Draft Initial Environmental Examination

April 2016

IND: Kolkata Environmental Improvement Investment Program (KEIIP) Tranche 2 - Sewerage and Drainage

Prepared by the Kolkata Municipal Corporation for Asian Development Bank. This is a revised version of the draft originally posted in May 2012 available on http://www.adb.org/sites/default/files/project-document/73266/42266-023-ind-rp-draft-02.pdf

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CURRENCY EQUIVALENTS

(as of 22 April 2016)

Currency unit	–	Indian rupee (Rs)
Rs1.00	=	$0.0150
$1.00	=	INR66.4983

WEIGHTS AND MEASURES

CFU	-	Colony Forming Unit
cum/hr	-	cubic meter per hour
cum/m^3	-	cubic meter
dB(A)	-	Decibal in A network
Ft	-	feet
Ha	-	hectare
Km	-	kilometer
km^2 or sq km	-	square kilometer
KVA	-	Kilovolt ampere
lpcd	-	liter per capita per day
M	-	meter
m/yr	-	meter per year
mg/l	-	milligram per liter
MGD	-	million gallon per day
MGH	-	million gallon per hour
MPN	-	Most Probable Number
MT	-	Metric Ton
ML	-	million liter
MLD	-	million liter per day
mm	-	Millimeter
NTU	-	Nephelometric turbidity Unit

ABBREVIATIONS

AAS	-	Atomic Absorption Spectroscopy
ADB		Asian Development Bank
APHA	-	American Public Health Association
ASI	-	Archaeological Survey of India
BIS	-	Bureau of Indian Standards
BOD	-	Biochemical Oxygen Demand
CBO	-	Community Based Organization
COD	-	Chemical Oxygen Demand
CESC	-	Calcutta Electric Supply Corporation'
CHWTSDF	-	Common Hazardous Waste Treatment Storage & Disposal Facility
CPCB	-	Central Pollution Control Board
CPHEEO	-	Central Public Health and Environmental Engineering Organisation
CTE	-	Consent to Establish
CTO	-	Consent to Operate
CRZ	-	Coastal Regulation Zone
CW	-	Canal Water
DG	-	Diesel Generator
DO	-	Dissolved Oxygen
DPR	-	Detailed Project Report
DSC	-	Design and Supervision Consultants
DWF		Dry Weather Flow
DVC	-	Damodar Valley Corporation
KMC	-	Kolkata Municipal Corporation
EA	-	executing agency
EARF	-	environmental assessment and review framework
EIA	-	environmental impact assessment
EKW	-	East Kolkata Wetlands
EKWMA	-	East Kolkata Wetland Management Authority
EMP	-	Environmental Management Plan
GC	-	Gas Chromatography
GRC	-	Grievance Redressal Committee
GRM	-	grievance redress mechanism
GW	-	Groundwater
HC	-	Hydrocarbons
HPLC	-	High-performance liquid chromatography
ICP	-	Inductively Coupled Plasma Chromatograph
IEE	-	initial environmental examination
INR	-	Indian National Rupee
KEIP	-	Kolkata Environmental Improvement Project
KEIIP		Kolkata Environmental Improvement Investment Program
KMC	-	Kolkata Municipal Corporation
KMDA	-	Kolkata Metropolitan Development Authority
LPG	-	liquefied petroleum gas
MoEF	-	Ministry of Environment and Forest, Government of India
MSDS	-	Material Data Safety Sheet
MTBM	-	Micro Tunnel Boring Machine
NEERI		National Environmental Engineering Research Institute
NIOSH	-	National Institute of Occupational Health

NGO	-	nongovernment organization
NRW	-	nonrevenue water
O&M	-	operation and maintenance
PAH	-	Polynuclear Aromatic Hydrocarbon
PBPS	-	Palmer Bazar Pumping Station
PMC	-	Project Management Consultant
PMU	-	Project Management Unit
PS	-	Pumping Station
REA	-	Rapid Environmental Assessment
ROW	-	right-of-way
RP	-	resettlement plan
S&D	-	Sewage & Drainage
SEIAA	-	State Level Environmental Impact Assessment Authority
SPM	-	Suspended Particulate Matter
SEMR	-	Semi-annual Environmental Monitoring Report
SMU	-	Safeguard Monitoring Unit
SPS	-	Safeguard Policy Statement
STP	-	Sewage Treatment Plant
SWF	-	Storm Water Flow
SW	-	Surface Water
TDS	-	Total Dissolved Solids
TMP	-	Traffic Management Plan
TP	-	Tollygunge-Panchanangram
TSS	-	Total Suspended Solids
TVS	-	Total Volatile Solids
UFW	-	Unaccounted For Water
WBPCB	-	West Bengal Pollution Control Board
WBSEB		West Bengal State Electricity Board
WBWML	-	West Bengal Waste Management Ltd.
WTP	-	Water Treatment Plant

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EXECUTIVE SUMMARY

1. The Kolkata Environmental Improvement Investment Program (KEIIP) is a key urban infrastructure initiative of the Kolkata Municipal Corporation (KMC), and aims to improve the urban environment and quality of life in parts of Kolkata Municipal Area mainly through the delivery of improved water supply, sewerage, drainage and sanitation. The Project will be implemented over a 5-year period from 2014 to 2019. The Program is proposed to be implemented using a multi-tranche financing facility (MFF) of ADB. The first loan under the MFF, Tranche 1 or Loan 3053-IND, amounting to $100 million, was approved by ADB on 22 October 2013, signed on 3 March 2014 and made effective on 30 May 2014. Project 1, supported by Tranche1, included subprojects for improvement of infrastructure, operations and sustainability in sewerage, drainage and water supply in KMC. While Project 2, supported by the Tranche 2, will include physical and non-physical investments in water supply and sanitation improvement in KMC. Project 2 is aligned with improved access to water supply and sanitation in KMC as defined by KEIIP. At present KEIIP Tranche 1 project is under implementation.

2. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. This states that ADB needs environmental assessment of all project loans, program loans, sector loans, sector development program loans, and loans involving financial intermediaries, and private sector loans.

