will involve expensive repair costs. Flooding of areas could also occur.

Mitigation Measure:

- ▶ Circulating the layout plans of the existing underground alignment near the work site.
- ▶ Contacting the relevant department in case there is any damage to any of the utility services and ensuring prompt fixing/replacing of damaged infrastructure.

All construction personnel must receive detailed layout plans of existing underground structures to prevent accidental water/electricity supply disruptions. The relevant departments should also be made aware of the timing and location of digging near supply lines so they can make the necessary preparations to respond swiftly to disruptions.

Safety Hazards

There are potential hazards for the bikers, workers as well as for the pedestrians. Safety equipment for workers is provided as part of the DPR. Safety equipment for O&M requirement such as half & full-face masks, gumboots, safety lamps, harnesses, hard hats and communication systems are to be provided.

Mitigation Measure: Fencing of the excavation site and providing proper caution sign boards.

As mentioned above, fencing should be erected around construction sites and appropriately marked with caution signage. These fences/signs should remain in place even if construction is not active, so long as a hazard (e.g. open pit) remains.

Elevated Noise Levels

Increase noise pollution (continuous Siren from bikers) was observed during the site assessment due to congested traffic at narrow roads. This will further disturb the residences during construction and especially sensitive areas like schools and hospitals.

Mitigation Measure:

According to KMC officials, construction will take place during the daytime to avoid the noise during the night time due to proximity of residential area. Beyond that, construction must simply proceed in a deliberate and judicious manner to avoid unnecessary noise pollution.

Failure to Restore Temporary Construction Site

Excessive debris, trash or construction remnants (e.g. dirt piles) would create problems related to drainage, unhygienic conditions and poor aesthetics; however, clean-up and debris clearance is budgeted in the DPR so this should not be a concern.

Mitigation Measure: As mentioned above, provisions to rehabilitate roads and clear debris are already included in the DPR.

Effect to daily life

Residents will be affected due to take out their vehicles and also access to their house also is problematic.

Mitigation Measure: a prior notice to each and every locality with the details of the project, street wise start date of construction and street wise end date of construction to be circulated. This information would help them better adjust to the situation and make necessary adjustments and provisions.

Damage to buildings

The task of correctly identifying the vulnerable parties is virtually impossible. Thus, the best mitigation plan is to reroute sewage lines to avoid disturbing the old sewage network in instances where the contractors determine that a house may be built upon it. The mitigation plan for this social concern proceeds in the following steps:

- ▶ Redirecting sewer lines around those houses that rely on the sewage lines for foundation.
- ▶ Should that not prove possible, identification of affected houses and categorization into different level of houses (permanent, semi-permanent, etc.) to determine possible compensation
- ▶ Payment of compensation to affected houses on a “cost of repairs” basis. Should total destruction of the property ensue, then the full valuation of the property must be paid, and resettlement/rehabilitation policies come into effect according to the ESMF.

Health Programs for Workers

If un-sanitary conditions prevail at workers camp, health programs for their well-being should be implemented.

Social mitigation plans during operation phase

Noise pollution due to improper handling of machines: proper O&M should be carried out during the operation phase to ensure least disturbance is caused to the neighbouring residents.

Mitigation measures adopted by locals during similar nature of project activities

From the field surveys and interviewing the locals including shop-owners, residents, mobile vendors, following local adaptive measures have been recorded;

- ▶ Using transparent plastic sheets to block entry of dust into shops
- ▶ Avoiding opening of windows, especially when the construction is going on
- ▶ Taking different routes if possible to avoid areas where construction is happening
- ▶ Laying wooden/plywood plank over the excavated pits for making access route to house or shops
- ▶ Environmental and Social Assessment with Management Plan

The above measures indicate that the general public has already created adaptation measures to sewage construction projects.

Land Availability

As per ESMF provision, the land identified for STPs are preferentially government land. In current project, a total of approximately 1.8 hectare of land requirement is envisaged, which has been fulfilled by allotting 4 patches of government land at four different locations for 3 STPs and 1 pumping station. The identified land pieces are open government land of 2.85, 0.7228, 0.8 and 0.014 acres respectively for 3 STPs and 1 pumping station. The identified area would be feasible with respect to their connectivity with the nearby lifting stations for further treatment. The details about the available land area along with their present status have been provided in **Table 7-2**.

Table 7-2: Land requirement details of proposed Tolly nullah project (for 3 STPs & 1 pumping station)

Plot No.	Area	Classification	Ownership
Bansdroni STP and pumping station site			
341	2.23 Acre	Sali (vacant dry land)	Earlier Irrigation & Waterways Department, now transferred to KMC
343	0.19 Acre	Doba (water body / marshy land)	Refugee Rehabilitation Department, Govt. of West Bengal
346	0.43 Acre	Sali (vacant dry land)	Refugee Rehabilitation Department, Govt. of West Bengal
Total available land	2.85 Acres (1.15 Ha)		In the process of transferring to KMC
Briji road STP and pumping station site			
763 (P), 766 (P), 770 (P), 771(P) & 772(P)	0.7228 Acres (0.3 Ha)	BPAD Township at U block under ward no.110; vacant dry land with bushes and shrubs	Earlier KMDA, now transferred to KMC during December 2019
Golf Green, Sukhapukur STP			
Premises no. 3 (Por), Russa Road south	0.8 Acres (0.32 Ha) (3190.38m²)	Kolkata Improvement Trust Scheme No. 118; low marshy land	Earlier KMDA, now transferred to KMC during July 2017
Mini pumping station at Patuapara, Bhowanipore			
15 A, 17 A	0.014 Acre (0.006 Ha) 11 m X 5.3 m, i.e., 58.3 m²	Illegal colonization	KMC land

Source: As per land documents and information given by KMC

Public Grievances

Locals also reported few instances where they lodged complaints about un-cleared debris, or damage of public utility generally to ULB officials. They usually do not lodge complaints due to the prior experience of the lack of response from government officials. Additionally, the interviewees said that they understood the inconveniences were of a temporary measure and are providing a social good. Thus, they have created local adaptation measures as quick and efficient ways to mitigate the temporary inconveniences. However, the proposed project has grievance redress mechanism which will be adopted as mentioned below:

Grievance Redress Mechanism

National Mission for Clean Ganga (NMCG) under the Ministry of Water Resources, River Development & Ganga Rejuvenation has set an objective to ensure effective abatement of pollution and conservation of the river Ganga by adopting a river basin approach for comprehensive planning and management.

- ▶ NMCG has adopted Government of India's Centralized Public Grievance Redress and Monitoring System (CPGRAM) to record and monitor grievances that come either to NMCG directly or through various ministries/ PMO/ states.
- ▶ NMCG has one GRM officer, who addresses all queries registered on the Centralized Public Grievance Redress and Monitoring System (CP GRAM) portal of NMCG. The nodal officer will reply the applicant

and if the matter relates to the SMCGs of Ganga Basin States, the grievances are forwarded to the concerned State with the request to furnish reply direct to the applicants under intimation to NMCG.

- ▶ The GRM officer is supported by one social expert who coordinates with all the SMCGs. At SMCG level, reporting of grievances are being monitored by environmental and social experts.
- ▶ All Executing Agencies have a GRM mechanism at each project site. The project manager and deputy project managers are in-charge of these GRMs. To register grievances, a register has been kept at all project site offices and sometime field team received grievances over mobile phones as well as on WhatsApp messages.
- ▶ To resolve the grievances, project manager from EAs side, contractor's project engineer and his team, work together sorted out at the earliest. If site team is unable to resolve the issue its own, the complaint/matter is brought up to senior management of EA as well as Contractor and discussed in monthly review meetings and escalated to the level of SMCG and NMCG.
- ▶ In continuation, Grievance Redress Committees (GRCs) has also been constituted in some of the basin States. The GRC discusses grievances on weekly basis at their safety meetings¹¹.

District level GRC system is available through District Magistrate's Office and KMDA handles grievances if any. Project specific GRC to be established by the KMDA/SMCG in West Bengal.

7.3 Labour management plan

Contractor shall prepare and submit Labour Influx and Worker's Camp Management Plan to the concerned EA that addresses specific activities that will be undertaken to minimize the impact on the local community, including elements such as worker codes of conduct, accommodation facilities, training programs on workers safety, and also to address COVID-19 pandemic measures. A Workers' Labour Camp Management Plan addresses specific aspects of the establishment and operation of workers' camp.

This Labour Influx and Worker's Camp Management Plan will include:

- (i) Provision of safe and healthy working condition, and a comfortable environment and accommodation with adequate facilities for migrant labour and to ensure compliance with the national labour laws.
- (ii) Potential impacts associated with influx on the host population and receiving environment are minimized
- (iii) mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;
- (iv) informing workers about national laws that make sexual harassment and gender-based violence a punishable offense which is prosecuted;
- (v) introducing a Worker Code of Conduct as part of the employment contract and including sanctions for non-compliance (e.g., termination), manual scavenging, engagement with local residents, child labour, non-discrimination, harassment of co-workers including women and those belonging to SC and STs and other minority social groups;

¹¹ Draft Report on GBV-GRM in National River Ganga Basin project (NGRBA), June 2019, World Bank

- (vi) Contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence;
- (vii) training programs on HIV/AIDS and other communicable diseases;
- (viii) workers' Camp Management Plan addressing specific aspects of the establishment and operation of workers' camps provided the Local Body/ Executing Agency is unable to cater to the demand for affordable housing for this additional workforce in terms of rentals, hostels, apartments, etc.; and complaint handling mechanism at the project level.

Health and safety at operation stage

- In order to have emergency care at commissioned STP/MPS/ PS/LS site and avoid any mis-happening, Contractor shall tie-up with nearest hospital (at least- 2nos.) for emergency health care services. On any health issues at site, the workers can get the treatment in normal circumstances as well any emergency.
- An Initial Health screening along with screening at regular interval (in every 6 months) should be provided for all workers and staff in operation phases..
- Biomedical waste emanated from the construction site shall be managed as per BMW Rule 2016 and amendments
- Provisions of First Aid services, having trained health care service provider at site
- Contractor shall be responsible for providing safe Drinking water facility for workers and ensure regular drinking water quality monitoring (RO plant) at worker quarter/ STP/MPS/ LS site.
- All provision such as separate toilet for male and female workers, proper sanitation, sanitary waste disposal to be provided at STP/MPS/LS as per BOCW act & Factory Act 1948
- Proper disposal of wastes generated from the STP staff camp will be followed to maintain the general hygiene in the area.

7.4 Management of COVID-19 Pandemic at the Project Site

Additional measures to address the COVID-19 situation that a systematic approach to planning, recognizing the challenges associated with rapidly changing circumstances shall be prepared by the Contractor. Addressing COVID-19 at a project site is beyond occupational health and safety and is a broader project issue which will require a designated team for documentation and discussed at regular meetings to facilitate adaptive management measures. The following good workplace management pertinent in preparing a response to COVID-19 are:

- a. The Contractor should prepare a detailed profile of the workforce, key work activities, schedule period of such activities etc. Worker's accommodation should be kept with minimum contact with people near the site and regular contact should be avoided with the local communities.
- b. Entry/exit to the work site should be controlled and documented for all the local workers (who return home daily), staff and suppliers. Confirming that workers are fit for work before they enter the site to start work.
- c. The requirement of general hygiene should be communicated and monitored such that training to workers and staff on site on the symptoms of COVID-19, how it spread and how to protect themselves (including handwashing, social distancing). Ensuring handwashing facilities supplied with soap, disposal paper napkins/towels and closed dust bins etc.

- d. Placing posters and signs around the site, with images and text in the local language.
- e. Regular cleaning of all site facilities including offices, accommodation, canteen and common spaces.
- f. Providing them appropriate PPE (masks, gloves, eye protection, boots etc.).
- g. Expanding medical infrastructure facilities, if a worker is ill and unable to breathe properly on his/her own, they should be referred immediately to the local hospital. Agreeing with local medical services/ facilities the scope of services to be provided.
- h. Workers if any symptoms of COVID-19 (fever, dry cough, fatigue) should be required to stop work, and immediately be required to be quarantined/isolated and transported to local health facilities for further tests. Family and close contacts of the works should be required to quarantine themselves to 14 days, even if they have no symptoms.
- i. Training and monitoring should be conducted regularly and document procedures. If project representatives, contractors or workers are interacting with the community, they should practice social distancing and follow COVID-19 guidance (latest updated guidance issued) issued by relevant authorities, both national and international (e.g. WB or WHO).
- j. In practice, workers may be employees of the contractors, or they may be informal, casual hires on a short-term basis. Many are also migrant workmen. Contractors can be advised to continue the employment of all workers during the period of COVID-19.
- k. It would also be important to ensure that all eligible workers are given Building and Other Construction Workers (BOCW) registration, to be able to avail of benefits which are either under existing welfare schemes or provided as a part of the Covid-19 relief package.

7.5 Monitoring of COVID-19 pandemic by the Executive Agency (EA)

The Executing Agency (KMC) shall monitor the COVID-19 issues at the project site and will make sure that the Contractor taking adequate precautions to prevent or minimize the outbreak of COVID-19. The following suggestions to deal with the situation are set out as below:

- l. The EA, either directly or through the Supervising Consultant, should request details in writing from the main Contractor of the measures being taken to address the risks.
- m. Monitoring health and safety requirements are done by the contractor which can be used as the basis for identification, and requirement to implement, COVID-19 specific measures.
- n. The EA should require the Contractor to convene regular meetings with the project health and safety specialists and medical staff (and where appropriate the local health authorities), and to take their advice in designing and implementing the agreed measures.
- o. Where possible, a senior person should be identified as a focal point to deal with COVID-19 issues. This can be a work supervisor or a health and safety specialist. This person can be responsible for coordinating the preparation of the site and making sure that the measures taken are communicated to the workers, those entering the site and the local community. It is also advisable to designate at least one back-up person, in case the focal point becomes ill; that person should be aware of the arrangements that are in place.
- p. In many cases, the EA can play a valuable role in connecting project representatives with local Government agencies and helping coordinate a strategic response, which takes into account the availability of resources. To be most effective, projects authorities should consult and coordinate with relevant Government agencies and other projects in the vicinity.

- q. The EA should make sure that workers should be encouraged to use the existing project grievance mechanism to report concerns relating to COVID-19, preparations being made by the project to address COVID-19 related issues, how procedures are being implemented, and concerns about the health of their co-workers and other staff.

7.6 Gender Assessment, Development

According to ESMF, the objective of Gender Assessment and Development is to analyse gender issues during the preparation stage of sub projects, design interventions and primary data collection. The gender analysis shall be carried out based on findings from gender specific queries and requirements during data collection and community consultation process. The quantitative and qualitative analysis shall include sex-disaggregated data, issues related to gender disparity, needs, constraints, priorities and understanding of gender-based inequitable risks, benefits and opportunities as well as gender relevant indicators.

7.7 Gender Based Violence (GBV)

GBV is an umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially ascribed gender differences. GBV includes acts that inflict physical, mental, sexual harm or suffering; threats of such acts; and coercion and other deprivations of liberty, whether occurring in public or in private life. The project site includes both the actual locations where civil works are conducted and also the associated areas such as the locations of workers' camps, quarries, etc. These GBV risks need to be assessed throughout the project's life by monitoring the situation, assessing the effectiveness of risk mitigation measures, and adapting them.

Since a sub project involves construction work that will demand a constant supply of labourers, the influx of migrant workforce can be a potential risk for the host population. The influx of labour force can lead to the risk of Gender-Based Violence.

The interventions will be at three levels, that of SPMG, EA and the Contractor. According to guidelines of ESMF on GBV prevention has been prepared to define the roles and responsibilities at all levels. Robust measures shall be prepared and implemented to address the risk of gender based violence in the project and adjoining communities.

The World Bank team organized a workshop in line with requirements of the GBV Taskforce of the World Bank (2017). The emerging discussions also referred to the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redress) Act, 2013 and subsequently, constitution and functionality of Vishakha Committees. Further, the Bank team conducted an extensive mapping exercise of service providers in the state to strengthen the referral system for a potential victim. The Bank team put forth the context and internal risk assessment based on review of project documents and estimates of labour influx and scale of on-going construction.

A gender assessment to assess potential risks linked to GBV and, a review of existing surveys and research available at the national level was carried out, which outlines the key drivers and risks of gender-based violence in the project location.

As per National Crime Records Bureau, 2020, there are total 36,439 crimes observed against women in Uttar Pradesh. Out of these cases, 19,962 cases of 'Kidnapping & Abduction of Women' are registered which are highest among all the crimes against women in West Bengal followed by cases of 'Assault on Women with Intent to Outrage her Modesty' (7,740), 'Kidnapping & Abduction of Women' (4,858) and 'Assault on Women with Intent to Outrage her Modesty' (2,488).

Other indicators were also considered to understand the gender representation in the State. Indicators like women's empowerment and autonomy, including employment and earnings, decision-making, ownership of assets, gender role attitudes, and domestic violence.

As per National Family Health Survey (NFHS-5), 2019-2021, in the 12 months prior to the study, only 18.5 percent of all women aged 15 to 49 were employed compared to 80.4 percent of men. Out of these employed women, 92.3 percent of employed women received cash compared to 98.9 percent of employed men.

Another important indicator is the decision making about their own health care, major household purchases, and visits to their own family or relatives. Women are somewhat more likely to participate in decisions about their own health care (81.8 percent) than decisions about visits to their own family (81.4 percent) and relatives or about major household purchases (80.8 percent each)¹². Further, 22 percent of women and 51.6 percent of men age 15-49 in West Bengal own a house alone or jointly with someone else, and 16.7 percent of women and 33.6 percent of men own land alone or jointly with someone else.

In case of gender-based violence, 20.6 percent of women aged 18 to 49 in West Bengal have experienced physical abuse, and 1.6 percent have experienced sexual violence. Overall, 30.4 percent of women have been subjected to physical or sexual violence, and 8.1 percent have been subjected to both.

During site visits it was observed that, the land is being transferred from Government departments to KMC for construction of STPs. After this, they will contract agencies to undertake civil works, agencies/firms to support core-functions; primary suppliers of material/equipment and other implementation support partners. All categories of project workers: Permanent workers, Contracted workers, Migrant Workers and Community Workers would be involved. An influx of labour in the form of rapid migration and settlement of workers or locals can negatively impact a project area, especially in contexts with high prevalence and social acceptability of violence against women and girls.

The officials of KMC intimated that the transfer of land for the project is under process. After which the STP will be established in the location. The contractor will provide labour camps for the labourers working in the project which would be constructed within the STP premises only. The officials assured that they will take precautionary measures to combat GBV through project. They were also aware of the measures they should be taking during the implementation process to combat GBV like display of posters and conducting focus group discussions with women in the community in order to sensitize and aware people. The officials also intimated that they have conducted the preliminary discussions with the community people regarding the project inception and the issue of GBV.

¹² **Source:** National Family Health Survey (NFHS-5), 2019-2021

The following actions were recommended and agreed upon with the client:

- ▶ Sensitization of contractors and laborers by nodal officers
- ▶ Constitution and functionality of Internal Complaint Committee (ICC)
- ▶ Strengthening of Grievance Redress Mechanism
- ▶ Providing infrastructure on camp sites from a safety perspective

The GBV assessment and action plan prepared in 2019 had identified several actions to be taken for GBV prevention and risk mitigation in NGRBP.

There are certain mitigation measures to be adopted by the States:

- ▶ **Registration of laborers:** The state agencies to undertake registration of laborers in collaboration with the labor department across the five states. This initiative covers migrant laborers as well and is beneficial for them to access health benefits, pension and several other safety nets deployed by the government. Additionally, it helps the state agencies keep track of laborers on-site.
- ▶ **Separate toilets:** Camp-sites should have separate toilet facilities for men and women laborers.
- ▶ **Grievance redress mechanism on-site:** An established procedure to address complaints to be rolled-out across sites.
- ▶ **Safety information on-site:** Project sites should display safety related information for laborers.
- ▶ **Awareness amongst communities:** Community level consultations and prominently display information related to the general helpline number, as well as contact details of junior/field engineers in case instances involving laborers to be disseminated.
- ▶ **Establishment of ICC committee**
- ▶ Contractors shall have a corporate sexual harassment policy and have displayed this policy in the English and Hindi at their site offices.
- ▶ The contractors shall display the board with Emergency contact numbers at all sites and labour camps, the safety procedures and processes such as: Workers Code of Conduct, a strict no alcohol, no smoking and no drug policy in place.
- ▶ Regular orientations and spot checks shall be carried out for all workers for strict adherence.

The table below (Table 7-3) provides the Social Management Plan with possible mitigation measures.

Table 7-3: Social Management Plan

Activity	Potential Negative Impact/Concern	Mitigation Measures	Cost/Remarks
1. Sewerage Network			
A. Design and Development Stage			
Land Acquisition for STP and MPS	Minor Impact	As per interaction with official from KMC& site visit, it is observed that approximately 1.8 hectare of land requirement has been envisaged for 3 STPs and 1 PS. Out of these three STPs, the locations of two STPs are finalized and land transfer for the third STP (11.6 MLD at Bansdroni) is under process. The land which was earlier identified for 15.3 MLD STP at Police telecom was under dispute. As an alternative site selection, land at Bansdroni under Refugee, Relief & Rehabilitation Department, Kolkata will be	Rehabilitation of 8 families is envisaged. They will be settled in a proposed one-bedroom apartment each having 370-ft ² area under Banglar Bari Housing scheme of State Urban Development Agency, UD&MA Department, Government of West Bengal. During detailed design stage, KMC needs to engage an NGO to make the detailed survey for assessing actual

Activity	Potential Negative Impact/Concern	Mitigation Measures	Cost/Remarks
		transferred to KMC. As a result, no private land acquisition has been anticipated. A proposed mini pumping station besides Madan Pal Lane at Patuapara, Bhowanipore will involve displacement of 8 families	number of affected families to whom necessary compensations need to be awarded.
B. Construction Stage			
Impact on Livelihood during desilting work of trunk sewer near to Tolly' Nullah area	Temporary Impact due to location of folly activities, accessibility to nullah and stacking of silt.	During lying of sewer lines, people residing on the banks of the Tolly nullah would be temporarily impacted with respect to commuting to work. It will create disruption in their daily chores. During construction stage, it is suggested that the contractor should take necessary precautionary measure such as barricading, sensitization to local public and work during day time, finish the open trench within day itself etc. Other safe practices to be adopted as per EMP of bid document. Safety cautions and sign boards should be displayed near the construction area.	-
Safety hazards to workers and residents		Provide workers with adequate safety equipment such as helmets, safety shoes, gloves, etc. Fences/temporary enclosures should be put around construction sites (even inactive ones, if hazards, like open pits, remain); enclosures should be properly marked with caution signs. Cautionary hoardings should be displayed in the construction area during construction work along with following other safety protocols.	-
Dust generation, with resulting implications for human health	Construction of temporary enclosures to entrap dust.	Water sprinkling, removal of excess materials, cleaning of sites upon completion of activities.	Part of Construction activities
Reduced pedestrian and vehicle access to residences and businesses Temporary water, electricity, supply interruptions		Work should proceed on schedule so as to minimize road closures Circulation of layout plan for all underground infrastructures to ensure that contractor is aware of water/electricity lines in construction zone. Local utilities should be made aware of timing/location of all construction, enabling them to respond swiftly to supply disruption, especially in the event of flooding, etc. Upon project completion, quick clearance of debris, etc. will facilitate access by customers to local business and residents to their households	Part of Construction activities
Increased traffic inconvenience (emissions, congestions, longer		Use of alternate traffic routes; signage should clearly indicate dates of road closures and new routes so residents can plan accordingly Placement of traffic officers at busy	Part of Construction activities

Activity	Potential Negative Impact/Concern	Mitigation Measures	Cost/Remarks
travel times)		intersections to facilitate easy of movement	
Impact to daily life		Prior public notice indicating the date of start of construction and end date of completion should be provided road-wise to the locals allowing them to make adjustments accordingly.	Notice boards are part of construction management practice by the Contractor
C. Operation Stage:			
Regular Monitoring of Sewerage Network and STP/SPS		Regular visits by the environmental and social specialists of the NMCG/SMCG. Safety precautions and protocols should be in regular practice at the STP site.	

7.8 Conclusion

Based on the overall secondary data analysis, field investigation and stakeholder consultations, the proposed project is expected to benefit the Tolly's Nullah's water quality, as the wastewater that currently flows untreated into the Tolly Nalla will be captured, treated and the remainder of the treated effluent will be allowed to discharge into the river Hooghly. The likely beneficial impacts of the projects include:

- ▶ Improvement in sewerage collection and treatment within the cities/towns
- ▶ Prevention of storm drains carrying sanitary sullage or dry weather flow
- ▶ Prevention of groundwater and soil pollution due to infiltration of untreated liquid waste
- ▶ Environmental and Social Assessment with Management Plan
- ▶ Prevention of discharge of untreated sewage into River Hooghly
- ▶ Improvement in water quality of River Hooghly, Adi Ganga, a tributary of River Ganga (a national resource)
- ▶ Improvement in environmental sanitation health and reduction in associated health hazards within the cities/towns
- ▶ Improvement in quality of life, human dignity and increased productivity
- ▶ The reduction of the nuisance of open defecation due to low cost sanitation and reduced malarial risks and other health hazards
- ▶ Control of River water pollution, if usage of treated water can be managed crucially (like washing, water sprinkling, gardening, irrigation etc.), it will reduce the expenditure of fresh water for non-domestic uses.
- ▶ Although there would not be any permanent negative or adverse environmental impacts but will have temporary impacts, that can be mitigated with appropriate mitigation plans. However, the large environmental benefit of the project greatly outweighs the temporary inconveniences.

Table 7-4: Impact Evaluation Matrix (without and with EMP Implementation)

Environmental Components		Without EMP Implementation			With EMP Implementation		
		Pre-Construction Stage	Construction Stage	Operation Stage	Pre-Construction Stage	Construction Stage	Operation Stage
Physical Environment	Air quality		Severe	Significant		Not Significant	

	Noise levels		Severe	Significant		Not Significant	
	Temperature		Significant			Not Significant	
	Odour			Significant			Not Significant
Land Environment	Soil quality		Severe	Significant		Not Significant	
	Soil Erosion		Severe	Significant		Not Significant	
	Debris disposal		Severe	Significant		Not Significant	
	Solid waste disposal			Severe			Not Significant
	Agriculture/Open land	Significant				Not Significant	
	Sludge disposal			Severe			Not Significant
	Water Environment	Surface Water		Significant			Not Significant
Ground Water				Significant			Not Significant
Water bodies			Severe			Not Significant	
Ecological Environment	Flora	Not Significant				Not Significant	
	Fauna	Not Significant				Not Significant	
	Aquatic Habitat		Significant			Not Significant	

Not Significant	Not Significant
Significant	Significant
Severe	Severe

Based on above impact evaluation matrix, it is perceived that proposed STPs and S&D location along with sewerage laying work are rated under **moderate impact category**. The environmental & social impact is anticipated during construction stage which would be local and site specific and can be mitigated through site specific environmental management plan. Construction specific impact has been anticipated on air, water, land and social aspects. With effective site-specific environmental management plan, the associated negative impact can be mitigated. The E&S impacts will be significant, if not managed through specific EMP. The haphazard and unsafe construction may cause severe impact on air, water and soil quality of the city and create nuisance to the local people.

Similarly during operation phase, health safety issues, operation and maintenance issues are anticipated, the management measure following the consent condition of STP will be sufficient to reduce the impact during operation phase. The management measure such as maintaining treated water quality, green belt measures, providing good leak proof sewerage lines, sludge management within the site / reuse will obviously benefit the project and create a good ambience in the region. Above all, the provision of sewerage and sanitation in Tolly's Nullah region will uplift the hygiene and health standard of the region.

8 ANALYSIS OF ALTERNATIVES

Analysis of alternatives involves a thorough study of the possible future conditions in the project study area in response to a set of alternatives without the project or status and condition.

Sewerage Treatment Plant: The project is for establishment of three treatment plants to enhance the capacity of the existing sewerage treatment system available in the city to meet the projected population for year 2040 and 2055.

The project aims to provide a sustainable sanitation and hygiene to the city and subsequently reduce the domestic pollution load into the River Ganga. The proposed project components have been planned to be established within the government land therefore **no alternative site selection has been considered**. However, the STP locations are close to the habitation, hence 33% of the STP area will be considered for developing green cover/plantation to avoid dispersion of any bad odour and noise to the nearby residential area. Moreover, the proposed plant sites will be as per the guidelines of MoEF&CC & ESMF as follows:

- ▶ There are no National Parks/Sanctuaries within 5 km radius.
- ▶ No historical places/places of tourist importance within 0.5 km radius
- ▶ Choice of appropriate technology
- ▶ Land availability, with a preference for government-owned land
- ▶ Engineering and environmental suitability of land
- ▶ Availability of infrastructure facility
- ▶ No forest area (RF/PF)
- ▶ No litigation on land

An analysis of alternatives of Land selected for proposed STP has been presented below:

Table 8-1: Analysis of Land profile

Sl. no.	STPs*	Land Availability	Type of Land
1	Construction of 10 MLD STP near Shahid Khudiram Metro Station, Brijji road	0.3 ha	Open government land, the land has been transferred to KMC from KMDA in year 2019. As per ESMF provision the open government land has been identified closed to the S&D drain and Lift Station. Hence no alternative option has been worked out.
	Construction of 11.6 MLD STP, Bansdroni	1.15 ha	<ul style="list-style-type: none"> • First Option: Earlier, the land to be acquired for the construction of STP was of police telecom department. • Second Options: Due to dispute raised on first option (a person has filed a case for ownership of the same land), an alternate land of Refugee, Relief & Rehabilitation Department in Bansdroni is finalized for STP

Sl. no.	STPs*	Land Availability	Type of Land
			construction. Land transfer to the KMC is under process.
	Construction of 3.5 MLD STP, near Golf Green Pukur	0.32 ha	The land for STP construction was transferred from Sewerage and Drainage Department. Presently land is open Government Land, no alternative approach worked out. The land is sufficient for MBBR/SBR technology
2	Renovation of 11 existing pump house; construction of 7 fresh LS & 5 mini pumping stations - total 23 nos.	Within existing MPS premises, except 1 (0.006 ha) proposed at Madan Pal Lane	To avoid unnecessary burden to the project, based on exiting lift station condition, it is proposed to augment the capacity of existing station with few ancillary additions like pumping station, repairing etc., therefore, augmentation and replacement work have been proposed within existing MPS locations. Hence, no alternative options have been considered for them. The land area for only pumping station that is involving displacement of 8 families belongs to KMC.
4	Desilting, sewer pipeline and allied works including pumping main, box drain & lining of Suti Khal, trunk sewer line, manholes -72km	Existing trunk sewer line and connecting sewer lines of LS & STPs	Existing trunk sewer line & along the ROW of existing road. To avoid the disturbance in the Tolly's nullah embankment area, slight desilting work at broken sewage lines, system network has been proposed at few stretches, majorly out of the encroached areas.

As per discussion with Official at KMC and site visit, it is observed that based on the ESMF provisions of NMCG, the government land is preferred for establishment of STPs. The identified lands are located at different location to connect with the existing rising main line and subsequently to existing Lift stations. The following view point has been considered while selecting the identified land for STPs and LS. All three locations are open government land belong to KMC, rehabilitation department (site for STP2), interdepartmental transfer of land may not be major issue. No rehabilitation / resettlement issue has been envisaged.

- ▶ Availability of encumbrance free Government land (except 0.006 ha at Madan Pal Lane, Bhowanipore)
- ▶ Falling in Catchment zone of Tolly's Nullah
- ▶ Easy to connect with outfalls and lift stations
- ▶ Financially suitable to connect with existing Lift stations and rising mains and further convey to its treatment
- ▶ No involvement of Forest/ PAs
- ▶ No impact on permanent commercial / residential Structure
- ▶ Ease to discharge the treated water from STP

Sewage Pumping Stations: Augmentation of existing pumping capacity of 11 lifting stations and construction of seven fresh MPS along with 5 mini PS within the proposed STP premises as well as in the premises of existing defunct pumping stations under the project. Therefore, no alternative arrangement has been worked out. Other than this, due to congested city ambit, desilting work of existing trunk sewer and repairing of broken line has been proposed with the help of applying both open & trenchless mechanism, wherever applicable within the available ROW.

Technology Adopted for Sewerage Treatment: SBR technology being deployed in many parts of India, is a proven technology where there is space constraint accompanied by population pressure. As per discussions with Project Manager, KMC it is conveyed that analysis of suitable technology in terms of effluent quality, power requirement, land requirement, process flexibility, treatment residuals, performance, total cost involvement, O&M etc. shall be considered. Therefore, based on the efficiency and possessing the mentioned criteria, the tender shall be floated on technology neutral basis.

In order to control water borne diseases due to discharge of sewage to the waterbodies, high level of coliform removal is necessary. As per CPHEEO guidelines, the potential of coliform removal in all aerobic processes, such as Activated Sludge, Trickling Filter and Facultative Aerated Lagoon etc. has been rated as medium. Similarly WSP and low-rate Trickling Filter also show the same trend. On the other hand, potential coliform removal in anaerobic processes, like UASB, FPU is observed to be generally lower than aerobic processes. Potential coliform removal is highest in recycling technologies having tertiary treatment and is very high for MBR and SBR processes.

A comparison of STP technologies in various terms has been presented in table below:

Table 8-2: comparison of STP technologies in various terms

S.No	Type of STP	Process	Benefits	Drawback
1	Activated Sludge Process (ASP)	the conventional process for removal of BOD and SS alone, additionally incorporation of biological nitrification & denitrification for removal of nitrogen	<ul style="list-style-type: none"> The system itself does not cost much to install The effluent water produced is of high quality It does not require much room to install and operate the system within your facility There are very few odours or pests involved, which makes hygienic, safe, and convenient operation easy. The process is relatively efficient 	<ul style="list-style-type: none"> Not very flexible method (effluent and sewage being delivered should be uniform) ongoing operating costs of aerating and recycling the sludge can be high process may not be suitable for all types of wastewater, Industrial water activated sludge may not remain activated and aerated at all times, affects the performance of process Sludge disposal is required on large scale
2	Sequencing Batch Reactor (SBR)	Uses the activated sludge process, pass oxygen through wastewater and activated sludge, decreases the organic materials present in water 'flow-through' system where wastewater enters from one end and treated effluent exits from the other	<ul style="list-style-type: none"> moderate treatment costs (Rs. 3.5/kL), moderate land requirements (~2000 m² /MLD) Flexibility in operation and control High treatment efficiencies, Can remove N and P concurrent with BOD, Absence of odour and corrosive gases Various stages can be achieved in one single reactor vessel Minimal footprint (Compact tank reduces the required space) Possibility of producing electric energy from biogas (SBR+ Anaerobic sludge digestion) low land requirement (-600 m² /MLD) 	<ul style="list-style-type: none"> Skilled supervision is required to check that the returned sludge remains active Requires skilled person to operate Cost-effective, high treatment cost (Rs 5/kL) Dependence on uninterrupted power supply More automation required as compared to other types. Biogas is explosive (risk in case of improper operation) High maintenance, High Capex & Opex
3	Moving Bed Bio	based on the biofilm carrier elements;	<ul style="list-style-type: none"> enhance the activated sludge process 	<ul style="list-style-type: none"> processes designs are empirical and based on prior pilot-plant

4	Reactor (MBBR) / Fluidized Aerobic Bioreactor (FAB)	biofilm carrier elements are floated in the mixed liquor in the aeration tank enhance the activated sludge process by providing a greater biomass concentration in the aeration tank improve the volumetric nitrification rates, accomplish the denitrification in aeration tanks	maintain the concentration of nitrifying bacteria in the aerobic tank, nitrification reaction proceeds efficiently,	When upgrading existing treatment plants clogging may happen
			The structures can be easily covered for indoor air quality when needed	high driving force in terms of D O concentration across the biofilm is required
			accomplish the denitrification in aeration tanks used for the upgrading of existing STP	High reliance on energy
			Requires lower footprints compared to conventional activated sludge	
4	Membrane Bio Reactor (MBR)	a biofilm process which requires less space than activated sludge systems use of a physical barrier for separation liquid from the treated waste-water Low pressure membranes (ultrafiltration or microfiltration) are commonly used reaction tanks comprise an anoxic tank and an aerobic tank the membrane modules are immersed in the aerobic tank	MBR requires less involvement of the operators	Oil and grease is to be fully removed as otherwise membranes will get be choked
			lesser waste sludge than SBR	Needs higher capital and operating costs than conventional systems
			process does not need primary and final sedimentation tanks	Needs a flow equalization tank to regulate fluctuation of the influent flows
			operate at higher volumetric loading rates which result in lower hydraulic retention times	Needs fine screens for pre-treatment to protect membranes
			High quality effluent for reuse without separate nutrient removal and fine filtration, effluent from MBRs is transparent containing almost no TSS	High reliance on energy
			Compact system, reduces plant footprint by 25-40% compared to a conventional STP. lowest land requirements (600 m2/MLD)	highest treatment cost (Rs 9/kL)
			O & M works are easy and free from control of bulking and sludge recirculation	
5	Up flow Anaerobic Sludge Blanket - UASB	an anaerobic process and forming a blanket of granular sludge called three-phase separator, which enables the reactor to separate gas, water and sludge mixtures under high turbulence conditions reactor has multiple gas hoods for the separation of biogas relatively high loading rates of 10 – 15 kg/m3.d possible	valuable biogas energy will be produced	Anaerobic treatment cannot achieve surface water discharge quality without post-treatment
			Much less bio-solids waste generated compared with aerobic process	Reduced sulphur compounds are produced
			A low energy requirement for the treatment process	Longer start-up period
			Less nutrients required	A proper temperature range is required for the anaerobic process (15°C to 35°C)
			System can be shut down for extended periods without serious deterioration	professional staff is necessary for monitoring
			Can handle organic shock loads effectively	Coliform removal is poor, Low aesthetic
7	Waste Stabilisation Pond (WSP)	large, man-made water bodies; individually, or linked in a series for improved treatment There are three types of ponds, (1) anaerobic, (2) facultative and (3) aerobic (maturation), each with different treatment and design characteristics	Resistant to organic and hydraulic shock loads	highest land requirements (20000 m 2 /MLD)
			High reduction of solids, BOD and pathogens	High capital cost depending on the price of land
			High nutrient removal if combined with aquaculture	Requires expert design and construction
			Low operating cost, lowest treatment cost (Rs 1/kL)	Sludge requires proper removal and treatment
			No electrical energy required	
			No real problems with flies or odours if designed and maintained correctly	
8	Fluidized Aerobic Bio-Reactor (FAB)	consists of floating media of cylindrical shapes and different sizes works on the principle of attached bacteria growth process; promotes the growth of organisms that break down the organic solids; Increases the specific volumetric capacity of activated sludge tanks; Controls biomass activity	Significant reduction in space requirement	pumping power required to operate
			Reduced power and operating costs	Requires expert design and construction
			No sludge recycles required	low settling velocity of the particles near the top of the bed leads to a high porosity
			Operate plants in low temperature areas	Skilled operator is required
			Reduce bulking problems in existing treatment plants	Choking of reactor due to floating plastic matter
			Space required is much lower than ASP (0.06 ha/MLD)	Cost is higher than ASP, RS.3-5 million per MLD installation cost

9	Submerged Aerobic Fixed Film Reactor (SAFF)	<p>Cost-effective method of waste water treatment and sewage sanitation</p> <p>Primarily used in residential and commercial complexes.</p> <p>used to reduce the organic loading of residential and commercial sewage reduce the Biological Oxygen Demand (BOD) and a significant quantity of Suspended Solids (SS) ; process uses support media to retain an active biomass to reduce the influent BOD Levels</p>	<p>Small foot print area (0.05 ha/ MLD, much lower than ASP)</p> <p>stable process, lesser sludge production</p> <p>modular installations are the key features of SAFF process, Absence of odour and improved aesthetics</p> <p>Can be designed to any size to deal with larger flow and loads,</p> <p>Fine bubble diffused aeration used generally reduces the energy requirements as compared to surface aerators</p> <p>Higher BOD removal (98%), SS removal, Coliform Removal</p> <p>takes higher shock loads without reducing the plant performance, expandable</p>	<p>High reliance on external energy input (390kWh/ML, much larger than ASP)</p> <p>Clogging of reactor due to absence of primary sedimentation</p> <p>Requires skilled manpower</p> <p>Reliance on proprietary filter media</p>
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Source: Consultant analysis LASA, referred from Compendium of Sewage Treatment Technologies, NRCD-MOEF 2009

Looking at the scenario of busy city area, it is suggested to avoid typical methods of waste water treatment under current project. To control odour, noise and improve the aesthetics of the region, the advanced treatment technologies, such as MBBR, SBR, and MBR should be adopted and accordingly suggested in the bid document also. The sludge control measures have to be effectively taken in all the STP sites since those will be located in the **residential area**.