3. This IEE for Project 2 has been prepared as a part of Tranche 2 loan for the proposed sewerage and drainage subproject which includes (i)Sewerage & Drainage Work and Construction of 1 Pumping Station in Ward No. 114 (Part) in Borough XI,, (ii) Sewerage and Drainage Network in Rania Box catchment (Part of Ward 111, 112 & 113) in Borough XI , (iii) Sewerage and Drainage Network in Vivekananda Road Catchment (Part of Ward 113 & 114) & construction of 1 Pumping Station in Borough XI, (iv) Laying of sewer line along James Long Sarani in Ward - 123 & Ward – 124 by Micro-tunneling method, (v) Sewerage & Drainage Network within James Long Sarani and Mahatma Gandhi Road catchment in Borough XIII & XIV (Part of Ward no. – 123 & 124), (vi) Laying of lateral sewers in Borough XIII & Borough XIV (Part of Ward no. – 122 &123 and 128 to 132), (vii) S & D Mains and 2 pumping stations (Augnentation of Keorapukur MPS) in Tolly's Nullah/ Keorapukur Sub-basin in Borough- XIII (Ward no. 115 & Part of Ward no. 122), (viii) S & D Mains and Pumping station in Churial Extension catchment in Borough XIII and XVI (Part of Ward no. 122,123 & 124), and (ix) Construction of New Pumping Station at Lalababu Nikashi/ Bagjola Canal.

4. Construction work is likely to commence in 2016 and will be completed in 36 months for the total S&D subproject.

5. This IEE aims to (i) provide critical facts, significant finding, and recommended actions; (ii) present the national and local legal and institutional framework within which the environmental assessment has been carried out; (iii) provide information on existing geographic, ecological, social and temporal context including associated facilities within the subproject's area of influence; (iv) assess the subproject's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic, and physical cultural resources in the subproject's area of influence; (v) identify mitigation measures and any residual negative impacts that cannot be mitigated; (vi) describe the process undertaken during project design to engage stakeholders and the planned information disclosure measures and the process for carrying out consultation with affected people and facilitating their participation during project implementation; (vii) describe the subproject's grievance redress mechanism for resolving

complaints about environmental performance; (viii) present the set of mitigation measures to be undertaken to avoid, reduce, mitigate, or compensate for adverse environmental impacts; (ix) describe the monitoring measures and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures; and (x) identify who is responsible for carrying out the mitigation and monitoring measures.

6. Potential negative impacts were identified in relation to pre-, construction and operation of the improved infrastructure, but no permanent environmental impacts were identified as being due to either the subproject design or location. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the designs for the infrastructure. This means that the number of impacts and their significance have already been reduced by amending the design.

7. The public participation processes to be undertaken during project detailed design will ensure that stakeholders are engaged during the preparation/finalization of the IEE. The planned information disclosure measures and process for carrying out consultation with affected people will facilitate their participation during project implementation.

8. The subproject's Grievance Redress Mechanism will provide the citizens with a platform for redress of their grievances and describes the informal and formal channels, time frame and mechanisms for resolving complaints about environmental performance.

9. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between KMC, PMU, DSC and the contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (ii) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (iii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iv) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (v) ensure that safety recommendations are complied with.

10. The contractor for each package will be required to submit to KMC/PMU, for review and approval, site environmental plan (SEP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following **Tables 49 to 53** of the EMP to ensure no significant environmental impacts; (iii) monitoring program as per SEP; and (iv) budget for SEP implementation. No works are allowed to commence prior to approval of SEP.

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

12. The subproject is unlikely to cause significant adverse impacts because: (i) most of the individual components involve straightforward construction and operation, so impacts will be mainly localized; (ii) in most cases the predicted impacts are localized and likely to be associated with the construction process at isolated locations and are produced because the process is invasive, involving excavation, obstruction at specific construction locations, and earth movements; and (iii) being located mainly along roads and built-up area will not cause direct impact on terrestrial biodiversity values. The potential adverse impacts that are

associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

13. Therefore as per ADB SPS, the subproject is classified as environmental Category B and does not require further Environmental Impact Assessment.

I. INTRODUCTION

1. The city of Kolkata is the seventh largest metropolis in India, and had 4.5 million residents in 2011. It is the largest city in the state of West Bengal, and has been the biggest contributor to West Bengal's gross state domestic product. The continuous improvement in the city's urban environment is necessary to increase labor productivity through better health status of the urban population, especially when it has been experiencing lower population growth. There have been, however, geographical disparities in access and quality of the water supply and sewerage services, because the Kolkata Municipal Corporation (KMC), an urban local body with a mandate to provide these services under the KMC Act of 1980, has an aging water supply system, and has inadequate sewer coverage in the city's peripheral areas.[1] The Asian Development Bank (ADB) loans have assisted KMC in the expansion of the sewerage coverage through the Kolkata Environmental Improvement Project[2] (KEIP) since 2000. The Kolkata Environmental Improvement Investment Program[3](KEIIP) will help KMC not only continue sewer network expansion on a larger scale, but also gradually improve efficiency in water supply operations, which will enable KMC to generate operating surplus for capital investment in water supply and sewerage.

2. On 26 September 2013, ADB approved the provision of loans under a multi-tranche financing facility (MFF) for KEIIP for an aggregate amount not exceeding $400 million. The impact of KEIIP will be improved access to water supply and sanitation in KMC. The outcome will be improved water supply, sewerage and drainage service quality and operational sustainability in selected areas of KMC. Thus KEIIP has three outputs: (i) inefficient water supply assets rehabilitated; (ii) sewerage extension to peripheral areas continued; and (iii) financial and project management capacity further developed.

3. KMC is KEIIP's executing agency. A project management unit (PMU) created under KMC is implementing KEIIP.

4. The first loan under the MFF, Tranche 1 or Loan 3053-IND, amounting to $100 million, was approved by ADB on 22 October 2013, signed on 3 March 2014 and made effective on 30 May 2014. Project 1, supported by Tranche1,included subprojects for improvement of infrastructure, operations and sustainability in sewerage, drainage and water supply in KMC. While Project 2, supported by the Tranche 2, will include physical and non-physical investments in water supply and sanitation improvement in KMC. Project 2 is aligned with improved access to water supply and sanitation in KMC as defined by KEIIP.

5. The Tranche 2 project will be implemented over a 3-year period from 2016 to 2019. At present KEIIP Tranche 1 is under implementation.

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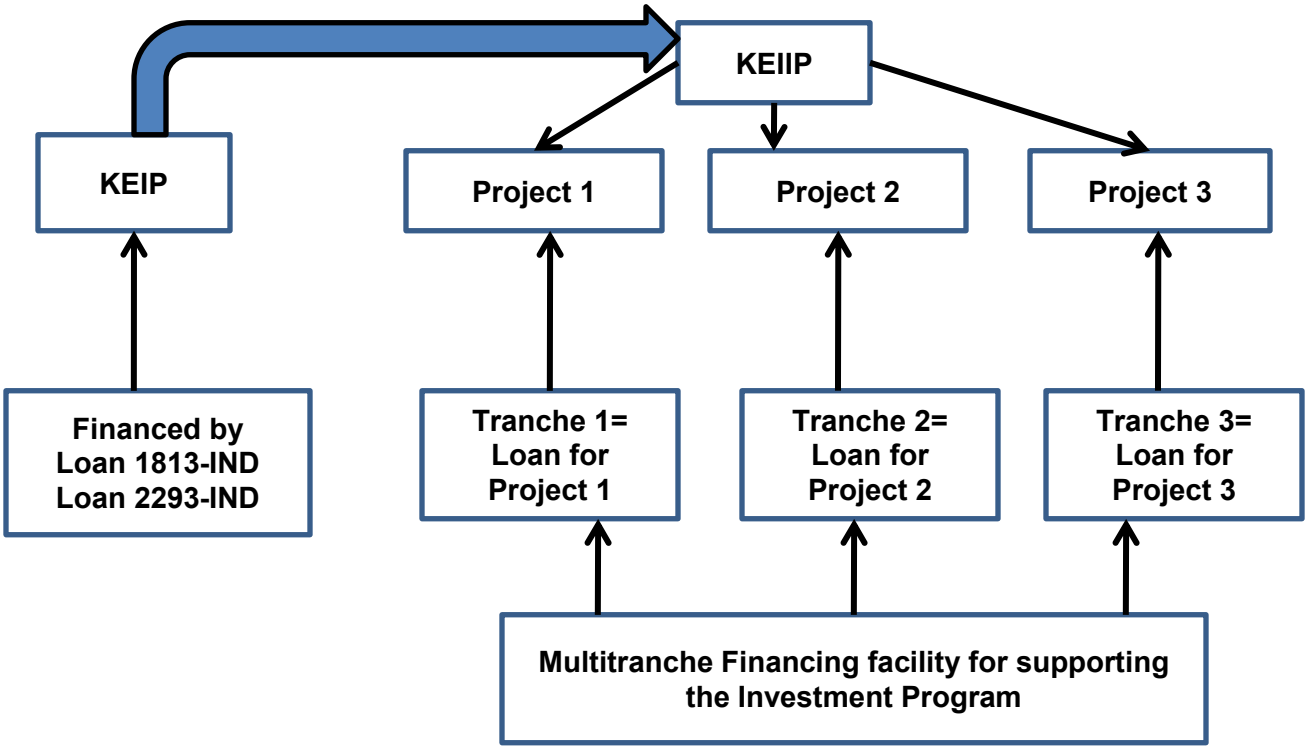
[1] The 1899 Calcutta Municipal Act defined the administrative domain of the municipal authority as covering 25 wards and 48.5 km^2. Many boundary changes followed, the latest one in January 1984, when Boroughs XI, XII, XIII, XIV, and XV were annexed to KMC. These boroughs are popularly known as the "added areas." Recently The KMC has been further expanded by including Joka area in the southern part of the city creating 3 additional wards under a new Borough XVI..

[2] ADB. 2000. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to India for the Calcutta Environmental Improvement Project.*Manila (Loan 1813-IND, $250 million, approved on 15 November 2000). The project completion date is 30 June 2012.
ADB 2006.*Report and Recommendation of the President to the Board of Directors: Proposed Supplementary Loan to India for the Kolkata Environmental Improvement Project.* Manila (Loan 2293-IND: $80 million, approved on 20 November 2006). The project completion date is 30 June 2012.

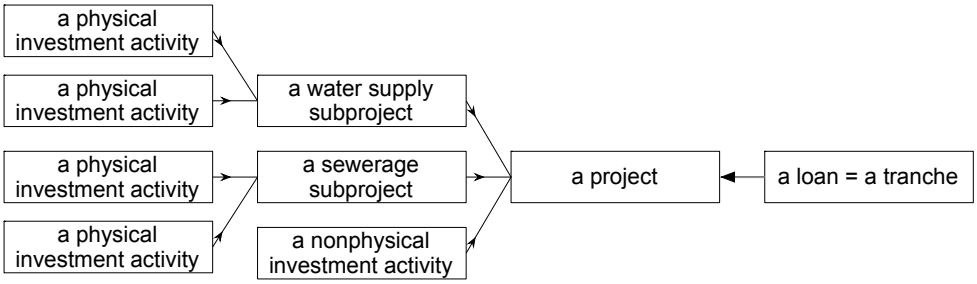
[3] ADB provided project preparatory technical assistance. ADB. 2009. *Technical Assistance to India for Preparing for Kolkata Environmental Improvement Project II*. Manila.

Figure 1: Relationship between the KEIP and the KEIIP



6. KEIIP Project 2 will include: (i) water supply, including pumping and transmission system, and (ii) sewerage and drainage (S&D) including dry weather flow (DWF) and storm water flow (SWF) pumping stations and sewage treatment plants (STPs).

Figure 2: Structure of a Project, Subprojects, and KEIIP Activities



7. A detailed description and outputs of Project 2 are given in the following paragraphs.

Output 1. Inefficient water supply assets rehabilitated.,. Project 2, under this output, will assist KMC to:

(i) Demarcate and hydraulically district metering areas (DMAs) and hydraulically isolate the DMAs, through installation of bulk water meters, procurement of NRW reduction equipment and upgrading of the SCADA, to ensure equitable

distribution and reduction in NRW across the overall water supply service area of KMC;

(ii) Upgrade water supply services in Joka and adjoining areas -peripheral areas recently merged into KMC - to deliver a continuous, pressurized supply of safe water to the population. It will include rehabilitation of the existing works; rehabilitation and construction of new transmission mains; construction of new overhead storage tanks and ground level storage reservoirs; renovation and construction of distribution mains and pipelines; and providing all customers with water connection meters; and

(iii) Implementation of performance based water loss/ NRW reduction measures in East Kolkata to provide continuous pressurized supply of safe water, including 20,000 consumer connections and metering, for a population of 200,000 population.

Output 2: Sewerage and drainage extension to peripheral areas continued. The overall objective of the subprojects is to rehabilitate and expand services in peripheral areas of KMC in South and South Eastern fringes such as Behala, Kasba to upgrade the sanitation status of the areas by collecting and transporting the domestic sewage, to be finally treated and disposed to the existing water bodies as also reducing the water logging problems in the target areas thereby reducing the loss in man hours, loss in properties and improvement in general sanitation of the areas by reduction of the level and duration of the water logging. Construction of a new pumping station in Lalababu Nikashi is expected to provide substantial relief to population in Cossipur area by reduction of chronic water logging problem in the areas.