9 ENVIRONMENTAL MANAGEMENT PLAN

9.1 Environmental Management Plan

The site-specific environmental management plan identifies the potential risk of various activities anticipated in the design and development, construction, and operation phases of the proposed sewerage project in Tolly's Nullah is summarized in Table 9-1. The environmental management plan ensures to suggest appropriate mitigation measure against the issues/ concerns identified during the environmental and social assessment study.

In general, KMC Kolkata Municipal Corporation (with assistance from Contractor and Independent Engineer/Supervision Consultant) is the responsible entity for ensuring that the mitigation measures as suggested in the ESAMP. The roles and responsibilities of the involved institutes are described below.

Implementation of EMP- Specific activities by Jal Nigam

The role of KMC in the implementation of EMP involves the following activities:

- ▶ EMP approval from NMCG and World Bank and disclosure as required;
- ▶ Integrating the ESAMP in the bid document of contractor;
- ▶ Ensure the Tree Plantation in the STP site
- ▶ Ensure the regulatory requirement are compiled under the project

Implementation of EMP- Specific activities by Contractor

- ▶ Site Clearance and site establishment as per SPCB standards
- ▶ Obtain Consent to Establish from State Pollution Control Board for the STP
- ▶ Implementation of other mitigation measures as suggested in the EMP

9.2 Implementation of EMP

As nodal Ministry for the Namami Gange program, the Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation (DoWR, RD&GR) through NMCG is the primary implementing agency for the project at the national level. The implementing agencies at the state level are the State Mission for Clean Ganga (SMCGs). At the local level, specific Executing Agencies (EAs) will be selected for implementation of various activities, including infrastructure investments under the Namami Gange program KMC, Kolkata is the Executive Agency as the parastatal organization for the development of Sewerage and Sewerage Treatment plant at Tolly' s Nullah, West Bengal.

The main functions of the various agencies with regard to the Namami Gange program include the following:

- ▶ The NMCG will be responsible for overall project planning and management at the national level; direct implementation of the national level activities; ensuring satisfactory implementation of the state-level investments and activities; providing guidance, support and approvals to the SMCGs where needed; and monitoring implementation performance;

- ▶ The SMCGs will be responsible for project planning and management at state level, ensuring satisfactory implementation of the state-level investments and Activities; direct implementation of some of the state-level activities; providing guidance, support and approvals to the state EAs where needed; and monitoring implementation performance of the EAs;
- ▶ The EA will plan and implement the activities/investments and put in place arrangements for satisfactory and sustainable operation and maintenance of the assets created. The EA will be responsible for all contract management, including preparation of feasibility reports and DPRs, and seeking the necessary approvals.

The contractor shall be responsible to implement the EMP primarily in assistance with the Project Executing Agency (KMC). The Environmental Engineer/Specialist from the Contractor and Independent Engineer/ Supervision Consultant shall implement and monitor the compliance of the EMP and all the design drawings of various civil structures shall be implemented after his approval. Also, to assist to the respective Project managers to ensure social and environmentally sound and safe construction practices.

The State, local Government will be responsible for Coordination, Monitoring and evaluation of the Environmental Management Plan. It should ensure all the safeguarding plans are in line and acted upon. The Contractor shall report the implementation of the Environment Management Plan to the Environmental Expert and as well as to EA through monthly reports. Further, a quarterly report is required to be prepared and required to be given to SPMG (State Program Management Group) and National Mission for Clean Ganga (NMCG) for the progress made in implementing the Environment Management Plan. Please refer Figure 9-1.

Feedback from the residents can also be taken from time to time to cross check the contractor's report. KMC and SMCG officials should make inspection visits at the construction site to check the implementation of Environment Management Plan as per the contract.

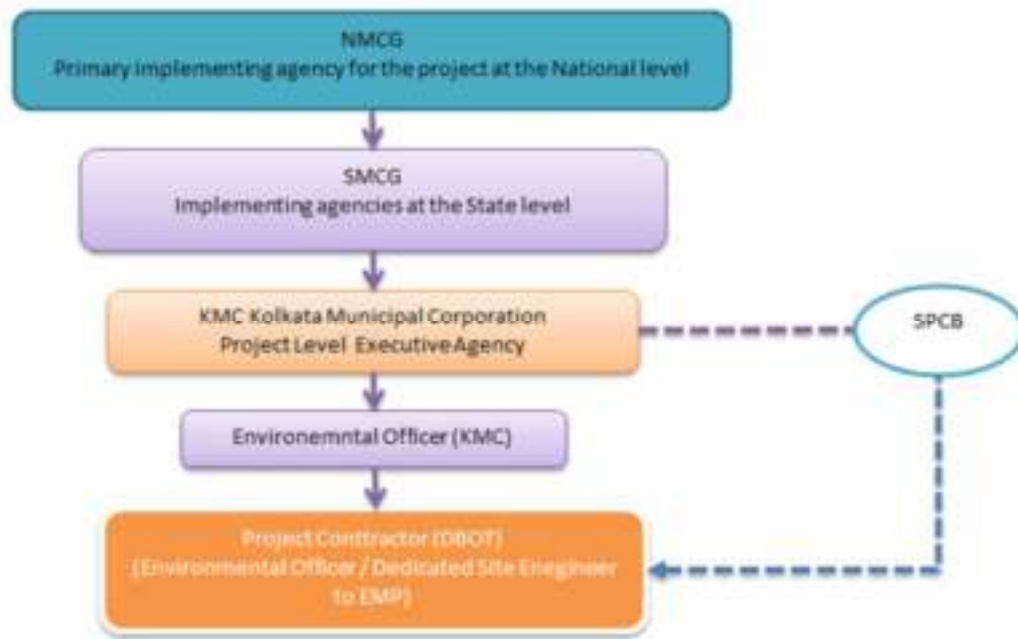


Figure 9-1: Responsibility Flow for EMP Implementation

Function and Organization Structure of Executive Agency

During ESAMP preparation it was discussed that with the Government officials of KMC and ULBs, according to the discussions with the officials presently at Urban Development & Municipal affairs Department, Government of West Bengal is functioning as the State Program Management Group (SPMG) for the implementation of NBRGA projects. Under the SPMG, Kolkata Municipal Corporation (KMC) is functioning as the Executing Agency. The Sewerage and STP Scheme at Tolly’s Nullah will also be implemented under the same structure. One Environmental Safeguard Official placed at SPMG is functioning as the focal point for environment and social safeguards.

The vision and the mission of KMDA are to provide sustained and improved quality of life through basic urban services and an inclusive manner and create enabling environment for attracting domestic and international investors to live, work and invest in Kolkata Municipal Corporation.

**Table 9-1: Environmental Management Plan for Low impact category Investments
 (Interception and Diversion (I&D) with STP works at Tolly's Nullah, Kolkata)**

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
Pre-construction Stage					
Statutory clearances, NOCs, Permits, etc.)	<ul style="list-style-type: none"> All statutory clearances required for Environmental and Social aspects during construction shall be ensured and made available prior to award of civil works and/or before start of civil works. Ensure that all necessary approvals for construction to be obtained by Contractor are in place before start of construction activities. Include in detailed design drawings and documents all conditions and provisions if necessary. Effort should be taken as such to minimize the tree cutting as much as possible In case of using ground water, contractor shall ensure approval from CGWB for extraction of water, or authorized source water supply should be undertaken with consultation with KMC Ensure NOC for the proposed land is in place Ensure the land without encroachment is available 	The Environment (Protection), Act, 1986	Contractor	NMCG / KMC/ SMCG	Before Construction
Consent to Establish (CtE)/ Consent to Operate (CtO)	<ul style="list-style-type: none"> Consent to Establish (CtE) need to be obtained prior to the start of STP construction work from the State Pollution Control Board 	Under the Air (Prevention and Control of Pollution) Act, 1981. The Water (Prevention and Control of Pollution) Act, 1974	Contractor	NMCG/SMCG/KMC	Before start of construction work.
Utility Relocation	<ul style="list-style-type: none"> As per information from KMC, few utilities shifting will be required in laying Sewer line along the existing Road of about 72 km. Therefore prior to construction, the following measure shall be adopted by Contractor: Identify the common utilities to be affected such as: telephone cables, electric cables, electric poles, water pipelines, public tabs, etc. Identify and include list of affected utilities and Contractors of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase. 	ESMF Guideline NMCG	Contractors in collaboration and approval of concerned department / KMC/ SMCG	Concerned department / KMC/ SMCG	Pre-construction & Construction phase

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> Affected utilities shall be relocated with prior approval of the concerned agencies before construction starts. Provide advance notice (not less than 10 working days) to affected parties. The advance notice shall be in the form of written notice and a grievance redressal cell shall be established for timely addressing of grievances. Bid document to include requirement for a Contingency Plan for service interruptions (For example provision of water if disruption is more than 24 hours). 				
Labor Camps/ Stacking yard	<p>The identification of locations of labor camps should be finalized prior to the start of construction work. The raw material stacking area should be identified and get approved by the implementing agency prior to start of construction work.</p> <p>To avoid local dispute, preference should be given to hire local Labour as much as possible.</p>	ESMF Guideline NMCG	Contractor	SMCG/NMCG/Other implementing agency	Pre-construction & Construction phase
Provision of flood risk management, effective storm water drainage	<ul style="list-style-type: none"> Around 1634 mm annual rainfall recorded in the project, which is quite good above than state average, accordingly provision should be given for adequate holding capacity for storage of sewage to prevent flow of untreated sewage into river. Suitable drainage provision should be made to divert the rain water likely to be accumulated from peripheral catchment area of STP, to natural drainage stream or area. Specific Garland drains to be provided at all lifts stations and STPs to avoid the water logging during monsoon. The height of STP should be considered with HFL level of the river, though this has been mentioned in the DPR, even executive team should reconfirm this. Proposed STPs are located at 50 m from Tolly's Nullah bank, special care in terms of Monsson protection will be required. 	<p>ESMF Guideline NMCG</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Contractor	SMCG/NMCG/Other implementing agency	Pre-construction & Construction phase
Disposal of treated waste water	<ul style="list-style-type: none"> The treated water quality shall comply with the prescribed standards of the State Pollution Control Board and NGT 2019 before let out into the stream/nullah/drain/open land/irrigation purposes. 	<p>ESMF Guideline NMCG</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Contractors	KMC / SMCG	Pre-construction, Construction and Post

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> Provision of effective separation and controlled disposal of digested sludge Preference shall be given to reuse the treated water in nearby agricultural field available to the site. Effort should be taken to sale the treated water to nearby by Industries. . 				Construction phase
Provision for accidental leakages/ bursts, STP Breakdown	<ul style="list-style-type: none"> Provide proper drainage arrangements so that the water does not stagnate on the site especially for new STP and MPS/SPS building site A provision of holding of untreated sewage is required to be made so that during the STP breakdown the untreated sewage does not flow to the river Designing sewers with adequate capacity and gravity flow velocity, Regular inspection and maintenance of the sewer lines 	ESMF Guideline	Contractors	KMC / SMCG	Pre-construction, Construction and Post Construction phase
Safety measure for COVID 19 Pandemic issue	<ul style="list-style-type: none"> During COVID 19 Scenario, a Separate Safety Preparedness plan shall be prepared by Contractor before start of Work for COVID 19. Criteria such as Initial health Screening w.r.t COVID 19 Issue, vaccination (if available for Migrant laborers) & avoid overage worker deployment (above 60 yrs.) deployment at site shall be added in the COVID 19 Safety Plan. 	Occupational Safety and Health Administration (OSHA) 2020	Contractors	KMC / SMCG	Pre-construction, Construction
Construction Stage					
sources of construction materials	<ul style="list-style-type: none"> Contractor to prepare list of approved quarry sites and sources of materials with the approval of KMC/ SMCG. Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary. The contractor has to procure aggregate from the identified authorized vendor who has all the necessary approvals. 	Vendor/Supplier should have prior approval for sand/ quarry material mining under Amended EIA notification dated 15 th January, 2016.	Contractors / Contractors to finalize quarry sites and sources of materials in consultation and approval of KMC/ SMCG	KMC / SMCG	Upon submission of work plan by the Contractor / Contractor.
Storage of construction materials	<ul style="list-style-type: none"> The construction materials shall be stockpiled in designated areas only. The contractor shall identify the site for temporary use of land for construction sites / storage of construction 	ESMF Guideline NMCG	Contractors	KMC / SMCG	Pre-construction, Construction and Post

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>materials, etc. These sites shall be operated only after prior approval of the engineer.</p> <ul style="list-style-type: none"> • Prioritize areas within or nearest possible vacant space in the project location. • Construction materials shall be stored on the high laying areas and storing near to storm water run-off channels or any low lying areas to be avoided. • 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. 				Construction phase
Fencing of project sites	<ul style="list-style-type: none"> • The project sites shall be properly fenced prior to the commencement of construction activities, to restrict public access. • All structures are new; thus fencing will be required for STPs. • Since the desilting work and STP work is located in the city area, proper fencing at each side to safeguard the site from local public, traffic etc. to be ensured by the contractor. • Pipelines shall be laid phase-wise in small stretches of land and reclaimed back immediately before starting with next stretch of land, • Awareness among the local public to be made by contractor in advance before start of the work. • All cut trenched should be properly fenced and should be provided with light blinkers for night time. • Contractors shall work during the lean traffic period and avoid peak hours of traffic. • During the detailed design phase, contractor will come up with a detailed traffic diversion plan and suitable construction plan. • Necessary EHS measurements will also be taken up with hard barricading. 	The World Bank Group General EHS Guideline for Occupational Health and Safety.	Prospective Contractors	KMC/ SMCG	During Construction and Operation
Site clearing and grubbing and lying of	<ul style="list-style-type: none"> • All work shall be done in feasible manner so that minimal flora disturb. 	ESMF Guideline	Prospective Contractors	KMC/ SMCG	During Construction

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame and Operation
rising main, STP (Excavation, cutting, back filling and compaction operations)	<ul style="list-style-type: none"> All these underground utilities encountered in excavating trenches carefully shall be supported, maintained and protected from injury or interruption of service until backfill is complete and settlement has taken place. Maintaining the excavation by Shoring trench sides by placing sheeting, timber shores, trench jacks, bracing, piles, or other materials to counter the surrounding earth load pressure. Exposed surface will be resurfaced and stabilized by making the sloping sides of trench to the angle of repose at which the soil will remain safely at rest. Backfilling activity should follow the construction schedule, as recommended by the DPR, which estimates that a 1 km stretch of construction work is to be completed in approximately 2.6 days. To ensure the excavated area to be filled, covered at end of every day to avoid local nuisance and accidents. 				
Disposal of construction debris and excavated materials	<ul style="list-style-type: none"> Excavated soil and construction debris shall be suitably stored to filling back the excavated areas after placing the sewer lines. Suitable site should be identified for safe disposal of construction debris and excavated materials, in relatively low-lying areas, away from the water bodies, residential and agricultural fields, etc., and got approved by the engineer. Ensure the 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 for reuse of excess spoils. Care should be taken that dumped material does not affect natural drainage system. Top soil generated during various construction activities shall be used for agricultural purpose, planned land filling and landscaping. All the plastic/ cement bags should be stored properly and should be disposed through authorized vendor. Debris should not be dumped near to the TollyNalla's 	<p>The Construction & Demolition Waste Management Rules, 2016. Solid Waste Management Rule , 2016.</p> <p>The Plastic Waste Management Rules, 2016.</p>	Prospective Contractors	KMC / SMCG	During construction

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>region, the dumping site should be identified in consultation with local public and KMC staff. Low lying area to be used for excess dumping activities.</p> <ul style="list-style-type: none"> Arrangement to be made to reuse the excavated debris in filling of STP site itself. 				
Pollution from fuel and lubricants	<ul style="list-style-type: none"> Care to be taken to store fuel and oil (if required) at a place away from any drainage channel/nalla preferably to be stored in drums mounted on a concrete paved platform. The contractor shall ensure that all constructions vehicle parking location, fuel / lubricants storage sites, vehicle machinery and equipment. Maintenance and refueling sites will be located at least 500m from rivers and irrigation canal/ponds. Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the engineer. All spills and collected petroleum products will be disposed off in accordance with MoEF&CC and state PCB guidelines. 	<p>Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016</p> <p>The World Bank Group General EHS Guideline for Occupational Health and Safety</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	KMC / SMCG	During Construction and Operation
Air pollution for emissions from the construction vehicles, equipment and machinery	<ul style="list-style-type: none"> As evident from the ambient air quality level sampling record shows that all the CPCB's prescribed parameters except Particulate Matter were found within permissible limit (i.e., gaseous pollutants SO_x, NO_x, CO). Particulate Matters (PM₁₀, PM_{2.5}) were found as crossing the permissible limit slightly at all the sampling locations. Thus during construction phase plying of construction vehicle, civil work may will enhance the dust and particulate matters. So keeping in mind following mitigation measures shall be adopted by contractor Maintain DG sets using at site should follow enough Stack as per CPCB norms. Water shall be sprinkled regularly to suppress airborne dusts from truck / dumper movements particularly on unpaved surfaces. Damp down exposed soil and any stockpiled material on site by water sprinkling necessary during dry 	<p>The World Bank Group General EHS Guideline for Occupational Health and Safety</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	KMC / SMCG	During Construction and Operation

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>weather. Maintain of log book too for the same.</p> <ul style="list-style-type: none"> • Tarpaulins shall be to cover sand and other loose material when transported by trucks. • All heavy equipment and machinery shall be fitted with air pollution control devices. • Maintain construction vehicles and obtain "Pollution under Control" certificate from concerned Authority. • Ambient Air Quality monitoring has to be performed as per the Environmental Monitoring Program. • The Contractor has to submit the method statement to comply with Air Act, 1981 before construction. • Appropriate PPEs (Mask N-95) to be provided to worker/labourer handling the fine dust and construction material. • Transportation of materials to the site shall be covered to avoid spillage of materials. • Practice traffic diversion near the heavy traffic zones and implement the diversion plan as approved by client, avoid the common traffic area to haulage the material. 				
Decline of ground water quality	<ul style="list-style-type: none"> • Ground water quality may get contaminated due to leaching of waste water. So, the treated water quality shall comply with the standards laid down by the CPCB for disposal onto land, water body or for irrigation use. • The extraction of ground water for construction work should not be anticipated. If required, prior permission from the CGWB is required. • All the construction work, cut trench, piling etc should be three feet above the ground water table. • No hazardous chemicals etc should not be stored near cut trench, bore well. • The construction should be such that no leakage in underground sewerage, MPS well and LS should undergo hydrometric test for leaks. 	<p>The Environment (Protection) Act, 1986</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	KMC / SMCG	During Construction and Operation
Water pollution from construction	<ul style="list-style-type: none"> • The Contractor shall avoid construction works close to the streams or water bodies during monsoon. • No construction camp shall be allowed near to 100 m of 	World Bank's EHS Guidelines for Water and Sanitation	Prospective Contractors	KMC / SMCG	During Construction and Operation

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>River line, pond water bodies.</p> <ul style="list-style-type: none"> • Proper barricading, bund protection shall be done if work is closed to these regions. • The contractor shall take all precautionary measures to prevent the waste water generated during construction from entering into streams, water bodies or the irrigation system. All waste arising from the project is to be disposed off in the manner that is acceptable by the Engineer. • STP operations shall take place only after Consent to Operate (CTO) certificate is accorded by the PCB and treated water quality shall comply with the consent conditions stipulated by SPCB or at minimum shall meet the discharge standards depending on the type of receiving water body (stream / nullah / drain / open land / irrigation purpose, etc.). • Performance standards shall always be maintained, ensuring efficient working condition of treatment plant. • The contractor can utilize STP treated water, if water quality meets the water quality requirement for construction work. 				
Portable Water	<ul style="list-style-type: none"> • Sufficient supply of portable water at all the construction camp, active site, etc. should be provided and maintained. 	<p>The water Quality should comply with IS:10500(2012) norms World Bank's EHS Guidelines for Water and Sanitation</p>	Contractor	MNCG/SMCG /Implementing agency	During Construction phase/ Operation Phase
Flooding of adjacent areas	<ul style="list-style-type: none"> • Garland drain shall be constructed within the premises of proposed STP and MPS to avoid flooding in premises and neighborhood area in case of storm water during monsoon. • Stockpiled areas shall be bordered by berms. • Monsoon preparedness plan to be done for each STP site and adhere to that prior to monsoon. 	<p>ESMF Guideline World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	Project Supervision Consultant/KMC / SMCG	During Construction and Operation phases
Increased noise level due to construction activities	<p>The desilting, cleaning, changing of sewer pipe and construction of STP works are proposed in city area, accordingly noise pollution reduction measure to be adopted at each construction site by the contractor.</p>		Prospective Contractors	Project Supervision Consultant KMC / SMCG	During Construction and Operation phases

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>The measure like:</p> <ul style="list-style-type: none"> • Provide curtains or sound barriers (poly sheets / GI sheets) all around the construction site. • Proper maintenance of construction equipment and vehicles. • The Contractor has to submit the method statement to comply with Noise Rules as per EP Act, 1986 before construction. • Construction activities to be carried out in day time with prior intimation to local residents. • Construction activities particularly near sensitive zones like schools and colleges to be carried out during vacations and the works near hospitals to be completed on priority basis (in short time period with alternate provision of traffic, accessibility of exit / entry gates, etc.). • DG Sets to be used at site should have acoustic enclosure. • Proper PPEs (ear muff) shall be provided to worker having long time noise generated heavy work etc. • All the construction activities should be carried out during the day time i.e 10:00 A.M to 6:00 P.M No nights time work should be allowed. • Awareness to local public to be made prior to start of construction. • Safety signages, precautionary board at each active site to be done by the contractor. 	<p>THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000</p> <p>The World Bank Group General EHS Guideline for Occupational Health and Safety</p>			
Noise pollution due to operation of pumps and machineries	<ul style="list-style-type: none"> • DG sets will be provided with acoustic enclosures. • The Stack height of the D.G set should be maintained as per the CPCB guideline for noise abatement. • The D.G set should be thickly padded as abatement to vibration pollution. • No night time construction work should be anticipated • Green belt / two rows tree plantation and landscaping will be developed along the periphery of the STP and SPS which will attenuate noise. 	The World Bank Group General EHS Guideline for Occupational Health and Safety	Prospective Contractors	Project Supervision Consultant KMC / SMCG	During Construction and Operation phases

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> Pump station and air blowers in STP shall ensure minimum noise generation by locating within a noise reducing structure or in an enclosed space (such as concrete/brick structure). Equipment's need to meet the noise standards as prescribed by CPCB13. Ambient Air Quality monitoring with respect to Noise should be carried out at all the construction site, stacking yard, loading and unloading area, etc. as per the general and specific condition of CtE. 				
Odour	To avoid the problems of foul smell polluted air, insects, noise pollution and other problems buffer zones to be provided in the form of green belt around the STP site, this has to be strictly ensured.	ESMF Guideline World Bank's EHS Guidelines for Water and Sanitation	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Construction and Operation
Protection of soil and Environmental enhancing	The 15 cm top soil should be stored at designated location within the site. It should be stabilized using seeding and mulching as preventive measures. it can be used for gardening purposes at STP site as an environmental enhancing measure.	ESMF Guideline	Prospective Contractors / Contractors	KMC / SMCG	During construction
Settlement of backfilled area after construction	<ul style="list-style-type: none"> The backfilling material shall be free from petroleum products, slag, cinders, ash or other material. Backfilling activity should strictly follow the construction schedule. Proper compaction as per the soil condition and retain the original level/ alignment. 	ESMF Guideline	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Construction and Operation
Information signs and hoardings	The contractor shall provide, erect and maintain informatory /safety signs, hoardings written in English and local languages, whatever required or as suggested by the Engineer.	ESMF guideline	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Construction and Operation
Planning temporary traffic	<ul style="list-style-type: none"> Appropriate Traffic Management Plan shall be prepared and implemented by the Contractor after necessary approval of SMCG / NMCG. Temporary diversion will be provided with the approval 	ESMF guideline	Prospective Contractors / Contractors	Project Supervision Consultant /KMC / SMCG	Pre-construction, Construction and Post

¹³<http://moef.gov.in/citizen/specinfo/noise.html>

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>of the engineer. Detailed traffic control plans will be prepared and submitted to the engineers for approval, at least two weeks prior to commencement of works.</p> <ul style="list-style-type: none"> Construction activities at commercial / business and market areas must be completed on war footing basis to minimize business loss. The traffic control and plans shall contain details of temporary diversion, details of traffic arrangements after cessation of work each day, SIGNAGES, safety measures for transport of hazardous materials and arrangements of flagmen. Any accidents and/or risk of inconveniences caused to the community shall be borne by the Contractor. 				Construction phase
Disposal of treated waste water	<ul style="list-style-type: none"> The treated water quality shall comply with the prescribed standards of the State Pollution Control Board and NGT before let out into the stream/nullah/drain/open land/irrigation purposes, and necessary permission to be obtained from the concerned department. Ensure efficient working condition or treatment plant. Prevent the pollution of stream water and other water bodies receiving STP discharge. 	<p>The treated effluent shall comply with schedule –VI (General Standard for Discharge of Environmental pollutants Part –A : Effluents as per the CPCB Guidelines.</p> <p>World Bank’s Group Environmental, Health, and Safety Guidelines for Water and Sanitation. & the World Bank Group Environmental, Health and Safety (EHS) Guideline General.</p>	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	Pre-construction, Construction and Operation phase
Disposal of sludge	<ul style="list-style-type: none"> Proper sludge management plan shall be prepared by the Contractor. A logbook for sludge disposal shall be maintained at STP sites Instead of disposing digested sludge opt for providing it to local farmers or to the authorities for the landscaping purposes in city level / district level. The Contractor shall need to identify specific site for intermittent storage of waste from SPS and STP site within plant premises. 	<p>CPHEEO; Manual on Sewerage and Sewage Treatment Systems - 2013</p> <p>World Bank’s EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Construction and Operation

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> Surplus amount of Sludge shall be properly disposed at authorized Solid Waste Management Site at Dhapa and/or at Keorapukur site, which is about 17 to 20 km away from the project sites of Kolkata Municipal Corporation. Contractor will be responsible for proper coordination with ULB' SWM agency for safe disposal of sludge. Contractor shall be responsible to get the Bio chemical quality check of dried sludge before handling to farmer or using as soil conditioner in nearby area. The sludge disposal standard as per CPHEEO 2016. 				
Compensatory plantation of trees/ protection of Flora , Fauna	<ul style="list-style-type: none"> Compensatory plantation of at least thrice the number of trees felled should be done in line with competent authority guidelines. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including restriction of fishing in any water body and hunting of any animal. 	ESMF Guideline	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	Pre-construction, Construction and Post Construction phase
Construction of labour camps	<ul style="list-style-type: none"> Contractor/Contractor shall follow all relevant provisions of the Factories Act, 1948, the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and World Bank's Accommodation Processes and Standards for construction and maintenance of labour camp. Though the project is located in dense urban area, so provision of construction camp near to the site is not advisable and feasible. While during construction phase, local labour shall be preferred for construction activities. However, location of construction camp shall be finalized not close to 1 km vicinity of dense habitation. Contractor/Contractor shall follow all relevant provisions of the Factories Act, 1948 and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. 	Building and the Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 World Bank's Accommodation Processes and Standards	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During the Construction

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. The construction will commence only upon the written approval of the Engineer. The contractor shall maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the engineer. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. The sewage system for the camp must be planned. Adequate health care is to be provided for the work force. The layout of the construction camp and details of the facilities provided should be prepared shall be approved by the engineer. The construction camp shall not be located within 1000m from the nearest water stream, residential areas and / or any sensitive land uses like schools, hospitals, etc. Labour Management Plan shall also be prepared and implemented by the Contractor after necessary approval of SMCG / NMCG. 				
Labour camp & facilities	<ul style="list-style-type: none"> Settling up of labour camps needs to be done as per all relevant provisions of the Factories Act, 1948, the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and World Bank's Accommodation Processes and Standards. Adequate potable water facilities, sanitation and drainage etc., in conformity with the Indian labour laws shall be ensured. The contractor shall also guarantee the following: The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. The construction will commence only upon the written approval of the Engineer. 	<p>Building and the Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996</p> <p>World Bank's Accommodation Processes and Standards</p>	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Pre-construction and Construction phase

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> The contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. The provision of good drinking water and sanitation facility shall be plan of construction safety plan. It is the responsibility of contractor for Sufficient supply of potable water (as per IS: 10500) at workplace. Separate Washrooms for female labour must be constructed at the labour camps and each construction sites. The sewage system for the camp are designed, built and operated in such fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. Ensure adequate water supply is to be provided in all toilets and urinals. <p>Health and safety</p> <ul style="list-style-type: none"> In order to have emergency care at construction site and avoid any mis-happening, Contractor shall tie-up with nearest hospital (at least- 2nos.) for emergency health care services. On any health issues at site, the workers can get the treatment in normal circumstances as well any emergency. An Initial Health screening along with screening at regular interval (in every 6 months) should be provided for all workers and staff during construction and operation phases.. Health condition will also be checked before mobilizing the labour at site. Biomedical waste emanated from the construction site shall be managed as per BMW Rule 2016 and amendments Provisions of First Aid services, having trained health care service provider at site 				

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> Ambulance should be deputed at active construction site, STP site, network laying in congested area etc.. Contractor shall be responsible for providing safe Drinking water facility for workers and ensure regular drinking water quality monitoring (RO plant) at labour camps as well as construction sites. All provision such as separate toilet for male and female workers, proper sanitation , bio toilet to provided at construction camp and construction sites as per BOCW act & Factory Act 1948 Labour camp will be provided with sanitation, drinking water, medical, food and space for recreation activities after work. Proper disposal of wastes generated from the camp and construction activity will be followed to maintain the general hygiene in the area. 				
Risk from Electrical Equipment	<ul style="list-style-type: none"> The contractor shall take all required precautions to prevent danger from electrical equipment and ensure that – No material shall be stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to satisfaction of the Engineer. OHS Management Plan shall also be prepared and implemented by the Contractor after necessary approval of SMCG / NMCG 	Building and the Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 The World Bank Group Environmental, Health and Safety (EHS) Guideline General for Occupational Health and Safety.	Prospective Contractors / Contractors	Project Supervision Consultant /KMC / SMCG	During Construction and Operation
Desilting of trunk nala & LS and	<ul style="list-style-type: none"> All the de-silting operation should be carried out during non – monsoon season. 				

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
Sewerage	<ul style="list-style-type: none"> • Drained labors and engineers should be used. • While de-silting sewerage, the manhole cover should be removed 6 hours on both side prior to start of work. • Provision of gas detector, lighting system, ventilation system, gas supply system, escape rope, etc should be ensured before start of work. • Maximize use of machinery for de-silting work for under ground sewerage and for trunk nala. • De-silting area should be properly fence. • PPE kits should be available at site. • The silt material should be removed on regular bases and not left for dewatering or drying. The silt should be properly covered during transportation. • The removed silt should be dumped at identified site provided by KMC. • SOP for under ground should be approved before start of work. • Provision of underground cameras, robot should be explore by the contractor. 				
Occupational Safety aspects	<ul style="list-style-type: none"> • Adequate precautions shall be taken to prevent the accidents and from the machineries. All machines used shall confirm to the relevant Indian standards code and shall be regularly inspected. • The excavation and loose soil shall be maintained with the provisions of shoring trench sides by placing sheeting, timber shores, trench jacks, bracing, piles, etc. to avoid collapse of soil. • Exposed surface shall be resurfaced and stabilized on priority basis. • Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. • Welder's protective eye shields shall be provided to workers who are engaged in welding works. • Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or 	<p>Building and the Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During construction

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>concrete mixing operation.</p> <ul style="list-style-type: none"> • The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. to workers and staffs. • All the maintenance work should minimize slipping and tripping hazard • Use proper techniques for trenching and shoring • Accident reporting mechanism at active site to be adopted and each case wise root cause analysis (RCA) to be done by safety staff and senior engineer of the contractor. • Gas analyzers with proper calibration must be facilitated at desilting, sewer cleaning work on priority basis. • Toe boards should be available at almost all locations for SPS (Sewerage Pumping Stations) to avoid trip/fall hazards. • excavation safety in general- this includes barricading, diversion signage, ladders for escape of persons working, safe escape area, shoring, electrical hazards and others are required to be attended regularly by contractor • Caution boards and Danger sign boards should be displayed at all construction sites along with fencing with safety barricade tape. • A Construction Permit to Work must be in place to avoid electrical, mechanical and chemical hazards during specific work/ maintenance • Use safety harness and lifeline before entering the sewer line. • Ventilate the sewer line by opening two or three manholes on both the sides where work is to be carried out. • Use Gas masks when men have to enter into the sewer line. • The contractor will comply with all the precautions as 				

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>required for ensuring the safety of the workmen as per the International Labour Organization (ILO) convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction work all relevant provisions of the factories act, 1948 and Building and other Conditions of Services) Act, 1996 are adhered to.</p> <ul style="list-style-type: none"> The contractor will not employ any person below the age 14 years. 				
Safety Alertness on the site due to COVID 19 pandemic Disease	<p>Contractor shall be responsible to provide following safety arrangement for COVID 19 issue</p> <ul style="list-style-type: none"> A basic Health screening of all new workers shall be carried out before deployment (Risk of serious illness rises with age wise). Avoid over aged (more than 60 years old) workers deployment in Project area during COVID-19. If available, ensure vaccination to all workers against COVID 19 pandemic. Always ensure all workplaces are clean and hygienic, Promote regular and thorough hand-washing by all workers with any soap or Alcohol based hand rub Regular Sanitization shall be carried out in all workplace, common areas, equipment, handle, railing etc. Promote good respiratory hygiene in the Workplace. Wearing of a face mask is compulsory to all workers during this period of COVID 19. Always maintain sufficient gap between workers / staff as per mentioned in the guidelines (Min 1m interval) All kinds of Social Gathering must be avoided. There will be strict ban on the use of Gutka', 'Tambaku', 'Paan' etc. at work sites and spitting shall be strictly prohibited as well. Entire construction site including site office, labour camp, canteens, pathways, toilets, and entry / exit gates must be disinfected on a basis. Housekeeping 	Occupational Safety and Health Administration (OSHA) 2020	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Construction and Operation phase

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>team should be provided with all necessary equipment/tools.</p> <ul style="list-style-type: none"> • Encourage workers to stay home if they are sick. • Avoid large gatherings or meetings (Eg : TBT/ Site / Office committee meeting) . Maintain at least 1 meter (3 feet) distance from persons. • Especially with those having flu-like symptoms, during interaction. Not more than 2/4 persons (depending on size) should be allowed to travel in lifts or hoists. Use of staircase (Height works) for climbing should be encouraged for manual concrete work. • Appropriate signage shall be installed at construction sites, spelling out safety practices in the language which is understood by all. • Organize regular awareness program on COVID 19. • Employers should inform and encourage employees to self-monitor for signs and symptoms of COVID-19 if they suspect possible exposure. • Providing workers with up-to-date education and training on COVID-19 risk factors and protective behaviors (e.g., cough etiquette and care of PPE). • Rest area should be maintained in good hygienic with regular cleaning and sanitization. <p>During the activity, meetings, events</p> <ul style="list-style-type: none"> • Develop and agree a preparedness plan to prevent infection at meeting or event. • Provide information or a briefing, preferably both orally and in writing, on COVID-19 and the measures that organizers are taking to make this event safe for workers • If anyone who starts to feel unwell, follow your preparedness plan. <p>Common Area/ Construction vehicle & Activities</p> <ul style="list-style-type: none"> • All vehicle need to be sanitized regularly and advise workers / Staff need to maintain the gaps (1m interval minimum) . • All vehicles and machinery entering the premise should be disinfected by spray mandatorily. 				

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> Non-touch garbage bins with biodegradable garbage bag should be installed for waste collection at all common access areas. Proper disposal of garbage bags along with daily cleaning and sanitization of bins should be ensured. Wipe down interiors and door handle of machines or construction vehicles, the handles of equipment and tools that are shared, with disinfectant prior to using. Maintaining the social distance during material shifting 				
First Aid	<ul style="list-style-type: none"> The contractor shall arrange for: Readily available first aid units including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules I every work zone. Availability of suitable transport at all times to take injured or sick persons to the nearest hospital. 	Building and the Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Construction
Livelihood	<ul style="list-style-type: none"> If any impacts on livelihood of any permanent shop owners, licensed kiosks noticed during construction, then should be compensated according to the Entitlement Matrix of ESMF. Awareness for safe construction amongst the local to be done prior to construction by contractor. 	ESMF Guideline	KMC/ SMCG / Prospective Contractor	NMCG / KMC / SMCG	Pre-construction & Construction phase
Protection near to historical Monuments	<ul style="list-style-type: none"> No construction is envisaged near to regulatory zone of ASI Monuments, however contractor shall ensure that no disturbance activity to be undertaken near to sensitive zones. Precautionary Signage to be provided. Sensitization among worker shall be undertaken for awareness about significance of monuments and penalties prescribed under Ancient Monuments and Archaeological Sites and Remains Rules 1959 and Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act 2010. 	ESMF Guideline It should also comply with the World Banks Operational Policy (O.P) 4.11 – Physical Cultural Resources.	Contractor/ Project Supervision Consultant	NMCG / KMC / SMCG	Pre-construction & Construction phase
Impact on Community	<ul style="list-style-type: none"> If any temporary/Permanent impact on residential structures, Land and assets will be occurred during construction, then should be compensated according to the Entitlement Matrix of ESMF. 	ESMF Guideline	KMC/ SMCG/Project Supervision Consultant / Prospective Contractor	NMCG / KMC / SMCG	Pre-construction & Construction phase

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
Possible conflicts with and/or disruption to local community	<ul style="list-style-type: none"> Community Consultations shall be conducted at all the project locations, all the project locations and in nearby residential and market area prior to the initiation of construction activities. All possible disputes during construction work shall be avoided by hiring of local labour as much as possible. In case of migrant labour hiring, the fundamental facility in labour camp shall be ensured by contractor to avoid further disputes. 	ESMF Guideline World Bank's Accommodation Processes and Standards	KMC/ SMCG / Prospective Contractor	NMCG / KMC / SMCG	Pre-construction & Construction phase
Grievance Redressal	<ul style="list-style-type: none"> A grievance Register must be maintained and monitored at each of the construction site. Contact details of designated Grievance Redressal Officer (GRO) must be displayed at the each construction site. 	ESMF Guideline	KMC/ SMCG / Prospective Contractor	NMCG / KMC / SMCG	During Construction and Operation
Gender Assessment and Development	<ul style="list-style-type: none"> Employ female in construction and other project related activities. A gender disaggregated details of labourers shall be maintained in register at all the projects sites. Female participation in O&M, Monitoring & Evaluation processes Training & Capacity Building of project staff focusing on Labour Standards Orientation of project staff, contractors and other stakeholders regarding Gender Sensitive issues and Gender development indicators. Subproject design should be Gender responsive. Preparation and development of IEC (Information, Education and Communication) material in the local language on gender equality. 	ESMF Guideline	KMC/ SMCG / Prospective Contractor	NMCG / KMC / SMCG	During Construction and Operation
Gender Based Violence (GBV)	<ul style="list-style-type: none"> Mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women Informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; Introducing a Worker Code of Conduct as part of the 	ESMF Guideline Sexual Harassment of Women at Work Place (Prevention, Prohibition and Redressal) Act, 2013	KMC/ SMCG / Prospective Contractor/Contractor	NMCG / KMC / SMCG	Pre-construction, During Construction and Operation phase

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> employment contract and including sanctions for non-compliance (e.g., termination), Contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence. Internal Complaint committee addressing GBV and GRM need to be constituted at EA, SPMG and NMCG level. Prepare IEC material in the local language for policy against Sexual harassment at workplace and display in strategic locations Capacity Building of Social and Environment Specialists and project officials and project staff on GBV to be organized at regular intervals. Inclusion of consequences of GBV in safety induction. A Grievance Register must be maintained in Project offices and at each Construction site followed by the Status of GBV Complaints - Total cases, Resolved, Pending, and Type of action taken. 				
Site Restoration	<ul style="list-style-type: none"> The Contractor shall prepare site restoration plans that shall be approved by the Engineer. The plan shall be implemented by the Contractor prior to demobilization. On completion of the works, all temporary structures shall be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer. 	Construction guideline MOEF & CC	Prospective Contractor	NMCG / KMC/Project Supervision Consultant / SMCG	During the closure of Construction
Inclusion of Environmental & Social Monitoring Plan	<ul style="list-style-type: none"> Environmental & Social Monitoring Plan shall be included in the detailed ESAMP prepared and implemented by the Contractor after necessary approval of SMCG / NMCG. 	ESMF Guideline NMCG	Prospective Contractor	Project Supervision Consultant /KMC/ SMCG	During Construction and Operation phase
Operation Stage					
Maintaining treated waste water quality	Comply with applicable condition of CTO, treated water shall meet the NGT standard of treated waste water quality strictly. Follow standard operating procedures for operation and maintenance. Inline sensors will be installed to monitor basic parameters in	ESMF Guideline World Bank's EHS Guidelines for Water and Sanitation	Prospective Contractor	Project Supervision Consultant /KMC/ SMCG	During Operation phase

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	the effluent, like flow, pH, BOD, COD and TSS.				
Reuse and recycle of Treated waste Water from STP	<p>As per the AA&ES for Adi Ganga, (Tolly Nala) projects, NMCG has mandated 20% re-use of treated waste water from the project.</p> <p>The treated wastewater may be used for irrigation purpose and for usage in gardens, parks and landscapes in the nearest locations as well as street and road washing for which necessary MoUs to be signed with the local authorities. Contractor shall be responsible for reusing and recycling of treated water under guidance and suggestion of KMC/SMCG.</p> <p>The treated effluent from STP might be used preferably for toilet flushing in the nearest public toilets by providing dual plumbing system.</p> <p>Contractor shall also explore the other alternative possibilities of using treated water in various purposes like Gardening purpose (For example, parks, playgrounds, school yards, residential landscape, etc.), Toilet & Urinal Flushing in public places, gated communities' commercial establishments and other educational institutions.</p> <p>The reclaimed water can be used in construction activities including foundation compaction, dust control, water jetting for consolidation of backfill around pipelines and mixing concrete.</p>	<p>ESMF Guideline</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractor	Project Supervision Consultant /KMC/ SMCG	During Operation phase

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>Treated water can be used for firefighting and protection.</p> <p>The treated water may be reused in Industries where the requirement of water is more than the available water for production.</p> <p>As per latest NGT standard, BOD of treated water shall be less than 10 mg/l, the provision of using treated water in nearby agricultural field may be recommended.</p>				
Leakages, blockages and overflow issues in sewers	<ul style="list-style-type: none"> • Bid document to include requirement for an effective action plan to avoid and/or immediate clearance of such leakages, blockages and overflow. • Implementation of regular O&M schedules. • Regular monitoring of sewer line manhole leakages/overflows should be done. • Proper emergency plan shall be in place in STP area. 	<p>ESMF Guideline</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Operation
Odour control	<ul style="list-style-type: none"> • Adequate green belt / tree plantation and landscaping will be developed along the periphery of the STP and SPS will reduce the negative impact of odour. • Spraying of water will be done on the odour creating units. • Spraying of herbicides like Maple and Gtech on accumulated sludge/solid waste will reduce the negative impact of odour. • Monitoring will be done on Ambient Air Quality around STP site. 	<p>ESMF Guideline</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Operation
Aesthetics and landscaping	<ul style="list-style-type: none"> • Since site is located close to habitat region, a good landscaping, green belt maintenance is mandatory at each STPs 		Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Operation
Disposal of sludge	<ul style="list-style-type: none"> • Instead of disposing digested sludge it shall be provided to the local farmers for agriculture purpose, and/or to 	CPHEEO; Manual on Sewerage and	Prospective Contractors	Project Supervision Consultant /KMC /	During Operation

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>the local authorities to use as manure for landscaping purposes in city level / district level.</p> <ul style="list-style-type: none"> • Suitable site should be identified for the safe disposal of sludge generated at the STP and got approved by the Engineer. Prepare a Sludge Disposal Plan and adheres to the same. • A logbook for sludge disposal shall be maintained at STP sites. • Provision for regular clearance of sludge and solid waste to minimize odor nuisance pumping station areas • Surplus amount of Sludge shall be properly disposed at authorized Dhapa and/or at Keorapukur site, which is about 17 to 20 km away from the project sites. Solid Waste Management Site of Kolkata Municipal Corporation. The sludge management shall be integrated with Solid Waste management facility of ULB Municipal Corporation. • Contractor will be responsible for proper coordination with ULB' SWM agency for safe disposal of sludge. • After having testing of heavy /toxic content of the sludge, priority to be made by contractor under supervision with KMC for handing over sludge/ manure to nearby local farmer. • EA and Contractor to undertake sensitization program about importance of sludge and safe use of sludge in agricultural practices with local farmer. 	<p>Sewage Treatment Systems - 2013</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>		SMCG	
Noise pollution due to operation of pumps and machineries	<ul style="list-style-type: none"> • The D.G set should be provided with acoustic enclosures and thickly padded to prevent vibration. The stack height is properly maintained. • Ensure installation of air blowers with vibration mounts and acoustic enclosures to reduce the noise pollution from STP area. • Green belt / tree plantation and landscaping will be developed along the periphery of the STP and SPS which will attenuate noise. • Pump station in STP shall ensure minimum noise generation by locating within a noise reducing structure 	<p>ESMF Guideline</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	Project Supervision Consultant /KMC / SMCG	During Operation phases

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> or in an enclosed space (such as concrete/brick structure). Contractor shall ensure the ambient noise level of the STP/ MPS area shall be within Residential, Institutional area standard i.e. 55dBA during day time (7AM to 10PM) and 45dBA during night time (10PM-7AM) The contractor should comply with the World Bank Group Environmental, Health and Safety General EHS Guidelines for Occupational Health and Safety. 				
Protective Equipment's	<p>For Chlorination System the following mitigation measures will be in place to arrest/ identify any leakage of chlorine</p> <ul style="list-style-type: none"> Neutralization System. Leak Detection System. Ventilation System <p>Appropriate personal protection equipment (PPE) including oxygen masks will be provided for personnel working in plants where there is a risk due to harmful gaseous emissions [Hydrogen sulphide (H₂S), Carbon Monoxide (CO), Methane (CH₄), etc.].</p>	World Bank's EHS Guidelines for Water and Sanitation	Prospective Contractors	KMC / SMCG	During Operation
Safety measures	<ul style="list-style-type: none"> Mechanised system and trained people shall be deployed to run the Pumping Stations and STPs to reduce the risk of safety hazards. Handrails on both sides of walkways close to deeper tanks and STPs needs to be ensured. Toe guard at all SPS to be provided Smaller on and off switches at STP units to be installed with protection from rain water to minimize electrical short circuit All personnel engaged in plant will be provided safety clothing and Personal Protective Equipment's (PPE) and also trained to implement Occupational Health and Safety (OHS). OHS Management Plan shall also be prepared and implemented by the Contractor after necessary approval of SMCG / NMCG Chlorine will be stored in accordance with safety 	<p>ESMF Guideline</p> <p>World Bank's EHS Guidelines for Water and Sanitation</p>	Prospective Contractors	KMC / SMCG	During Operation

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>standards and regulations in force.</p> <ul style="list-style-type: none"> Operating staff will be provided induction training on safe handling, storage and precautions in use of hazardous materials. Also directions will be given regarding Chlorine emergency repair kits, and other emergency procedures. Leak detecting arrangements will be properly provided in the plant. Storage of large quantity of Chlorine will be avoided and only procured based on need and accurate inventory will be maintained. Only approved instruments should be used for lifting and opening cylinders. Appropriate personal protection equipment (PPE) including oxygen masks will be provided for personnel cleaning underground sewers where there is a risk due to oxygen deficiency and harmful gaseous emissions [Hydrogen sulphide (H₂S), Carbon Monoxide (CO), Methane (CH₄), etc.]. The contact details of police station, ambulance services and fire stations nearby to the site shall be displayed. <p>Health and safety at operation stage</p> <ul style="list-style-type: none"> In order to have emergency care at commissioned STP/MPS/ PS/LS site and avoid any mis-happening, Contractor shall tie-up with nearest hospital (at least- 2nos.) for emergency health care services. On any health issues at site, the workers can get the treatment in normal circumstances as well any emergency. An Initial Health screening along with 				

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>screening at regular interval (in every 6 months) should be provided for all workers and staff in operation phases..</p> <ul style="list-style-type: none"> • Biomedical waste emanated from the construction site shall be managed as per BMW Rule 2016 and amendments • Provisions of First Aid services, having trained health care service provider at site • Contractor shall be responsible for providing safe Drinking water facility for workers and ensure regular drinking water quality monitoring (RO plant) at worker quarter/ STP/MPS/ LS site. • All provision such as separate toilet for male and female workers, proper sanitation, sanitary waste disposal to be provided at STP/MPS/LS as per BOCW act & Factory Act 1948 • Proper disposal of wastes generated from the STP staff camp will be followed to maintain the general hygiene in the area. 				
Safety Precautions COVID 19 Scenario	<ul style="list-style-type: none"> • A basic Health screening of all new workers shall be carried out before deployment (Risk of serious illness rises with age wise). • Avoid over aged (more than 60 years old) workers deployment in Project area during COVID-19. • If available, ensure vaccination to all worker against COVID 19 pandemic. • Always ensure all workplaces are clean and hygienic, 	Occupational Safety and Health Administration (OSHA) 2020	Prospective Contractors	KMC / SMCG	During Operation phase

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<ul style="list-style-type: none"> Promote regular and thorough hand-washing by all workers with any soap or Alcohol based hand rub Regular Sanitization shall be carried out in all workplace, common areas, equipment, handle, railing etc.. Promote good respiratory hygiene in the Workplace. Wearing of a face mask is compulsory to all workers during this period of COVID 19. Always maintain sufficient gap between workers / staff as per mentioned in the guidelines (Min 1m interval) All kinds of Social Gathering must be avoided. Entire office, Lab, canteens, pathways, toilets, and entry / exit gates must be disinfected on a basis. Housekeeping team should be provided with all necessary equipment/tools. Encourage workers to stay home if they are sick. Avoid large gatherings or meetings (E.g. : TBT/ Site / Office committee meeting) . Maintain at least 1 metre (3 feet) distance from persons. Appropriate signage shall be installed at construction sites, spelling out safety practices in the language which is understood by all. Develop and agree a preparedness plan to prevent infection at meeting or event. Organize regular awareness program on COVID 19. Employers should inform and encourage employees to self-monitor for signs and symptoms of COVID-19 if they suspect possible exposure. Providing workers with up-to-date education and training on COVID-19 risk factors and protective behaviors (e.g., cough etiquette and care of PPE). All vehicle need to be sanitized regularly and advise workers / Staff need to maintain the gaps (1m interval minimum) . Non-touch garbage bins with biodegradable garbage bag should be installed for waste collection at all common access areas. Proper disposal of garbage bags along with 				

Potential Impacts	Mitigation Measures	Reference	Responsible for Implementation	Responsible for Monitoring	Time Frame
	<p>daily cleaning and sanitization of bins should be ensured.</p> <ul style="list-style-type: none"> Wipe down interiors and door handle of machines or construction vehicles, the handles of equipment and tools that are shared, with disinfectant prior to using. Maintaining the social distance during material shifting 				
Inclusion of Environmental & Social Monitoring Plan	<ul style="list-style-type: none"> Environmental & Social Monitoring Plan shall be included in the detailed ESAMP prepared and implemented by the Contractor after necessary approval of SMCG / NMCG. 	ESMF Guideline NMCG	Prospective Contractor	KMC/ SMCG	During Construction and Operation phase
Grievance Redressal	<ul style="list-style-type: none"> The name and contact information of Grievance Redressal Officers (GROs) should be displayed at the project/construction site, labour camps, in communities where construction work is taking place and in the websites of ULB, EA and SMCG. A grievance Register must be maintained and monitored at each of the construction site. Also, a toll free number should be generated and displayed in work sites and websites of ULB, EA and SMCG for registering grievances. Mandatory training's for the workforce on the GBV grievance redressal mechanism for reporting and response of GBV incidents Training should be imparted to the stakeholders, Implementing Agencies and Contractor regarding identification, reporting, recording and resolving the GBV cases. 	ESMF Guideline NMCG	KMC/ SMCG / Prospective Contractor	NMCG / KMC/ SMCG	During Construction and Operation

9.3 Environmental Monitoring Plan

The Environmental Monitoring Programme has been detailed out in Table 9-2. Monitoring locations for environmental components such as air, noise, water, Soil and sludge are presented in Figure 9.1. Successful implementation of the Environmental Monitoring Program is contingent on the following:

- ▶ The Project Supervision Consultant along with EA to request the Contractor to commence all the initial tests for monitoring (i.e. for Air, Water Quality and Noise Levels) early in the Contract to establish 'base' readings (i.e. to assess the existing conditions prior to effects from the Construction activities being felt);
- ▶ Contractor to submit for approval a proposed schedule of subsequent periodic tests to be carried out;
- ▶ Monitoring by the Environmental Officers of Supervision Consultant of all the environmental monitoring tests, and subsequent analysis of results;
- ▶ Where indicated by testing results, and any other relevant on-site conditions, PSC to instruct the Contractor / Contractor to:
 - ▶ Modify the testing schedule (dates, frequency);
 - ▶ Modify (add to or delete) testing locations;
 - ▶ Verify testing results with additional testing as/if required;
 - ▶ Require recalibration of equipment, etc., as necessary; and,
 - ▶ Request the Contractor to stop, modify or defer specific construction equipment, processes, etc., as necessary, that are deemed to have contributed significantly to monitoring readings in excess of permissible environmental "safe" levels.

9.4 Monitoring of Contractor's Facilities, Plant and Equipment

- ▶ All issues related to negative environmental impacts of the Contractor's Facilities, Plant and equipment are to be controlled through;
- ▶ The Contractor's self-imposed quality assurance plan;
- ▶ Regular / periodic inspection of the Contractor / Contractor's plant and equipment;
- ▶ Monthly appraisal of the Contractor.

Other environmental impacts are to be regularly identified and noted on the monthly appraisal inspection made to review all aspects of the Contractor's operation. The officer is to review all monthly appraisal reports, and through the team leader is to instruct the Contractor to rectify all significant negative environmental impacts.

Table 9-2: Environmental Monitoring Plan

Environmental Component	Stage	Parameters	Locations	Frequency	Standards /Methods	Implementation Agency
Air quality	Construction	PM10 µg /m3, PM2.5 µg/m3, SO2, NOX, CO	2 nos MPS (Chetla PS & LS-2); 3 nos. STP	Once in every season (except monsoon) for 4 years	National Ambient	Contractor through approved monitoring agency/Lab (NABL/MoEF&CC accredit Laboratory) under the

Environmental Component	Stage	Parameters	Locations	Frequency	Standards /Methods	Implementation Agency
	Operation			Twice in every year (except monsoon) for first 5 years	Air Quality Standards, CPCB	approval of the supervision consultant
Noise levels	Construction	Leq dB (A) (Day and Night) Average and Peak values	3 nos. MPS (Chetla PS & LS-2 & LS 6); 3 nos. STP	Once in every season (except monsoon) for 4 years	National Ambient Air Quality Standards with respect to Noise Standards, CPCB	Contractor through approved monitoring agency/Lab (NABL/MOEF&CC accredited Laboratory) under the approval of the supervision consultant
	Operation			Twice in every year (except monsoon) for first 5 years		
Water Quality (Surface and Ground water)	Construction	Ground Water Parameter as per IS:10500 (2012) and surface water parameters as per CPCB guideline for discharge of treated effluents in Inland water bodies	Surface Water (upstream, midstream and downstream) & Ground water (from 3 STP and 2 LS)	Once in every season (except monsoon) for 4 years	As per CPCB Standards for treated effluent discharge and IS:10500 (2012) for ground water	Contractor through approved monitoring agency/Lab (NABL/MOEF&CC accredited Laboratory) under the approval of the supervision consultant
	Operation		Surface Water (upstream, downstream and Outfall of 3 STP) & Ground water (from 3 STP)	Twice in every year (Pre and post monsoon) for first 5 years		
Soil	Construction	Physical Parameter: Texture, Grain Size, Gravel, Sand, Silt, Clay; Chemical Parameter: pH,	STP Site and at Sludge dumping site	Twice in every year (Pre and post monsoon) for first 4 years	Soil test method by Ministry of Agriculture	Contractor through approved monitoring agency/Lab (NABL and MoEF&CC accredited Laboratory) under the approval of the supervision consultant
	Operation	Conductivity, Calcium, Magnesium, Sodium, Nitrogen, Absorption Ratio		once in a year (except monsoon) for first 5 years		
Sludge	Operation Phase	Heavy metals, Toxic Metals and Biological Parameters as per the parameters for Testing of STP Soil	Sludge Disposal Site	Six monthly for 15 Years (Operation Phase)	STP Soil testing procedure	Contractor through approved monitoring agency/Lab (NABL and MoEF&CC accredited Laboratory) under the approval of the supervision consultant



Figure 9.1: Environmental Monitoring Locations at the STP project area, Tolly's Nullah

9.5 Environmental and Social budget

The cost of environmental budget for the various environmental management measures proposed in the EMP and the cost of the Environmental Monitoring is given in **Error! Reference source not found.**, EMP aspects and monitoring which is not included in the DPR are estimated separately in the ESAMP as EMP management cost. This is estimated around 1,420,000 (**Table 9-3**). Apart from this, around 580 lakhs EMP Management and monitoring cost has been considered under the DPR (Table 9-4). This environmental budget is a tentative one and a construction specific Environment Management Plan along with the appropriate expenses required to abide by the environmental guidelines prescribed by CPCB will be framed by the construction contractor during detailed designing stage of the STPs.

Table 9-3. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted in the Engineering Cost. Various environmental aspects covered/will be covered under engineering costs are listed below:

- ▶ Proper drainage arrangements to prevent water stagnation/ flooding in MPS site
- ▶ Appropriate siting, and enclosing within building to reduce noise and odour nuisance to surrounding area
- ▶ Alternate traffic re-routing,
- ▶ Ensuring storage of excavated soil material on the higher lying areas
- ▶ Flushing and desilting of sewers at necessary locations
- ▶ Excavation, cutting and filling operations

- ▶ Sump cleaning
- ▶ Safety hazards to workers and residents
- ▶ Landscaping and Mass afforestation
- ▶ Public Awareness, training
- ▶ Regulatory clearances, NOCs from Department (SPCB, railway, Irrigation etc.)

EMP aspects and monitoring which is not included in the DPR are estimated separately in the ESAMP as EMP management cost. This is estimated around 1,420,000 (Table 9-3). Apart from this, around 580 lakhs EMP Management and monitoring cost has been considered under the DPR (Table 9-4). This environmental budget is a tentative one and a construction specific Environment Management Plan along with the appropriate expenses required to abide by the environmental guidelines prescribed by CPCB will be framed by the construction contractor during detailed designing stage of the STPs.

Table 9-3: Environmental Management & Monitoring Costs

Item	Location	Season	Year	Total no. of samples	Unit cost (INR)	Total cost (INR)
A.Environmental Monitoring during Construction Stage-						
1. Construction Stage Air, Noise, Soil , Ground Water at 5 location (3 STP and MPS) & Surface Water Quality Upstream, Mid-Stream, Down Stream, HFL,LFL; 10 location out fall location monitoring cost for 4 years has been taken in DPR						6,000,000 (Included in the DPR)
B. Environmental Monitoring during Operation Stage-						
2.Operation Stage monitoring of waste Water Quality Upstream, Mid-Stream, Down Stream, HFL,LFL; 10 location of outlet for 15 years has been taken in DPR						9,000,000 (included in the DPR)
3.Sludge (STP sites) during operation stage	3	2	15	90	6500	5,85,000
C.EMP Management cost						
Parameter	Description				Unit	Amount
4.Dust Suppression	Water sprinkling on excavated material and provision of top cover when transported through vehicles				(included in DPR Lumpsum)	2500000
5.Health & sanitation and Labour camp/construction camp	Creation of Sanitation and water supply at construction camp Sanitation Arrangement at Camp (6				(included in DPR Lumpsum)	2500000
6. Isolation /fencing of sites near to heavy settlements & traffic areas/ Use of sound barriers or sheets	Lump sum Cost- Rs 70 per KG –GI sheet (including loading , unloading , installation etc.) Approximately 72000 m Sewer line desilting and fresh line & 15,000 sqm STP area involves; perday requirement of barricading on active area assumed as 250m; approximately 350 active days requires for installing and shifting barricading from completed to active area. GI sheet of 250 m length & 3 m height will have 750 sqm. and converting to KG (@6kg/sqm)=4500 total weight & total cost of that is 3,15000 (4500*70) Labour cost (assuming 350 days total active days at rate of 300rs)= 105000 Total cost of GI installation - 4,20,000				Not included in the DPR	4,20,000
7. Fly nuisance at STP	Applications of Insecticides	--	--	--	Lumpsum	2,00,000
8. Tree planation/land scape at STP and IPS	Reduction of noise and odour	Lump sum cost (three STP locations @rs 1800/tree including maintenance 5 year & 75 trees at each STP) + Soft cover 20 % at plant- Lumpsum 2 lakhs + 1 lakhs at existing MPSS			Lumpsum	8,00,000
9. Training/ Awareness generation along with IEC material	Undertake to develop communication strategy, capacity building and training initiatives for all stakeholders such as the SMCGs, EAs, ULBs, NGOs and common citizens				(included in DPR Lumpsum)	500,000
10.CSR						37500000
ESMP Cost included in DPR (sl.no.1,2,4,5,9,10)						58,000,000
EMP Cost Excluded from the DPR (sl.no.3,6,7,8)						1420000
Total budget Cost of EMP implementation (Sum of DPR's ESMP Cost + EMP remaining aspects of ESAMP)						59,420,000

Table 9-4: Environmental Management Budget as given in the DPR

Sl. No.	Component	Item	Unit	Quantity	Rate (in Rs.)	Amount (in Rs.)
A. Construction Stage						
1	Environmental issues at construction sites	Sanitation Arrangement at Camp (6 Camps)			Lump sum	2500000.00
		Dust Suppression Measures			Lump Sum	2500000.00
		Environmental Training			Lump sum	500000.00
		Corporate Social Responsibility			Lump sum	37500000.00
2	Environmental Monitoring	(a) Ambient Air Quality monitoring of PM10, PM2.5, CO, SO2 & NO2 (5 locations for three season for four years except monsoon)	No.	60	15000.00	900000.00
		(b) Ambient Noise level monitoring: Leq dB(A) Day & Night time (5 locations for three season for four years except monsoon)	No.	60	5000.00	300000.00
		(c) Monitoring of surface water Quality (5 locations for three seasons during HFL and LFL for four years except monsoon)	No.	120	10000.00	1200000.00
		(d) Monitoring of ground water (5 locations for three	No.	60	10000.00	600000.00

		season for four years except monsoon)				
		(e) Soil Quality monitoring (5 locations along the Bank of Nullah and 5 location in Construction site) for three season for four years except monsoon.	No.	120	10000.00	1200000.00
		(f) Monitoring of waste water quality at outlet (10 locations for three season for four years except monsoon)	No.	120	10000.00	1200000.00
		(g) Monitoring of drinking water quality at construction camp (5 locations for three season for four years except monsoon)	No.	60	10000.00	600000.00
Total ESAMP Cost during Construction Stage (A)						49000000.00
B. Operation Stage						
	Environmental Monitoring	(a) Monitoring of surface water Quality (5 locations for three season during	No.	450	10000.00	4500000.00
		HPL and LPL for fifteen year except monsoon)				
		(b) Monitoring of waste water quality at outlet (10 locations for three season for fifteen years except monsoon)	No.	450	10000.00	4500000.00
ESAMP cost during Operation Phase (B)						9000000.00
Total ESAMP Cost (A+B)						58000000.00
Total ESAMP Cost in Lakh						580.00

Source: As per KMC DPR Tolly Nulla Abatement of pollution September 2022

9.6 Implementation Schedule

The implementation schedule, responsibilities and respective time frame is tabulated below:

Table 9-5: Implementation Schedule and Associated Responsibilities

Sl. No.	Action	Responsibility	Timeframe
ENVIRONMENT SAFEGUARD			
1	Prepare EMP & incorporate suitable conditions in Contract to prepare and implement ESMP by the Contractor.	EA / SMCG	Site specific EMP shall be prepared by Contractor before execution of the project.
2	Obtain 'Consent' from State Pollution control Board for establishment and operation of STPs.	Contractor/SPCB	Immediate and ensure that the works shall be initiated after receiving the Consents.

DETAILED ENVIRONMENTAL MANAGEMENT PLAN

Sl. No.	Action	Responsibility	Timeframe
3	Preparation of detailed EMP (as per the Contract) and obtain the approval of the NMCG / Word Bank.	Contractor	Within 3 months of the commencement of Contract.
SOCIAL SAFEGUARDS			
4	Hiring of NGO/CBO for information dissemination	EA / SMCG	Immediate/ Prior to disbursement of retroactive claim under the project, if required.
5	Prepare IEC material	EA / SMCG/NGO	One Month after Action No. 4.
6	Establish GRC	EA / SMCG	Immediate
7	Designate Grievance Officer	EA / SMCG/ Contractor	Immediate
8	Information dissemination	EA/ SMCG/NGO/Contractor	Continuous after Action No. 5.
9	In- Country disclosure of this ESAMP	EA / SMCG / NMCG	Immediate (Prior to initiation of Bidding process)

The Kolkata Municipal Corporation (KMC/KMDA) and State Program Management Group (SPMG-West Bengal) is an extended arm of National Mission for Clean Ganga (NMCG) for the state of West Bengal and implementing and monitoring the Namami Gange under NGRBA projects through various executing agencies. At the State level, it is implementing arm of State Ganga Committee constituted vide S.O. 3187 E dated 07th October 2016 under Environment protection act 1986. The KMC which is headed by the Director/Chief Engineer and a separate directorate for finance headed by a Director. All the heads of directorates report to the CEO directly or through the Director General/Secretary/Special secretary assisted by the Superintending Engineer/Project Manager, Tolly's Nullah and Executive Engineer with assistance from Assistant Executive Engineer/Junior Engineer and Contractor / Supervision Consultant is the responsible entity for ensuring the implementation of mitigation measures as suggested in the EMP/SMP in the ESAMP Report.

10 CONCLUSION

The environmental and social impact assessment for the proposed sub-project for sewerage network systems in Tolly's nala is categorized as 'Moderate impact category project'. It will have positive impact on the people residing in the Tolly's Nullah catchment area. It would also improve water quality of Ganga River by treating sewerage, which are discharge without treatment. The proposed sewerage project mainly involves setting up of treatment plants and main pumping station and strengthening of existing sewerage treatment plants without involvement of land acquisition. No loss of income or livelihood, relocation of households etc. is anticipated. This ESAMP complies with provisions of environmental and social management framework (ESMF) guidelines of NGRBA.

The whole impact evaluation process is based considering design stage, construction and operation stage ancillary activities. A detailed mitigation plans have been suggested to encounter temporary impact anticipated during construction and for operation and Maintenance Phase. The environmental management plan brings forth appropriate mitigation measures against the issues/ concerns identified during study. The report also ensures that well defined institutional mechanism is in place to monitor and evaluate the progress of the project during construction, implementation and operation phases do exists.

ANNEXURES

ANNEXURE 1: ENVIRONMENTAL AND SOCIAL INFORMATION FORMAT FOR SCREENING

Environmental and Social Information Format for Screening

Project Title : Pollution Abatement of Tolly's Nullah (Adi Ganga)
Implementing Agency : Kolkata Municipal Corporation, KMC, Kolkata, West Bengal
Project Cost : 685.61Crore

Project Components:

- Construction of 3 Sewage Treatment Plant of capacities 5.7 MLD, 15.3 MLD & 5.06 MLD
- Capacity Augmentation of 16 existing pump house; construction of one fresh LS & O&M of 2 existing LS- total 19nos
- Desilting , Sewer pipeline and allied works including Pumping Main, Box Drain & Lining of Suti Khal, trunk sewer line, manholes-72km
- O&M for 15 Years

Project Location:Tolly's Nullah, Kolkata, State West Bengal

Sl. No.	Screening Criteria	Yes/No	Assessment of Category (High/Moderate/Low)	Remarks /Explanatory note for categorisation
1	Is the project in an eco-sensitive area or adjoining an eco-sensitive area? (Yes/No) If Yes, which is the area? Elaborate impact accordingly.	No	No Impact	Within 10 km periphery of the project site, no eco sensitive area/ zone, National Park, Wild life sanctuary is identified. A Ramsar Site (East Kolkata Wetland) is located at 9km from the project region. The current project is abatement of pollution from Tolly Nallas, this will improve the existing water quality and thus direct – indirect negative impact has not been anticipated.
2	Will the project create significant/ limited/ no social impacts?	Yes	Moderate impact	No major social inverse impact, however desilting of trunk sewer work near to Slum / encroachment area of Tolly's Nullah may have construction specific disturbances in dense patches. This will be mitigated through prior notice to local, sensitization amongst slum, local people of Tolly nullah region before to commencement of the project. During visit and as per DPR, Madan Pal Lane outfall under the Sashi Sekhar Bose Row drainage pumping station has some disturbance to slum dwellers. For the fulfillment of the implementation of the proposed project, the Nine (9) nos. of families stated above are found residing presently over the structure of existing penstock gates at Madan Pal Lane in ward no.- 73 are inevitable for shifting to the nearby location at Sashi Sekhar Bose Row in the campus of the existing drainage pumping station in the same ward without hampering/compromising their livelihood. The project in this regard is planned to consider under 'Affordable Housing Schemes'. Contractor, while preparing for construction specific ESIA-MP will conduct detailed survey of

Sl. No.	Screening Criteria	Yes/No	Assessment of Category (High/Moderate/Low)	Remarks /Explanatory note for categorisation
				the roads, lanes and the locality where laying of pipelines have to be carried out. The pipe laying and opening of the road will be done within ROW in small stretches and restored back immediately so that the dug-out soil can be refilled. Any displacement of temporary hawkers, vendors will be effective only during small duration of time and they can further resettle back to the location, once the laying is complete. As far as possible, loss of livelihood and displacement will be avoided to the least possible extent.
	Land acquisition/ purchase resulting in loss of income from agricultural land, plantation or other existing land-use.	No	No Impact	A total of about 2.00 hectares of land identified for construction of three STPs are Government Land. Also 58.3 sq m of land will be acquired for installation of mini pumping station at Patuapara, Bhowanipore, which will not result into any loss of income as the 8 families who are presently residing on the land will be relocated to a planned apartment in the nearby locality.
	Land acquisition/ purchase resulting in relocation of households.	Yes	Yes	The proposed mini pumping station besides Madan Pal Lane at Patuapara, Bhowanipore will involve displacement of 8 families. These 8 families will be resettled at a location about 200 m away from the place of displacement in a proposed one bedroom apartment each having 370 ft ² area under Banglar Bari Housing Scheme of State Urban Development Agency, UD&MA Department, Government of West Bengal.
	Any reduction of access to traditional and river dependent communities (to river and areas where they earn for their primary or substantial livelihood).	Yes	Low impact during construction	The proposed project will not cause any loss of access to traditional and river dependent communities (to river and areas where they earn for their primary or substantial livelihood). However, during construction stage, desilting work & maintenance work of Box drain & trunk Sewer close to TollyNalla might have some local disturbance to encroacher /slum on some patches of TollyNalla. This will be mitigated through proper sensitization to workers as well as slum communities. No displacement of river dependent communities will be required.
	Any displacement or adverse impact on tribal settlement(s).	No	No	There is no tribal settlement in or around project area. Therefore, the proposed project components will not displace any tribal community or settlement(s).
	Any specific gender issues.	No	No	No gender specific issue directly related to the project is envisaged.

Sl. No.	Screening Criteria	Yes/No	Assessment of Category (High/Moderate/Low)	Remarks /Explanatory note for categorisation
3	Will the project create significant / limited / no environmental impacts during the construction stage? (significant/limited/ no impacts)	yes	Low and short term Impact	<p>The 3 STPs are going to be constructed on government land near to Tolly's Nullah. Therefore, there will be only short term/ limited construction specific environmental impact. The land selected for STPs is presently plain and no mature tree or plant will be impacted, however slight bush cleaning is required.</p> <p>All the augmentation of existing capacity of lift station has been proposed, no fresh land has been envisaged thus, environmental impact will be insignificant.</p> <p>The trunk sewer, pumping main lines connected to LS & STP has been considered for maintenance and desilting work, construction specific temporary environmental impact has been anticipated and shall be managed through Construction specific EMPS.</p>
	Direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials adversely affecting water quality and flow regimes.	Yes	Low and short term impact during construction phase	<p>STP will be based on SBR Technology units with minimal civil works. The STP to be developed on fresh land will have construction specific impact during civil construction activity. With due care and management direct discharge, improper storage of wastes shall be taken care of.</p> <p>The desilting work of sewer lines is proposed along the Tolly's Nullah and on internal roads, which will cause some traffic disruption of temporary nature. Sensitive locations like schools, hospitals will have special problems, which will be taken care of during construction.</p> <p>During laying work, excavated debris may cause temporary impact in the nearby area, this can be mitigated through regular backfilling and dumping of extra debris on identified dumping site, filling the STP area for backfilling.</p> <p>Contractor to avoid the discharge and debris at the site, shall follow construction specific EMP. The C-EMP shall be part of Bid Document.</p>
	Flooding of adjacent areas	Yes	Low Impact short term impact during construction phase	<p>Construction of project will not obstruct any of natural drain /channel near the site. The level of STPs and SPS will be made with due care of high flood level record.</p> <p>Dewatering for construction will not generate any significant amount of water to flood adjacent areas</p> <p>Proposed STP will have garland drain to avoid further flooding in premises and neighbourhood area in case of storm water during monsoon.</p> <p>During construction stage, contractor shall prepare and execute monsoon Preparedness Plan to avoid the inundation or flooding within or adjoining the site area.</p>
	Improper storage and handling of substances leading to contamination of soil and water	Yes	Low and short term impact during construction phase	<p>Civil Construction material like cement, sand, earth etc. will be prevalent in use, while contaminated material such as fuel, used oil shall be taken care of properly for storage and handling properly at site. Further the construction specific EMP shall be framed with inclusion of site specific Environmental issues to address the safety health related issues.</p>
	Elevated noise and dust emission	Yes	Low and short term impact	<p>Proper measures should be taken during sewer laying to minimise the noise and dust emissions. Contractor should ensure the proper acoustic measure for noise</p>

Sl. No.	Screening Criteria	Yes/No	Assessment of Category (High/Moderate/Low)	Remarks /Explanatory note for categorisation
				generating unit like DG set as per CPCB norm, etc. Proper construction scheduling, avoiding the peak time etc..shall be specified and implemented through C-specific EMP. The Contractor has to submit the method statement to comply with Air Act, 1981 & Noise Rules as per EP Act, 1986 before construction.
	Disruption to traffic movements	Yes	moderate and short term Impact during construction phase	S&D work to be done near road and drain & Sewer laying work will need proper traffic management at the site. Proper diversion of traffic will ensure less disruption during construction. Contractor shall ensure proper traffic management in place prior to construction activities.
	Damage to existing infrastructure, public utilities, amenities etc.	No	Low and short term Impact during construction phase	Utility mapping of the existing infrastructure and relocation of the same if required will minimise the damage on existing infrastructure. Sewer laying work is envisaged however shifting of other utilities like telephone lines, electric poles or street lights etc. if required shall be shifted temporarily or relocated (only if needed) after taking due permission from the concerned department.
	Failure to restore temporary construction sites	No	Low and short term Impact during construction phase	The roads will be reinstated to its original conditions after lying of sewer line on daily basis. Mitigation measures towards restoration of temporary construction sites will be part of ESMP of contractor's bid document.
	Possible conflicts with and/or disruption to local community	No	No impact	The local community will be made aware of the temporary nature of disruption. All possible disputes during construction work shall be avoided by hiring of local labour as much as possible. In case of migrant labour hiring, the fundamental facility in labour camp shall be ensured by contractor to avoid further disputes.
	Health risks due to unhygienic conditions at workers' camps	Yes	Low Impact	Adequate sanitation facilities and safety arrangement will be provided to the workers in construction camp. A site specific ESAMP shall be having Health and hygiene maintenance plan for project construction site, which will be part of BID document for its complete implementation at sites.
	Safety hazards during construction	Yes	Low and short term Impact during construction phase	Proper health and safety statement will be submitted by the Contractor and approved by the Engineer prior to the construction. This will be included in ESAMP and be part of Bid document.
4	Will the project create significant / limited / no environmental impacts during the operational stage? (Significant / limited / no impacts)	Yes	Limited	STP will have minimal odour and noise pollution. Moreover, provision of green belt, landscaping within the STP and SPS premises will reduce the negative impact of odour. The proposed projects of establishment of STP are based on advance technologies of sewerage waste water treatment plan.
	Flooding of adjacent areas	Yes	Low Impact	Proposed STPs will have garland drain to avoid further flooding in premises and neighbourhood area in case of storm water during monsoon. All the STPs should be designed above the High Flood Level of Hoogly River.. Construction stage EMP shall ensure the ground level of STPs pertains to highest flood level.

Sl. No.	Screening Criteria	Yes/No	Assessment of Category (High/Moderate/Low)	Remarks /Explanatory note for categorisation
	Impacts to water quality due to effluent discharge	Yes	Low Impact	The characteristics of the treated waste water from STP will be within permissible limit set by latest NGT /CPCB guideline 2019.
	Gas emissions	Yes	Low Impact	SBR or other Aerobic reactor is a compact system and the possibility of the Gas emission is very less.
	Safety hazards	Yes	Low Impact	Mechanised system and trained people will be used to run the Pumping stations and STPs will reduce the risk of safety hazards. The contractor shall ensure proper PPEs for Contractor and Staff of STP. First Aid Measures shall be adhered as part of safety management. Emergency Site management plan shall be adhered to the deputed STP area to avoid unsafe hazard like fire, electricity etc.
5	Do projects of this nature / type require prior environmental clearance either from the MOEF or from a relevant state Government department? (MOEF/ relevant State Government department/ No clearance at all)	No	No clearance required	The proposed STP Project is not listed under the Schedule to the 14th September 2006 EIA notification and its amendment made thereafter. Hence it is exempted from environmental clearance. However, the proposed project needs Consent to Establish (CTE) prior to start of construction of STP and Consent to Operate (CTO) prior to start operation of STP. These permissions are required from State Pollution Control Board (SPCB) under Air and Water act.
6	Does the project involve any prior clearance from the MOEF or State Forest department for either the conversion of forest land or for tree-cutting? (Yes/ No). If yes, which?	No	Low Impact	With respect to project area, none of the land proposed for the STPs are falling under forest notified (PF/ RF / Social Forestry Zone). As per site investigation, no trees are impacted in selected sites, however, few trees are left at site, these has been considered under designing & Landscaping.
	Overall Assessment		Moderate	Based on the initial Environmental screening, Tolly's Nullah Sewerage Project has been rated under Moderate risk zone.