Output 3: Financial and Project Management Capacity Further Developed. Under this output, Project 2 will continue to support KMC and the newly established Utility Finance Improvement Unit and Water Loss Management Unit in implementing the policies on NRW reduction, water metering, user charges, and in achieving institutional reforms and full cost recovery of services, and implementing Project 2.Outputs will include (i) training and capacity building of PMU, and (ii) consulting services to engage project management, supervision and design consultants.

8. All subprojects and their components are to comply with relevant safeguard requirements in each loan agreement for the Government of India, the state government of West Bengal, and the Safeguards Policy Statement (SPS), 2009 of ADB as applicable.

9. The provision for the use of frameworks is required for implementation of the investment program under the MFF to guide safeguard assessments in all tranches, as well as in non-sensitive components of each project under the investment program where detailed design takes place.

10. ADB classified the Project as environment Category B and accordingly initial environmental examination (IEE) is required for all subprojects. This IEE has been prepared as a part of Tranche 2 loan for the proposed sewerage and drainage subproject which includes (i)Sewerage & Drainage Work and Construction of 1 Pumping Station in Ward No. 114 (Part) in Borough XI,, (ii) Sewerage and Drainage Network in Rania Box catchment (Part of Ward 111, 112 & 113) in Borough XI , (iii) Sewerage and Drainage Network in Vivekananda Road Catchment (Part of Ward 113 & 114) & construction of 1 Pumping Station in Borough XI, (iv) Laying of sewer line along James Long Sarani in Ward - 123 & Ward – 124 by Micro-tunneling method, (v) Sewerage & Drainage Network within James Long Sarani and Mahatma Gandhi

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11. Construction work is likely to commence in 2016 and will be completed in 36 months for the total S & D Subproject.

12. This IEE aims to (i) provide critical facts, significant finding, and recommended actions; (ii) present the national and local legal and institutional framework within which the environmental assessment has been carried out; (iii) provide information on existing geographic, ecological, social and temporal context including associated facilities within the subproject's area of influence; (iv) assess the subproject's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic, and physical cultural resources in the subproject's area of influence; (v) identify mitigation measures and any residual negative impacts that cannot be mitigated; (vi) describe the process undertaken during project design to engage stakeholders and the planned information disclosure measures and the process for carrying out consultation with affected people and facilitating their participation during project implementation; (vii) describe the subproject's grievance redress mechanism for resolving complaints about environmental performance; (viii) present the set of mitigation measures to be undertaken to avoid, reduce, mitigate, or compensate for adverse environmental impacts; (ix) describe the monitoring measures and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures; and (x) identify who is responsible for carrying out the mitigation and monitoring measures.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

13. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, and loans involving financial intermediaries, and private sector loans.

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

(i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.

(ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

(iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.

(iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all Projects will result in insignificant impacts.

15. **Environmental Management Plan.** An EMP which addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project's impact and risks.

16. **Public Disclosure.** The IEE will be put in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into local language for the project affected people and other stakeholders. The following safeguard documents will be put up in ADB's website so that the affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

(i). For environmental category A projects, a draft EIA report at least 120 days before Board consideration;

(ii). Final or updated EIA and/or IEE upon receipt; and

(iii). Environmental monitoring reports submitted by the Project Management Unit (PMU) during project implementation upon receipt.

B. National and State Laws

17. Implementation of the subproject will be governed by the national and State of West Bengal environmental acts, rules, regulations, and standards. These regulations impose restrictions on activities to minimize/mitigate likely impacts on the environment. It is the responsibility of the project executing and implementing agencies to ensure subprojects are consistent with the legal framework, whether national, state or municipal/ local. Compliance is required in all stages of the subproject including design, construction, and operation and maintenance.

18. The following legislations are applicable to the subproject:

(i) Environmental (Protection) Act of 1986, its rules and amendments;

(ii) Environmental Impact Assessment (EIA) Notification of 2006 and 2009;

(iii) Water (Prevention and Control of Pollution) Act of 1974, its Rules, and amendments;

(iv) Air (Prevention and Control of Pollution) Act of 1981, its Rules and amendments;

(v) Central Pollution Control Board (CPCB) Environmental Standards;

(vi) Ancient Monuments and Archaeological Sites and Remains Rules of 1959;

(vii) Land Acquisition Act of 1894 and as amended in 1985;

(viii) Wetlands (Conservation and Management) Rules, 2010;

(ix) Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules 2008

(x) Noise Pollution (Regulation and Control) Rules of 2000 as amended up to 2011.

(xi) National Institute of Occupational Safety and Health Criteria for a recommended standard: occupational noise exposure, NIOSH Publication No. 98-126

(xii) West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006;

(xiii) East Kolkata Wetlands (Conservation and Management) Act, 2006

(xiv) The Child Labour (Prohibition and Regulation) Act, 1986

19. The summary of environmental regulations and mandatory requirements for the subproject is shown in **Table 1.** During the design, construction, and operation of the project the PMU and PIUs will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the contractor shall achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 1: Applicable Environmental Regulations for S & D subproject

Law	Description	Requirement
EIA Notification	The EIA Notification of 2006 and 2009 (replacing the EIA Notification of 1994), set out the requirement for environmental assessment in India. This states that Environmental Clearance is required for certain defined activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts. Category A projects requires Environmental Clearance from the National Ministry of Environment, Forest and Climate Change (MoEFC). Category B projects require Environmental Clearance from the State Environmental Impact Assessment Authority (SEIAA).	The proposed components of this sewerage and drainage subproject are not listed in the EIA Notification's "Schedule of Projects Requiring Prior Environmental Clearance" and thus Environmental Clearance is not required.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Control of water pollution is achieved through administering conditions imposed in consent issued under provision of the Water (Prevention and Control of Pollution) Act of 1974. These conditions regulate the quality and quantity of effluent, the location of discharge and the frequency of monitoring of effluents. Any component of the Project having the potential to generate sewage or trade effluent will come under the purview of this Act, its rules and amendments. Such projects have to obtain Consent to Establish (CTE) under Section 25 of the Act from West Bengal Pollution Control Board (WBPCB) before starting implementation and Consent to Operate (CTO) before commissioning. The Water Act also requires the occupier of such subprojects to take measures	No work components of the S & D subproject under will require CTE and CTO from WBPCB. The construction of the pumping stations and pipe laying do not attract the provisions of the Act[4].

[4] WBPCB has a composite CTO form (Form L) for Local Authorities covering all aspects of municipal operation activities. All operations of proposed interventions under the S & D subproject will be covered under one KMC CTO permit.

Law	Description	Requirement
	for abating the possible pollution of receiving water bodies.	
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	The subprojects having potential to emit air pollutants into the atmosphere have to obtain CTE under Section 21 of the Air (Prevention and Control of Pollution) Act of 1981 from WBPCB before starting implementation and CTO before commissioning the project. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution.	For the subproject, the following will require CTE and CTO from WBPCB: (i) diesel generators; and (ii) hot mix plants, wet mix plants, stone crushers, etc. if installed for construction. All relevant forms, prescribed fees and procedures to obtain the CTE and CTO can be found in the WBPCB website (www.wbpcb.gov.in). CTE to be obtained by KMC prior to award of contract. CTO to be obtained prior to commissioning. CTO renewal to be undertaken by KMC during operations stage.
Environment (Protection) Act, 1986 and CPCB Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards notified.	**Appendix 1** provides applicable standards for ambient air, air emission, effluents, receiving water bodies, and drinking water at the consumer end. Contractors are required to ensure all emissions and discharges during civil works conform to all applicable standards
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	**Appendix 2** provides applicable noise standards. Contractors are required to ensure all noise-producing activities during civil works conform to applicable standards
National Institute of Occupational Safety and Health (NIOSH) Publication No. 98-126	NIOSH has laid down criteria for a recommended standard: occupational noise exposure. The standard is a combination of noise exposure levels and duration that no worker exposure shall equal or exceed.	**Appendix 3** provides applicable NIOSH occupationnel noise standards. Contractors are required to provide hearing-protection equipment and ensure exposures of workers to noise-generating activities are within allowed NIOSH standards.
Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2008.	According to the Rules, hazardous wastes are wastes having constituents specified in Schedule II of the Rules if their concentration is equal to or more than the limit indicated in the said schedule **(Appendix 4).**	If during excavation works, the excavated material is analyzed to be hazardous, they are to be stored and disposed of only in such facilities as may be authorized by the WBPCB for the purpose
Forest (Conservation) Act, 1980 and	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the Central Government.	No notified forest land within the subproject area.

Law	Description	Requirement
Forest Conservation Rules, 2003 as amended		
Wetlands (Conservation and Management) Rules, 2010	The Rules specify activities which are harmful and prohibited in the wetlands such as industrialization, construction, dumping of untreated waste and effluents, and reclamation. The Central Government may permit any of the prohibited activities on the recommendation of Central Wetlands Regulatory Authority.	The subproject is not within the East Kolkata Wetlands thus no permission from the Central Government is required.
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	The Rules designate areas within a radius of 100 meters (m) and 300 m from the "protected property" as "protected area" and "controlled area" respectively. No development activity (including mining operations and construction) is permitted in the "protected area" and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	There are no protected properties in the subproject area. However, in case of chance finds, the contractors will be required to follow a protocol as defined in the Environmental Management Plan (EMP).
Land Acquisition, Rehabilitation and Resettlement Act, 2013 (The Act shall come into force on January 1, 2014 as notified by the Central Government. The Act will replace the Land Acquisition Act, 1894, a nearly 120-year-old law enacted during British rule and lays emphasis on Rehabilitation & Resettlement in cases of land acquisition)	Private land acquisition is guided by the provisions and procedures under this Act. Before the acquisition of any land, the Government is required to consult the concerned Panchayat or Municipal Corporation and carry out a Social Impact Assessment in consultation with them. The Act provides a transparent process for land acquisition for industrialization, development of essential infrastructural facilities and urbanization by giving adequate financial compensation to the affected people.	For one subproject component for construction of Pumping Station at Vivekananda Road there will be requirement of acquisition of 3000 sq m of private land. Presently land is "vacant low land". Temporary resettlement of shops and establishment will not be involved during pipe laying work. A Resettlement Plan has been prepared in accordance with the ADB SPS, 2009.
West Bengal Trees (Protection and Conservation in	The Act states that those who want to fell trees will have to obtain permission from the Forest Directorate, Government of West Bengal. Violators (means whoever fells or causes to be	Permission from the Divisional Forest Officer (Utilization Division), Forest Directorate, Government of West Bengal will

Law	Description	Requirement
Non-Forest Areas) Act, 2006	felled any tree or cuts, uproots or otherwise disposes of any fallen tree or contravenes the permission granted) shall be punished with imprisonment up to one year or with fine of Rs.5000/- or both. Also, until plantation of requisite number of trees is undertaken, the violators will be fined for each day of default of Rs.50/-. In case the development agency or entrepreneur fails to implement the plantation plan, the defaulter might have to face an imprisonment up to two years or fine that may extend to Rs.10,000/- or with both.	be required if trees, particularly those looked upon as sacred groves, identifies as belonging to an endangered species, or given the status of heritage, will be cut/felled. Promoters/developers will have to submit a 'Tree Plantation Plan' while they seek approval for a residential/ commercial/ industrial project.
East Kolkata Wetlands (Conservation and Management) Act, 2006	In August 2002, 12,500 hectares (ha) of the East Kolkata Wetland area was included in the 'Ramsar List' making it a 'wetland of International Importance'. The Ramsar convention is playing a vital role by providing certain basic guidelines to draw up suitable plans for the maintenance and sustenance of the wetlands. Among these, the three most important guiding principles are: (i) maintenance of the special characteristics of the ecosystem; (ii) wise use of its resources with an eye towards sustainability; and (iii) economic development for the wetland community. The East Kolkata Wetlands Management Authority (EKWMA) has the power to enforce land use control in the substantially water body-oriented areas and other areas in the East Kolkata wetlands.	The subproject is not within the East Kolkata Wetlands thus no permission from the Central Government is required.
The Child Labour (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act's Part A of the Schedule or in any workshop wherein any of the processes set forth in Part B of the Schedule.	No children between the age of 14 to 18 years will be engaged in hazardous working conditions.

III. DESCRIPTION OF THE SUBPROJECT

A. Existing Situation

20. Though Kolkata was provided with organised sewerage and drainage system years ago and the system has been expanded with the growth of the city several times, the city is afflicted with water logging and inadequate sanitary conditions in many areas. The core city comprising wards 1 to 100 are provided with the organised S&D system though improvements are still needed to make it comprehensive and complete. The areas added to the KMC in 1984 have grossly inadequate S&D infrastructure posing severe problems to the citizens living in these areas till 2003.