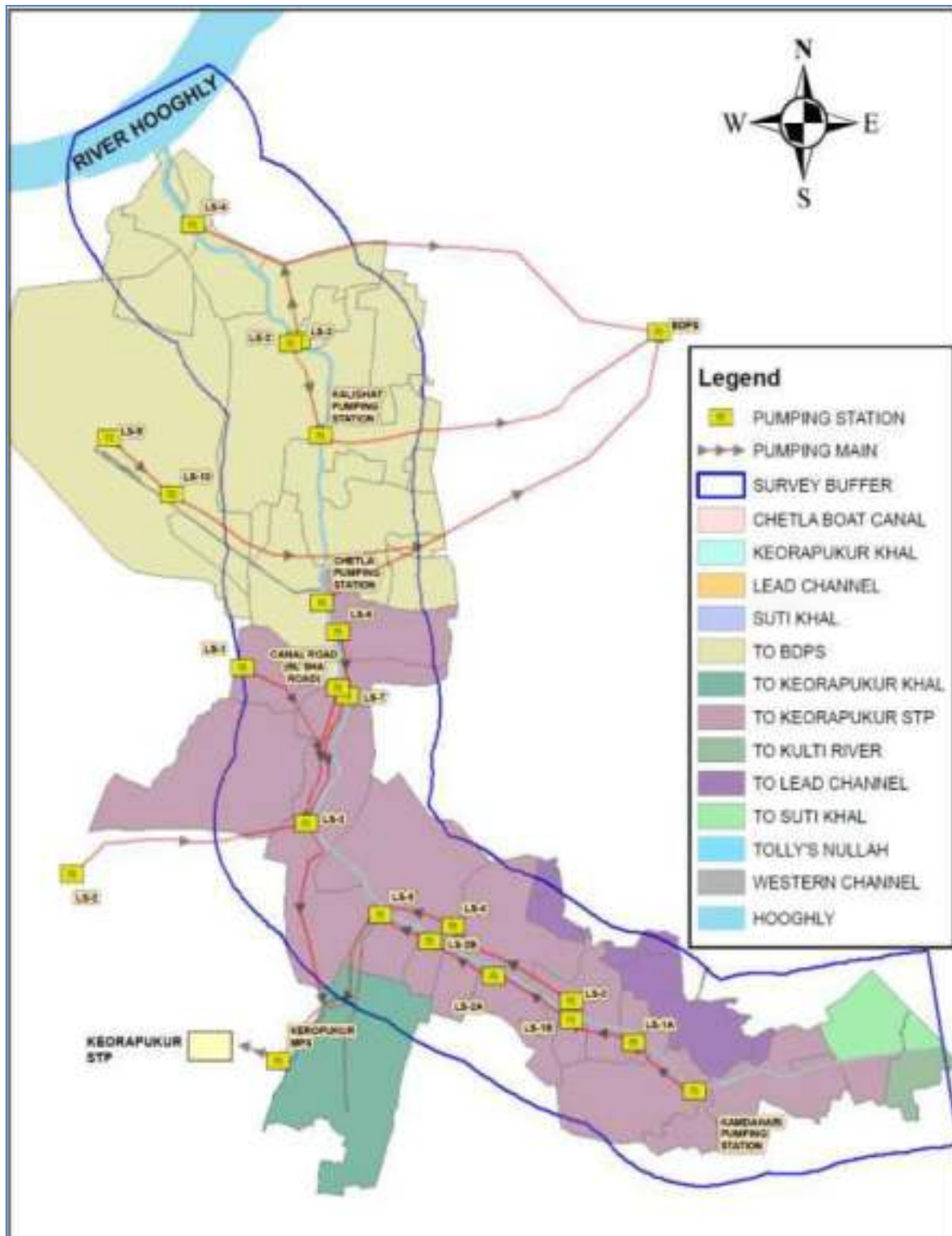
Further, below table can be referred for the overall rating and assessment (high/Moderate/low) of the project.

Table-10-1: Rating Index

Sl.no.	Categorization Criteria	Applicability (Yes/No)	Remarks
1	Is the treatment plant of the project is located within Eco Sensitive Zone as per the Wildlife (Protection) Act, 1972	No	Within 10 km periphery of the project site, no eco sensitive area/ zone, National Park, Wild life sanctuary is identified. The location of proposed STPs (3 no.) in Tolly's Nullah is located from the River Adi-ganga/Tolly'Nullah (100 m away from the river). As per DPR and discussion with KMC, the STP has been designed with consideration to River HFL. As per Judgment dated 13.07.2017 (OA. No. 200/2014), MC Mehta vs Union of India& Ors , 100 m from the edge of the river would be demarcated as no development zone, thus the site is not falling in the zone, the other clarification and supporting to the same has been presented in (Sitting guideline along the river, OM. Dated 14th Feb

Sl.n o.	Categorization Criteria	Applicability (Yes/No)	Remarks
			2022, MOEF &CC) and annexed in the report. (Annexure 7) The OM also mentions that river cleaning projects, treatment plan might be established as per NMCG direction, MoJS, India
2	Is the treatment plant of the project is located within Ecological Sensitive Area (ESA) as per the Environmental (Protection) Act, 1986	No	None of the Project unit falls in Declared Ecologically Sensitive Areas (ESAs) under "The Environment (Protection) Act (EPA), 1986".
3	Is treatment plant of the project is located within notified Forest Area as per the Indian Forest Act 1927	No	With respect to project area, none of the land proposed for the STP are falling under forest notified (PF/ RF / Social Forestry Zone). The Proposed land are open Government land, land transfer process is under process (Refer Annexure 2)
4	Is the treatment plant of the project is located within Critically Polluted Area (CPIA) as per Environmental (Protection) Act, 1986	No	Kolkata does not fall under 43 critically polluted Areas as per CPCB record.
5	Does the treatment plant of the project attract the 14th September 2006 EIA Notification & further amendments	No	The proposed STP Project is not listed under the Schedule to the 14th September 2006 EIA notification and its amendment made thereafter. Hence it is exempted from environmental clearance.
6	Is the treatment plant of the project is located within the Notified zone Coastal Regulation Zone (CRZ) notification 2016	No	The Project region is located in Lower Gangetic alluvial Plain, does not fall under Notified Coastal Regulation Zone 2019, of India.
7	Is the treatment plant of the project is located within the area as notified under Wetlands (Conservation and Management) Rules, 2017	No	The project region does not falls under 26 notified areas as specified under Wetlands (Conservation and Management) Rules, 2016. The project catchment area of Tolly's Nullah is 9 km far from the Ramsar Site East Kolkata Wetland. No construction activities are proposed within 5 km periphery of the Ramsar Site.
8	Is the treatment plant of the project is located within the regulatory zone of area as per The Ancient Monuments and Archaeological Sites and Remains Act 1958.	No	None of the project unit proposed in Region Tolly' s Nullah under Kolkata District falls under regulated zone of ASI protected Archaeological site/ Monuments. The ASI Monuments are located 5-6 km away from the proposed STP
9	Is Resettlement / displacement /permanent loss of livelihood involved? (more than 200 persons)	No	Proposed land identified for STP construction is government land while desilting work envisaged for trunk sewer line under the project may have slight disturbances to Local people/ encroachments during construction phase. These are identified in patches. Project does not involve relocation or resettlement or any permanent loss of structure or Livelihood.
	Overall Rating	Moderate	As per indicator given in the categorization criteria, none of the Indicator is answered as yes, however depending on the project sites & I&D work located in busy internal areas of Kolkata Metropolitan region and project activities may cause temporary social inconvenience during construction stage hence the project is considered under Moderate risk Category.
<i>Note: If any of these indicators is answered yes, the project will be considered as high impact sub project.</i>			

ANNEXURE 2: PROJECT MAP



ANNEXURE 3: GRIEVANCE REDRESS MECHANISM

Grievance Redress Mechanism																
Format for recording grievances at investment level																
Sl. No.	Name of the investment	District	Unique ID	Date of receipt	Name of the aggrieved person (if agreed by the aggrieved person)	Details of the complaint	Action taken	Date of action taken	Whether resolved/ Date	if not, reason thereof	Whether escalated	If yes, to whom		Date of escalation	Number of court cases	Number of court case resolved
												(i) SMCG	(ii) NMCG			
												1				
2																
3																
4																
5																
6																
7																

Reporting Format for SMCG																
Sl. No.	Districts	Total Number of grievances received	Type of grievances received							# of grievances resolved	# of cases escalated	# of Cases escalated to		Total # of court cases	# of court cases resolved	
			Land Acquisition/ Purchase related	Noise and dust / environmental	Damage to personal property	Damage to communal property	Damage to Public property	Labour issues	Others			SMCG	NMCG			
																1
2																
3																

ANNEXURE 4: HEAVY METALS PERMIT LEVEL FOR TREATED SLUDGE TO BE DISPOSED AS FERTILIZER)

No.	Chemical	Ceiling concentration (A)	No.	Chemical	Ceiling concentration (A)
1	Arsenic	75	6	Chromium	500(total)
2	Cadmium	85	7	Selenium	100
3	Copper	4300	8	Zinc	7500
4	Mercury	57	9	Molybdenum	75
5	Nickel	420	10	Lead	840

(A)-Expressed as mg/kg on dry weight basis

Figure: Ceiling concentration of heavy metals in treated sewage sludge for use in Agriculture (Source: as per MOUD manual 2016)

For dewatered septage/sludge agriculture application, it should satisfy the following criteria of Class ABiosolids of US EPA either by lime stabilization, solar drying and or composting.

- A faecal coliform density of less than 1,000 MPN/g total dry solids
- Salmonella sp. density of less than 3 MPN per 4 g of total dry solids (3 MPN/4 g TS)

ANNEXURE 5: ENVIRONMENTAL MONITORING REPORT

Soil Sampling at project Location



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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENVS2022051461
		Date Of Sampling	12.05.2022
		Date of Issue in lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESODR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Soil	Testing Completed on	21.05.2022

Sampling Details:
 Sampling Method : SOP/SOIL/001
 Type of Sample : Soil
 Location of Sampling Point : IS-4, Moor Avenue, Tolly Nala
 Environmental Conditions : Normal
 Average Temperature Degree Celsius : 41.6
 Sampling Done by : Lab Boy

TEST REPORT


S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Brownish grey	STRL/STP/SOIL/01
2.	Textural class		Sandy Loam	IS27720 (P-4), 1985 (Reaff: 2015)
3.	Bulk Density	g/cm ³	1.08	IS 14765: 2006, RA 2010
4.	Water Holding Capacity	%	26.0	STRL/STP/SOIL/01
Particle Size Distribution				
7.	Sand	%	47.6	IS27720 (P-4), 1985 (Reaff: 2015)
8.	Silt	%	17.3	IS27720 (P-4), 1985 (Reaff: 2015)
9.	Clay	%	35.1	IS27720 (P-4), 1985 (Reaff: 2015)
Chemical Characteristics				
10.	pH (1:2 Suspension)	-	7.74	IS: 2770 (part-26), 1987 (Reaff: 2011)
11.	Electrical Conductivity (1:2)	µmhos/cm	114.0	IS: 14767(2000), RA 2016
12.	Organic Matter	%W/W	2.32	STRL/STP/SOIL/01
13.	Exchangeable Calcium	mg/kg	9627	IS: 2770 (Part 24): 1976, RA 2010

Authorized Signature
 (Name, Designation & Signature With Seal)

 Technical Manager


STRL/AB/058 Rev:00

Note: 1.The results indicated only refer to the tested samples and listed parameters and do not endorse any product. The customer asked for the above tests only
 2.The certificate shall not be reproduced wholly or in part without prior written consent of the laboratory
 3.This certificate shall not be used in any advertising media or as evidence in the court of Law without prior written consent of the laboratory
 4.The samples received shall be destroyed after 30 days from the date of issue of the certificate unless specified otherwise and sample for



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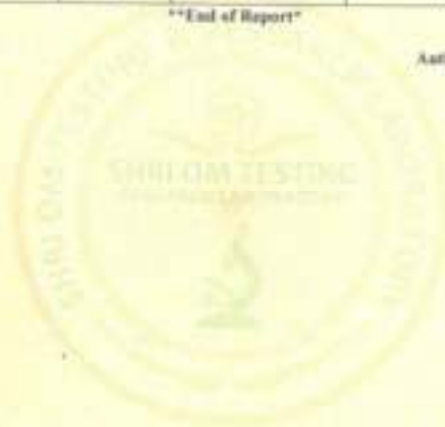



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14.	Exchangeable Magnesium	mg/kg	7418	IS 2720 (Part 24): 1976, IAS 2010
15.	Copper	mg/kg	1.82	IS 2720(Part-27): 1977,
16.	Nickel	mg/kg	1.61	IS 2720(Part-27): 1977,
17.	Chromium	mg/kg	13.7	IS 2720(Part-27): 1977,
18.	Iron	mg/kg	1921.5	IS 2720(Part-27): 1977,
19.	Lead	mg/kg	45.0	IS 2720(Part-27): 1977,
20.	Sulphate	mg/kg	167.4	IS 2720(Part-27): 1977,
Available Nutrients (Kg/ha)				
21.	Nitrogen (as N)	Kg/ha	774.3	IS:10158:1982, IAS 2008
22.	Phosphorus	Kg/ha	312.5	IS:10159:1983, IAS 2008
23.	Exchangeable Potassium	Kg/ha	83.3	STRLL/STR/SOIL/01

****End of Report****

Authorized Signature (Chemist)



Shri Om Testing & Research Laboratory
 Ravinder Kumar Sharma

 Technical Manager
 Authorized Signature
 (Name, Designation & Signature With Seal)

STRLLAB/Q/058 Rev. 00

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 4. The samples received shall be destroyed after 30 days from the date of issue of the certificate unless specified otherwise and sample for institutional facilities will be destroyed after 7 days of testing.



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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENYS2022051682
		Date Of Sampling	12.05.2022
		Date of Issue in lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the sample	Soil	Testing Completed on	21.05.2022

Sampling Details:

Sampling Method : SOP/SOIL/001
 Type of Sample : Soil
 Location of Sampling Point : LS-3, Naktala, Tolly Nala
 Environmental Conditions : Normal
 Average Temperature Degree Celsius : 41.2
 Sampling Done by : Lab-Invy

TEST REPORT

S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Brown	STRL/STP/SOIL/01
2.	Textural class		Sandy Loam	IS 2720 (P-4), IS 85 (Reaff: 2013)
3.	Bulk Density	g/cm ³	1.14	IS 14765: 2006, RA 2010
4.	Water Holding Capacity	%	28.0	STRL/STP/SOIL/01
Particle Size Distribution				
5.	Sand	%	43.2	IS 2720 (P-4), IS 85 (Reaff: 2013)
6.	Silt	%	19.3	IS 2720 (P-4), IS 85 (Reaff: 2013)
7.	Clay	%	37.5	IS 2720 (P-4), IS 85 (Reaff: 2013)

Shri Om Testing & Research Laboratory
Authorized Signature
 (Name, Designation & Signature With Seal)

 Technical Manager

STRL/LAB/QMS

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Chemical Characteristics			Chemical Characteristics
10.	pH (1:2 Suspension)	-	7.64
11.	Electrical Conductivity (1:2)	µmhos/cm	123.0
12.	Organic Matter	%W/W	1.87
13.	Exchangeable Calcium	mg/kg	10391
14.	Exchangeable Magnesium	mg/kg	6945
15.	Copper	mg/kg	1.76
16.	Nickel	mg/kg	1.73
17.	Chromium	mg/kg	11.8
18.	Iron	mg/kg	2457.6
19.	Zinc	mg/kg	32.6
20.	Sulphur	mg/kg	187.8
Available Nutrients (Kg/ha)			
21.	Nitrogen (as N)	Kg/ha	1143.3
22.	Phosphorus	Kg/ha	293.4
23.	Exchangeable Potassium	Kg/ha	74.2

****End of Report****



Shri Om Testing & Research Laboratory
Rajender Kumar Sharma

R Sharma
Authorized Signatory

(Name, Designation & Signature With Seal)

STR/LAB/QI/056

Rev. 00

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Issued To	LEA Associate-South Asia Pacific Pvt. Ltd.	Report No	ENV52022051603
		Date Of Sampling	12.05.2022
		Date of Issue in Lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Soil	Testing Completed on	21.05.2022

Sampling Details:

Sampling Method

Type of Sample

Location of Sampling Point

Environmental Conditions

Average Temperature Degree Celsius

Sampling Done by

SOP:SOIL/001

Soil

IS-6, Charu Avenue, Tolly Nala

Normal

42.1

Lab In-ly

TEST REPORT

S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Greyish Brown	STRL/STP/SOIL/01
2.	Textural class		Clay	IS27720 (P-4), 1983 (Reaff: 2015)
3.	Bulk Density	g/cm ³	1.16	IS 14763: 2000, RA 2010
4.	Water Holding Capacity	%	29.0	STRL/STP/SOIL/01
Particle Size Distribution				
7.	Sand	%	36.4	IS27720 (P-4), 1983 (Reaff: 2015)
8.	Silt	%	24.2	IS27720 (P-4), 1983 (Reaff: 2015)
9.	Clay	%	39.4	IS27720 (P-4), 1983 (Reaff: 2015)

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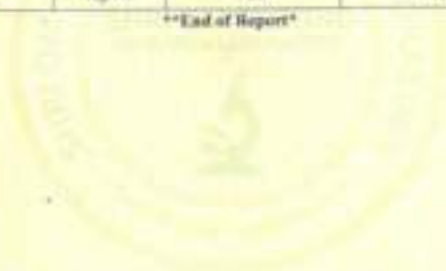
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Chemical Characteristics		Chemical Characteristics		
10.	pH (1:2 Suspension)	-	8.12	IS: 2720 (part-26), 1987 (Reaff:2011)
11.	Electrical Conductivity (1:2)	µmhos/cm	136.0	IS: 14763:2000, RA 2016
12.	Organic Matter	%W/W	2.18	ISIRI:STP:SOIL/01
13.	Exchangeable Calcium	mg/kg	8627	IS 2720 (Part 24): 1976, RA 2016
14.	Exchangeable Magnesium	mg/kg	6741	IS 2720 (Part 24): 1976, RA 2016
15.	Copper	mg/kg	2.43	IS 2720(Part-27): 1977,
16.	Nickel	mg/kg	1.42	IS 2720(Part-27): 1977,
17.	Chromium	mg/kg	14.2	IS 2720(Part-27): 1977,
18.	Iron	mg/kg	1827.6	IS 2720(Part-27): 1977,
19.	Lead	mg/kg	58.6	IS 2720(Part-27): 1977,
20.	Sulphate	mg/kg	148.3	IS 2720(Part-27): 1977,
Available Nutrients (Kg/ha)				
21.	Nitrogen (as N)	Kg/ha	861.8	IS:10158:1982, RA 2009
22.	Phosphorus	Kg/ha	381.4	IS:10158:1982, RA 2009
23.	Exchangeable Potassium	Kg/ha	78.9	ISIRI:STP:SOIL/01

****End of Report****



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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENV52822051684
		Date Of Sampling	12.05.2022
		Date of Issue in lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Soil	Testing Completed on	21.05.2022

Sampling Details:

Sampling Method : SOP/NOEL/001
Type of Sample : Soil
Location of Sampling Point : LS-7, Izzatullah, Tolly Nala
Environmental Conditions : Normal
Average Temperature Degree Celsius : 41.5
Sampling Done by : Lab Boy

TEST REPORT

S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Light Grey	STR/STP/NOEL/01
2.	Textural class		Sandy Loam	IS27720 (P-4), 1985 (Reaff: 2015)
3.	Bulk Density	g/cm ³	1.22	IS 14765: 2000, IA: 2010
4.	Water Holding Capacity	%	31.0	STR/STP/NOEL/01
Particle Size Distribution				
7.	Sand	%	41.3	IS27720 (P-4), 1985 (Reaff: 2015)
8.	Silt	%	24.2	IS27720 (P-4), 1985 (Reaff: 2015)
9.	Clay	%	34.5	IS27720 (P-4), 1985 (Reaff: 2015)

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	Chemical Characteristics			Chemical Characteristics
10.	pH (1:2 Suspension)	-	8.21	IS: 2720 (part-26), 1997 (Reaff2011)
11.	Electrical Conductivity (1:2)	µmhos/cm	136.0	IS: 14767(2000), RA 2016
12.	Organic Matter	%W/W	2.76	STRL/STP/SOIL/01
13.	Exchangeable Calcium	mg/kg	9692	IS 2720 (Part 24): 1976, RA 2010
14.	Exchangeable Magnesium	mg/kg	7648	IS 2720 (Part 24): 1976, RA 2010
15.	Copper	mg/kg	2.17	IS 2720(Part-27): 1977.
16.	Nickel	mg/kg	1.18	IS 2720(Part-27): 1977.
17.	Chromium	mg/kg	14.2	IS 2720(Part-27): 1977.
18.	Iron	mg/kg	2047.1	IS 2720(Part-27): 1977.
19.	Lead	mg/kg	23.2	IS 2720(Part-27): 1977.
20.	Sulphate	mg/kg	141.6	IS 2720(Part-27): 1977.
Available Nutrients (K_p/Ha)				
21.	Nitrogen (as N)	K _p /Ha	8273.6	IS: 10158:1982, RA 2009
22.	Phosphorus	K _p /Ha	184.2	IS: 10158:1982, RA 2009
23.	Exchangeable Potassium	K _p /Ha	86.3	STRL/STP/SOIL/01

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Shri Om Testing & Research Laboratory
 Ravinder Kumar Sharma

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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENV52822851484
		Date Of Sampling	12.05.2022
		Date of Issue in Lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Soil	Testing Completed on	21.05.2022

Sampling Details:

Sampling Method

Type of Sample

Location of Sampling Point

Environmental Conditions

Average Temperature Degree Celsius

Sampling Done by

SOP/SOIL/001

Soil

LS-2, Thackeray Road, Tolly Nala

Normal

42.3

Lab Boy

TEST REPORT

S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Brown grey	STR/STP/SOIL/01
2.	Texture class		Loam	IS:27720 (P-4), 1985 (Reaff: 2013)
3.	Bulk Density	g/cm ³	1.23	IS 14743: 2000, IS 2010
4.	Water Holding Capacity	%	29.0	STR/STP/SOIL/01
Particle Size Distribution				
7.	Sand	%	31.4	IS:27720 (P-4), 1985 (Reaff: 2013)
8.	Silt	%	26.2	IS:27720 (P-4), 1985 (Reaff: 2013)
9.	Clay	%	42.4	IS:27720 (P-4), 1985 (Reaff: 2013)

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Technical Manager

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Chemical Characteristics				Chemical Characteristics
10.	pH (1:2 Suspension)	-	7.92	IS: 2720 (part-26), 1987 (Reaff. 2011)
11.	Electrical Conductivity (1:2)	µmhos/cm	126.4	IS: 14763:2000, RA 2016
12.	Organic Matter	%W/W	2.63	STRL/STP/SOIL/01
13.	Exchangeable Calcium	mg/kg	10327	IS 2720 (Part 24): 1976, RA 2016
14.	Exchangeable Magnesium	mg/kg	7362	IS 2720 (Part 24): 1976, RA 2016
15.	Copper	mg/kg	1.04	IS 2720(Part-27): 1977,
16.	Nickel	mg/kg	1.38	IS 2720(Part-27): 1977,
17.	Chromium	mg/kg	11.2	IS 2720(Part-27): 1977,
18.	Iron	mg/kg	1873.3	IS 2720(Part-27): 1977,
19.	Lead	mg/kg	23.0	IS 2720(Part-27): 1977,
20.	Sulphate	mg/kg	141.6	IS 2720(Part-27): 1977,
Available Nutrients (Kg/ha)				
21.	Nitrogen (as N)	Kg/ha	953.6	IS:10158:1982, RA 2009
22.	Phosphorus	Kg/ha	274.2	IS:10158:1982, RA 2009
23.	Exchangeable Potassium	Kg/ha	76.4	STRL/STP/SOIL/01

End of Report

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Ravinder Kumar Sharma

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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENVN2022051605
		Date Of Sampling	14.05.2022
		Date of Issue to lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Soil	Testing Completed on	21.05.2022

Sampling Details:

Sampling Method : SOP/SOIL/001
 Type of Sample : Soil
 Location of Sampling Point : LS-1A, Bathata, Tolly Nola
 Environmental Conditions : Normal
 Average Temperature Degree Celsius : 42.3
 Sampling Done by : Lab Boy

TEST REPORT

S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Grey	STRL-STP/SOIL/01
2.	Textural class	%	Sandy Loam	IS 27720 (P-4), 1985 (Reaff: 2015)
3.	Bulk Density	gm/cm ³	1.24	IS 14763: 2000, RA 2010
4.	Water Holding Capacity	%	30.5	STRL-STP/SOIL/01
Particle Size Distribution				
7.	Sand	%	40.3	IS 27720 (P-4), 1985 (Reaff: 2015)
8.	Silt	%	17.4	IS 27720 (P-4), 1985 (Reaff: 2015)
9.	Clay	%	42.3	IS 27720 (P-4), 1985 (Reaff: 2015)

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 Technical Manager

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Chemical Characteristics		Chemical Characteristics		
10.	pH (1:2 Suspension)	-	8.19	IS: 2720 (part-26), 1987 (Reaff-2011)
11.	Electrical Conductivity (1:2)	µmhos/cm	132.0	IS: 14763(2000), RA 2016
12.	Organic Matter	%W/W	2.76	ISIRI-STP/NOIL/01
13.	Exchangeable Calcium	mg/kg	1108.0	IS 2720 (Part 24): 1976, RA 2010
14.	Exchangeable Magnesium	mg/kg	7637	IS 2720 (Part 24): 1976, RA 2010
15.	Copper	mg/kg	2.15	IS 2720(Part-27): 1977,
16.	Nickel	mg/kg	1.82	IS 2720(Part-27): 1977,
17.	Chromium	mg/kg	18.6	IS 2720(Part-27): 1977,
18.	Iron	mg/kg	2156.3	IS 2720(Part-27): 1977,
19.	Lead	mg/kg	26.8	IS 2720(Part-27): 1977,
20.	Sulphate	mg/kg	185.3	IS 2720(Part-27): 1977,
Available Nutrients (K ₂ O%)				
21.	Nitrogen (as N)	Kg/ha	1256.4	IS:10158:1982, RA 2009
22.	Phosphorus	Kg/ha	186.4	IS:10158:1982, RA 2009
23.	Exchangeable Potassium	Kg/ha	83.6	ISIRI-STP/NOIL/01

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Ajay Kumar Sharma

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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENVS2022081096
		Date Of Sampling	14.05.2022
		Date of Issue in Lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Soil	Testing Completed on	21.05.2022

Sampling Details:

Sampling Method : SOP/NOIL/041
 Type of Sample : Soil
 Location of Sampling Point : Chetia PS, Tolly Nala
 Environmental Conditions : Normal
 Average Temperature Degree Celsius : 42.3
 Sampling Done by : Lab In-ty

TEST REPORT

S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Light Grey	STRL/STP/NOIL/01
2.	Textural class		Sandy Loam	IS27720 (P-4), 1985 (Reaff: 2015)
3.	Bulk Density	g/cm ³	1.23	IS 14765- 2000, RA 2010
4.	Water Holding Capacity	%	30.0	STRL/STP/NOIL/01
Particle Size Distribution				
7.	Sand	%	43.1	IS27720 (P-4), 1985 (Reaff: 2015)
8.	Silt	%	22.6	IS27720 (P-4), 1985 (Reaff: 2015)
9.	Clay	%	34.3	IS27720 (P-4), 1985 (Reaff: 2015)

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Chemical Characteristics			Chemical Characteristics	
10.	pH (1:2 Suspension)	-	7.65	IS: 2720 (part-26), 1987 (Reaff: 2011)
11.	Electrical Conductivity (EC)	umhos/cm	142.0	IS: 14767:2000, RA 2016
12.	Organic Matter	%W/W	2.32	STRL/STP/SOIL/01
13.	Exchangeable Calcium	mg/kg	10549	IS 2720 (Part 24): 1976, RA 2010
14.	Exchangeable Magnesium	mg/kg	6493	IS 2720 (Part 24): 1976, RA 2010
15.	Copper	mg/kg	1.63	IS 2720(Part-27): 1977.
16.	Nickel	mg/kg	1.43	IS 2720(Part-27): 1977.
17.	Chromium	mg/kg	17.4	IS 2720(Part-27): 1977.
18.	Iron	mg/kg	167.3	IS 2720(Part-27): 1977.
19.	Lead	mg/kg	18.0	IS 2720(Part-27): 1977.
20.	Sulphate	mg/kg	148.6	IS 2720(Part-27): 1977.
Available Nutrients (Kg/Ha)				
21.	Nitrogen (as N)	Kg/Ha	964.5	IS:10158:1982, RA 2009
22.	Phosphorus	Kg/Ha	228.3	IS:10158:1982, RA 2009
23.	Exchangeable Potassium	Kg/Ha	86.3	STRL/STP/SOIL/01

****End of Report****

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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENVS2022051688
		Date Of Sampling	14.05.2022
		Date of Issue in lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESODR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Soil	Testing Completed on	21.05.2022

Sampling Details:

Sampling Method : SOP/NOEL/001
Type of Sample : Soil
Location of Sampling Point : Proposed Police Telecom Dept. Land, Tolly Nala
Environmental Conditions : Normal
Average Temperature Degree Celsius : 42.0
Sampling Done by : Lab Day

TEST REPORT

S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Brownish Grey	STRL/STP/NOEL/01
2.	Textural class		Sandy Loam	IS27720 (P-4), 1983 (Reaff: 2015)
3.	Bulk Density	g/cm ³	1.18	IS 14763: 2000, RA 2010
4.	Water Holding Capacity	%	29.0	STRL/STP/NOEL/01
Particle Size Distribution				
7.	Sand	%	60.4	IS27720 (P-4), 1983 (Reaff: 2015)
8.	Silt	%	21.3	IS27720 (P-4), 1983 (Reaff: 2015)
9.	Clay	%	18.3	IS27720 (P-4), 1983 (Reaff: 2015)

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Baujanpura, Kirti Nagar
Authorized Signature *[Signature]*
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Technical Manager

STRL/LAB/Q/008

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	Chemical Characteristics			Chemical Characteristics
10.	pH (1:2 Suspension)	-	7.21	IS: 2720 (Part-26), 1987 (Reaff: 2011)
11.	Electrical Conductivity (1:2)	µmhos/cm	153.0	IS: 34767(2006), RA 2016
12.	Organic Matter	%W/W	2.68	ISRL/STP/NOIL/01
13.	Exchangeable Calcium	mg/kg	10824	IS 2720 (Part 24): 1976, RA 2010
14.	Exchangeable Magnesium	mg/kg	8832	IS 2720 (Part 24): 1976, RA 2010
15.	Copper	mg/kg	2.14	IS 2720(Part-27): 1977,
16.	Nickel	mg/kg	1.86	IS 2720(Part-27): 1977,
17.	Chromium	mg/kg	16.5	IS 2720(Part-27): 1977,
18.	Iron	mg/kg	1731.6	IS 2720(Part-27): 1977,
19.	Zinc	mg/kg	23.3	IS 2720(Part-27): 1977,
20.	Sulphur	mg/kg	146.3	IS 2720(Part-27): 1977,
Available Nutrients (Kg/Ha)				
21.	Nitrogen (as N)	Kg/Ha	1165.2	IS:10138:1982, RA 2009
22.	Phosphorus	Kg/Ha	232.3	IS:10138:1982, RA 2009
23.	Exchangeable Potassium	Kg/Ha	86.6	ISRL/STP/NOIL/01

****End of Report****

Shri Om Testing & Research Laboratory
Rajender Kumar Sharma

(Signature)
Authorized Signatory
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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENV52022051609
		Date Of Sampling	14.05.2022
		Date of Issue in lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDOR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Soil	Testing Completed on	21.05.2022

Sampling Details:

Sampling Method : SOP/SOIL/001
 Type of Sample : Soil
 Location of Sampling Point : Proposed GolfGreen, Tolly Nala
 Environmental Conditions : Normal
 Average Temperature Degree Celsius : 42.3
 Sampling Done by : Lab Boy

TEST REPORT

S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Brown Grey	STRL/STP/SOIL/01
2.	Textural class		Loam	IS27720 (P-4), 1983 (Reaff. 2015)
3.	Bulk Density	g/cm ³	1.26	IS 14765: 2000, IA 2010
4.	Water Holding Capacity	%	30.0	STRL/STP/SOIL/01
Particle Size Distribution				
5.	Sand	%	36.2	IS27720 (P-4), 1983 (Reaff. 2015)
6.	Silt	%	22.4	IS27720 (P-4), 1983 (Reaff. 2015)
7.	Clay	%	41.4	IS27720 (P-4), 1983 (Reaff. 2015)

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	Chemical Characteristics			Chemical Characteristics
10.	pH (1:2 Suspension)	-	7.47	IS: 2720 (part-26), 1987 (Reaff:2011)
11.	Electrical Conductivity (1:2)	µmhos/cm	143.0	IS: 14763(2000), RA: 2016
12.	Organic Matter	%W/W	2.87	STRL/STP/900L/03
13.	Exchangeable Calcium	mg/kg	12843	IS 2720 (Part 24): 1976, RA: 2010
14.	Exchangeable Magnesium	mg/kg	7847	IS 2720 (Part 24): 1976, RA: 2010
15.	Copper	mg/kg	1.08	IS 2720(Part-27): 1977,
16.	Nickel	mg/kg	2.14	IS 2720(Part-27): 1977,
17.	Chromium	mg/kg	15.7	IS 2720(Part-27): 1977,
18.	Iron	mg/kg	1843.6	IS 2720(Part-27): 1977,
19.	Lead	mg/kg	19.6	IS 2720(Part-27): 1977,
20.	Sulphate	mg/kg	196.5	IS 2720(Part-27): 1977,
Available Nutrients (K_p/Ha)				
21.	Nitrogen (as N)	K _p /Ha	1548.7	IS:10138:1982, RA: 2009
22.	Phosphorous	K _p /Ha	224.5	IS:10158:1982, RA: 2009
23.	Exchangeable Potassium	K _p /Ha	84.2	STRL/STP/900L/01

****End of Report***



Shri Om Testing & Research Laboratory
 Ravinder Kumar Sharma
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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENVS2023051610
		Date Of Sampling	14.05.2022
		Date of Issue in Lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Soil	Testing Completed on	21.05.2022

Sampling Details:

Sampling Method : SOP:SOIL/001
 Type of Sample : Soil
 Location of Sampling Point : Near Proposed Kavi Nazrul Metro Station, Tolly Nala
 Environmental Conditions : Normal
 Average Temperature Degree Celsius : 42.5
 Sampling Done by : Lab Boy

TEST REPORT

S. No.	Parameters	Units	Results	Test Method
Physical Characteristics				
1.	Colour		Greyish Brown	STRL/STP/SOIL/01
2.	Textural class		Sandy Loam	IS27720 (P-4), 1985 (Reaff: 2015)
3.	Bulk Density	g/cm ³	1.34	IS 14765: 2000, RA 2011
4.	Water Holding Capacity	%	31.0	STRL/STP/SOIL/01
Particle Size Distribution				
7.	Sand	%	37.4	IS27720 (P-4), 1985 (Reaff: 2015)
8.	Silt	%	19.2	IS27720 (P-4), 1985 (Reaff: 2015)
9.	Clay	%	43.4	IS27720 (P-4), 1985 (Reaff: 2015)

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Authorized Signature
 (Name, Designation & Signature With Seal)
 Technical Manager

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	Chemical Characteristics			Chemical Characteristics
10.	pH (1:2 Suspension)	-	7.32	IS: 3720 (part-26), 1987 (Reaff:2011)
11.	Electrical Conductivity (1:2)	µmhos/cm	143.0	IS: 14767(2000), RA 2010
12.	Organic Matter	%W/W	2.67	ISIRI/STP/SOIL/01
13.	Exchangeable Calcium	mg/kg	9854	IS 2720 (Part 24): 1976, RA 2010
14.	Exchangeable Magnesium	mg/kg	3968	IS 2720 (Part 24): 1976, RA 2010
15.	Copper	mg/kg	1.48	IS 2720(Part-27): 1977,
16.	Nickel	mg/kg	1.84	IS 2720(Part-27): 1977,
17.	Chromium	mg/kg	17.2	IS 2720(Part-27): 1977,
18.	Iron	mg/kg	1854.4	IS 2720(Part-27): 1977,
19.	Lead	mg/kg	18.8	IS 2720(Part-27): 1977,
20.	Sulphate	mg/kg	184.1	IS 2720(Part-27): 1977,
Available Nutrients (Kg/Ha)				
21.	Nitrogen (as N)	Kg/Ha	1486.3	IS:10158:1982, RA 2009
22.	Phosphorus	Kg/Ha	258.2	IS:10158:1982, RA 2009
23.	Exchangeable Potassium	Kg/Ha	74.8	ISIRI/STP/SOIL/01

****End of Report***




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 Rawatpur Kuma Shamsi
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Air Quality Sampling



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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No :	ENVA3022051601
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental, Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	12.05.2022
		Date of Issue :	16.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	16.05.2022
Customer Ref. No :	LN5	Test Completed on :	23.05.2022

Monitoring Details:

Monitoring Location : LS-4, Meer Avenue, Tolly Nala

Monitoring Done by : Monitoring in-charge


Weather Condition : Clear Sky

Monitoring Period : 12/05/2022 to 13/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	116.3	100	IS:5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	72.5	60	SOP1/STR1/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	21.4	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.42	04(1hourly)	IS:5182 (P-10) : 199,KA-2083
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	19.4	80	IS:5182 (P-6) : 2006

End of Report

Shri Om Testing & Research Laboratory
 Rajendra Kumar Sarda

 Authorized Signature
 (Name, Designation & Signature With Seal)

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No :	ENVA2022051603
Project :	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental, Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	13.05.2022
		Date of Issue :	16.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	16.05.2022
Customer Ref. No :	NS	Test Completed on :	23.05.2022

Monitoring Details:

Monitoring Location : 13-3, Naktala, Tolly Nala
Monitoring Done by : Monitoring in-charge
Weather Condition : Clear Sky
Monitoring Period : 13/05/2022 to 13/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAGS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m3	121.4	100	IS 5182 (P-13) : 2006
2	Particulate Matter, PM 2.5	µg/m3	59.2	60	SCP1/STPL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO2)	µg/m3	21.2	80	IS 5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m3	1.16	04 (Hourly)	IS 5182 (P-10) : 199, RA-2001
5	Oxide of Nitrogen (as NO2)	µg/m3	21.4	80	IS 5182 (P-6) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma

Ravinder Kumar Sharma
Authorized Signature
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Rev. 03

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report / Sample No :	ENVA2022051603
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	12.05.2022
		Date of Issue :	18.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	18.05.2022
Customer Ref. No :	/ Nil	Test Completed on :	23.05.2022

Monitoring Details:

Monitoring Location : LS-6, Charu Avenue, Tolly Nala
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 11/05/2022 to 13/05/2022

Ambient Air Quality Reports

ES No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	117.4	100	IS 5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	74.4	60	SOP1/STR1/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	16.8	80	IS 5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.54	04 (hourly)	IS 5182 (P-10) : 1998A-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	21.8	80	IS 5182 (P-6) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No :	ENVA2022051604
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Management Plan (ESMP)	Date Of Monitoring :	14.05.2022
		Date of Issue :	16.05.2022
Nature of the Sample	Ambient Air Quality	Test Started On :	16.05.2022
Customer Ref. No	NS	Test Completed on :	23.05.2022

Monitoring Details:

Monitoring Location : 15-7, Isarattullah, Tolly Nala
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 12/05/2022 to 13/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m3	123.4	100	IS 5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m3	75.2	60	IS 5182 (P-23) : 2006
3	Sulphur Dioxide (as SO2)	µg/m3	17.3	80	IS 5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m3	1.45	04(1hourly)	IS 5182 (P-10) : 199,RA-2003
5	Oxide of Nitrogen (as NO2)	µg/m3	21.3	80	IS 5182 (P-6) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
 Environmental & Social Audit
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 Technical Manager

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Issued To:	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No :	ENVA2022051605
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	13.05.2022
		Date of Issue :	16.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	16.05.2022
Customer Ref. No :	NS	Test Completed on :	23.05.2022

Monitoring Details:

Monitoring Location : U-2, Thakernay Road, Turly Nala
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 13/05/2022 to 16/05/2022

Ambient Air Quality Reports

ES- No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	114.2	100	IS:5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	73.8	60	SOP1/STRL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	16.4	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.24	04(1hourly)	IS:5182 (P-10) : 199,RA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	23.2	80	IS:5182 (P-4) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
 Ravindra Kumar Sharma
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 Regional Manager

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No :	ENVA2022051606
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental, Social, Governance and Assessment Plan (ESGASAP).	Date Of Monitoring :	13.05.2022
		Date of Issue :	16.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	16.05.2022
Customer Ref. No :	NS	Test Completed on :	23.05.2022

Monitoring Details:

Monitoring Location : IS-1A, Rahtala
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 13/05/2022 to 14/05/2022

Ambient Air Quality Reports

S.S. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	116.6	100	IS 5182 (P-2) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	88.5	60	SOP1/STN/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	21.2	80	IS 5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.54	04 (hourly)	IS 5182 (P-10) : 199, RA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	17.2	80	IS 5182 (P-6) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
 Rajender Kumar Garg

 Authorized Signature
 (Name, Designation & Signature With Seal)

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Rev. 02

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd,	Report /Sample No :	ENVA2022051607
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental, Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	13.05.2022
		Date of Issue :	16.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	16.05.2022
Customer Ref. No :	NI	Test Completed on :	23.05.2022

Monitoring Details

Monitoring Location : Chetla Pk, Tolly Nala
 Monitoring Done by : Monitoring in charge
 Weather Condition : Clear Sky
 Monitoring Period : 13/05/2022 to 14/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m3	121.5	100	IS 5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m3	73.6	60	IS 5182 (P-2) : 2006
3	Sulphur Dioxide (as SO2)	µg/m3	20.5	80	IS 5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m3	1.43	04(hourly)	IS 5182 (P-10) : 1993AA-2003
5	Oxide of Nitrogen (as NO2)	µg/m3	20.3	80	IS 5182 (P-6) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd,	Report / Sample No :	ENVA2022051608
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	13.05.2022
		Date of Issue :	16.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	16.05.2022
Customer Ref. No :	ND	Test Completed on :	23.05.2022

Monitoring Details:

Monitoring Location : Proposed Police Telecom Dept Land, Tolly Nala
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 13/05/2022 to 14/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	ug/m3	123.4	100	IS:5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	ug/m3	71.6	60	IS:5182 (P-23) : 2006
3	Sulphur Dioxide (as SO2)	ug/m3	23.4	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m3	1.21	04(1hourly)	IS:5182 (P-10) : 199,IA-2003
5	Oxide of Nitrogen (as NO2)	ug/m3	18.1	80	IS:5182 (P-6) : 2006

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Shri Om Testing & Research Laboratory
 Manager
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 Technical Manager

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No :	ENVA2022051608
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental Impact Assessment and Management Plan (EIAMMP)	Date Of Monitoring :	14.05.2022
		Date of Issue :	16.05.2022
Nature of the Sample	Ambient Air Quality	Test Started On :	14.05.2022
Customer Ref. No	NS	Test Completed on :	23.05.2022

Monitoring Details:

Monitoring Location : Proposed Golf Green, Tolly Nala
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 14/05/2022 to 15/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	118.2	100	IS-5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	74.3	60	SOP1/STR1/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	21.4	80	IS-5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.48	04(1hourly)	IS-5182 (P-10) : 199,IA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	16.1	30	IS-5182 (P-6) : 2006

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Issued To:	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report / Sample No :	ENVA2022051610
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDOR) and Environmental & Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	14.05.2022
		Date of Issue :	16.05.2022
Nature of the Sample	Ambient Air Quality	Test Started On :	16.05.2022
Customer Ref. No	Nil	Test Completed on :	23.05.2022

Monitoring Details

Monitoring Location : Near Proposed Kavi Nand Metro Station
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 14/05/2022 to 15/05/2022

Ambient Air Quality Reports

Sl. No.	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1.	Particulate Matter, PM 10	ug/m3	118.7	100	IS:5182 (P-23) : 2006
2.	Particulate Matter, PM 2.5	ug/m3	69.3	60	SOP1/STRL/Ambient Air/Gravimetric Method
3.	Sulphur Dioxide (as SO2)	ug/m3	21.4	80	IS:5182 (P-2) : 2006
4.	Carbon Monoxide (as CO)	mg/m3	1.25	04(1)hourly	IS:5182 (P-10) : 199,RA-2003
5.	Oxide of Nitrogen (as NO2)	ug/m3	24.5	80	IS:5182 (P-6) : 2006

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 Gurgaon, Haryana, India

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd,	Report /Sample No :	ENVA2022052101
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	16.05.2022
		Date of Issue :	21.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No :	NS	Test Completed on :	24.05.2022

Monitoring Details:

Monitoring Location : G-4, Moor Avenue, Tolly Nala
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 18/05/2022 to 19/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	112.6	100	IS:5182 (P-21) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	67.3	60	SOP1/STL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	18.2	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.34	04(Hourly)	IS:5182 (P-20) : 199,RA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	21.1	80	IS:5182 (P-6) : 2006

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No :	ENV/A2022052102
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	16.05.2022
		Date of Issue :	21.05.2022
Nature of the Sample	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No	NS	Test Completed on :	24.05.2022

Monitoring Details:

Monitoring Location : IS-3, Nakhata, Tolly Nala
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 16/05/2022 to 17/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	ug/m3	114.8	100	(IS:5182 (P-23) : 2006)
2	Particulate Matter, PM 2.5	ug/m3	73.8	80	SOP1/STRL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO2)	ug/m3	18.4	80	(IS:5182 (P-2) : 2006)
4	Carbon Monoxide (as CO)	mg/m3	1.43	04(1Hourly)	(IS:5182 (P-10) : 199,NA-2003)
5	Oxide of Nitrogen (as NO2)	ug/m3	20.3	80	(IS:5182 (P-6) : 2006)

****End of Report****

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Issued To:	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report / Sample No :	ENVA2022052103
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	17.05.2022
		Date of Issue :	21.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No :	NS	Test Completed on :	24.05.2022

Monitoring Details:

Monitoring Location : 15-B, Charu Avenue, Tolly Nala
Monitoring Done by : Monitoring in-charge
Weather Condition : Clear Sky
Monitoring Period : 17/05/2022 to 18/05/2022

Ambient Air Quality Reports

Sl. No.	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	121.8	100	IS:5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	71.7	60	SOP1/STR1/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	13.5	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.42	04(1hourly)	IS:5182 (P-10) : 199,IA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	23.1	80	IS:5182 (P-6) : 2006

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd,	Report /Sample No :	ENVA2022052104
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental& Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	17.05.2022
		Date of Issue :	31.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No :	NS	Test Completed on :	24.05.2022

Monitoring Details:

Monitoring Location : LS-7, Isarathullah, Tolly Nala
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 17/05/2022 to 18/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	118.2	100	IS:3182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	73.0	60	SOPL/STR/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	21.1	80	IS:3182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.32	04(Hourly)	IS:3182 (P-16) : 199,IA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	17.2	80	IS:3182 (P-6) : 2006

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No :	ENVA2022052105
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental& Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	17.05.2022
		Date of Issue :	21.05.2022
Nature of the Sample	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No	NI	Test Completed on :	24.05.2022

Monitoring Details:

Monitoring Location : LS-2, Thackeray Road, Tolly Noh
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 17/05/2022 to 18/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	124.7	100	IS:5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	71.4	60	SOP3/STRU/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	18.1	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.51	04(1hourly)	IS:5182 (P-10) : 199,RA-2003
5	Dioxide of Nitrogen (as NO ₂)	µg/m ³	21.8	80	IS:5182 (P-6) : 2006

****End of Report****

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 Ravinder Kumar Sharma
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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report / Sample No :	ENVA2022052106
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental, Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	17.05.2022
		Date of Issue :	21.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No :	NE	Test Completed on :	24.05.2022

Monitoring Details:

Monitoring Location : IS-1A, Karkala

Monitoring Done by : Monitoring In-charge

Weather Condition : Clear sky

Monitoring Period : 17/05/2022 to 18/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	120.4	100	IS-5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	71.3	60	SOP1/STR1/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	13.7	80	IS-5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.35	04(1hourly)	IS-5182 (P-10) : 199,AA-2001
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	23.5	80	IS-5182 (P-6) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
 Rainbow Kulkarni Sharma



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 (Name, Designation & Signature With Seal)

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd,	Report /Sample No :	ENVA2022082107
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental, Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	18.05.2022
		Date of Issue :	21.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No :	NS	Test Completed on :	24.05.2022

Monitoring Details:

Monitoring Location : Okhla PS, Tolly Nala
Monitoring Done by : Monitoring in-charge
Weather Condition : Clear Sky
Monitoring Period : 18/05/2022 to 25/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	126.1	100	IS 5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	76.2	60	SOP1/STRL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	24.2	80	IS 5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.15	04(1hourly)	IS 5182 (P-10) : 1998A-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	17.2	80	IS 5182 (P-6) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
Noida, U.P., India
(Signature)
Authorized Signature
(Name, Designation & Signature With Seal)
Pratibha Misra
Pratibha Misra

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No :	ENVA2022052108
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	18.05.2022
		Date of Issue :	21.05.2022
Return of the Sample	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No	Nil	Test Completed on :	24.05.2022

Monitoring Details:

Monitoring Location : Proposed Police Telecom Dept Land, Tolly Naha
 Monitoring Done by : Monitoring in-charge
 Weather Condition : Clear Sky
 Monitoring Period : 18/05/2022 to 19/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	ug/m ³	118.0	100	IS-5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	ug/m ³	67.3	60	SOP1/STWL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	ug/m ³	30.2	80	IS-5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.32	04.1hourly	IS-5182 (P-10) : 199,RA-2003
5	Oxide of Nitrogen (as NO ₂)	ug/m ³	21.5	80	IS-5182 (P-6) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
 Reshmi Kumar Shigma
Authorized Signature
 (Name, Designation & Signature With Seal)
 Technical Manager

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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd,	Report / Sample No :	ENVA2022052109
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	18.05.2022
		Date of Issue :	21.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No :	NS	Test Completed on :	24.05.2022

Monitoring Details

Monitoring Location : Proposed Golf Green, Tolly Nala
 Monitoring Done by : Monitoring In-charge
 Weather Condition : Clear Sky
 Monitoring Period : 18/05/2022 to 19/05/2022

Ambient Air Quality Reports

Sl. No	Parameters	Unit	Project site	Requirement: permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	124.7	100	IS:5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	69.4	60	SOP1/STRL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	25.7	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.26	04(1hourly)	IS:5182 (P-10) : 199, AA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	21.4	80	IS:5182 (P-6) : 2006

****End of Report****

Shri Om Testing & Research Laboratory
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Issued To :	M/s LEA Associate South Asia Pacific Pvt. Ltd.	Report / Sample No. :	ENVA2022052110
Project:	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Date Of Monitoring :	18.05.2022
		Date of Issue :	21.05.2022
Nature of the Sample :	Ambient Air Quality	Test Started On :	21.05.2022
Customer Ref. No. :	NR	Test Completed on :	24.05.2022

Monitoring Details

Monitoring Location : Near Proposed Kavi Nandul Metro Station
Monitoring Done by : Monitoring in-charge
Weather Condition : Clear Sky
Monitoring Period : 18/05/2022 to 19/05/2022

Ambient Air Quality Reports

S. No	Parameters	Unit	Project site	Requirement permissible limits as per NAAQS/CPCB	Test Method
1	Particulate Matter, PM 10	µg/m ³	124.1	100	IS-5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m ³	72.2	60	SOPL/STRL/Ambient Air/Gravimetric Method
3	Sulphur Dioxide (as SO ₂)	µg/m ³	18.2	80	IS-5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m ³	1.42	04(Hourly)	IS-5182 (P-10) : 199,IA-2003
5	Oxide of Nitrogen (as NO ₂)	µg/m ³	22.7	80	IS-5182 (P-6) : 2006

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Shri Om Testing & Research Laboratory
Rakesh Kumar Sharma
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Technical Manager

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Noise Quality Monitoring



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TEST REPORT

Issued To:	LEA Associate South Asia Pacific Pvt. Ltd.	Report /Sample No:	ENVN2022051401
		Measurement Started :	12.05.2022
		Test Started:	16.05.2022
		Test Completed :	21.05.2022

Project Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDOR) and Environmental& Social Assessment and Management Plan (ESAMP)

Sample Identification Ambient Noise Quality

Sampling Details:

Type of Monitoring	: Ambient Noise Quality
Location of Sampling Point	: IS-6, Moor, Avenue, Tolly Nala
Measurement Started on	: (12.05.2022)
Measurement Completed on	: (21.05.2022)
Environmental Conditions	: Clear Sunny

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	12.05.2022	50.2	46.1	IS 9889 : 1981 (HA 2000)
Limit for Residential Zone As Per the NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000		50	50	

Note: *Day time mean from 6:00 a.m. to 10:00 p.m.
 ** Night time mean from 10:00 p.m. to 6:00 a.m.

End of Report

Shri Om Testing & Research Laboratory
 Ravinder Kumar Sharma

 Authorized Signature
 (Name, Designation & Signature With Seal)

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TEST REPORT

Issued To: **LEA Associate South Asia Pacific Pvt. Ltd.** Report / Sample No: **ENVN2022051602**
Measurement Started: **12.05.2022**
Test Started: **16.05.2022**
Test Completed: **21.05.2022**

Project: **Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)**

Sample Identification: **Ambient Noise Quality**
Sampling Details: **Ambient Noise Quality**
Type of Monitoring: **LS-3, Naitala, Tolly Nala**
Location of Sampling Point: **(12.05.2022)**
Measurement Started on: **(13.05.2022)**
Measurement Completed on: **Clear Sunny**
Environmental Conditions:

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	12.05.2022	51.4	44.7	IS 9889 : 1981 (IA 2000)
Limit for Residential Zone As Per the NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000		55	50	

Note: * Day time means from 6:00 a.m. to 10:00 p.m.
** Night time means from 10:00 p.m. to 6:00 a.m.

Shri Om Testing & Research Laboratory,
Ravindra Kumar Sharma

****End of Report****

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TEST REPORT

Issued To: **LEA Associate South Asia Pacific Pvt. Ltd.** Report /Sample No: **ENVN2022051603**
Measurement Started: **12.05.2022**
Test Started: **16.05.2022**
Test Completed: **21.05.2022**

Project: **Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDOR) and Environmental & Social Assessment and Management Plan (ESAMP)**

Sample Identification: **Ambient Noise Quality**
Sampling Details: **Ambient Noise Quality**
Type of Monitoring: **CG-6, Charo Avenue, Tolly Nala** Measurement Started on: **Clear Sunny**
Location of Sampling Point: **Environmental Conditions** Measurement Completed on: **Clear Sunny**
(12.05.2022)
(13.05.2022)

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	12.05.2022	52.0	42.6	IS 9889 : 1981 (ISA 2008)
Limit for Residential Zone As Per the NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000		55	50	

Note: * Day time means from 6:00 a.m. to 10:00 p.m.
** Night time means from 10:00 p.m. to 6:00 a.m.

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Ravinder Kumar Sharma

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TEST REPORT

Issued To: LEA Associate South Asia Pacific Pvt. Ltd. **Report /Sample No:** ENVN2022051604
Measurement Started : 12.05.2022
Test Year(s): 16.05.2022
Test Completed : 21.05.2022

Project: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDOR) and Environmental & Social Assessment and Management Plan (ESAMP)

Sample Identification: Ambient Noise Quality

Sampling Details:

- Type of Monitoring: Ambient Noise Quality
- Location of Sampling Point: LS-7, Issambullah, Tolly Nala
- Measurement Started on: (12.05.2022)
- Measurement Completed on: (19.05.2022)
- Environmental Conditions: Clear Sunny

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	12.05.2022	51.5	43.6	IS 9869 / 1981 (ISA 2000)
Limit for Residential Zone As Per the NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000		55	50	

Note: * Day time means from 6:00 a.m. to 10:00 p.m.
 ** Night time means from 10:00 p.m. to 6:00 a.m.

Shri Om Testing & Research Laboratory
 Ravinder Kumar Sharma

****End of Report****

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 (Name, Designation & Signature With Seal)

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TEST REPORT

Sample Identification Issued For: Ambient Noise Quality
LEA Associate South Asia Pacific Pvt. Ltd.

Report / Sample No.: ENVN2022051605
Measurement Started: 13.05.2022
Test Started: 14.05.2022
Test Completed: 21.05.2022

Project: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)

Sampling Details:
Type of Monitoring: Ambient Noise Quality
Location of Sampling Point: 13-2, Thackeray Road, Tolly Noh
Measurement Started on: 13.05.2022
Measurement Completed on: 14.05.2020
Environmental Conditions: Clear Sunny

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	13.05.2022	51.3	42.8	IS 9889 : 1983 (ISA 1088)
Limit for Residential Zone As Per the NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000		55	50	

Note: * Day time interval from 6:00 a.m. to 10:00 p.m.
** Night time interval from 10:00 p.m. to 6:00 a.m.

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Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma

Ravinder
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TEST REPORT

Issued To: **LEA Associate South Asia Pacific Pvt. Ltd.** Report / Sample No: **ENVN2022031606**
 Measurement Startd : **13.05.2022**
 Test Startd: **14.05.2022**
 Test Completed : **21.05.2022**

Project: **Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)**

Sample Identification: **Ambient Noise Quality**

Sampling Details: **Ambient Noise Quality**
 Type of Monitoring: **IS-1A, Kathala, Tolly Nala**
 Location of Sampling Point: **(13.05.2022)**
 Measurement Startd on: **(14.05.2022)**
 Measurement Completed on: **Clear Sunny**
 Environmental Conditions:

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	13.05.2022	52.5	44.0	IS 9589 : 1981 (ISA 2008)
Limit for Residential Zone As Per the NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000		55	50	

Note: *Day time means from 6:00 a.m. to 10:00 p.m.
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****End of Report****

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TEST REPORT

Issued To: **LEA Associate South Asia Pacific Pvt. Ltd.** Report /Sample No: **ENVN2022051607**
Measurement Started: **13.05.2022**
Test Started: **16.05.2022**
Test Completed: **21.05.2022**

Project: **Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)**

Sample Identification: **Ambient Noise Quality**
Sampling Details:
Type of Monitoring: **Ambient Noise Quality**
Location of Sampling Point: **Cherla PS, Tolly Nala**
Measurement Started on: **(13.05.2022)**
Measurement Completed on: **(16.05.2022)**
Environmental Conditions: **Clear Sunny**

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	14.05.2022	51.7	43.2	IS 9889 : 1982 (IA 2008)
Limit for Residential Zone As Per the NOISE POLLUTION [REGULATION AND CONTROL] RULES, 2000		55	50	

Note: *Day time means from 6:00 a.m. to 10:00 p.m.
** Night time means from 10:00 p.m. to 6:00 a.m.

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Ravinder Kumar Sharma

R. Sharma
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TEST REPORT

Issued To: **LEA Associate South Asia Pacific Pvt. Ltd.** Report /Sample No: **ENVN2022051408**
Measurement Started: **13.05.2022**
Test Started: **16.05.2022**
Test Completed: **21.05.2022**

Project: **Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)**

Sample Identification: **Ambient Noise Quality**
Sampling Details:
Type of Monitoring: **Ambient Noise Quality**
Location of Sampling Point: **Proposed Police Telecom Dept. Land, Tolly Nala**
Measurement Started on: **13.05.2022**
Measurement Completed on: **14.05.2022**
Environmental Conditions: **Clear Sunny**

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	13.05.2022	51.5	43.1	IS 9995 : 1981 (RA 2008)
Limit for Residential Zone, As Per the NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000		55	50	

Note: *Day time means from 6:00 a.m. to 10:00 p.m.
** Night time means from 10:00 p.m. to 6:00 a.m.

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma

****End of Report****

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(Name, Designation & Signature With Seal)

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TEST REPORT

Issued To: **LEA Associate South Asia Pacific Pvt. Ltd.** Report /Sample No: **ENVN2022051809**
Measurement started: **14.05.2022**
Test started: **16.05.2022**
Test Completed: **21.05.2022**

Project: **Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)**

Sample Identification: **Ambient Noise Quality**

Sampling Details: **Ambient Noise Quality**
Type of Monitoring: **Ambient Noise Quality**
Location of Sampling Point: **Proposed Golf Green, Tolly Nala**
Measurement Started on: **14.05.2022**
Measurement Completed on: **16.05.2022**
Environmental Conditions: **Clear Sunny**

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	14.05.2022	52.9	41.7	IS 9889 / 1981 (ISA 2000)
Limit for Residential Zone As Per the NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000		55	50	

Note: *Day time noise from 6:00 a.m. to 10:00 p.m.
** Night time noise from 10:00 p.m. to 6:00 a.m.

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma
****End of Report****
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TEST REPORT

Issued To: **LEA Associate South Asia Pacific Pvt. Ltd.** Report/Sample No: **ENVN2022051610**
 Measurement Started: **14.05.2022**
 Test Started: **16.05.2022**
 Test Completed: **21.05.2022**

Project: **Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)**

Sample Identification: **Ambient Noise Quality**

Sampling Details: : Ambient Noise Quality
 Type of Monitoring : Ambient Noise Quality
 Location of Sampling Point : Near Proposed Kauli Nand Metro Station, Tolly Nala
 Measurement Started on : (14.05.2022)
 Measurement Completed on : (15.05.2022)
 Environmental Conditions : Clear Sunny

Ambient Noise Monitoring Result at Project Site

S.No	Date	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq (Night**) dB (A)	Test Method
1	14.05.2022	53.0	44.1	IS 9999 : 1981 (RA 2004)
Limit for Residential Zone As Per the NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000		55	50	

Note: * Day time means from 6:00 a.m. to 6:00 p.m.
 ** Night time means from 6:00 p.m. to 6:00 a.m.

Shri Om Testing & Research Laboratory
 Ravinder Kumar Sharma

End of Report

Authoritative Signature

(Name, Designation & Signature With Seal)

STRELAB/QF/058

Rev: 00


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Surface Water Quality- Upstream



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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENVSW2022051401
		Date Of Sampling	12.05.2022
		Date of Issue in lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Surface Water	Testing Completed on	11.05.2022

SAMPLING DETAILS:

Sampling Location : Upstream, Tolly Nala
 Sampling Done by : Lab Day
 Weather Condition : Clear Sky
 Sample Packing & Marking : Plastic Bottle & Glass Bottle, PD/SW-1
 Sampling Protocol : IS-3025(P-1)-1988, Ref: 2003B IS: 1622-1981 (Ref: 2003)
 Sample Quantity : 5 x 500 ml

S. No.	Parameters	Unit	IS: 2296 - 1992(Class C)	Near STP	Test method
			Tolerance Limit		
1	pH	-	6.5 - 8.5	7.86	IS: 3025(P1-11)1983, RA, 2002
2	Temperature	°C	-	38.8	APHA 21 st Edn 2017-2550 B
3	D.O	mg/l	Minimum -4	3.6	IS 3025(Part-38): 2006
4	BOD	mg/l	30	74.8	IS 3025(Part-44):1993, RA 2009
5	Color	Hazen	300	35	IS: 3025 (Pt-4) 1983, RA 2017
6	Odour	-	-	Objectiorable	IS: 3025(Pt-5)
7	TDS	mg/l	1500	756.0	IS 3025(Part-16): 1984, RA 2006
8	TSS	mg/l	-	165.0	IS 3025(Part-17)
9	TKN	mg/l	-	36.8	IS: 3025(P1-34)1988, RA, 2003
10	Ammonical Nitrogen	mg/l	-	<0.1	IS: 3025(P1-34)1988, RA, 2003
11	Nitrate(as NO3)	mg/l	50	23.4	IS: 3025(P1-34)1988, RA, 2003
12	Free Ammonia	mg/l	-	<0.1	IS: 3025(P1-34)1988, RA, 2003
13	Chlorides (as Cl)	mg/l	600	46.2	IS 3025(Part-32): 1988
14	Sulphates(as SO4)	mg/l	400	41.4	IS 3025(Part-24):1988, RA 2003
15	Fluoride (as F)	mg/l	1.5	0.51	APHA 21 st Ed., 4500F(D)

For Shri Om Testing & Research Laboratory

 Authorized Signature
 (Name, Designation & Signature With Seal)
 Technical manager

STR/LAB/QC/058 Rev:00

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Report No: ENYSW2022051601

16	Oil & Grease	mg/l	0.1	<0.1	IS 3025(Part-39) 1991, RA 2009
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.005	<0.001	5510-B,C&E, APHA 23rd Ed. 2017
18	Arsenic	mg/l	0.2	<0.1	3110-B, APHA 23rd Ed. 2017
19	Mercury (as Hg)	mg/l	-	<0.001	3110-B, APHA 23rd Ed. 2017
20	Lead (as Pb)	mg/l	0.1	<0.1	3110-B, APHA 23rd Ed. 2017 (AAS)
21	Cadmium (as Cd)	mg/l	0.01	<0.001	3110-B, APHA 23rd Ed. 2017 (AAS)
22	Chromium (as CrVI)	mg/l	0.05	<0.1	IS 3025(Part-52): 200
23	Copper (as Cu)	mg/l	1.5	<0.01	3110-B, APHA 23rd Ed. 2017 (AAS)
24	Zinc (as Zn)	mg/l	15	0.21	3110-B, APHA 23rd Ed. 2017 (AAS)
25	Selenium (as Se)	mg/l	-	<0.1	IS 3025 (P-56)
26	Anionic detergents (as MBAD)	mg/l	1.0	<0.1	Annexure E Of IS 13428
27	Iron (as Fe)	mg/l	50	0.19	3500-Fe-B, APHA 23rd Ed. 2017
28	Sulphate (as S)	mg/l	-	<0.1	IS 3025 (P-29)
29	Phosphate (as PO ₄)	mg/l	-	3.6	APHA 22 nd Edn. 2012-4500-P C
30	Cyanide (as CN)	mg/l	0.05	<0.1	4500-CN-B,C & E, APHA 23rd Ed. 2017
31	Manganese (as Mn)	mg/l	-	0.04	3110-B, APHA 23rd Ed. 2017
32	CO ₂	mg/l	-	200.4	IS 3025(Part-58): 2009

Microbiological Parameters

33	Total Coli form	MPN/100 ml	5000	18500	IS - 1622-1981
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****End of Report****

For Shri Om Testing & Research Laboratory

SHWETA BHARGAVA
Technical manager

Authorized Signature

(Name, Designation & Signature With Seal)

STR/LAB/CF/008

Rev: 00

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Surface Water Quality- Midstream



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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENVSW2022051402
		Date Of Sampling	14.05.2022
		Date of Issue in lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Surface Water	Testing Completed on	21.05.2022

SAMPLING DETAILS:

- Sampling Location
- Sampling Done by
- Weather Condition
- Sample Packing & Marking
- Sampling Protocol
- Sample Quantity

Midstream, Tolly Nala

- Lab Boy
- Clear Sky
- Plastic Bottle & Glass Bottle, PQ/SW-2
- IS: 3025(P-1)-1987, Reel: 2008 & IS: 1622-1981 (Reel:2002)
- 5 L-500 ml

S. No.	Parameters	Unit	IS: 2296 -	Near STP	Test method
			1993(Clean Cl. Tolerance Limit)		
1	pH	-	6.5-8.5	7.56	IS: 3025(P1-11)1983, RA, 2002
2	Temperature	°C	-	40.2	APHA 23 rd Edn.2017-2550 B
3	D.O	mg/l	Minimum-4	3.4	IS: 3025(Part-38) 2006
4	BOD	mg/l	30	82.4	IS: 3025(Part-44)1993, RA, 2000
5	Color	Hazen	300	15	IS: 3025 (Pt-4) 1983, RA, 2017
6	Oil/Gur	-	-	Objectonable	IS: 3025(P1-5)
7	TDS	mg/l	1500	786.0	IS: 3025(Part-16) 1984, RA, 2006
8	TSS	mg/l	-	146.0	IS: 3025(Part-17)
9	TKN	mg/l	-	41.6	IS: 3025(P1-34)1988, RA, 2003
10	Ammonical Nitrogen	mg/l	-	<0.1	IS: 3025(P1-34)1988, RA, 2003
11	Nitrate(as NO3)	mg/l	50	28.5	IS: 3025(P1-34)1988, RA, 2003
12	Free Ammonia	mg/l	-	<0.1	IS: 3025(P1-34)1988, RA, 2003
13	Chlorides (as Cl)	mg/l	600	41.7	IS: 3025(Part-32) 1988
14	Sulphate(as SO4)	mg/l	400	52.8	IS: 3025(Part-24)1988, RA, 2003

For Shri Om Testing & Research Laboratory

Authorized Signature

(Name, Designation & Signature With Seal)

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Report No: ENVSW2022051002

15	Fluoride (as F ⁻)	mg/l	1.5	0.45	APHA 21 st Ed., 4500F01
16	Oil & Grease	mg/l	0.3	<0.1	IS 3025(Part-19)-1991, BA 2000
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.005	<0.001	5530-RC&I, APHA 23rd Ed 2017
18	Arsonic	mg/l	0.2	<0.1	3110- B, APHA 23rd Ed. 2017
19	Mercury (as Hg)	mg/l	-	<0.001	3110- B, APHA 23rd Ed 2017
20	Lead (as Pb)	mg/l	0.1	<0.1	3110- B, APHA 23rd Ed. 2017 (AAS)
21	Cadmium (as Cd)	mg/l	0.01	<0.002	3110- B, APHA 23rd Ed. 2017 (AAS)
22	Chromium (as CrVI)	mg/l	0.05	<0.1	IS 3025(Part-52): 200
23	Copper (as Cu)	mg/l	1.5	<0.01	3110- B, APHA 23rd Ed. 2017 (AAS)
24	Zinc (as Zn)	mg/l	15	0.25	3110- B, APHA 23rd Ed. 2017 (AAS)
25	Selenium (as Se)	mg/l	-	<0.1	IS: 3025 (P-16)
26	Arsonic detergents (as MBAS)	mg/l	1.0	<0.1	Annexure K Of IS 13428
27	Iron (as Fe)	mg/l	50	0.23	3500-Fe- B, APHA 23rd Ed. 2017
28	Sulphidate (H ₂ S)	mg/l	-	<0.1	IS-3025 (P-19)
29	Phosphate (as PO ₄)	mg/l	-	7.8	APHA 22 nd Edn.2012-4500-P C
30	Cyanide (as CN)	mg/l	0.05	<0.1	4500-CN-B,C & E, APHA 23rd Ed 2017
31	Manganese (as Mn)	mg/l	-	0.06	3110- B, APHA 23rd Ed 2017
32	COD	mg/l	-	275.2	IS 3025(Part-58): 2006
Microbiological Parameters					
33	Total Coli form	MPPN/100 ml	5000	16800	IS : 1622-1981

****End of Report****

For Shri Om Testing & Research Laboratory

(Signature)
 SHYAM BHARDWAJ
 Technical Manager

Authorized Signature
 (Name, Designation & Signature With Seal)

STR/LAB/QP/056

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Surface Water Quality- Downstream



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Issued To	LEA Associate South Asia Pacific Pvt. Ltd.	Report No	ENVSW1022051603
		Date Of Sampling	14.05.2022
		Date of Issue in lab	16.05.2022
Project Name	Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	Test Started On	16.05.2022
Nature of the Sample	Surface Water	Testing Completed on	21.05.2022

SAMPLING DETAILS

Sampling Location	: Downstream, Tolly Nala
Sampling Done by	: Lab Boy
Weather Condition	: Clear Sky
Sample Packing & Marking	: Plastic Bottle & Glass Bottle, PD/SW-3
Sampling Protocol	: IS: 3025(P-1)-1987, Recd. 2009& IS: 1622-1985 (Recd. 2003)
Sample Quantity	: 1 x 500 ml

S. No.	Parameters	Unit	IS: 2296 - 1999 Class C1	Near STP	Test method
			Tolerance Limit		
1	pH	-	6.5-8.5	7.72	IS- 3025(P1-11)1983, RA, 2002
2	Temperature	°C	-	29.6	APHA 23 rd Edn 2017-2550 B
3	D.O	mg/l	Minimum 4	3.7	IS 3025(Part-38): 2006
4	BOD	mg/l	30	32.2	IS 3025(Part-44): 1993, RA, 2009
5	Color	Hazen	300	15	IS: 3025 (Pt-4) 1983, RA, 2017
6	Odour	-	-	Objectivable	IS: 3025(Pt-5)
7	TDS	mg/l	1500	782.0	IS 3025(Part-16): 1984, RA, 2006
8	TSS	mg/l	-	176.0	IS 3025(Part-17)
9	TKN	mg/l	-	36.2	IS: 3025(Pt-34)1988, RA, 2003
10	Ammonical Nitrogen	mg/l	-	<0.1	IS: 3025(Pt-34)1988, RA, 2003
11	Nitrate(as NO3)	mg/l	50	31.2	IS: 3025(Pt-34)1988, RA, 2003
12	Free Ammonia	mg/l	-	<0.1	IS: 3025(Pt-34)1988, RA, 2003
13	Chlorides (as Cl)	mg/l	600	36.8	IS 3025(Part-32): 1988
14	Sulphates(as SO4)	mg/l	400	43.2	IS 3025(Part-34): 1988, RA, 2003

For Shri Om Testing & Research Laboratory
Authorized Signature
 (Name, Designation & Signature With Seal)
 Technical manager

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Report No: ENVSWR22851603

15	Fluoride (as F ⁻)	mg/l	1.5	0.57	APHA 21 st Ed., 4500F(D)
16	Oil & Grease	mg/l	0.1	<0.1	IS 3025(Part-39):1991, RA 2009
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.005	<0.001	IS 3025-B,C&E, APHA 23rd Ed 2017
18	Arsenic	mg/l	0.2	<0.1	3110- B, APHA 23rd Ed. 2017 (AAS)
19	Mercury (as Hg)	mg/l	-	<0.001	3110- B, APHA 23rd Ed 2017
20	Lead (as Pb)	mg/l	0.1	<0.1	3110- B, APHA 23rd Ed. 2017 (AAS)
21	Cadmium (as Cd)	mg/l	0.01	<0.001	3110- B, APHA 23rd Ed. 2017 (AAS)
22	Chromium (as Cr+6)	mg/l	0.05	<0.1	IS 3025(Part-52)- 200
23	Copper (as Cu)	mg/l	1.5	<0.01	3110- B, APHA 23rd Ed. 2017 (AAS)
24	Zinc (as Zn)	mg/l	15	0.11	3110- B, APHA 23rd Ed. 2017 (AAS)
25	Selenium (as Se)	mg/l	-	<0.1	IS 3025 (P- 56)
26	Anionic detergents (as MBAS)	mg/l	1.0	<0.1	Annexure E Of IS 13428
27	Iron (as Fe)	mg/l	50	0.11	3500-Fa- B, APHA 23rd Ed. 2017
28	Sulphide(as H ₂ S)	mg/l	-	<0.1	IS 3025 (P-29)
29	Phosphate (as PO ₄)	mg/l	-	11.6	APHA 22 nd Edn 2012-4500-P C
30	Cyanide (as CN)	mg/l	0.05	<0.1	4500-CN-B,C & E, APHA 23rd Ed 2017
31	Manganese (as Mn)	mg/l	-	0.06	3110- B, APHA 23rd Ed.2017
32	COD	mg/l	-	294.4	IS 3025(Part-56)- 2006
Microbiological Parameters					
33	Total Cell form	MPN/100 ml	5000	21400	IS - 1472-1981

****End of Report****

For Shri Om Testing & Research Laboratory

(Signature)
SHRUTI SHARDA
Technical manager

Authorized Signature

(Name, Designation & Signature With Seal)

STR/LAB/QF/56

Rev. 01

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Ground water Sampling



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Issued To: LEA Associates South Asia Private Pvt. Ltd.,	Report/Sample No. : ENV/W/2022/051601 Date of Sampling : 12.05.2022 Date of Issue in Lab : 16.05.2022
--	---

Project Name: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)

Nature of Sample : Ground Water Customer Ref. No.: NS	Test Started : 16.05.2022 Test Completed : 21.05.2022
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SAMPLING DETAILS:

Sampling Location	: 15-4, Moor Avenue, Tolly Nala
Sampling Done by	: Lab Boy
Weather Condition	: Clear Sky
Sample Packing & Marking	: Plastic Bottle & Glass Bottle, PD/GW-1
Sampling Protocol	: IS: 3025(P-1) & IS: 1622-1981 (Reaff.2003)
Sample Quantity	: 2 L+500 ml

S. No.	Parameters	Unit	Limit (IS:10500:2012)		Results (TW)	Test method
			Desirable Limit	Permissible Limit		
1	Color	Hazen	5	15	<5	IS: 3025(P1-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	IS: 3025(P1-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	IS: 3025(P1-6)
4	Turbidity	NFU	1	5	<1	IS 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.61	IS: 3025(P1-11)
6	Total Hardness (as CaCO3)	mg/l	200	600	186.6	IS 3025(Part-21)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.56	IS/IS-Fe-8, APHA 23rd Ed 2017
8	Chloride (as Cl)	mg/l	250	1000	28.4	IS 3025(Part-12)
9	Fluoride (as F)	mg/l	1	1.5	0.47	4500-F (I) APHA 23rd Ed 2017
10	TDS	mg/l	500	3000	342.3	IS 3025(Part-16)
11	Calcium (as Ca ²⁺)	mg/l	75	200	26.7	IS 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	20.2	IS/IS-Mg-8, APHA 23rd Ed 2017
13	Sulphate (as SO4)	mg/l	200	400	47.5	IS 3025(Part-24)
14	Nitrate (as NO3)	mg/l	45	No Relaxation	16.9	IS: 3025(P1-34)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	IS/IS-Cr-8, APHA 23rd Ed 2017
16	Alkalinity as CaCO3	mg/l	200	600	172.2	IS 3025(Part-23)
17	Aluminum (as Al)	mg/l	0.05	0.2	<0.01	IS 3025(Part-55)

For Shri Om Testing & Research Laboratory



Authorized Signature
(Name, Designation & Signature With Seal)

STRLAB/05/05H Rev. 00

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Report/Sample No. : **KNYW2022051601**