21. As a part of overall environmental upgradation with special emphasis to minimize the drainage congestion problem, Kolkata Environmental Improvement Project (KEIP) was taken-up with financial assistance from the Asian Development Bank (ADB). Following the master plan recommendations and detailed studies under KEIP, several improvement works have been taken up under KEIP 1 through two loans from the Asian Development Bank (1813-IND and

2293-IND) by KEIP/KMC. The main project component was to develop sewerage & drainage (S&D) system for a portion of the 'Added Areas' (Part of Borough XI to XV) and portion of Boroughs I & VII (Core area) including pumping stations and sewage treatment plants; canal improvement works; slum improvement works for selected slums; resettlement & rehabilitation of canal bank dwellers; procurement of solid waste management equipment; beautification of selected parks & water bodies etc. The Project was completed on 30th June, 2013.

22. In continuation of Kolkata Environmental Improvement Project program (KEIP), both KMC & ADB have wished to continue their combined effort to improve environmental degradation and basic urban services by a multi - tranche financing program 'Kolkata Environmental Improvement Investment Program' (KEIIP).The overall objective of the Kolkata Environmental Improvement Investment Program is to achieve sustainable economic growth through improved quality of urban life and the urban environment. The main objective of KEIIP is:

(i) To provide affordable access to water supply and providing sewerage and drainage facilities in KMC; and
(ii) To enhance quality and sustainability of urban service delivery by institutional reforms and capacity building.

23. In particular, development of a comprehensive S&D improvement proposal to minimize the long-lasting water logging problem and improve the overall environmental condition of the remaining portion of the 'Added Areas' area of KMC has been taken up under KEIIP.

B. Components of the Subproject

24. In order to mitigate in part the above deficiencies in relation to provision of adequate sewerage and drainage and related facilities in the target areas of KMC, Sewerage and Drainage Subproject of KEIIP Tranche 2 has been designed (**Table 2**). The locations of the S & D Subproject under KEIIP is shown in **Figure 3**.

Figure 3: Areas taken-up under KEIP works and the areas considered to be taken up under KEIIP for development of S&D system

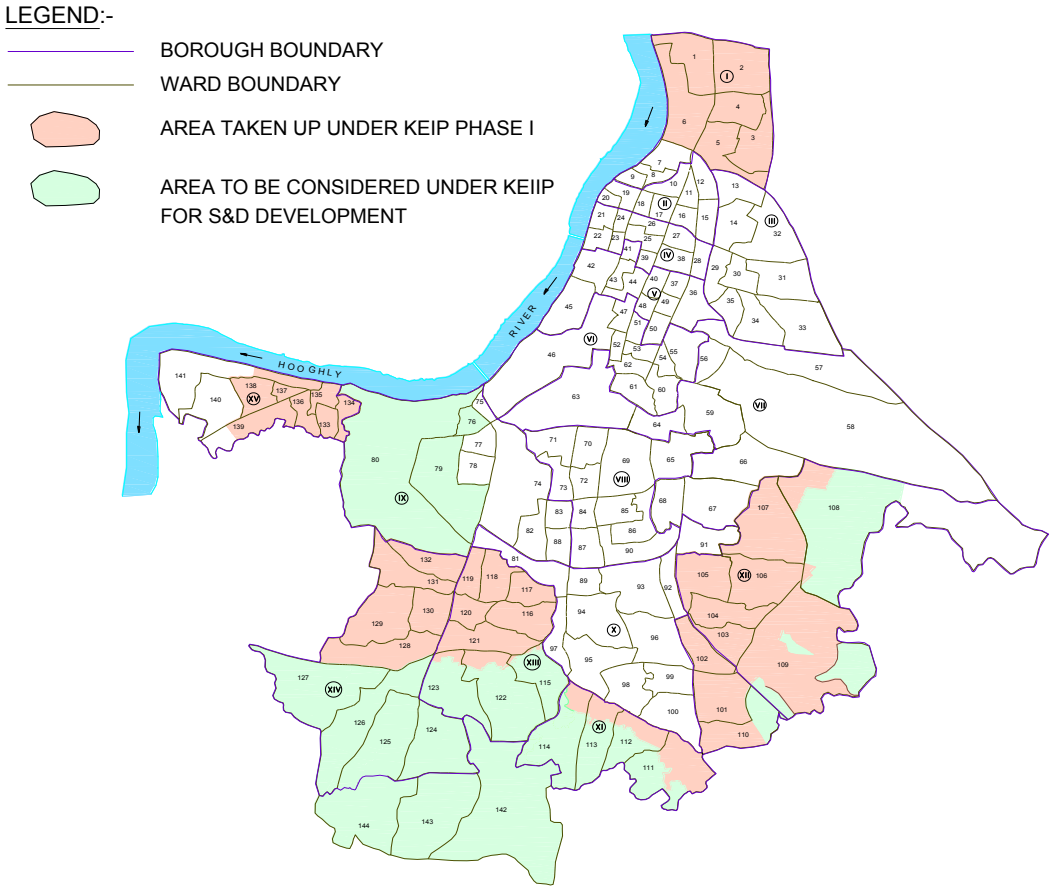

Table 2: KEIIP Tranche 2 S & D proposals 2016-2019

Sl. no.	Sub project	Package No.	Description	Components	Amount (Rs in million INR)
1	1	Tr 2/SD-09	Sewerage & Drainage Work and Construction of 1 Pumping Station in Ward No. 114 (Part) in Borough XI	Length of proposed trunk sewer to be laid 12.6 km under this package • Length of proposed sewer (600 mm & above) to be laid – 8 km • Length of proposed sewer (below 600 mm dia.) to be - laid 4.6 km A small part of ward 115 has also been included to cater DWF & SWF For laying of pipe below canals, jacking pushing method is considered • 1600 mm dia in ward 114 (Size of Pit (6.0 x 5.0 x 7.5) • 1000 mm dia in ward 115 (Size of Pit (5.0 x 4.0 x 7.5)	1034.00
				Construction of one combined pumping station (designated as Keorapukur PS) within the premises of Old Keorapukur Canal pumping station	
				Construction of gravity outfalls (13 nos. - 7 nos. to Keorapukur canal & 6 nos. to Western channel)	
				Recovering of canal section.	
				Laying of DWF Pumping main (500 mm dia., DI, K-9) for a length of about 2300 m. including MS bridge for crossing of the canal.	
				Laying of SWF Pumping main (1400 mm dia. MS) for a length of about 50 m	
2		Tr 2/SD-10	Sewerage and Drainage Network in Rania Box catchment (Part of Ward 111, 112 & 113) in Borough XI	Length of proposed trunk sewer to be laid about 11.75 km under this package • Length of proposed sewer (600 mm & above) to be laid – 11.7 km • Length of proposed sewer (below 600 mm dia.) to be laid – 0.05 km Length of proposed sewer to be laid by Jack pushing Method - 60 m	878.00
				Construction of RCC Box drain - 0.80 Km	
				Construction of gravity outfalls (1 no. to Rania canal)	
3		Tr 2/SD-11	Sewerage and Drainage Network in Vivekananda Road Catchment	Length of proposed trunk sewer to be laid about 9.85 km under this package • Length of proposed sewer (600 mm & above) to be laid – 8.80 km • Length of proposed sewer (below 600 mm dia.) to be laid – 1.05 km	1403.00