18	Total Arsenic (As)	mg/l	0.01	No Relaxation	<0.01	5110-B, APHA 23rd Ed 2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.06	5110-B, APHA 23rd Ed 2017
20	Manganese (as Mn)	mg/l	0.1	0.9	<0.01	5110-B, APHA 23rd Ed 2017
21	Zinc (as Zn)	mg/l	5	23	0.51	5110-B, APHA 23rd Ed 2017
22	Ammonia (as NH ₃ -N)	mg/l	0.5	No Relaxation	<0.1	4500-NH ₃ -B & C, APHA 23rd Ed 2017
23	Atomic Detergent (as MBAS)	mg/l	0.2	1	<0.1	Annexure K of IS-13478
24	Boron (as B)	mg/l	0.5	1	0.33	IS-3025(Pt-5T)
25	Mineral Oil	mg/l	0.5	No Relaxation	<0.1	IS-3025(Part-8B)
26	Phenolic Compound (as OHSO ₄)	mg/l	0.001	0.002	<0.001	IS-3025(Part-8A)
27	Cadmium (as Cd)	mg/l	0.001	No Relaxation	<0.002	5110-B, APHA 23rd Ed 2017
28	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	4500-CN-B,C & E, APHA 23rd Ed 2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	5110-B, APHA 23rd Ed 2017
30	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	5110-B, APHA 23rd Ed 2017
32	Residual Free Chlorine	mg/l	0.2	1.5	<0.3	4500-Cl-B, APHA 23rd Ed 2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	5110-B, APHA 23rd Ed 2017
34	Polynuclear Aromatic Hydro Carbons	mg/l	<0.0001	0.0001	No Relaxation	APHA 6440, 23rd Ed 2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	APHA 6430, 23rd Ed 2017
Microbiological Parameters						
36	Total Coliform	MPN/100ml	Shall not be detectable in any 100 ml of sample		<1	IS-1622-1981
37	E Coli	CFU/100ml	Shall not be detectable in any 100 ml of sample		Absent	IS-1622-1981

****End of Report****

For Shri Om Testing & Research Laboratory

ISHWAR BHARDWAJ
 Technical manager

Authorized Signature
 (Name, Designation & Signature With Seal)

STR/LAB/QF/058

Rev. 01

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SHRI OM TESTING & RESEARCH LABORATORY

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Issued To: LEA Associates South Asia
 Pacific Pvt. Ltd.,

Report/Sample No. : ENVW 2822851481
 Date of Sampling : 12.05.2022
 Date of Issue in Lab : 16.05.2022

Project Name: Consulting Services for Environmental & Social Audit and
 Preparation of Environmental and Social Due Diligence Report (ESDDR) and
 Environmental & Social Assessment and Management Plan (ESAMP)

Nature of Sample : Ground Water
 Customer Ref. No.: NS

Test Started : 16.05.2022
 Test Completed : 21.05.2022

SAMPLING DETAILS:

Sampling Location : LS-3, Naktala, Tolly Nala
 Sampling Done by : Lab Boy
 Weather Condition : Clear Sky
 Sample Packing & Marking : Plastic Bottle & Glass Bottle, PD/GW-2
 Sampling Protocol : IS: 3025(P-1) & IS: 1672-1981 (Reaff. 2003)
 Sample Quantity : 2 Lx500 ml

S. No.	Parameters	Unit	Limit (S-10500:2012)		Results-GW1	Test method
			Desirable Limit	Permissible Limit		
1	Color	Hazen	5	15	<5	IS: 3025(P-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-6)
4	Turbidity	NTU	1	5	<1	IS: 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.18	IS: 3025(P-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	500	184.2	IS: 3025(Part-21)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.68	3500-Fe-B, APHA 23rd Ed. 2017
8	Chlorides (as Cl)	mg/l	250	1000	25.6	IS: 3025(Part-22)
9	Fluoride (as F)	mg/l	1	1.5	0.56	4500-F-02, APHA 23rd Ed. 2017
10	TDS	mg/l	500	2000	262.4	IS: 3025(Part-16)
11	Cadmium (as Cd)	mg/l	0.1	200	16.7	IS: 3025(Part-40)
12	Magnesium (as Mg)	mg/l	30	100	11.6	3500-Mg-B, APHA 23rd Ed. 2017
13	Sulphate (as SO ₄)	mg/l	200	400	23.7	IS: 3025(Part-28)
14	Nitrate (as NO ₃)	mg/l	45	No Relaxation	18.2	IS: 3025(P-34)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	3110-Cr, APHA 23rd Ed. 2017
16	Alkalinity as CaCO ₃	mg/l	200	600	136.4	IS: 3025(Part-23)
17	Aluminum (as Al)	mg/l	0.05	0.2	<0.01	IS: 3025(Part-33)

For Shri Om Testing & Research Laboratory

Authorized Signature

(Name, Designation & Signature With Seal)
 Technical Manager

STR/LAB/GF/008

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Report/Sample No. : ENVW2022051602

18	Total Arsenic(as As)	mg/l	0.01	No Relaxation	<0.01	3110-B, APHA 23rd Ed 2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	3110-B, APHA 23rd Ed 2017
20	Manganese (as Mn)	mg/l	0.1	0.3	<0.01	3110-B, APHA 23rd Ed 2017
21	Zinc (as Zn)	mg/l	5	15	0.03	3110-B, APHA 23rd Ed 2017
22	Ammonia (as NH ₃ -N)	mg/l	0.5	No Relaxation	<0.1	4500-NH ₃ -B GC, APHA 23rd Ed 2017
23	Arsenic Detergent(as MSD)	mg/l	0.2	1	<0.1	Arsenic # of IS:13428
24	Boron(as B)	mg/l	0.5	1	0.18	IS:3025(PH-57)
25	Mineral Oil	mg/l	0.1	No Relaxation	<0.1	IS:3025(Pet-85)
26	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.001	0.001	<0.001	IS:3025(Pet-44)
27	Cadmium (as Cd)	mg/l	0.001	No Relaxation	<0.001	3110-B, APHA 23rd Ed 2017
28	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	4500-CN-B,C & E, APHA 23rd Ed 2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	3110-B, APHA 23rd Ed 2017
30	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	
31	Nickel (as Ni)	mg/l	0.01	No Relaxation	<0.01	3110-B, APHA 23rd Ed 2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.1	4500-Cl-B, APHA 23rd Ed 2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	3110-B, APHA 23rd Ed 2017
34	Polynuclear Aromatic Hydro Carbons	mg/l	<0.0001	0.0001	No Relaxation	APHA 6440.23rd Ed 2017
35	Poly chlorinated Biphenyl	mg/l	<0.0001	0.0005	No Relaxation	APHA 6430.23rd Ed 2017
Microbiological Parameters						
36	Total Coliform	MPN/100ml	Shall not be detectable in any 100 ml of sample		<1	IS:1622-1981
37	E.Coli	ECob/100ml	Shall not be detectable in any 100 ml of sample		Absent	IS:1622-1981

****End of Report****

For Shri Om Testing & Research Laboratory

(Signature)
ISHWAR SHARMA
Authorized Signature

(Name, Designation & Signature With Seal)

STR/LAB/OP/05#

Rev: 00

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Issued To: LEA Associates South Asia
Private Pvt. Ltd.,

Report/Sample No. : ENVW2022051683
Date of Sampling : 12.05.2022
Date of Issued in lab : 16.05.2022

Project Name: Consulting Services for Environmental & Social Audit and
Preparation of Environmental and Social Due Diligence Report (ESDDR) and
Environmental & Social Assessment and Management Plan (ESAMP)

Nature of Sample : Ground Water
Customer Ref. No.: NS

Test Started : 16.05.2022
Test Completed : 21.05.2022

SAMPLING DETAILS

Sampling Location : LS-8, Charu Avenue, Tolly Nala
Sampling Done by : Lab Boy
Weather Condition : Clear Sky
Sample Packing & Marking : Plastic Bottle & Glass Bottle, PD/GW-3
Sampling Protocol : IS: 3025(P-1) & IS: 1672-1981 (Reaff.2003)
Sample Quantity : 2 L+500 ml

S. No	Parameters	Unit	Limit (IS-11000:2012)		Results (GW)	Test method
			Desirable Limit	Permissible Limit		
1	Color	maxm	5	15	<5	IS: 3025(P-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-6)
4	Turbidity	NTU	1	5	<1	IS: 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.36	IS: 3025(P-11)
6	Total Hardness (as CaCO ₃)	mg/l	300	600	383.2	IS: 3025(Part-23)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.48	3300-Fe-8, APHA 23rd Ed Ed:2017
8	Chlorides (as Cl)	mg/l	250	1000	29.4	IS: 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	0.53	4500-F (II), APHA 23rd Ed:2017
10	TDS	mg/l	500	2000	254.3	IS: 3025(Part-16)
11	Calcium (as Ca ²⁺)	mg/l	75	200	51.2	IS: 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	28.3	3300-Mg-8, APHA 23rd Ed:2017
13	Sulphate (as SO ₄)	mg/l	200	400	24.2	IS: 3025(Part-34)
14	Nitrate (as NO ₃)	mg/l	45	No Relaxation	14.0	IS: 3025(P-38)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	3110-Cr, APHA 23rd Ed:2017
16	Alkalinity as CaCO ₃	mg/l	200	600	194.2	IS: 3025(Part-25)
17	Aluminum (as Al)	mg/l	0.05	0.2	<0.01	IS: 3025(Part-50)

For Shri Om Testing & Research Laboratory
Authorized Signature
(Name, Designation & Signature With Seal)
Technical Manager

SRLLLAB/01/056

Rev: (3)

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Report/Sample No. : ENVW2022051403

18	Total Aromatics (A)	mg/l	0.01	No Relaxation	<0.01	1113- B, APHA 23rd Ed 2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	1113- B, APHA 23rd Ed 2017
20	Manganese (as Mn)	mg/l	0.1	0.3	<0.01	1113- B, APHA 23rd Ed 2017
21	Zinc (as Zn)	mg/l	5	15	0.43	1113- B, APHA 23rd Ed 2017
22	Ammonia (as NH ₃ -N)	mg/l	0.5	No Relaxation	<0.1	4500-NH ₃ -B & C, APHA 23rd Ed 2017
23	Anionic Detergent (as MBAS)	mg/l	0.2	1	<0.1	Procedure 8 of D-13428
24	Nitrate (N)	mg/l	0.3	1	0.12	(D-3025/Part 11)
25	Mineral Oil	mg/l	0.3	No Relaxation	<0.1	(D-3025/Part 26)
26	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.001	0.001	<0.001	(D-3025/Part 44)
27	Cadmium (as Cd)	mg/l	0.001	No Relaxation	<0.001	1113- B, APHA 23rd Ed 2017
28	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	4500- CN-B, C & E, APHA 23rd Ed 2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	1113- B, APHA 23rd Ed 2017
30	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	1113- B, APHA 23rd Ed 2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	4500-Cl-B, APHA 23rd Ed 2017
33	Molybdenum (Mo)	mg/l	<0.01	0.07	No Relaxation	1113- B, APHA 23rd Ed 2017
34	Polynuclear Aromatic Hydrocarbons	mg/l	<0.0001	0.0001	No Relaxation	APHA 6440, 23rd Ed 2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	APHA 6430, 23rd Ed 2017
Microbiological Parameters						
36	Total Coliform	MPN/100ml	Shall not be detectable in any 100 ml of sample		<1	(D-1622-1981)
37	E Coli	EC ₁₀₀ /100ml	Shall not be detectable in any 100 ml of sample		Absent	(D-1622-1981)

****End of Report****

For Shri Om Testing & Research Laboratory

(Signature)
ISHWAR SHUKLA
Technical manager

**Authorized Signature
(Name, Designation & Signature With Seal)**

STR/LAB/058

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Issued To: LEA Associates South Asia Pacific Pvt. Ltd. Report/Sample No.: ENVW2022051604
Date of Sampling: 12.05.2022
Date of Issue: 16.05.2022

Project Name: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDOR) and Environmental & Social Assessment and Management Plan (ESAMP)

Nature of Sample: Ground Water Test Started: 16.05.2022
Customer Ref. No.: NS Test Completed: 21.05.2022

SAMPLING DETAILS:

Sampling Location: LS-7, Izzatullah, Tolly Nala
Sampling Done by: Lab Boy
Weather Condition: Clear Sky
Sample Packing & Marking: Plastic Bottle & Glass Bottle, PD/GW-4
Sampling Protocol: IS: 3025(P-1) & IS: 1622-1981 (Reaff.2003)
Sample Quantity: 2 L-500 ml

S. No.	Parameters	Unit	Limit (IS: 3025/2012)		Result (ppm)	Test method
			Desirable Limit	Permissible Limit		
1	Color	Hazen	5	15	<5	IS: 3025(P-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-6)
4	Turbidity	NTU	1	5	<1	IS: 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.62	IS: 3025(P-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	600	161.6	IS: 3025(Part-21)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.33	2000-Fe-8, APHA 21nd Ed.2017
8	Chlorides (as Cl ⁻)	mg/l	250	1000	31.6	IS: 3025(Part-32)
9	Fluoride (as F ⁻)	mg/l	1	1.5	0.45	4883-F-1(L)APHA 23rd Ed.2017
10	TDS	mg/l	500	2000	286.2	IS: 3025(Part-34)
11	Calcium (Ca ²⁺)	mg/l	75	200	26.4	IS: 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	18.2	2000-Mg-6, APHA 23nd Ed.2017
13	Sulfate (as SO ₄)	mg/l	200	400	26.2	IS: 3025(Part-24)
14	Nitrate (as NO ₃)	mg/l	45	No Relaxation	18.1	IS: 3025(P-34)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	3110-Cr, APHA 23nd Ed.2017
16	Alkalinity as CaCO ₃	mg/l	200	600	174.6	IS: 3025(Part-23)
17	Aluminum (as Al)	mg/l	0.05	0.2	<0.01	IS: 3025(Part-50)

For Shri Om Testing & Research Laboratory

Authorized Signature
(Name, Designation & Signature With Seal)

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Report/Sample No. : ENVW2022851684

18	Total Arsenic(as As)	mg/l	0.01	No Release	<0.01	1113-8, APHA 23rd Ed 2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	1113-8, APHA 23rd Ed 2017
20	Manganese (as Mn)	mg/l	0.1	0.5	<0.01	1113-8, APHA 23rd Ed 2017
21	Zinc (as Zn)	mg/l	5	15	0.53	1113-8, APHA 23rd Ed 2017
22	Arsenic (as Hg-A)	mg/l	0.3	No Release	<0.1	4500-AR, 8-BC, APHA 23rd Ed 2017
23	Anionic Detergent(as MBAS)	mg/l	0.2	1	<0.1	Annexure K of IS-13426
24	Hexan(e)l	mg/l	0.1	1	0.25	IS-3025(Part-17)
25	Mineral Oil	mg/l	0.5	No Release	<0.1	IS-3025(Part-18)
26	Phenolic Compound (as CBHSOH)	mg/l	0.001	0.002	<0.001	IS-3025(Part-14)
27	Cadmium (as Cd)	mg/l	0.001	No Release	<0.001	1113-8, APHA 23rd Ed 2017
28	Cyanide (as CN)	mg/l	0.05	No Release	<0.1	4500-CN-B,C 8E, APHA 23rd Ed 2017
29	Lead	mg/l	0.01	No Release	<0.01	1113-8, APHA 23rd Ed 2017
30	Mercury (as Hg)	mg/l	0.001	No Release	<0.001	
31	Nickel (as Ni)	mg/l	0.02	No Release	<0.02	1113-8, APHA 23rd Ed 2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	4500-CL-P, APHA 23rd Ed 2017
33	Molybdenum (Mo)	mg/l	<0.01	0.07	No Release	1113-8, APHA 23rd Ed 2017
34	Polynuclear Aromatic Hydro Carbons	mg/l	<0.0001	0.0001	No Release	APHA 6440, 23rd Ed 2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0001	No Release	APHA 6430, 23rd Ed 2017
Microbiological Parameters						
36	Total Cell form	MPN/100ml	Shall not be detectable in any 100 ml of sample	<1		IS-1622-1981
37	E.Coli	E.coli/100ml	Shall not be detectable in any 100 ml of sample	Absent		IS-1622-1981

****End of Report****

For Shri Om Testing & Research Laboratory

ISHWAR BHARGAVA

Technical manager

Authorized Signature

(Name, Designation & Signature With Seal)

STR/LAB/05B

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SHRI OM TESTING & RESEARCH LABORATORY

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Issued To: LEA Associates South Asia Pacific Pvt. Ltd.,

Report/Sample No. : ENVW2022051605
Date of Sampling : 14.05.2022
Date of Issue: in lab : 16.05.2022

Project Name: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDR) and Environmental & Social Assessment and Management Plan (ESAMP)

Nature of Sample : Ground Water
Customer Ref. No.: NS

Test Started : 16.05.2022
Test Completed : 21.05.2022

SAMPLING DETAILS:

Sampling Location : LS-2, Thackeray Road, Tolly Nala
Sampling Done by : Lab Boy
Weather Condition : Clear Sky
Sample Packing & Marking : Plastic Bottle & Glass Bottle, PD/GW-5
Sampling Protocol : IS: 3025(P-1) & IS: 1622-1981 (Reaff.2003)
Sample Quantity : 2 L=500 ml

S. No.	Parameters	Unit	Limit (IS:20000:2012)		Results (GW)	Test method
			Desirable Limit	Permissible Limit		
1	Color	hapen	5	15	<5	IS: 3025(P-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-6)
4	Turbidity	NTU	1	5	<1	IS: 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.32	IS: 3025(P-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	600	188.4	IS: 3025(Part-11)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.51	2500-Fe-8, APHA 23rd Ed Ed.2017
8	Chloride (as Cl)	mg/l	250	1000	26.2	IS: 3025(Part-12)
9	Fluoride (as F)	mg/l	1	1.5	0.47	4500-F-11, APHA 23rd Ed.2017
10	TDS	mg/l	500	2000	254.4	IS: 3025(Part-16)
11	Calcium (as Ca ²⁺)	mg/l	75	200	36.2	IS: 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	22.8	2500-Mg-8, APHA 23rd Ed.2017
13	Sulfate (as SO ₄)	mg/l	200	400	31.5	IS: 3025(Part-24)
14	Nitrate (NO ₃)	mg/l	45	No Relaxation	15.3	IS: 3025(P-54)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	3110-Cr, APHA 23rd Ed.2017
16	Alkalinity as CaCO ₃	mg/l	200	600	174.8	IS: 3025(Part-23)
17	Aluminum (as Al)	mg/l	0.05	0.2	<0.01	IS: 3025(Part-51)

For Shri Om Testing & Research Laboratory

Authorized Signature
(Name, Designation & Signature With Seal)
Technical manager

STRLLAB/01/058

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Report/Sample No. : JNVW2022651465

18	Total Arsenic (As)	mg/l	0.01	No Relaxation	<0.01	1110-B, APHA 23rd Ed 2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	1110-B, APHA 23rd Ed 2017
20	Manganese (as Mn)	mg/l	0.1	0.5	<0.01	1110-B, APHA 23rd Ed 2017
21	Zinc (as Zn)	mg/l	5	15	0.53	1110-B, APHA 23rd Ed 2017
22	Arsenic (as H ₃ AsO ₄)	mg/l	0.1	No Relaxation	<0.1	4500-As-E, APHA 23rd Ed 2017
23	Anionic Detergents (as MBAS)	mg/l	0.2	1	<0.1	Annexure K of IS-13426
24	Nitrate (N)	mg/l	0.3	1	0.36	IS-3025(Pt-1)
25	Mineral Oil	mg/l	0.3	No Relaxation	<0.1	IS-3025(Part-2)
26	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.001	0.002	<0.001	IS-3025(Part-4)
27	Cadmium (as Cd)	mg/l	0.001	No Relaxation	<0.001	1110-B, APHA 23rd Ed 2017
28	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	4500-CN-B,C & C, APHA 23rd Ed 2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	1110-B, APHA 23rd Ed 2017
30	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	1110-B, APHA 23rd Ed 2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	4500-Cl-6, APHA 23rd Ed 2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	1110-B, APHA 23rd Ed 2017
34	Polynuclear Aromatic Hydrocarbons	mg/l	<0.0001	0.0005	No Relaxation	APHA 6440, 23rd Ed 2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	APHA 6430, 23rd Ed 2017
Microbiological Parameters						
36	Total Coliform	MPN/100ml	Shall not be detectable in any 100 ml of sample		<1	IS-1632-1981
37	E.Coli	Eq/100ml	Shall not be detectable in any 100 ml of sample		Absent	IS-1632-1981

****End of Report****

For Shri Om Testing & Research Laboratory

(Signature)
SHRI OM TESTING & RESEARCH LABORATORY

Technical Manager

Authorized Signature

(Name, Designation & Signature With Seal)

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Issued To: LEA Associates South Asia Pacific Pvt. Ltd.,	Report/Sample No. : ENV-W-2822851486
	Date of Sampling : 14.05.2022
	Date of Issued in lab : 16.05.2022

Project Name: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)

Nature of Sample : Ground Water	Test Started : 16.05.2022
Customer Ref. No.: NS	Test Completed : 21.05.2022

SAMPLING DETAILS:

Sampling Location	: LS-1A, Rathala, Tolly Nala
Sampling Done by	: Lab Boy
Weather Condition	: Clear Sky
Sample Packing & Marking	: Plastic Bottle & Glass Bottle, PD/GW-4
Sampling Protocol	: IS: 3025(P-1) & IS: 1622-1981 (RevR.2003)
Sample Quantity	: 2 L x 500 ml

S. No.	Parameters	Unit	Limit (IS-10500:2012)		Results-GWS	Test method
			Desirable Limit	Permissible Limit		
1	Color	pcen	5	15	<5	IS: 3025(P1-6)
2	Odour	-	Agreeable	Agreeable	Agreeable	IS: 3025(P1-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	IS: 3025(P1-8)
4	Turbidity	NTU	1	5	<1	IS: 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.42	IS: 3025(P1-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	600	168.8	IS: 3025(Part-21)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.51	2000-Fe-8, APHA 23rd Ed.2017
8	Chloride (as Cl)	mg/l	250	1000	26.4	IS: 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	0.45	4500-F-10, APHA 23rd Ed.2017
10	TDS	mg/l	500	2000	264.8	IS: 3025(Part-16)
11	Calcium (as Ca ²⁺)	mg/l	75	200	28.6	IS: 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	21.4	2000- Mg-8, APHA 23rd Ed.2017
13	Sulphate (as SO ₄)	mg/l	500	400	26.3	IS: 3025(Part-26)
14	Nitrate (as NO ₃)	mg/l	45	No Relaxation	24.7	IS: 3025(P1-34)
15	Total Dissolved (as Cl)	mg/l	0.05	No Relaxation	<0.01	2100-8, APHA 23rd Ed.2017
16	Alkalinity as CaCO ₃	mg/l	200	600	184.2	IS: 3025(Part-23)

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(Name, Designation & Signature With Seal)

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Report/Sample No. : ENVW2822051696

		mg/l	0.01	0.2	<0.01	IS 3025(Part-53)
18	Aluminum (as Al)	mg/l	0.01	No Relaxation	<0.01	3110-B, APHA 23rd Ed 2007
19	Total Arsenic(as As)	mg/l	0.05	1.5	<0.05	3110-B, APHA 23rd Ed 2007
20	Copper (as Cu)	mg/l	0.1	0.1	<0.01	3110-B, APHA 23rd Ed 2007
21	Manganese (as Mn)	mg/l	5	15	<0.5	3110-B, APHA 23rd Ed 2007
22	Zinc (as Zn)	mg/l	0.1	No Relaxation	<0.1	4500-NH ₄ -B & C, APHA 23rd Ed 2007
23	Aromatic Detergent(as MBAS)	mg/l	0.2	1	<0.1	Annexure E of IS 13426
24	Boronic Acid (B)	mg/l	0.5	1	0.21	IS 3025(Pt-57)
25	Mineral Oil	mg/l	0.5	No Relaxation	<0.1	IS 3025(Part-39)
26	Phenolic Compound (as C6H5OH)	mg/l	0.001	0.002	<0.001	IS 3025(Part-44)
27	Cadmium (as Cd)	mg/l	0.001	No Relaxation	<0.002	3110-B, APHA 23rd Ed 2007
28	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	4500-CN-B,C & E, APHA 23rd Ed 2007
29	Lead	mg/l	0.02	No Relaxation	<0.01	3110-B, APHA 23rd Ed 2007
30	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	3110-B, APHA 23rd Ed 2007
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	3110-B, APHA 23rd Ed 2007
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	4500-Cl-B, APHA 23rd Ed 2007
33	Niobium (as Nb)	mg/l	<0.05	0.17	No Relaxation	3110-B, APHA 23rd Ed 2007
34	Polynuclear Aromatic Hydro Carbons	mg/l	<0.0001	0.0001	No Relaxation	APHA 6440, 23rd Ed 2007
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	APHA 6430, 23rd Ed 2007
Microbiological Parameters						
36	Total Coliform	MPN/100ml	shall not be detectable in any 100 ml of sample	<1		IS : 3622-1981
37	E. Coli	1.005/100ml	shall not be detectable in any 100 ml of sample	Absent		IS : 3622-1981

****End of Report****

For Shri Om Testing & Research Laboratory

(Signature)
ISHWAR BHARGAVA
Technical Manager

Authorized Signature

(Name, Designation & Signature With Seal)

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Issued To: LEA Associates South Asia Pacific Pvt. Ltd.,
 Report/Sample No. : E-NVW 2022046807
 Date of Sampling : 14.05.2022
 Date of Issue in Lab : 16.05.2022

Project Name: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDR) and Environmental & Social Assessment and Management Plan (ESAMP)

Nature of Sample : Ground Water
 Customer Ref. No.: NS
 Test Started : 16.05.2022
 Test Completed : 21.05.2022

SAMPLING DETAILS

Sampling Location : Chetta PS, Tolly Nala
 Sampling Done by : Lab Boy
 Weather Condition : Clear Sky
 Sample Packing & Marking : Plastic Bottle & Glass Bottle, PD/GW-7
 Sampling Protocol : IS- 3025(P-1) & IS- 1622-1981 (Reaff 2003)
 Sample Quantity : 2 L+500 ml

S. No	Parameters	Unit	Limit (IS- 10500:2012)		Results (GW-7)	Test method
			Desirable Limit	Permissible Limit		
1	Color	Hazen	5	15	<5	IS- 3025(P-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	IS- 3025(P-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	IS- 3025(P-6)
4	Turbidity	NTU	1	5	<1	IS- 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.51	IS- 3025(P-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	600	196.2	IS- 3025(Part-21)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.46	2500-Fe- B, APHA 23rd Ed. 2017
8	Chlorides (as Cl)	mg/l	250	1000	21.4	IS- 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	0.51	4500-F- (D), APHA 23rd Ed. 2017
10	TDS	mg/l	500	2000	236.2	IS- 3025(Part-26)
11	Calcium (as Ca ²⁺)	mg/l	75	200	54.6	IS- 3025(Part-43)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	22.4	3500- Mg & APHA 23rd Ed. 2017
13	Sulphate (as SO ₄)	mg/l	200	400	29.2	IS- 3025(Part-24)
14	Nitrate (as NO ₃)	mg/l	45	No Relaxation	21.4	IS- 3025(P-34)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	9110- 8, APHA 23rd Ed. 2017
16	Alkalinity as CaCO ₃	mg/l	200	600	164.2	IS- 3025(Part-23)

For Shri Om Testing & Research Laboratory
 Authorized Signatory
 (Name, Designation & Signature With Seal)
 Technical manager

STR/LAB/Q/058

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Report/Sample No. : KSVW2022051407

17	Aluminium (as Al)	mg/l	0.03	0.2	<0.01	IS 3025(Part-50)
18	Total Arsenic(as As)	mg/l	0.01	No Relaxation	<0.01	IS 3025-B, APHA 23rd Ed 2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	IS 3025-B, APHA 23rd Ed 2017
20	Manganese (as Mn)	mg/l	0.1	0.3	<0.01	IS 3025-B, APHA 23rd Ed 2017
21	Zinc (as Zn)	mg/l	5	15	0.56	IS 3025-B, APHA 23rd Ed 2017
22	Amonia (as NH ₃ -N)	mg/l	0.1	No Relaxation	<0.1	4500-NH ₃ -N & C, APHA 23rd Ed 2017
23	Arsenic, Determinates (MnAs)	mg/l	0.2	1	<0.1	Revision E of IS 13428
24	Boron(as B)	mg/l	0.1	1	0.17	IS 3025(Pt-57)
25	Mineral Oil	mg/l	0.1	No Relaxation	<0.1	IS 3025(Part-58)
26	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.001	0.002	<0.001	IS 3025(Part-44)
27	Cadmium (as Cd)	mg/l	0.005	No Relaxation	<0.002	IS 3025-B, APHA 23rd Ed 2017
28	Cadmium (as Cd)	mg/l	0.05	No Relaxation	<0.1	4500-Cd-B,C & E, APHA 23rd Ed 2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	IS 3025-B, APHA 23rd Ed 2017
30	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	IS 3025-B, APHA 23rd Ed 2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	4500-Cl-B, APHA 23rd Ed 2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	IS 3025-B, APHA 23rd Ed 2017
34	Polynuclear Aromatic Hydro Carbons	mg/l	<0.0001	0.0001	No Relaxation	APHA (6440) 21st Ed 2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	APHA (6430) 21st Ed 2017
Microbiological Parameters						
36	Total Coliform	MPN/100ml	Shall not be detectable in any 100 ml of sample		<1	IS 1622-1983
37	E Coli	E.coli/100ml	Shall not be detectable in any 100 ml of sample		Absent	IS 1622-1981

****End of Report****

For Shri Om Testing & Research Laboratory

SHRI OM BHANUJ
Technical Incharge

Authorized Signature

(Name, Designation & Signature With Seal)

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N.A.B.L. Accredited. ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Issued To: LEA Associates South Asia Pacific Pvt. Ltd., Report/Sample No.: ENV/2022051608
 Date of Sampling: 14.05.2022
 Date of Issue: 16.05.2022

Project Name: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)

Nature of Sample : Ground Water, Test Started : 16.05.2022
 Customer Ref. No.: NS, Test Completed : 21.05.2022

SAMPLING DETAILS:

Sampling Location : Proposed Police Telecom Dept. Land Tolly Nala
 Sampling Done by : Lab Boy
 Weather Condition : Clear Sky
 Sample Packing & Marking : Plastic Bottle & Glass Bottle, PD/GW-B
 Sampling Protocol : IS: 3025(P-1) & IS: 1022-1981 (Reaff.2003)
 Sample Quantity : 2 L=300 ml

S. No.	Parameters	Unit	Limit (S-10500:2012)		Results-GWB	Test method
			Desirable Limit	Permissible Limit		
1	Color	Platen	5	15	<5	IS: 3025(P-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-6)
3	Taste	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-6)
4	Turbidity	NTU	5	5	<1	IS: 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.47	IS: 3025(P-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	600	182.5	IS: 3025(Part-21)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.58	3100 Fe - S, APHA 23rd Ed.2017
8	Chlorides (as Cl)	mg/l	250	1000	25.8	IS: 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	0.56	4500 F - (D), APHA 23rd Ed.2017
10	TDS	mg/l	500	2000	266.1	IS: 3025(Part-16)
11	Calcium (as Ca ²⁺)	mg/l	75	300	27.4	IS: 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	17.8	3500 - Mg S, APHA 23rd Ed.2017
13	Sulphate (as SO ₄)	mg/l	200	400	36.1	IS: 3025(Part-34)
14	Nitrate (as NO ₃)	mg/l	45	No Relaxation	15.8	IS: 3025(P-34)
15	Total Dissolved Solids (as D ₅₀)	mg/l	0.05	No Relaxation	<0.01	2110 - B, APHA 23rd Ed.2017
16	Alkalinity as CaCO ₃	mg/l	200	600	172.6	IS: 3025(Part-23)

For Shri Om Testing & Research Laboratory
 Authorized Signature
 (Name, Designation & Signature With Seal)
 Technical manager

STR/LAB/058

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Report/Sample No. : **ENVW2022051608**

17	Aluminum (as Al)	mg/l	0.03	0.2	<0.01	IS 8015(Part-55)
18	Total Arsenic(as As)	mg/l	0.01	No Relaxation	<0.01	IS 1150-B, APHA 23rd Ed 2017
19	Copper (as Cu)	mg/l	0.05	1.0	<0.05	IS 1150-B, APHA 23rd Ed 2017
20	Manganese (as Mn)	mg/l	0.5	0.5	<0.01	IS 1150-B, APHA 23rd Ed 2017
21	Zinc (as Zn)	mg/l	5	10	0.34	IS 1150-B, APHA 23rd Ed 2017
22	Arsenic (as HCl-Ar)	mg/l	0.5	No Relaxation	<0.1	4500-As, B & C, APHA 23rd Ed 2017
23	Bromo Detergent(as MBAS)	mg/l	0.2	1	<0.1	Annexure 4 of IS-13428
24	Boron(as B)	mg/l	0.5	1	0.18	IS 3025(Pt-57)
25	Mineral Oil	mg/l	0.5	No Relaxation	<0.1	IS 8025(Part-16)
26	Phenolic Compound (as C6H5OH)	mg/l	0.001	0.002	<0.001	IS 3025(Part-44)
27	Calcium (as Ca)	mg/l	0.005	No Relaxation	<0.200	IS 1150-B, APHA 23rd Ed 2017
28	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	4500-CN-RC & E, APHA 23rd Ed 2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	IS 1150-B, APHA 23rd Ed 2017
30	Mercury (as Hg)	mg/l	0.005	No Relaxation	<0.001	
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	IS 1150-B, APHA 23rd Ed 2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.1	4500-Cl-B, APHA 23rd Ed 2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	IS 1150-B, APHA 23rd Ed 2017
34	Polynuclear Aromatic Hydro Carbons	mg/l	<0.0001	0.0001	No Relaxation	APHA 6440.23rd Ed 2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	APHA 6430.23rd Ed 2017
Microbiological Parameters						
36	Total Coliform	MPN/100ml	Shall not be detectable in any 100 ml of sample		<1	IS-1822-1981
37	E.Coli	5.000/100ml	Shall not be detectable in any 100 ml of sample		Absent	IS-1822-1981

****End of Report****

For Shri Om Testing & Research Laboratory

(Signature)
SHRI OM SHARMA

Technical Manager

Authorized Signature

(Name, Designation & Signature With Seal)

STR/LAB/01/058

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SHRI OM TESTING & RESEARCH LABORATORY

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Issued To: LEA Associates South Asia Pacific Pvt. Ltd.,
 Report/Sample No.: ENVW2022051609
 Date of Sampling: 14.05.2022
 Date of Issue in lab: 16.05.2022

Project Name: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)

Nature of Sample: Ground Water
 Customer Ref. No.: NS
 Test Started: 16.05.2022
 Test Completed: 21.05.2022

SAMPLING DETAILS:

Sampling Location: Proposed Golf Green, Tolly Nala
 Sampling Done by: Lab Boy
 Weather Condition: Clear Sky
 Sample Packing & Marking: Plastic Bottle & Glass Bottle, PD/GW-9
 Sampling Protocol: IS: 3025(P)-13 & IS: 1632-1981 (Reaff. 2003)
 Sample Quantity: 2 L+500 ml

S. No.	Parameters	Unit	Limit (IS-15001:2022)		Results-GW9	Test method
			Desirable Limit	Permissible Limit		
1	Color	ntn/cm	5	25	<5	IS: 3025(P)-8
2	Odour	-	Agreeable	Agreeable	Agreeable	IS: 3025(P)-5
3	Taste	-	Agreeable	Agreeable	Agreeable	IS: 3025(P)-8
4	Turbidity	NTU	5	5	<1	IS: 8025(Part-08)
5	pH	-	6.5-8.5	No Relaxation	7.83	IS: 3025(P)-11
6	Total Hardness (as CaCO3)	mg/l	300	600	285.8	IS: 8025(Part-23)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.63	3000-Fe-B, APHA 23rd Ed. 2017
8	Chlorides (as Cl)	mg/l	250	1000	31.7	IS: 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	0.48	4500-F-(D), APHA 23rd Ed. 2017
10	TDS	mg/l	500	2000	258.4	IS: 8025(Part-24)
11	Calcium (as Ca ²⁺)	mg/l	75	200	37.5	IS: 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	21.4	5500-Mg-B, APHA 23rd Ed. 2017
13	Sulphate (as SO4 ²⁻)	mg/l	200	400	21.4	IS: 3025(Part-34)
14	Nitrate (as NO3)	mg/l	45	No Relaxation	13.4	IS: 3025(P)-34
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.1	3110-Cr, APHA 23rd Ed. 2017
16	Alkalinity as CaCO3	mg/l	200	600	182.7	IS: 3025(Part-23)

For Shri Om Testing & Research Laboratory

Authorized Signature
 (Name, Designation & Signature With Seal)

STRLLAB/058

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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Report/Sample No. : ENVW2022851409

17	Aluminum (as Al)	mg/l	0.04	0.2	<0.01	IS 3025(Part 55)
18	Total Arsenic(as As)	mg/l	0.01	No Relaxation	<0.01	SI 10- B, APHA 23rd Ed 2017
19	Copper (as Cu)	mg/l	0.05	1.0	<0.05	SI 10- B, APHA 23rd Ed 2017
20	Manganese (as Mn)	mg/l	0.3	0.8	<0.01	SI 10- B, APHA 23rd Ed 2017
21	Zinc (as Zn)	mg/l	3	10	0.54	SI 10- B, APHA 23rd Ed 2017
22	Arsenic (as HAs As)	mg/l	0.3	No Relaxation	<0.1	4500-As-B & C, APHA 19th Ed 2017
23	Arsenic, Detergent(as MMAI)	mg/l	0.2	1	<0.1	Arsenate K of IS 13428
24	Boron(as B)	mg/l	0.3	1	0.18	IS 3025(PH-47)
25	Mercural (as Hg)	mg/l	0.1	No Relaxation	<0.1	IS 3025(Part 98)
26	Phenolic Compound (as C6H5OH)	mg/l	0.001	0.002	<0.001	IS 3025(Part 44)
27	Cadmium (as Cd)	mg/l	0.001	No Relaxation	<0.001	SI 10- B, APHA 23rd Ed 2017
28	Cyanide (as CN)	mg/l	0.01	No Relaxation	<0.1	4500-CN-B,C & E, APHA 19th Ed 2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	SI 10- B, APHA 23rd Ed 2017
30	Mercural (as Hg)	mg/l	0.001	No Relaxation	<0.001	
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	SI 20- B, APHA 23rd Ed 2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	4500-Cl-B, APHA 23rd Ed 2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	SI 10- B, APHA 23rd Ed 2017
34	Polynuclear Aromatic Hydro Carbon	mg/l	<0.0001	0.0001	No Relaxation	APHA 6840, 23rd Ed 2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	APHA 6430, 23rd Ed 2017
Microbiological Parameters						
36	Total Cell form	MPN/100ml	Shall not be detectable in any 100 ml of sample		<1	IS : 1622-1981
37	E.Coli	E.coli/100ml	Shall not be detectable in any 100 ml of sample		Absent	IS : 1622-1981

****End of Report****

For Shri Om Testing & Research Laboratory

(Signature)
 JISHAR BHARDWAJ
 Technical manager

Authorized Signature
 (Name, Designation & Signature With Seal)

STRLLAB/Q056

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 4. The samples received shall be destroyed after 30 days from the date of issue of the certificate unless specified otherwise and sample for



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N.A.B.L. Accredited. ISO 9001. ISO 14001 & ISO 18001 Certified Laboratory.

Issued To : L&A Associates South Asia Pacific Pvt. Ltd.,	Report/Sample No. : ENVW20220516010
	Date of Sampling : 14.05.2022
	Date of Issued in lab : 16.05.2022
Project Name: Consulting Services for Environmental & Social Audit and Preparation of Environmental and Social Due Diligence Report (ESDDR) and Environmental & Social Assessment and Management Plan (ESAMP)	
Nature of Sample : Ground Water	Test Started : 16.05.2022
Customer Ref. No.: NS	Test Completed : 21.05.2022

SAMPLING DETAILS:

Sampling Location	: Near Proposed Kavi Nazrul Metro Station, Tolly Nala
Sampling Done by	: Lab Boy
Weather Condition	: Clear Sky
Sample Packing & Marking	: Plastic Bottle & Glass Bottle, PD/GW-10
Sampling Protocol	: IS: 3025(P-1) & IS: 1822-1981 (Reaff.2003)
Sample Quantity	: 2 L x 500 ml

S. No.	Parameters	Unit	Limit (IS:10500:2012)		Results-GW10	Test method
			Desirable Limit	Permissible Limit		
1	Color	Maxim	5	15	<5	IS: 3025(P-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	IS: 3025(P-6)
4	Turbidity	NTU	1	5	<1	IS: 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	7.10	IS: 3025(P-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	400	162.8	IS: 3025(Part-21)
7	Iron (as Fe)	mg/l	1.0	No Relaxation	0.31	5500-Fe-B, APHA 23rd Ed. 2017
8	Chlorides (as Cl ⁻)	mg/l	250	1000	36.4	IS: 3025(Part-32)
9	Fluoride (as F ⁻)	mg/l	1	1.5	0.83	4500-F-DLAPHA 23rd Ed. 2017
10	TDS	mg/l	500	2000	278.2	IS: 3025(Part-10)
11	Calcium (Ca ²⁺)	mg/l	75	200	38.8	IS: 3025(Part-63)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	31.8	5500-Mg-B, APHA 23rd Ed. 2017
13	Sulphate (as SO ₄)	mg/l	200	400	29.3	IS: 3025(Part-24)
14	Nitrites (NO ₂)	mg/l	45	No Relaxation	17.5	IS: 3025(P-34)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	8110-B, APHA 23rd Ed. 2017
16	Alkalinity as CaCO ₃	mg/l	300	600	176.8	IS: 3025(Part-25)

For Shri Om Testing & Research Laboratory

Authorized Signature
(Name, Designation & Signature With Seal)

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 4. The samples received shall be destroyed after 30 days from the date of issue of the certificate unless specified otherwise and sample for biological testing will be destroyed after 7 days of testing.



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N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 18001 Certified Laboratory.

Report/Sample No. : JNVW20228514018

17	Aluminum (as Al)	mg/l	0.03	0.2	<0.01	IS 3025(Part-55)
18	Total Arsenic (As)	mg/l	0.05	No Relaxation	<0.01	1110-B, APHA 23rd Ed.2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	1110-B, APHA 23rd Ed.2017
20	Manganese (as Mn)	mg/l	0.1	0.5	<0.01	1110-B, APHA 23rd Ed.2017
21	Zinc (as Zn)	mg/l	5	10	0.10	1110-B, APHA 23rd Ed.2017
22	Arsenic (as As) (H)	mg/l	0.3	No Relaxation	<0.1	4000-As, B & C, APHA 23rd Ed.2017
23	Arsenic Detergent/Cat (MAD)	mg/l	0.2	1	<0.1	Annexure F of IS-13426
24	Boron (as B)	mg/l	0.5	1	0.11	IS 3025(PH-57)
25	Mineral Oil	mg/l	0.0	No Relaxation	<0.1	IS 3025(Part-58)
26	Phenolic Compound (as C ₆ H ₅ OH)	mg/l	0.001	0.002	<0.001	IS 3025(Part-64)
27	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001	1110-B, APHA 23rd Ed.2017
28	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	4000-CN-B,C & E, APHA 23rd Ed.2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	1110-B, APHA 23rd Ed.2017
30	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	1110-B, APHA 23rd Ed.2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	4500-Cl-6, APHA 23rd Ed.2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	1110-B, APHA 23rd Ed.2017
34	Polynuclear Aromatic Hydro Carbons	mg/l	<0.0001	0.0001	No Relaxation	APHA 6440, 23rd Ed.2017
35	Poly chlorinated Biphenyl	mg/l	<0.0001	0.0005	No Relaxation	APHA 6430, 23rd Ed.2017
Microbiological Parameters						
36	Total Coliform	MPN/100ml	Shall not be detectable in any 100 ml of sample		<1	IS 1623-1981
37	E.Coli	ECOB/100ml	Shall not be detectable in any 100 ml of sample		Absent	IS 1623-1981

****End of Report****

For Shri Om Testing & Research Laboratory

ISHWAR SHARMA
 Technical manager

Authorized Signature
 (Name, Designation & Signature With Seal)

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ANNEXURE 6: SITTING GUIDELINE OM UNDER MOEF&CC

F. No. 22-39/2020-IA.III

Government of India
Ministry of Environment, Forest and Climate Change
Impact Assessment Division

Indira Paryavaran Bhawan
Jor Bagh Road, Aliganj
New Delhi - 110003
dirisapolicy-moefcc@gov.in

Date: 14th February, 2022

Office Memorandum

Subject: Guidelines for siting industries which are in close proximity with the river – reg.

In light of various court directions about the criteria for siting of industries, which are in close proximity to a river, the requirement for framing specific criteria with regards to siting of industries has arisen.

2. The "Environmental guidelines for industries" of the Ministry with regard to siting of industries prescribes that industrial sites shall maintain at least ½ km., from flood plain or modified flood plain affected by dam in the upstream or by flood control systems.

3. The Hon'ble National Green Tribunal while considering restoration measures for Yamuna and Ganga rivers dealt with the issue of flood plains vide judgment dated 13.01.2015 in OA No. 6/2012 and O.A. No. 300/2013, in the context of river Yamuna, observed that, "it is necessary to call upon the authorities to demarcate the floodplain for the flood of once in 25 years and to prohibit any kind of development activity in the area in question".

4. Further vide judgement dated 13.07.2017 in OA No. 200/2014, M.C. Mehta vs. Union of India & Ors. reported in 2017 NGTR (3) PB1 in the context of river Ganga, it was observed that "till the demarcation of the floodplains and identification of permissible and non-permissible activities by the State Government of this judgement, we direct that 100 meters from the edge of the river would be treated as no development/construction zone in Segment-B of Phase-I (Haridwar to Unnao, Kanpur)".

5. Based on the above, the aspect related to siting of industries was deliberated in the Ministry and suggestions/comments/observations were sought from different Ministries including Ministry of Jal Shakti (MoJS). Based on the inputs received, it is hereby directed that the following criteria for siting of industries in close proximity to rivers shall be followed:

Industries shall not be located within the river flood plain corresponding to one in 25 years flood, as certified by concerned District Magistrate/ Executive Engineer from state water resource Deptt. or any other officer authorised by State Govt. for this purpose."

6. This above criterion is subjected to following conditions:
- i. The activities undertaken under Namami Gange Programme like construction/development / renovation of STPs, CETPs, RFDs, bathing ghats, crematoria, toilets etc. for pollution abatement of river Ganga and its tributaries are not prohibited. Further, any 'developmental project' taken by MoJS under the said program are also exempted from these guidelines.
 - ii. River Ganga (Rejuvenation, Protection and Management) Authorities Order notified vide Notification no. S.O. 3187(E) dated 07.10.2016 which defines the floodplain as such area of river Ganga and its tributaries which comes under water on either side of it due to floods corresponding to its greatest flow or with water on either side of it due to floods corresponding to its greatest flow or with a flood of frequency once in hundred years, will prevail over any other guideline.
 - iii. Further, in respect of regulatory activities in floodplain of the river Ganga and its tributaries, prior approval of National Mission on Clean Ganga (NMG) is required to be taken by the concerned authorities/ departments/agencies /persons.
 - iv. As per the draft Flood Plain Zoning Bill, 2020 prepared by Central Water Commission (CWC), a Flood Plain Zoning Authority shall, on the basis of the remote sensing/modeling results/ground survey, establish flood plain zones of different frequencies. After its creation, guidelines/decisions/orders of Flood Plain Zoning Authority will prevail over above guidelines.
 - v. Any other directions/judgments of Courts/Tribunals with regard to siting of Industries in the proximity of rivers and/or demarcation of flood plain.
7. The siting criteria prescribed in 'Environmental guidelines for industries' in respect of flood plains of the riverine systems shall get modified to this extent.
8. This is issued with the approval of the competent authority.



(A.K. Agrawal)
Director

To

1. Chairman of all the Expert Appraisal Committees
2. Chairperson/Member Secretaries of all the SELAAs/SEACs
3. Chairperson of all State/UT Pollution Control Boards and Pollution Control Committees

Copy for information to

1. PS to Hon'ble Minister for Environment, Forest and Climate Change
2. PS to Hon'ble MoS (EF&CC)
3. PPS to Secretary (EF&CC)
4. PPS to AS (TK)/ AS(RS)/ AS (NPG)/JS (SKB)
5. Website MoEF&CC/Guard file

ANNEXURE 7: SAMPLE IEC MATERIAL ON GENDER BASED VIOLENCE (GBV)



छेड़खानी के विषय चुप्पी तोड़ो अब तो बोलो

सुरक्षा कॉल करें **1090**

सीमेन पीपल लाइन

जलेश्वर प्रदीप पुस्तिका

छेड़खानी की संख्या पर 1090 कॉल करें जब

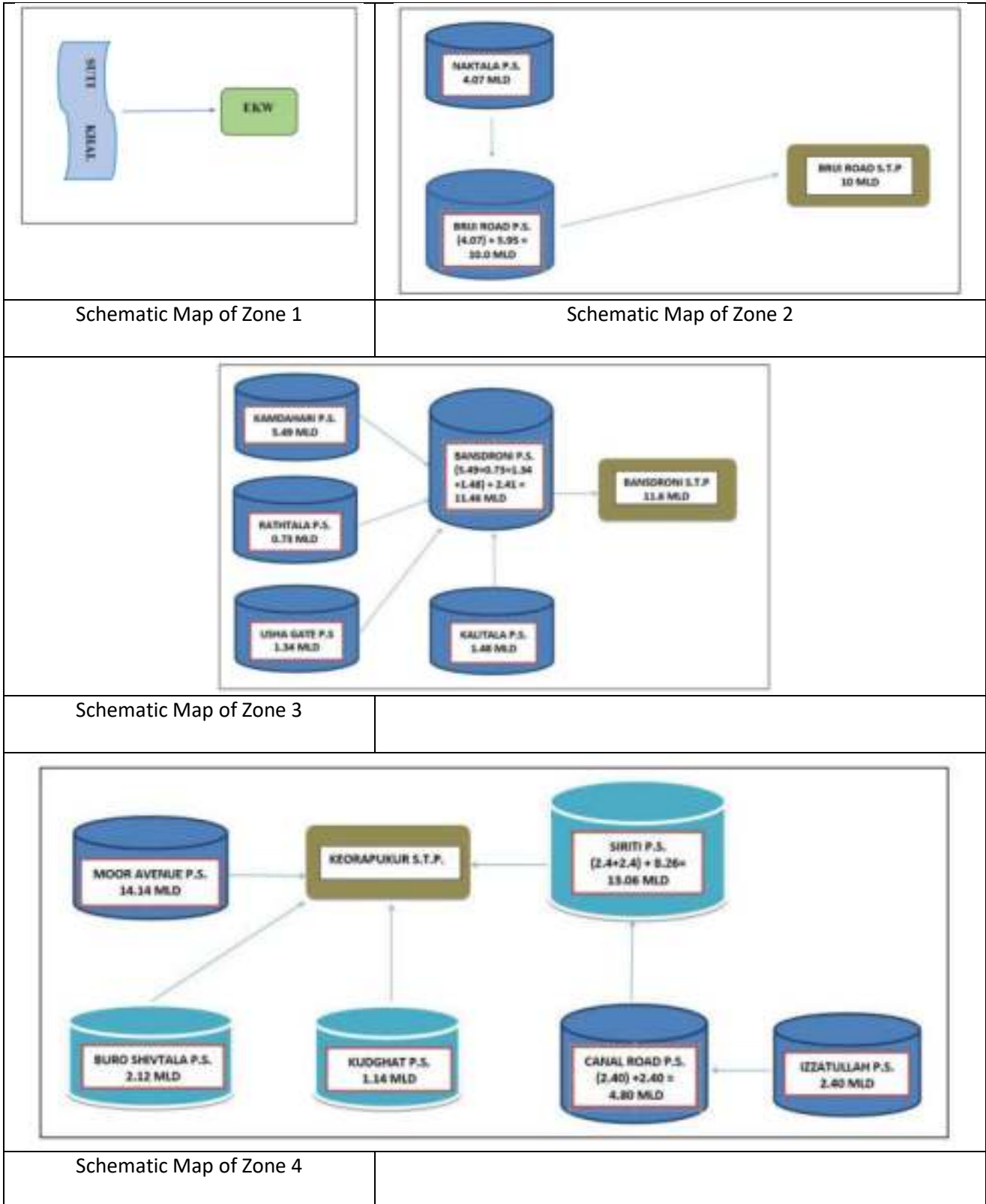
- कोई महिला अपने घर के बाहर से अज्ञात एक व्यक्ति से अज्ञानता से मिले।
- कोई महिला किसी व्यक्ति से अज्ञानता से मिले और उससे अज्ञानता से मिले।
- कोई महिला अज्ञानता से किसी भी व्यक्ति से मिले और उसे अज्ञानता से मिले।
- कोई भी व्यक्ति उसे अज्ञानता से अज्ञानता से मिले और उसे अज्ञानता से मिले।

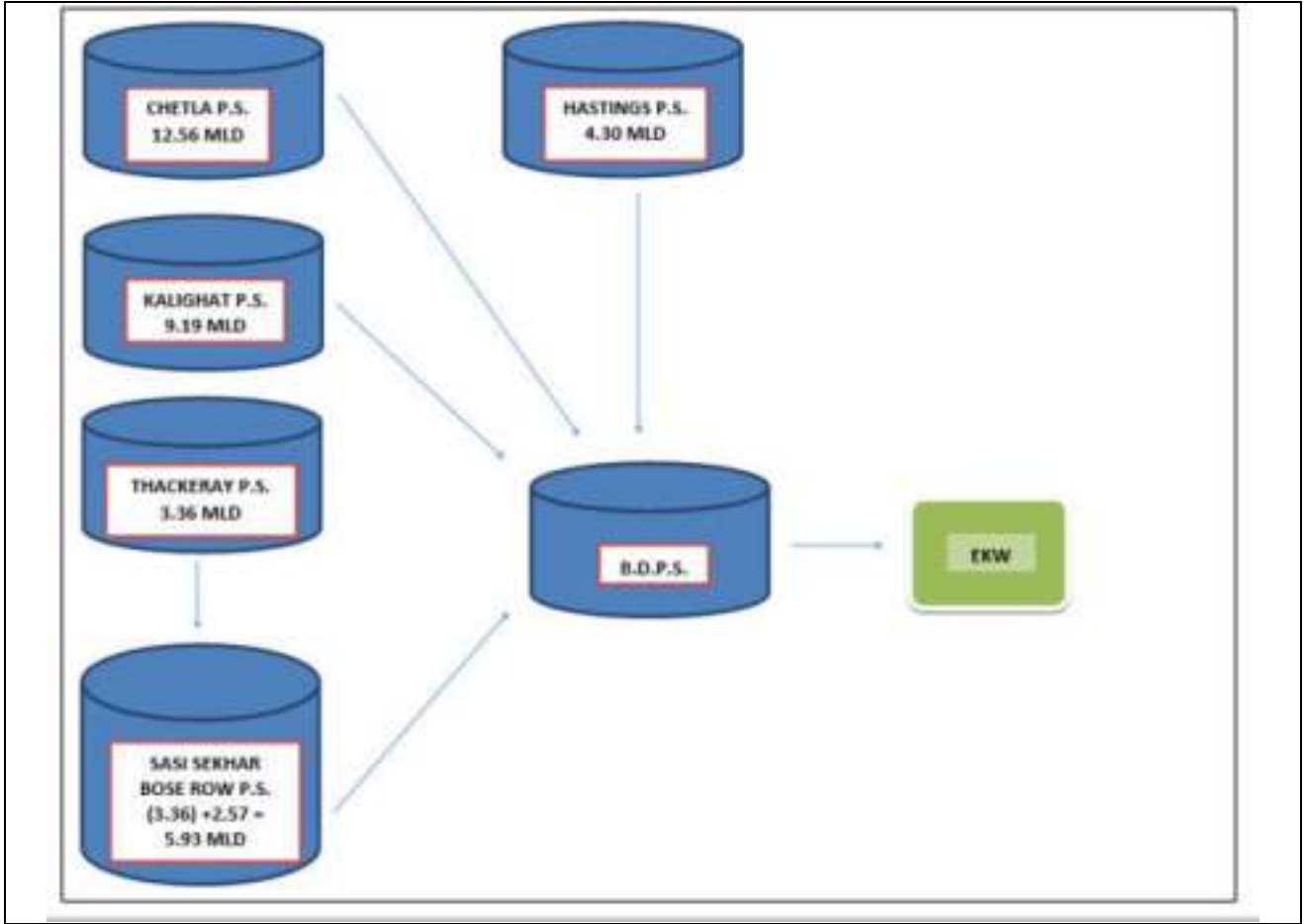
सिमेंट पीपल लाइन 1090 की कार्यवाही

- महिला को जलेश्वर पीपल लाइन कॉल करने की सलाह दें।
- महिला को सुरक्षा कॉल करने के लिए सलाह दें और महिला को सुरक्षा कॉल करने के लिए सलाह दें।
- महिला को सुरक्षा कॉल करने के लिए सलाह दें और महिला को सुरक्षा कॉल करने के लिए सलाह दें।
- महिला को सुरक्षा कॉल करने के लिए सलाह दें और महिला को सुरक्षा कॉल करने के लिए सलाह दें।
- महिला को सुरक्षा कॉल करने के लिए सलाह दें और महिला को सुरक्षा कॉल करने के लिए सलाह दें।



ANNEXURE 8: SCHEMATIC DIAGRAM OF STP AND WASTE WATER TREATMENT ZONE WISE





Schematic Map of Zone 6

ANNEXURE 9: LAND DOCUMENT FOR BANSDRONI STP

NOT TP&D/0/87/2022-23

Date: 23.05.2022

Re : Requirement of a piece of vacant land in the vicinity of the existing Bansdrongi Police Station under Ward no.- 113 from I&W Deptt., Govt. of West Bengal for setting up a Drainage Pumping Station under the scheme of 'Pollution Abatement of Tolly's Nullah'.

OSD & Ex-officio Dy. C.E (C)
Chief Valuer & Surveyor Deptt.

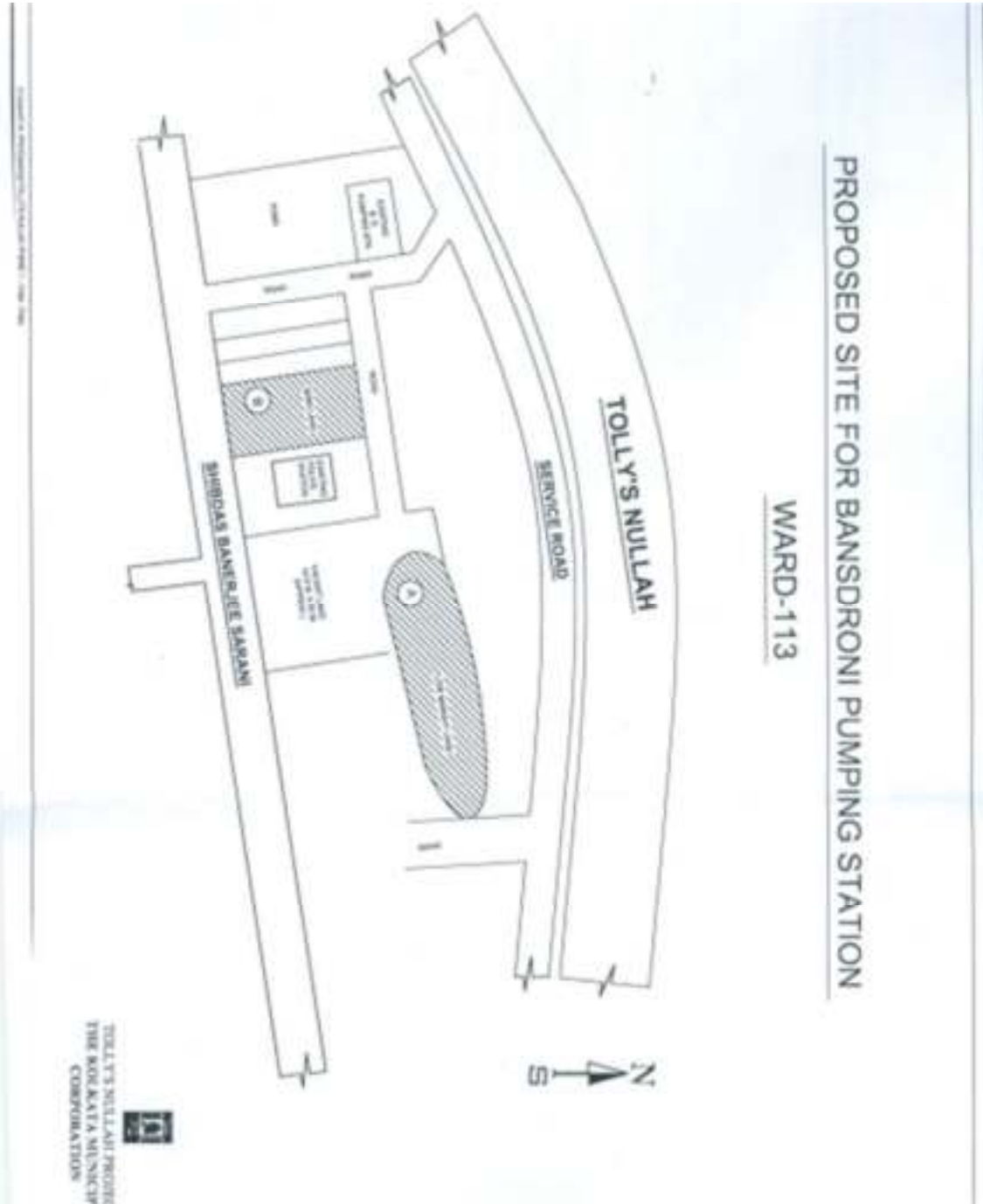
TP&D Department has been entrusted for the preparation of the DPR of the project of 'Pollution Abatement of Tolly's Nullah'. The fund of which will be provided by Govt. of India through World Bank.

After joint inspection held on 20.05.2022 along with the local Councillor of Ward no.-113 in presence of the officials of Chief Valuer & Surveyor Department two pieces of land have been detected which are demarcated as 'A' and 'B' in the attached drawing and those lands will be required for setting up of a DWF pumping station and STP for the said project.

Therefore, Chief Valuer & Surveyor Deptt. is hereby requested to explore the possibility to take over the said pieces of land from I&W D Govt. of W.B. for the purpose as stated above.

23.5.
Executive Engineer (C)
E E(C)(TP&D) J.T.N.P.
K.M.C

Encl: Schematic drawing of the said lands.



Re: Status of land of two pieces of vacant as marked A & B in the vicinity of the existing Bamdrani Police Station for setting up a Drainage Pumping Station under the scheme of "Pollution Abatement of Tolly's Nullah" under Mouza- Bamdrani, J.I. No.45 in Wd.113,Br.XI

Executive Engineer (C)
TP & DD/T.N.P
OSD & Ex-Off. Ch. V & S

Note of E.E (C), T.P & D Deptt. dated 21-05-2022 in the captioned matter is referred (Flagged-A)

In connection with the above, joint inspection has been done dated 07-06-2022 by concerned officials of R.I. & LRD and KMC for identification & status of subject land.

Accordingly, R.I. & LRD, Kolkata vide letter memo no 2093/RLRD/KOL/2022 dated 13-06-2022 stated as follows:-

"The site marked in location 'A' consists of plots 341,343,346 partly, Mouza-Bamdrani, J.I. No.45. The area is lying as water body(pond). The site marked in location 'B' consists of plot 341 partly. The area is lying as vacant dry land.

As per RDR status is as follows:-

Plot 341: Total area 2.23 Acre, Classification-'Sal', 0.2159 Acre is vested to State;
One raiyat in rest area.

Plot 343: Total area 0.29 Acre, Classification-'Deba', R.R Department Govt. of West Bengal.

Plot 346: Total area 0.43 Acre, Classification-'Sal', R.R Department, Govt. of West Bengal."

Photocopy of the same is being sent herewith(Flagged-B) for information.

Submitted

A.E.(C)

17/6/22

17/06/22

OBD

Ex-Officio, Ch. Val. & S
Kolkata M.D.

eyor



Summary Pouch
20-14936

Re : Urgent acquisition of the pieces of vacant land in the vicinity of the existing Bamdrani Police Station under Ward no.- 113 from I&W Deptt., Govt. of West Bengal for setting up a Drainage Pumping Station under the scheme of 'Pollution Abatement of Tolly's Nullah'.

OSD & Ex-officio Chief Valuer & Surveyor

Referring the note of OSD & Ex-officio Chief Valuer & Surveyor dated 17.06.22 attached herewith as flagged '1' this can be understood that the land under consideration marked as 'A' & 'B' in the attached drawing belong to Govt. of West Bengal.

Both the pieces of lands marked as 'A' & 'B' may be acquired from the Govt. of West Bengal as both the pieces of lands will be required for the development of the Tolly's Nullah Project under KMC.

The necessary action in this regard may urgently be taken as accordingly.

Executive Engineer (C)
(TP&DD)

ANNEXURE 10: LAND DOCUMENT FOR BRIJI ROAD STP

Kolkata Metropolitan Development Authority

Office of the Executive Engineer
 BPPD – H, E & AM Sector, KMDA
 KIT Market Complex, Jadavpur, Kolkata -700032

Address – 25/13/BPPD – H/E&AM/MDA/W-434 (p.02) Date: - 15.11.2019

Subject: Possession of KMDA land 0.1864 acre to KMC in Mouza – Brij, Jadavpur at BPPDP Township under Ward No – 119 for construction of sewerage pumping station and STP for upcoming Tolly Nullah Rehabilitation Project under NMCG Scheme.

POSSESSION PROCEEDING

As per decision of Authority KMDA & as per requirement of KMC, previously 0.5364 acre land was handed over to KMC on 25.04.2019 vide memo no-25/EE/DP-H/ESAM/KMDA/W-434(P1-II) dated - 05.04.2019. Similarly as per decision of competent Authority KMDA & requirement of KMC & subsequent order of Joint Secretary, (EIA)/KMDA Vide memo no 276/LAB-145/18 dated 11.12.18 & subsequent order of DG(EI)/ESAM Sector, KMDA vide I.O. No- 113, F-06/DGO/ESAM/KMDA dated 13.12.2019 and as per survey drawing prepared & supplied by Estate LA unit, KMDA, additional land measuring area 0.1864 acre adjacent to land area 0.5364 acre, RS Dug no-770 in mouza Brij, IL, No-27, P.S – Jadavpur, Ward 24 Np. Under BPPDP Township at U block beside Tolly Nullah for construction of sewerage pumping station and STP for upcoming Tolly Nullah Rehabilitation Project under NMCG Scheme of KMDA ward no 119, under Kolkata Municipal Corporation, measuring schedule of land 0.1864 acres is hereby handed over to Kolkata Municipal Corporation.

Received: 01 Area Site plan.

<p>Handed over by</p> <p>15/11/19</p> <p>Executive Engineer (E&AM) BPPD-H/E&AM/MDA/W-434 (p.02)</p>	<p>Taken over by</p> <p>15/11/19</p> <p>Chief Valuer & Surveyors Department, Kolkata Municipal Corporation</p>
---	--

Address – 25/13/BPPD – H/E&AM/MDA/W- 434 (p.02) Date: - 15.11.2019

Copy to be sent for information to:

1. The Joint Secy, (EIA), KMDA, Bhub.
2. The Joint Secretary, Estate (EIA)/KMDA
3. The Joint Secretary, Estate (EIA)/KMDA
4. The Joint Secretary, Estate (EIA)/KMDA

The original stated of land duly signed is handed over to representative of Tolly's Nullah Project Deptt.

Handed over by

Taken over by

Tolly's Nullah Project Deptt.

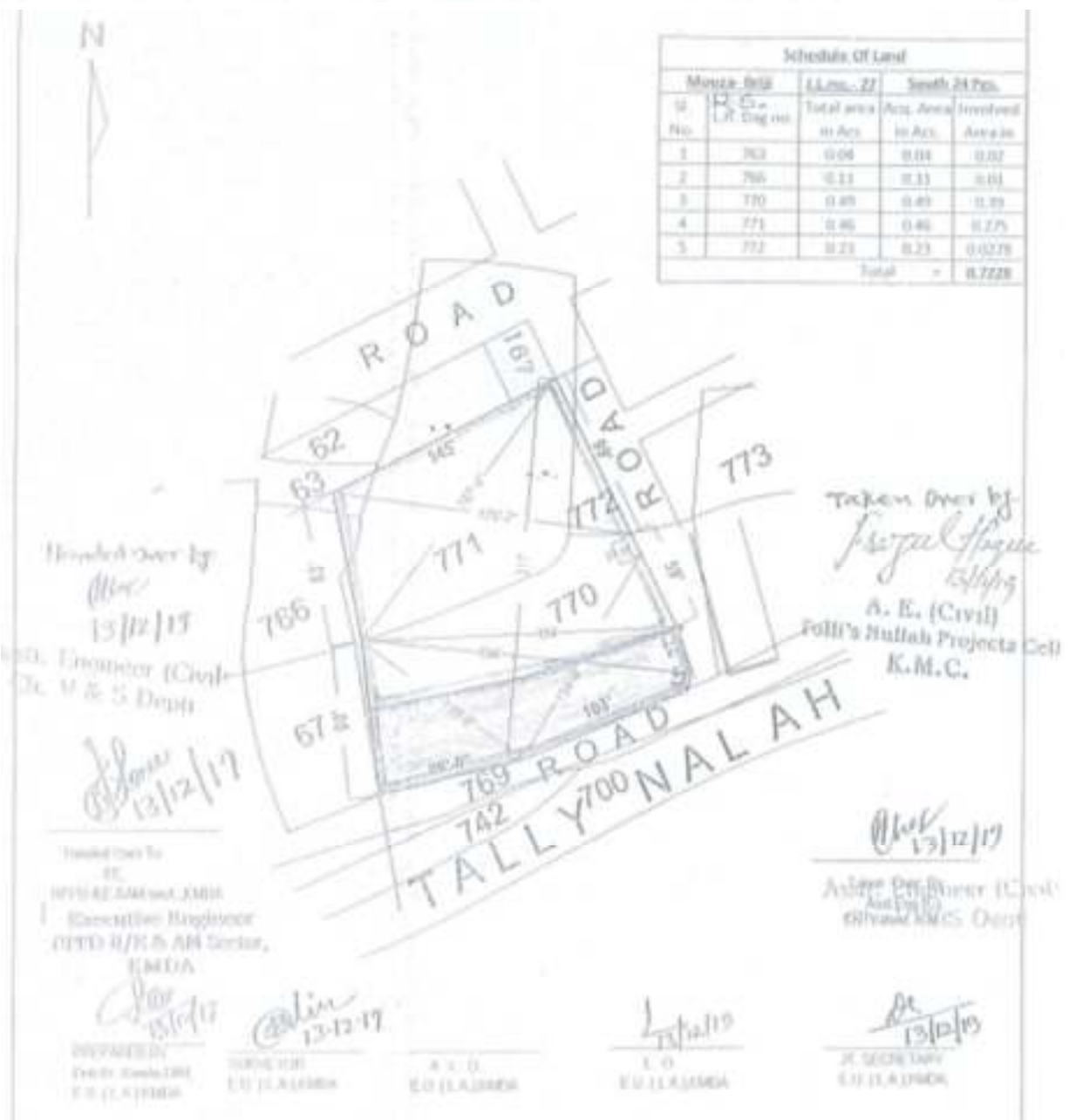
SITE PLAN OF PLOT OF LAND IN MOUZA - BRIJI, J.L.NO.- 27, INVOLVED R.S.DAG NOS ARE 763(P),766(P),770(P), 771(P) & 772(P),P.S.- JADAVPUR, DIST.- SOUTH 24 PGS. UNDER KMDA BPAD TOWNSHIP AT BLOCK-U, BESIDE TALLY NALLAH FOR CONSTRUCTION OF SEWERAGE PUMPING STATION AND PROPOSED S.T.P. FOR UP COMMING TALLY NALLAH REHABILITATION PROJECT UNDER NAMAMI GANGA SCHEME OF NMCG OF K M C, WARD NO.- 110.

SCALE: 1:1000

TOTAL PLOT AREA = 0.7228 Ac. shown thus -

PERMISSIVE POSSESSION ALREADY DONE = 0.5364 Ac shown thus -

PERMISSIVE POSSESSION TO BE DONE (Part of R.S. Dag No. 770(P)) = 0.1864 Ac. shown thus -



ANNEXURE 11: LAND DOCUMENT FOR GOLF GREEN STP

KOLKATA METROPOLITAN DEVELOPMENT AUTHORITY
(ERSTWHILE KOLKATA IMPROVEMENT TRUST)
1st FLOOR, BLOCK - A
UNNAYAN BHAVAN, SALT LAKE
KOLKATA - 700091

No. EM/2017-18/67
To
The Special Secretary to the
Government of West Bengal,
Department of Urban Development & Municipal Affairs,
"NAGARAYAN", DF - 8, Sector - 1,
Salt Lake,
Kolkata - 700064.

**RECEIVED
NOT VERIFIED
26 AUG 2017
468**
Tolly's Nullah Municipal Corporation
Drainage Department

Date: 22nd August 2017
Du (S&D)
Du (Tolly Nullah)
Pl. dis case

Ref: Memo No. 2748-UD/O/M/SI/S-4/2017 dated 11.08.2017.
Sub: Handing over the land of KMDA at Golf Green, Kolkata - 700033 to KMC to set up Sewer Treatment Plant (STP) under Tolly's Nullah Rehabilitation Project

Municipal Commissioner
The Kolkata Municipal Corporation

Madam,
With reference to your memo as above, I am directed to inform you that the land of at Premises No. 22, Russa Road South, 1st Lane, Sukha Pukur, Golf Green, KIT Scheme No. 118 has already been handed over to KMC on 26.07.2017 for setting up Sewage Treatment Plant (STP) under Tolly's Nullah Rehabilitation Project.

Thanking you,

Yours faithfully,
Sd/-
Deputy Secretary (KIT Wing), KMDA
Date: 22nd August 2017

No. EM/2017-18/67(3)
Copy forwarded for information to :

1. Joint Secretary (Law), KMDA,
2. PS to CEO, KMDA,
3. PS to Municipal Commissioner, KMC.

for (Tolly's Nullah) Nodal office (T.N. Project)
Chh
Director General
Sewerage & Drainage

An 22/8/17
Deputy Secretary (KIT Wing), KMDA
Pl. dis case
keep it in file

**KOLKATA METROPOLITAN DEVELOPMENT AUTHORITY
(ERSTWHILE KOLKATA IMPROVEMENT TRUST)
ESTATES DEPARTMENT, 6th FLOOR
F - 16, INDIA EXCHANGE PLACE EXTENSION
KOLKATA - 700073
Ph. No. 2221-8688**

Ref. File No. CE-MISC-4004

Date: 26th July 2017

Sub: Handing over the possession of land at 3 (Por), Russa Road South, 1st Lane, KIT Scheme No. 118

Plot No. 3 (Por - at western end), Russa Road South, 1st Lane

This is to certify that on behalf of Kolkata Improvement Trust I have this day handed over the possession of 3 (Por), Russa Road South, 1st Lane, KIT Sch. 118 to Sri Nishi Karita Bhattacharya, Chief Valuer & Surveyor, The Kolkata Municipal Corporation, 5, S. N. Banerjee Road, Kolkata - 700013.

Area: 37 bighas 13 chhatak 20 sq. ft (3200 sq. mt)

Handed over by:
Haraj Kumar Shaw (ES)
Pradip Kumar Banerjee
Estates Inspector, KIT
Kolkata
26/7/17

Taken over by: Nishi Karita Bhattacharya
A. B. S. / Ch. V & S Dey
on behalf of
26/7/17

Asstt. Engineer (ES)
Ch. V & S Dey

Witness:
1. Anirban Mukherjee
S.O (Civil), 26-7-17

Countersigned:
[Signature]
Estates Manager, KIT
Kolkata
26.07.17

2. Anirban Mukherjee
V.O. 26-7-17

possession handed over to DG & OSD, Tolly Nullah Project, on this day.

Handed over by:
[Signature]
26/7/17

Taken over by:
[Signature]
DG & OSD
Tolly's Nullah Rehabilitation Project
26/7/17

ANNEXURE 12: TARIFF POLICY RESOLUTION JAN'2016

[भाग 1-संलग्न 1]

वर्षा का समय : अक्टूबर

29

domestic coal supplied by CL, vis-à-vis the assured quantity or quantity indicated in Letter of Assurance/PSA the cost of imported/market based e-auction coal procured for making up the shortfall, shall be considered for being made a pass through by Appropriate Commission on a case to case basis, as per advisory issued by Ministry of Power vide OM No. FU-12/2011-IPC (Vol-III) dated 31.7.2013.

6.2 Tariff structuring and associated issues

- (1) A two-part tariff structure should be adopted for all long-term and medium-term contracts to facilitate Merit Order dispatch. According to National Electricity Policy, the Availability Based Tariff (ABT) is also to be introduced at State level. This framework would be extended to generating stations (including grid connected captive plants of capacities as determined by the SERC). The Appropriate Commission shall introduce differential rates of fixed charges for peak and off peak hours for better management of load within a period of two years.

Power stations are required to be available and ready to dispatch at all times. Notwithstanding any provision contained in the Power Purchase Agreement (PPA), in order to ensure better utilization of un-requisitioned generating capacity of generating stations, based on regulated tariff under Section 62 of the Electricity Act 2003, the procurer shall communicate, at least twenty four hours before 00.00 hours of the day when the power and quantum thereof is not requisitioned by it enabling the generating stations to sell the same in the market in consonance with laid down policy of Central Government in this regard. The developer and the procurer signing the PPA would share the gains realized from sale, if any, of such un-requisitioned power in market in the ratio of 50:50, if not already provided in the PPA. Such gain will be calculated as the difference between selling price of such power and fuel charge. It should, however, be ensured that such merchant sale does not result in adverse impact on the original beneficiary(ies) including in the form of higher average energy charge vis-à-vis the energy charge payable without the merchant sale. For the projects under section 63 of the Act, the methodology for such sale may be decided by the Appropriate Commission on mutually agreed terms between procurer and generator or unless already specified in the PPA.

- (2) Power Purchase Agreement should ensure adequate and bankable payment security arrangements to the Generating companies. In case of persisting default on payment of agreed tariff as per PPA in spite of the available payment security mechanisms like letter of credit, escrow of cash flows etc. the generating companies may sell such power to other buyers.
- (3) In case of coal based generating stations, the cost of project will also include reasonable cost of setting up coal washeries, coal beneficiation system and dry ash handling & disposal system.
- (4) After the award of bids, if there is any change in domestic duties, levies, cess and taxes imposed by Central Government, State Governments/Union Territories or by any Government instrumentality leading to corresponding changes in the cost, the same may be treated as "Change in Law" and may unless provided otherwise in the PPA, be allowed as pass through subject to approval of Appropriate Commission.

- (5) The thermal power plant(s) including the existing plants located within 50 km radius of sewage treatment plant of Municipality/local bodies/similar organization shall in the order of their closeness to the sewage treatment plant, mandatorily use treated sewage water produced by these bodies and the associated cost on this account be allowed as a pass through in the tariff. Such thermal plants may also ensure back-up source of water to meet their requirement in the event of shortage of supply by the sewage treatment plant. The associated cost on this account shall be factored into the fixed cost so as not to disturb the merit order of such thermal plant. The shutdown of the sewage treatment plant will be taken in consultation with the developer of the power plant.

6.3 Harnessing captive generation

Captive generation is an important means to making competitive power available. Appropriate Commission should create an enabling environment that encourages captive power plants to be connected to the grid.

Such captive plants could supply surplus power through grid subject to the same regulation as applicable to generating companies. Firm supplies may be bought from captive plants by distribution licensees using the guidelines issued by the Central Government under section 63 of the Act taking into account second proviso of para 5.2 of this Policy.