Sl. no.	Sub project	Package No.	Description	Components	Amount (Rs in million INR)
			(Part of Ward 113 & 114) & construction of 1 Pumping Station in Borough XI	Construction of one combined pumping station (designated as Vivekananda Road PS) at crossing of Rania Canal and Vivekananda Road	
				Construction of gravity outfalls (5 nos. - 2 nos. to Rania canal & 3 nos. to Western channel)	
				Laying of DWF Pumping main (800 mm dia., DI, K-9) for a length of about 1000 m. including MS bridge for crossing of the canal.	
				Laying of SWF Pumping main - 1250 mm dia. MS pipe about 500 m length and 1400 mm dia. MS pipe about 1700 m including MS bridge for 1400 mm dia. for crossing of Western channel.	
4	2	Tr 2/SD-12	Laying of Trunk sewer along James Long Sarani by Micro-tunneling method	Sewer of about 3.8 Km along James Long Sarani (from Sakher Bazar crossing to near Joka Tram depot) - proposed to be laid along western flank by Micro tunneling technology 1400 mm diameter- 670 m 2000 mm diameter- 1025 m 2400 mm diameter- 2110 m Connection from western flank to be done by open cut method and to be implemented under package – TR-2/14.	937.00
5		Tr 2/SD-13	Sewerage & Drainage Network within James Long Sarani and Mahatma Gandhi Road catchment in Borough XIII & XIV (Part of Ward no. – 123 & 124)	Length of proposed sewer (600 mm & above) to be laid 11.5 km	772.00
				Length of proposed sewer (below 600 mm dia.) to be laid 2.5 km	
				Construction of outfall structures – 3 nos.	
6		Tr 2/SD-22	S & D Mains and Pumping station in Churial Extension catchment in Borough XIII and XVI (Part of Ward no. 122,123 & 124)	Construction of two combined pumping station – Vidyasagar Palli PS	1140.0
				Trunk sewer to be laid 14.9 km under this package • Length of proposed sewer (600 mm & above)to be laid –12,0 km • Length of proposed sewer (below 600 mm dia.)to be - laid 3.3 km	
				Construction of gravity outfalls - 13 nos. to Churial Extension canal	

Sl. no.	Sub project	Package No.	Description	Components	Amount (Rs in million INR)
				Laying of DWF Pumping main – From Vidyasagar Palli PS proposed for a length of 45 m (approx.) From Churial PS – considered in other package	
				Laying of SWF Pumping main From Vidyasagar Palli PS proposed for a length of 20 m (approx.) From Churial PS – To be considered in other package	
7	3	Tr 2/SD-14	Laying of lateral sewers in Borough XIII & Borough XIV (Part of Ward no. -122&123 and 128 to 132)	Laying of S&D network 600 mm & above- 0.8 km	1452.40
				Laying of S&D network 250 to 500 mm- 60.6 km	
				Brick cover drain (400 mm x 600 mm)- 0.5 km	
				Restoration of drain along DH Road- 2.7 km	
8	4	Tr 2/SD-19	S & D Mains and 2 pumping stations (Augnentation of Keorapukur MPS) in Tolly's Nullah/ Keorapukur Sub-basin in Borough- XIII (Ward no. 115 & Part of Ward no. 122)	Construction of two combined pumping station – Modification of LS-5 from DWF PS to Combined PS (name proposed as Kudghat PS) Modification of existing Keorapukur MPS to combined PS	910.00
				Trunk sewer to be laid 9.3 km • Length of proposed sewer (600 mm & above)to be laid –9.13 km • Length of proposed sewer (below 600 mm dia.)to be - laid 0.16 km For laying of pipe below canals, jacking pushing method is considered • 1800 mm dia in ward 114 (Size of Pit (6.0 x 5.0 x 7.5)	
				Construction of gravity outfalls (Total 7 nos. - 1 nos. to Tollynullah & 6 nos. to Keorapukur canal)	
				Laying of DWF Pumping main – From Kudghat PS proposed for a length of 320 m From Keorapukur S&D – considered in other package From Keorapukur MPS- Existing to be utilised	

Sl. no.	Sub project	Package No.	Description	Components	Amount (Rs in million INR)
				Laying of SWF Pumping main From Kudghat PS to Tollysnullah - 50 m From Keorapukur S&D – considered in other package From Keorapukur MPS to Keorapukur canal – 170 m	
				Construction of MS bridge for canal crossing	
9	5	Tr 2/SD-23	Construction of New Pumping Station at Lalababu Nikashi/ Bagjola Canal	Construction of Pumping station capacity 5000lps Construction of Bypass Arrangement (including sluice gate)	360.00
				Pumping main 1600mm dia (MS) 60 m length	

25. Package Tr 2/SD-09 focuses on the development of sewerage & drainage (S&D) system in the area covering part of Ward 114 of Borough XI. Development of S&D system for portion of this Borough (Part of ward no – 111, 112,113 & 114) has already been carried out under KEIP. Development S&D system for remaining part of the Borough has been planned to be taken up in different subprojects under KEIIP Tranche – 2.

26. Proposed Disposal arrangement of SWF & DWF for package Tr 2/SD-09 is as follows:

SWF	To Keorapukur Canal by 7 nos. Gravity outfalls (Purbaputiary-7 nos.)
	To Western Channel Canal by 6 nos. of Gravity outfalls (East Bank – 3 nos. and West Bank- 3 nos.)
	To Keorapukur canal at a location beyond confluences Western channel and Keorapukur canal by pumping main from proposed Keorapukur combined pumping station.
DWF	To existing SSE STP by dedicated pumping main from proposed Keorapukur combined pumping station

27. Outfall arrangement is proposed for S&D Network to Keorapukur canal and Western channel at suitable location for discharging SWF to the said canal / channel. Each outfall arrangement will have corresponding sluice gate structure / Flap gate as per site condition.