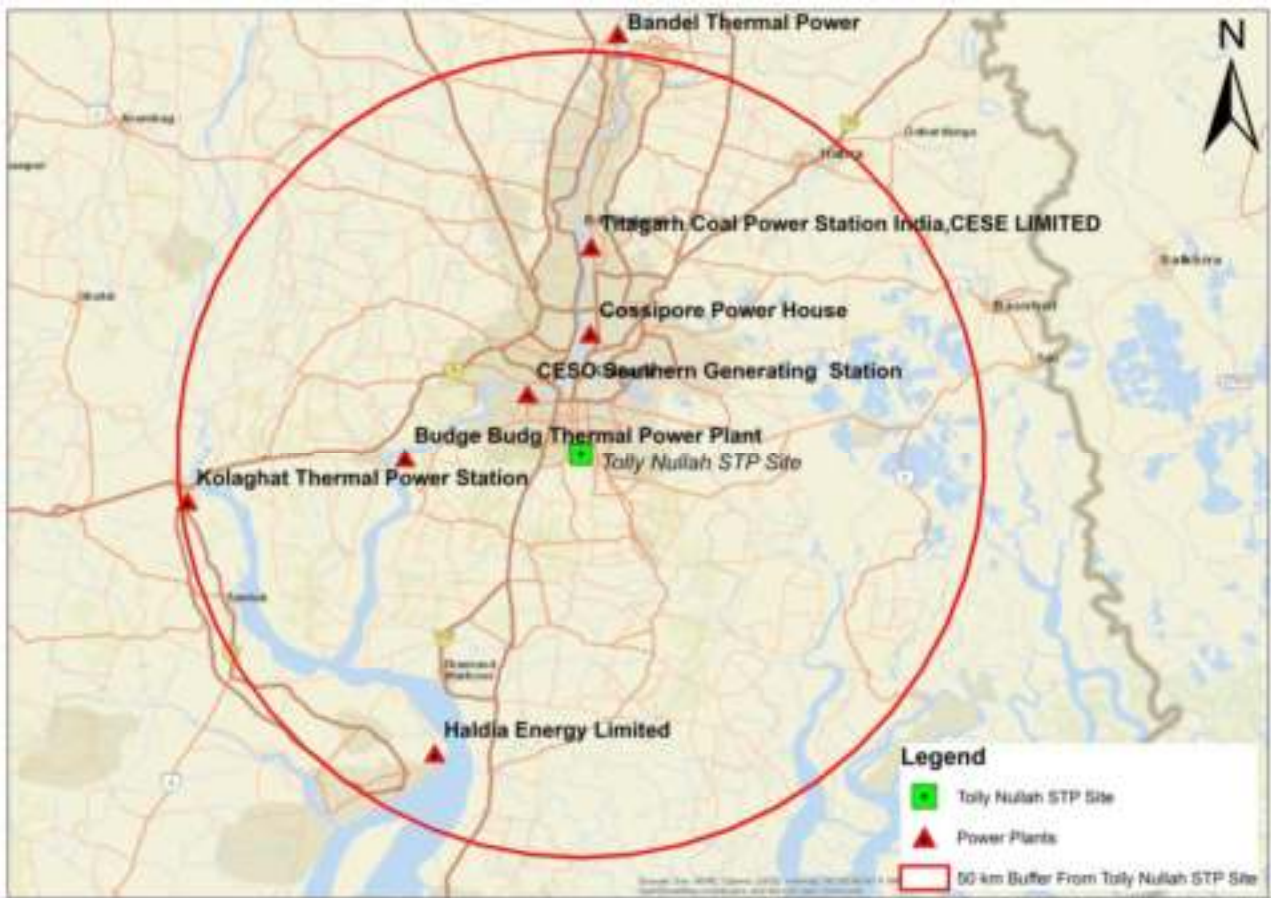
The prices should be differentiated for peak and off-peak supply and the tariff should include variable cost of generation at actual levels and reasonable compensation for capacity charges.

Wheeling charges and other terms and conditions for implementation should be determined in advance by the respective State Commissions, duly ensuring that the charges are reasonable and fair.

The full notification can be accessed on

https://cercind.gov.in/2018/whatsnew/Tariff_Policy-Resolution_Dated_28012016.pdf

ANNEXURE 13: THERMAL POWER PLANTS WITHIN 50 KM OF TOLLY NULLAH PROJECT SITES



ANNEXURE 14: BMW TREATMENT FACILITIES NEAR TOLLY NULLAH PROJECT SITE

S.No	Name and Address of the Facility	Office Address and contact No.
1	Greentech Environ Management Pvt. Ltd. Amratala Dhamua Road, P. O- Chakparan Kantakhali, P. S- Mograhat, Dist.- 24 Parganas (S), PIN- 743503.	Shyam Vatika, 397/1/1, Dakshindari Road, Shreebhumi, Kolkata- 700048 Ph. No. 2534-3649
2	Greenzen Bio Pvt. Ltd. Binnaguri, Fulbari, Bhaktinagar, Dist.- Jalpaiguri	Arati Bhawan, Ground Floor, 7, Sreema Sarani, Haiderpara, Siliguri-6, Dist- Darjeeling Ph. No.- 0353-2595575
3	Medicare Environmental Management Pvt. Ltd. 'F', Road, Belgachia, Dist.- Howrah, PIN- 711105	'F', Road, Belgachia, Dist.- Howrah, PIN- 711105 Ph. No.- 2651-3890/6207
4	Medicare Environmental Management Pvt. Ltd. KIGC, Phase III, Kalyani, Dist.- Nadia	'F', Road, Belgachia, Dist.- Howrah, PIN- 711105 Ph. No.- 2651-3890/6207
5	Medicare Environmental Management Pvt. Ltd. Mangalpur, Raniganj, Dist.- Burdwan	'F', Road, Belgachia, Dist.- Howrah, PIN- 711105 Ph. No.- 2651-3890/6207
6	West Bengal Waste Management Pvt. Ltd. Sutahata, Haldia, Dist.- Purba Medinipur	Jindal Towers, Block- A, 4th Floor, 21/1A/3, Darga Road, Kolkata- 700017 Ph. No.- 2289-3088/2527
7	RVD Waste Tech Pvt. Ltd. P.O.-Koichar, P.S.-Mangalkote, Purba Bardhaman-713143	Shyam Vatika, 397/1/1, Dakshindari Road, Shreebhumi, 3rd Floor, Flat B/3, Kolkata- 700048. Ph. No. 033-2534-1121

ANNEXURE 15: RECOMMENDATIONS IN SOIL TEST REPORT OF BANSDRONI PROJECT SITE

SITE: BANSDRONI PUMPING STATION, WARD NO.-113, B. R. NO. - XI, KOLKATA - 700070

Report on Soil Investigation at

**BANSDRONI PUMPING STATION, WARD NO. - 113,
BR. NO. - XI, KOLKATA**

for

Kolkata Municipal Corporation

by

**Civil Engineering Department
Jadavpur University
Kolkata 700032
August 2022**

Civil Engineering Department, Jadavpur University, Kolkata - 700032 **1**

SITE: BANSDRONI PUMPING STATION, WARD NO.-113, B. R. NO. - XI, KOLKATA - 700070

Report on Soil Investigation at

**BANSDRONI PUMPING STATION, WARD NO. - 113,
BR. NO. - XI, KOLKATA**

for

Kolkata Municipal Corporation

by

**Civil Engineering Department
Jadavpur University
Kolkata 700032
August 2022**

INTRODUCTION :

The Subsoil investigation work for the proposed **BANSDRONI PUMPING STATION, WARD NO. - 113, B. R. NO. - XI, KOLKATA - 700 070** was entrusted to **Civil Engineering Department, Jadavpur University, Kolkata - 700032** vide letter no. **DG/TNP/WO/01/2022-23** dated **20.06.2022** with a view to determine the soil properties and give recommendation for the well foundation and pile foundation at / near the proposed site.

This report presents the findings of the above soil investigation work and then recommends for the probable foundation systems for the structure.

1.0 SCOPE OF WORK :

Scope of the investigation work includes

- i.** Sinking of a total of **2 (Two)** nos. of bore holes at maximum depth of **30.45m** below the existing ground level, conducting standard penetration tests and collection of soil samples.
- ii.** Laboratory testing on selected soil samples for classification purpose and to determine their strength and other physical properties.
- iii.** Engineering analysis to determine safe bearing capacity of the foundation system for the proposed structure.
- iv.** Preparation and submission of report, which will include the results of study, analysis and recommendations of suitable parameters for design of foundations.

2.0 FIELD WORK:

Necessary field work was carried out during the period between **26.06.2022** and **28.06.2022** and subsequently laboratory tests were taken up on undisturbed and disturbed samples collected from site.

SITE: BANSDRONI PUMPING STATION, WARD NO.-113, B. R. NO. - XI, KOLKATA - 700070

One borehole (No. 1) was conducted near the proposed site of STP (in an existing pond) on northern side of a playground in Bansdrone. Another borehole (No. 2) was done in the boundary of irrigation department and about 25m from the borehole no.1. The locations of boreholes were decided in consultation with representative of Kolkata Municipal Corporation.

A brief description of method of boring, field tests, collection of samples etc. and type of equipment used are given below.

TABLE - 1

BORE HOLE NO.	TERMINATING DEPTH OF BORE HOLE BELOW E.G.L.	DATE OF COMMENCEMENT	DATE OF COMPLETION	S.W.T. BELOW E. G. L.	NO. OF SAMPLES COLLECTED		
					UNDISTURBED (U)	DISTURBED (D)	PENETROMETER (P)
1	24.00 m	26.06.2022	27.06.2022	2.20m	1	2	12
2	25.45 m	27.06.2022	28.06.2022	2.00m	1	2	15

2.1 BORING:

Auger boring was adopted up to a depth of about 3.0 m below the existing ground level (E.G.L.) followed by Rotary Wash boring technique to advance the 150 mm dia. boreholes up to termination depths. Casing was used at top and bentonite slurry was used for stabilization of boreholes.

2.2 STANDARD PENETRATION TEST :

S.P.T. was conducted at the boring points at suitable intervals. The number of blows required for last 30.0 cm penetration of split spoon sampler out of a total penetration of 45.0 cm driven by a 63.5 kg hammer falling freely through a height of 75 cm was recorded as 'N' value. The sample from split spoon sampler was collected after each test and was properly labeled and placed in air-tight polythene bag before sending it to the laboratory. The test procedure conformed to IS- 2131-1981.

2.3 COLLECTION OF SOIL SAMPLES:

Undisturbed soil samples were collected, wherever required and feasible, by means of a two tier 100 mm I.D. open drive sampling assembly. Before sampling, the borehole was thoroughly cleaned. The sampling assembly was driven to the required depth manually with the help of a jarring link. Sample collected in the lower tube was retained, labeled and waxed at both ends before sending to the laboratory.

Representative disturbed soil samples were collected frequently from auger, split spoon sampler of standard penetrometer and cutting shoe of undisturbed sampling assembly to maintain a continuous record of strata encountered.

3.0 LABORATORY TESTS:

All samples brought to the laboratory were first subjected to through physical examination before judiciously selecting a few of them for carrying out various relevant tests as per IS specifications. The following laboratory tests were conducted on soil samples.

⇒ Determination of Natural Moisture Content and Bulk density.

⇒ Determination of Liquid Limit and Plastic Limit

⇒ Sieve and Hydrometer Analysis.

⇒ Determination of Specific Gravity.

⇒ Triaxial Compression (UU) / Direct Shear (DS) Test

⇒ One-dimensional Consolidation Test.

Laboratory test results are summarized in “Test Result Sheet”.

3.1 Natural moisture content & Atterberg limits

Natural moisture content of this soil samples have been determined by oven drying liquid limit and plastic limit of clayey samples were determined (a) to classify the soil by the IS classification system and (b) to qualitatively assess their consistency and compressibility.

3.2 Bulk density

These were determined by measuring the weights and dimensions of tri-axial shear test samples before testing. The bulk densities of the samples have been given in the enclosed laboratory sheet.

3.3 Grain size analysis

The grain size distributions of some representative samples were determined from hydrometer and /or sieve analysis. The results are plotted and shown in this report.

3.4 Tri-axial shear test (UU)

For triaxial shear and unconfined compressive strength tests, three no. 38 mm diameter 76 mm long specimens were obtained by jacking out the soil core, each into a thin-walled brass tube, having the wall thickness of 1/32". The inside of the tubes was coated with a thin layer of silicon oil. The tests were run on the clayey silt samples to determine their shear strengths. The cell pressures employed, in case of triaxial tests were 0.5, 1.0 and 1.5 kg/sq.cm. The samples were tested under quick condition at a rate of 1.25 mm/min and were loaded up to maximum 20% axial strain.

Direct shear test (DS)

Direct shear test was conducted on disturbed remoulded sand samples of size 60mm x 60mm x 25mm in direct shear box under normal stresses of 0.5, 1.0 and 1.5 kg/sq.cm at specified density and moisture content to determine shear strength parameters.

3.5 Consolidation test

To obtain specimens for consolidation test, the odometer ring was placed on the trimmed horizontal faces of the soil within the 10 cm diameter sampling tube and the soil around the cutting edge was gradually removed with a spatula as the ring was gently pushed into the soil. The ring with the soil was then removed by cutting across the soil core with the help of a piano

wire saw. Consolidation tests were run in floating ring type odometers, mounted in single & four unit consolidation frames under standard load increment ratio starting from 0.25 kg/sq.cm and going up to 8 kg/sq.cm in general. The pressure vs void ratio curves are given in this report.

3.6 Specific Gravity

The Specific Gravity of the soil samples was determined by adopting standard procedure. The soil sample was oven dried for 24 hours and pulverized. The sample was then poured into a specific gravity bottle and topped up with distilled water. The specific gravity bottle was stirred and heated to eliminate air bubbles. The weight of the specific gravity bottle was recorded along with the temperature of the sample.

3.7 STANDING WATER LEVEL:

Water levels in the bore holes were observed and 24 hours after completion of boring operation, the final water readings were recorded in the field and are shown in the bore-logs. The average level of water was found approximately at **2.10 m** below E.G.L.

4.0 SUB-SOIL STRATIFICATION AND PROPERTIES:

A study of the borehole logs, laboratory test results and field standard penetration test results indicates the following stratification of the sub-soil deposit. The deposits in all the boreholes are more or less of similar nature.

Table-2 : SUB-SOIL STRATIFICATION

Stratum	Description Of Stratum	Bore Hole No.	Depth Of Existence Below E.G.L.			Thickness (M)
			B. H.	From (m)	To (m)	
I	Fill: filling with brown clayey silt / plastics, brick pieces etc.	1 & 2	1	0.00	2.00	1.50
			2	0.00	0.50	
II	Brown silty clay / clayey silt with lenses of silt	1 & 2	1	2.00	5.00	3.50
			2	0.50	4.00	
III	Loose to medium grey silty fine sand	1 & 2	1	5.00	17.00	13.00
			2	4.00	18.00	
IV	Stiff bluish grey silty clay / clayey silt	1 & 2	1	17.00	20.50	2.50
			2	18.00	20.50	
V	Stiff mottled brown and bluish grey silty clay /clayey silt	1 & 2	1	20.50	24.00	3.50
			2	20.50	24.00	
IV	Medium grey fine sand with mica	2	2	24.00	25.45*	1.45

* Up to termination Depth

Brief descriptions of the various soil strata are as follows.

STRATUM I : (0.0 – 1.50m)

The soil in this stratum consists of top soil with brownish silt / clayey silt and maximum thickness is **1.50m**. For design and calculation of overburden pressure, its bulk unit weight may be considered as 1.70 t/m^3 .

STRATUM II: (1.50 – 5.00m)

The soil in this stratum consists of soft / medium brownish silty clay / clayey silt with lenses of silt with average thickness of about **3.50m**. Range of 'N' value is 5 - 6 blows / 30cm with average of 6 blows / 30cm. As per IS, the soil may be classified as **CI**. The following values of relevant soil parameters may be considered in design (Based on field 'N' values, laboratory tests):

Bulk Unit Weight γ : 1.85 t/m³

Moisture Content : 26%

LL =36%, PL = 23%

Cohesion Value, C_u = 3.2 t/m²

m_v : 0.0040 m²/ t

STRATUM III: (5.00 – 18.00m)

The soil in this stratum consists of loose / medium grey silty fine sand. Field 'N' value is 13-26 blows / 30cm and extending down to a maximum depth of **18.00 m** below E.G.L. with average thickness of **13.00m**. As per IS, the soil may be classified as **SM/SP**. The following values of relevant soil parameters may be considered in design (Based on field 'N' values, laboratory tests):

Bulk Unit Weight γ : 1.90 t/m³

Moisture Content : 27 %

Angle of shearing resistance, $\phi = 31^0$

STRATUM IV: (18.00 – 20.50m)

The soil in this stratum consists of medium / stiff bluish grey silty clay / clayey silt with average thickness of about **2.50m**. Range of 'N' value is 10 - 12 blows / 30cm with average of 11 blows / 30cm. As per IS, the soil may be classified as **CI**. The following values of relevant soil parameters may be considered in design (Based on field 'N' values, laboratory tests):

Bulk Unit Weight γ : 1.90 t/m³

Moisture Content : 21%

LL =42%, PL = 17%

Cohesion Value, C_u = 6.5 t/m²

STRATUM V: (20.50 – 24.00m)

The soil in this stratum consists of stiff bluish grey silty clay / clayey silt with average thickness of about **3.50m**. Range of 'N' value is 13 - 17 blows / 30cm with average of 15 blows / 30cm. As per IS, the soil may be classified as **CI**. The following values of relevant soil parameters may be considered in design (Based on field 'N' values, laboratory tests):

Bulk Unit Weight γ : 1.93 t/m³

Moisture Content : 20%

LL =43%, PL = 24%

Cohesion Value, C_u = 7.5 t/m²

STRATUM VI: (24.00 – 25.45m)

The soil in this stratum consists of medium grey fine sand with mica with 'N' value 28 blows / 30cm extending down to termination depth of **25.45m** below E.G.L. As per IS, the soil may be classified as **SM/SP**. The following values of relevant soil parameters may be considered in design (Based on field 'N' values, laboratory tests):

Bulk Unit Weight γ : 1.90 t/m³

Angle of shearing resistance, ϕ = 33⁰

5.0 RECOMMENDATION FOR FOUNDATION:

Considering the subsoil conditions and soil parameters as obtained for this proposed site of bearing capacities of both shallow and deep (well) foundations are given below.

5.1 Type 1 : Shallow Foundations

From the subsoil exploration it may be seen that soil below the topfill of average thickness 1.50m is soft / firm extending down to a depth of **5.00 m**. This is followed by loose / medium / dense / very dense silty sand down to 18.00m underlain by medium / stiff bluish grey / mottled brown silty clay / clayey silt down to 24.00m and silty sand till termination depth of **25.45m** below G.L.

As the soil in the upper region is soft / firm in nature with average 'N' value 6 blows / 30cm in the upper reaches having moderate compressibility, it is suggested to adopt shallow foundations, if required, for the proposed project. Bearing capacities of such foundations (isolated) of different sizes resting at a depth of 1.5m below G.L. are given below:

Table 3 Bearing capacity of shallow foundation

Type of foundation	Size of foundation	Safe bearing capacity(ton / m ²)	Settlement (mm)
ISOLATED	1.5m x 1.5m	10.2	26
	2.0m x 2.0m	9.8	33
	2.5m x 2.5m	9.5	40

5.2 Type 2: Deep Foundations (Well foundation)

For the proposed pumping station a well foundation of diameter 12m x depth 11m will be constructed at the site. Bearing capacity of such well foundation has been determined and is presented below: **Diameter 12m x Depth 11m**

Safe bearing capacity 21 ton/m²

Settlement 100 mm

As the well foundation for the proposed pumping station will be resting in a deep deposit of sand layer following operations are to be carried out while sinking:

- Excavate the material inside the well curb
- Allow the well to remain vertical
- Up to a depth of 1m, excavation under water can be made manually. When the depth of water exceeds 1m, excavate by grabs
- When the well does not sink, sunk it applying kentledge

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- After sinking the well properly, bottom plug and bottom raft are to be constructed after lowering the ground water table below the tip level of well foundation. Details of dewatering system to be adopted are as follows:

a. Take coefficient of permeability of sand, $k = 0.0001 \text{ m/sec}$

Depth of well point is taken to be 16m below existing ground level and GWT at the site is 2m below EGL which is to be lowered to 2.0m below the bottom of well by dewatering. So, radius of influence is calculated as below:

So, for the well influence radius $= C' (h_{wo} - h_{wi})k^{0.5} = 3000*(14-3)(0.0001)^{0.5}=330\text{m}$. However, for estimation of number of well points influence is taken to be 100m.

b. Total discharge required $= \phi * k * (h_{wo}^2 - h_{wi}^2) / \ln(R_i/R_0) = 0.0209 \text{ m}^3/\text{sec}$

c. Taking diameter of wells in well points = 100mm, discharge by each well $= 0.0077 \text{ m}^3/\text{sec}$

d. Nos of well points $= 0.0209 / 0.0077 = 3$, however, taking a factor safety of 1.5, required number of well points = 5 with diameter 100mm and length 16m below EGL having filter of length 1000-1200mm length at the tip.

e. During installation proper quality control should be done to ensure location and depth of well, size of the holes, quality of the filter material and connection of all pipes with pumps. After the installation of the dewatering system a full-scale pumping test should be performed to evaluate the performance for adequacy or need for any modification of the existing system.

f. The dewatering should be continued without any interruption during and also after construction, till the concrete get hardened as may be decided by the Engineer-in-charge.

- Alternatively, grouting may be done before construction of bottom plug and base raft. However, due to the uncertainty in effectiveness of improvement due to grouting, post-grouting tests are to be conducted to reduce the coefficient of permeability which will totally prevent inflow of water to the well during construction of bottom plug and base raft etc.

5.3: Type 3 : Deep Foundation (Pile Foundation)

Bored cast -in -situ pile foundation resting at **20.0m** below existing G.L with cut off level at **5.00m** below existing ground level may be adopted for the proposed construction at the site. Bearing capacity of such piles of different diameter **450mm, 500mm, 550mm** are given in **Table – 3**. Typical calculations are given in Annexure.

Adequate precautions during constructions of piles should be taken in order to prevent collapse of the walls of the boreholes. For this bentonite slurry is to be used and proper schedule of construction should be maintained. Boreholes should be cleaned properly after lowering the reinforcement and before concreting the piles. Integrity tests and also pile load tests should be conducted as per IS code of practices.

Table– 4: R.C.C. BORED CAST-IN-SITU PILE FOUNDATION

Pile Dia.	Cut-off Level	Pile Tip Level	Pile Shaft Length	Safe Vertical Capacity of Pile		Grade of Concrete In Pile=M30	
				In Compression (Ton)	In Tension Uplift (Ton)	Safe lateral capacity for a deflection of 5mm	Depth of fixity (below cut of level)
500 mm	5.00m	20.0m	15.0 m	37	27	5.20 ton	4.59 m
550 mm	Below			41	30	6.06 ton	4.96 m
600 mm	EGL.			45	32	6.96 ton	5.32 m

6.0 : RECOMMENDATIONS :

- 1) From the subsoil exploration it is observed that sub-soil below the top fill consists of soft / firm silty clay / clayey silt down to a maximum depth of **5.00m** below G.L. followed by layer of loose / medium / dense silty sand / silty clay / clayey silt down to termination depth of **25.45m**.

- 2) It is, therefore, suggested to adopt shallow foundations for one to two storied buildings, if required, at the proposed site. Bearing capacity of such foundations of different sizes is given in Table 3.
- 3) For the pump house well foundation of diameter 12m x depth 11m may be constructed at the site. Safe bearing of such foundation is given in section 5.2.
- 4) Bored Cast-in-situ pile foundation resting at a depth of 20.0m with Cut – Off level 5.00m B.G.L. may be adopted, if required, to take superstructure load. Bearing capacity of such piles recommended to take superstructure load with (Shaft length 15.00m) has been given in Table 4.
- 5) Proper care should be taken during sinking to maintain verticality of the well foundation. Further, dewatering should be done to lower the ground water level below the founding level of well during construction of bottom plug and the raft at the base of the well.
- 6) Adequate precautions during constructions of piles should be taken in order to prevent collapse of the walls of the boreholes. For this bentonite slurry is to be used and proper schedule of construction should be maintained. Boreholes should be cleaned properly after lowering the reinforcement and before concreting the piles.
- 7) Pile load tests should be conducted as per IS. Code of practice. Integrity tests should also be done to check the continuity of piles.
- 8) All stability criteria should be checked as per BIS code of practice.

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CALCULATIONS

Safe load calculation for Shallow foundation :

Location : Chetla Lock Drainage Pumping Station

The net allowable bearing capacity of 2 m x 2 m square footing founded at 1.5 m below G.L. has been obtained as follows :

Depth of foundation (Df) = **1.50 m**

Length of the foundation (L) = **2.00 m** Breadth of the foundation (B) = **2.00 m**

Safe bearing capacity of soil (qn) = $\frac{1}{F} \times C \times N_c \times s_c \times d_c \times i_c$

Where,

C (Cohesion) = **3.2 t/m²**

Nc = **5.14**

sc (Safe factor) = $1 + 0.2 B/L =$ **1.30**

dc (Depth factor) = $1 + 0.2 Df/B =$ **1.15**

ic (Inclination factor) = **1.0**

F (factor of safety) = **2.5**

qs = **9.84 t/m²** Say = **9.84 t/m²**

Estimation of settlement :

a) Immediate settlement (Si) = $\frac{(q_n \times B)}{E} \times (1 - \nu^2) I_e$

Where,

qn (Net foundation pressure) = **9.84 t/m²**

B (Bredth of the foundation) = **2000 mm**

E (Young's modulus of soil) = **1600 t/m²**

v (Poisson,s ratio) = **0.5**

I_p (Influence coefficient) = **1.12**

Si = **10.33 mm**

b) Consolidation Settlement (Sc) = $m_v \times H \times \delta \tau$

Where,

i)1st stratum

m_v (Coefficient of volume compressibility) = **0.004**

H (Thickness of the stratum considered) = **3.50 m**

(Increase of effective pressure at the center of the stratum considered) = **2.797768249**

Sc1 = **39.17 mm**

i)2nd stratum

m_v (Coefficient of volume compressibility) = **0**

H (Thickness of the stratum considered) = **0.00 m**

(Increase of effective pressure at the center of the stratum considered) = **1.300615405**

Sc2 = **0.00 mm**

Sc = (Sc1+Sc2) = **39.17**

Therefore total settlement = **33.33 mm**

Say = **33.33 mm** < **75 mm** Hence ok

The suggested net safe bearing capacity to be adopted for the 2m x 2m isolated footing at 1.5 m depth is 9.835904 t/m² with an estimated settlement of 33.3320035100444 mm.

CALCULATION FOR WELL FOUNDATION

LOCAL SHEAR FAILURE

Circular foundation

Size (m)	12
B (m)	12
D_f (m)	11
C (t/m^2)	0
ϕ (degree)	31
ϕ' (degree)	21.83
γ (t/m^3)	1.84
q (t/m^2)	9.24
α (degree)	0

Bearing Capacity factor

N_q'	7.96
$N\gamma'$	7.40

Shape Factor

s_q	1.2
s_γ	0.6

Depth Factor

d_q	1.14
d_γ	1.14

Inclination Factor

i_q	1
i_γ	1
W'	0.5
$q(N_q'-1)s_qd_qi_q$	87.59
$0.5B\gamma N_\gamma' s_\gamma d_\gamma i_\gamma W'$	27.82
N.U.B.C.	115.41
F.O.S.	2.5
N.S.B.C.	46.16

GENERAL SHEAR FAILURE

Circular foundation

Size (m)	12
B (m)	12
D_f (m)	11
C (t/m^2)	0
ϕ (degree)	31
ϕ' (degree)	21.83
γ (t/m^3)	1.84
q (t/m^2)	9.24
α (degree)	0

Bearing Capacity factor

N_q'	21.38
$N\gamma'$	27.53

Shape Factor

s_q	1.2
s_γ	0.6

Depth Factor

d_q	1.16
d_γ	1.16

Inclination Factor

i_q	1
i_γ	1
W'	0.5
$q(N_q'-1)s_qd_qi_q$	262.54
$0.5B\gamma N_\gamma' s_\gamma d_\gamma i_\gamma W'$	105.92
N.U.B.C.	368.46
F.O.S.	2.5
N.S.B.C.	147.38

General Shear = 147.38
Local Shear = 46.16

BC For 30% R_D = 66.41 t/m^2

Foundation Size(M)= 12 20 2350

Settlement(mm) = 308.58

For 100mm settlement safe bearing capacity = 21 t/m^2

SAMPLE CALCULATION OF PILE CAPACITY

SITE : BANSDRONI PUMPING STATION, WARD NO. - 113, B. R. NO. - XI, KOLKATA - 700 070.

CUT OFF LEVEL AT 2.00 (m)	AVG. THICK.	A _p	D in (m)	γ	N _γ	P _D	N _q	K	P _{Di}	Φ	tan δ	A _{Si}	A _p	C _p	N _c	α	C	A _s
CUT OFF LEVEL	5.00			0.00							-0.05	D						D
STRATUM III	13.00			1.90	17.80	15.00	14.00	1.05	5.85	31	0.53	D				0.00	0.00	40.83 D
STRATUM IV	2.00			1.90	0.00	0.00	0.00	0.00	12.60	0	-0.05	D				0.68	6.50	6.28 D
END PROP	3.00	0.785		1.90	0.00	0.00	0.00	0.00	13.50	0	-0.05	D	0.785	6.50	9.00	0.00	0.00	0.00 D
SAND											CLAY							

Here, $A_p = \frac{\pi D^2}{4}$, $N_\gamma = (N_q - 1) \times \tan(1.5 \times \text{deg})$, $K = 1 \text{ OR } 2$, $\tan \delta = \tan(\Phi - 3^\circ)$, $A_{Si} = \pi Dh$

Ultimate Skin Resistance

$$Q_{ult} = (\alpha \times C \times A_s) + \sum K \times P_{Di} \times \tan \delta \times \pi \times D \times h$$

For Cohesive Soil
 $(\alpha \times C \times A_s) = (\alpha \times C \times \pi \times D \times h)$

Depth 18.00m to 20.00m - $Q_{uiii} = 0.68 \times 6.50 \times 3.141 \times D \times 2.00 = 27.766 D$

For Non - Cohesive Soil
 $\sum K \times P_{Di} \times \tan \delta \times \pi \times D \times h$

Depth 5.00 m to 18.00 m - $Q_{uiii} = 1.05 \times 5.85 \times 0.532 \times 3.141 \times D \times 13.00 = 133.36 D$

Total Ultimate Skin Resistance = 161.13 D

P_{Di} Calculation

$P_{di (iii)} = (0.000 \times 5.000) + (0.850 \times 0.00) + (0.900 \times 6.500) = 5.85$

END BEARING

For Cohesive Soil

$Q_{uit} = A_p (C_p N_c)$
 $= \frac{\pi D^2}{4} (6.500 \times 9.000) = 45.923 D^2$

Ultimate load carrying capacity in Compression = $0.000 D^3 + 45.923 D^2 + 161.13 D$

Ultimate load carrying capacity in Tension = $161.128 D$

For uniform diameter straight shaft RCC bored Pile when toe at 20.00 m below EGL and cut off at 2.00 m below EGL

	500	550	600
Safe load carrying capacity in Compression (MT) (Using Factor of Safety = 2.5)	37	41	45
Safe load carrying capacity in Tension (MT) (Using Factor of Safety = 3)	27	30	32

SITE: BANSDRONI PUMPING STATION, WARD NO. - 113, B. R. NO. - XI, KOLKATA

Pile Dia (D) = 0.50 meter
Grade of Concrete = M 30
N - Value = 14 (Considering saturated sand filling)

Depth of Fixity Calculation

Constant of horizontal subgrade reaction η_h = 1.976 MN/m³

Here, $E = 5000\sqrt{f_{ck}} = 27386.13$ MN/m²

And $I = \frac{\pi D^4}{64} = 0.00306796$ m⁴

Hence, relative stiffness factor $T = \sqrt[3]{\frac{EI}{\eta_h}} = 2.12$ meter

Unsupported length of pile (L_1) = 0 meter

Therefore, $L_1/T = 0.00$

From graph (L_f/T - Vs- L_1/T) for normally loaded clays & free head pile, $L_f/T = 2.17$
(From IS 2911-Part 1-Section 2 : 2010)

Hence, depth of fixity (L_f) = 4.59 meter

Therefore, effective depth of fixity (L_{eff}) = $L_f + L_1 = 4.59$ meter

Calculation of Lateral Load Capacity

Deflection $\delta = 0.005$ upto 500 dia pile and above 500 dia 1% of pile dia.

Here, $\delta = 0.005$ m

Lateral Load Capacity of Pile = $[Q]_D = \frac{12EI \times \delta}{(L_f + L_1)^3} = 0.051999$ MN = 5.20 ton
ton

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LOCATION : BANSDRONI PUMPING STATION, WARD NO. - 113, BOROUGH NO. - XI, KOLKATA - 700 070.				LABORATORY TEST RESULT SHEET										SHEET NO. 1		JOB NO.							
B.H. No. & Sample No.	Type of Sample	Depth (meter)	Description	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	IS classification	Type of Test	Bulk density gm/cc	Water Content %	UNCONFINED/ TRIAXIAL COMPRESSION				CONSOLIDATION				GRADING			
												Lateral Pressure Kg/cm ²	Compressive Strength Kg/cm ²	Cohesion Kg/cm ²	Angle of friction degrees	Consolidation Pressure Kg/cm ²	Coefficient of Volume decrease Cm ² /kg	Gravel %	Sand %	Silt %	Clay %	% Passing micron IS Sieve	
1	U	3.00-3.45	Medium brown silty clay with lenses of silt / high silt content with traces of kankars.	36	24		2.66		UU	1.85 1.87 1.84	20.4 20.6 19.9			0.30	0	0.25 - 0.5 0.5 - 1.0 1.0 - 2.0 2.0 - 4.0 4.0 - 8.0	0.0420 0.0297 0.0219 0.0161 0.0092	2	6	72	20	92 (hyd)	
1	P	6.00-6.45	Loose grey sandy silt / silty sand with traces of clay.	N	P						22.2							0	47	50	13	63 (hyd)	
1	P	12.00-12.45	Medium grey silty fine sand.	N	P				DS	1.85	30.6			0	33			0	96	4	0	4	
1	P	18.00-18.45	Bluish grey sandy silty clay.	42	17						23.5							0	21	52	27	79 (hyd)	
1	P	20.00-20.45	Stiff bluish grey silty clay.	-	-				UCR	1.90	21.4			0.70	0			0	7	54	39	93 (hyd)	
2	U	2.00-2.45	Soft / medium brown silty clay.	43	24				UU	1.84 1.83 1.86	25.7 25.5 24.8			0.35	0			0	1	64	35	99 (hyd)	
2	P	5.00-5.45	Loose grey silty fine sand.	N	P						25.0							0	95	5	0	5	
2	P	9.50-9.95	Medium grey silty fine sand with traces of clay.	N	P				DS	1.96	23.8			0	32			0	53	34	13	47 (hyd)	
2	P	15.50-15.95	Medium grey silty fine sand.	N	P						25.8							0	96	4	0	4	
2	P	23.00-23.45	Stiff mottled brown and bluish grey silty clay with traces of sand.	43	24				UCR	1.93	20.0			0.75				0	13	56	31	97 (hyd)	
2	P	25.00-25.45	Medium brown silty fine sand.	N	P						27.5							0	84	16	0	16	

NOTE :N.P.=Non-Plastic,Hyd= Hydrometer,UU= Triaxial Undrained,UD= Triaxial Drained,UC= Unconfined,UCR= Unconfined Remoulded,CU/CD= Consolidated Undrained/Drained,DS= Direct Shear.

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BORELOG DATA SHEET

SITE:		BANSDRONI PUMPING STATION, WARD NO. - 113, B. R. NO. - XI, KOLKATA - 700 070.			
COMMENCED ON	26.6.2022	BORE HOLE NO.	1 (one)	SAMPLES	NOS.
COMPLETED ON	27.6.2022	TERMINATION DEPTH	23.95 m below E.G.L.	UNDISTURBED (U)	1
BOREHOLE DIA	150 mm			PENETROMETER (P)	12
R.L.GROUND				DISTURBED (D)	2
WATER STRUCK				WATER SAMPLES (W)	Nil
STANDING WATER LEVEL	2.20 M below E.G.L.			CO - ORDINATES	Not known
TYPE OF BORING	Augar & Rotary Wash method.				

ALL DEPTHS ARE MEASURED FROM THE EXISTING GROUND LEVEL (E.G.L.)

DESCRIPTION	DEPTH (m)		THICKNESS (m)	SAMPLES		'N' VALUE
	From	To		Type	Depth (m)	
Fill: filling with brown clayey silt / plastics, brick pieces etc.	0.00	2.00	2.00	D	1.00	
				D	2.00	
Soft / medium brown silty clay / clayey silt with lenses of silt	2.00	5.00	3.00	U	3.00-3.45	
				P	4.50-4.95	5
Loose to medium grey silty fine sand	5.00	17.00	12.00	P	6.00-6.45	13
				P	7.50-7.95	15
				P	9.00-9.45	14
				P	10.50-10.95	18
				P	12.00-12.45	23
				P	14.00-14.45	25
Stiff bluish grey / grey silty clay with traces of sand.				P	16.00-16.45	23
	17.00	20.50	3.50	P	18.00-18.45	11
				P	20.00-20.45	12
Stiff mottled brown and bluish grey silty clay / clayey silt.	20.50	24.00	3.50	P	21.50-21.95	13
				P	23.00-23.45	17

BOREHOLE TERMINATED AT 24.00 M DEPTH

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BORELOG DATA SHEET

SITE:		BANSDRONI PUMPING STATION, WARD NO. - 113, B. R. NO. - XI, KOLKATA - 700 070.				
COMMENCED ON	27.6.2022	BORE HOLE NO.	2 (two)	SAMPLES	NOS.	
COMPLETED ON	28.06.2022	TERMINATION DEPTH	25.45 m below E.G.L.	UNDISTURBED (U)	1	
BOREHOLE DIA	150 mm			PENETROMETER (P)	15	
R.L.GROUND	(+) 0.20 M			DISTURBED (D)	2	
WATER STRUCK				WATER SAMPLES (W)	Nil	
STANDING WATER LEVEL	2.00 M below EGL			CO - ORDINATES	Not known	
TYPE OF BORING	Augar & Rotary Wash method.					
ALL DEPTHS ARE MEASURED FROM THE EXISTING GROUND LEVEL (E.G.L.)						
DESCRIPTION	DEPTH (m)		THICKNESS (m)	SAMPLES		'N' VALUE
	From	To		Type	Depth (m)	
Fill: filling brown silty clay & brick pieces.	0.00	0.50	0.50	D	0.50	
Soft /medium brown silty clay / clayey silt.	0.50	4.00	3.50	D	1.00	
				U	2.00-2.45	
				P	3.45-3.95	6
Loose to medium grey silty fine sand	4.00	18.00	14.00	P	5.00-5.45	14
				P	6.45-6.95	17
				P	8.00-8.45	19
				P	9.50-9.95	18
				P	11.00-11.45	21
				P	12.50-12.95	23
				P	14.00-14.45	23
				P	15.50-15.95	25
				P	17.00-17.45	26
Stiff bluish grey silty clay / clayey silt	18.00	20.50	2.50	P	18.50-18.95	10
				P	20.00-20.45	12
Stiff mottled brown and bluish grey silty clay / clayey silt	20.50	24.00	3.50	P	21.50-21.95	13
				P	23.00-23.45	17
Medium brown silty fine sand	24.00	25.45	1.45	P	25.00-25.45	28
BOREHOLE TERMINATED AT 25.45 M DEPTH						

SITE: BANSDRONI PUMPING STATION, WARD NO.-113, B. R. NO. - XI, KOLKATA - 700070

SITE : BANSDRONI PUMPING STATION, WARD NO. - 113, B. R. NO. - XI, KOLKATA

Borehole Location