28. Both Keorapukur canal and Western canal are capable to carry storm water. SAR stage site photographs, Google maps of outfall are attached in **Appendix 5.** Drawing of typical sluice gate is provided in **Appendix 6**. Maintenance of sluice gate will be done by KMC, this is confirmed by the authority. Only small amount of silt will be cleared before monsoon and which will be disposed at selected area under KMC's own jurisdiction. Since collected amount will be small there is no contingency measure planned. Just after collection, KMC authority transport of the silt to designated disposal sites.

29. **Sewage Treatment:** DWF generated from the sub project area is proposed to be diverted to SSE STP by dedicated pumping main from proposed Keorapukur PS. The STP has

been augmented to 45 MLD for the year 2031 AD under KEIP. DWF generated from the package TR-02/SD-09 & TR-02/SD-13 will be conveyed to the STP. Therefore, augmentation of STP is required for 2045. S&D development for the package TR-02/SD-09 has been taken up under this sub project, but design of S&D network for package TR-02/SD-13 is in preliminary stage. Augmentation of SSE STP has been taken up under package Tr-1/SD-07 of Tranche 1 of KEIIP. Under Tranche 2 waste water will be treated in SSE STP and that has been mentioned in this IEE report. SSE STP have sufficient capacity to treat waste water from Tr -2 sub projects. After screening of the scope it has been decided that there is no necessity to change categorization of the project from B to A..

30. Under package Tr-2/SD-11,
    (i) New combined pumping station (Vivekananda road PS) is to be constructed at the tail end of the network near the crossing of Rania canal and Vivekananda Road.
    (ii) System has been considered to be partially pump dependent for SWF and to be fully pump dependant to transport DWF to proposed STP
    (iii) SWF is to be discharged at two locations by two dedicated pumping main.
    (iv) Two set of SWF pumps (capacity of each set of pumps is 50%) are proposed for discharging SWF at two locations.

31. DWF generated from the Tr 2/ SD 11 sub project area is proposed to be diverted to proposed Jiadagor STP by dedicated pumping main from proposed Vivekananda Road PS.

32. Under package Tr-2/ SD 19**,** new modified combined pumping stations are to be constructed at the tail end of the catchment network. The existing sewage pumping stations would be modified to combined pumping stations. These modifications would be done at LS-5 (Kudghat) and Keorapukur MPS.

33. The DWF generated from the a part of subproject area has been considered for design of Keorapukur S&D PS under Sub-project TR2/SD-9.

34. The existing GAP sewer along Mahatma Gandhi Road carries DWF from part of Boroughs XIII, XI and X. Presently DWF from these areas is being transmitted to SSE STP through this sewer. KMC has since taken up a Sewerage and Drainage project on Tolly's Nullah Basin under other funding, it is proposed that ultimate size of this sewer would be finalised after obtaining the proposal from the said project. So, it is proposed to retain the existing GAP sewer in this Sub-project.

35. DWF pumps are proposed for DWF generated from the subproject area. SWF pumps are also proposed for storm water flow generated from the subproject area and package TR-02/SD 19.

36. Land is required to be handed over to KMC from the I&WD, GoWB for construction of Kudghat combined pumping station.

37. Package Tr-2/SD 20 focuses on the S&D development works within Rajadanga catchment. Part of SWF generated from the sub project area is proposed to be discharged to tributaries of T-P canal through gravity outfalls and major part of SWF is designed to be conveyed to pumping station.

38. DWF generated from the sub project area is proposed to be pumped to existing PS-4 (DWF pumping station) for onward transmission for treatment.

39. Under package Tr-2/SD 21, new combined pumping stations, named as Rabindranath Sarani PS and Churial PS are to be constructed.

40. The DWF generated from the part of subproject area would be pumped either directly to STP or to a strategic manhole chamber for onwards transmission to terminal pumping station. Trunk sewer network has also been considered.

41. Development of S&D network in part of Ward 122, 123,&124 has been considered to be taken up. The entire DWF generated from Churial basin of the sub project area has been proposed to be taken to Joka PS for onward transmission to proposed Kalagachia STP. The entire DWF generated from Keorapukur sub-basin of the sub project area has been proposed to be pumped to Jiadagor STP.

42. Under Package Tr-2/SD 22, **n**ew combined pumping stations, named as Vidyasagar Palli PS and Churial PS are to be constructed. Vidyasagar Palli PS location is at the middle of the catchment and adjacent to the Churial extension canal. Churial PS will be on the canal itself. The main function of Churial PS is to lower water level in the Churial Extension canal, so that the outfalls work effectively.

43. The DWF generated from the part of subproject area would be pumped to a strategic manhole chamber in the James Long Sarani PS (Sub-project TR 02 – SD/ 13). The entire DWF generated from the sub project area has been proposed to be taken to Joka PS for onward transmission to proposed Kalagachia STP.

44. Package Tr-2/SD 23 focuses on construction of the Pumping station. Lalababu pumping station (capacity 5000 lps) is proposed close to the confluence of Lalababu Nikashi and Bagjola Canal to cater the storm water, generated from part of Ward no 3, 4, 5 and SWF flow generated from a portion of South Dum Dum Municipality. In addition to that a bypass arrangement is now also proposed to keep provision of gravity flow directly to the Bagjola canal when the water level in the canal is low or during pump house shutdown period. Sluice gates at the end of the by – pass arrangement is also proposed to prevent backflow from the canal.

C. Need of the sub project

Existing situation
Package- Tr-2/SD-09

45. The present study area which is a part of the ‘Added Areas’ but not covered under KEIP is almost devoid of any organized sewerage and drainage system except for some segregated parts of Purbaputiary, Dinesh Pally, Natun Pally, Thakurpara road, Babu para, Thakurpara, Tall Bagan road, Guru Charan Naskar road, etc. At present there is no existing sewerage system in this sub-basin. It is observed that the sub project area depends largely on septic tank arrangement. However there are few drainage lines which were either laid by KMC or by some other agencies. These existing lines not only carry storm water but also carry DWF to Keorapukur canal and Western channel which ultimately leads to River Hooghly. In the process, not only the canals but also the river water is getting polluted.

46. Based on the first hand information collected and supplemented by findings of extensive site visits during medium to heavy showers as well as one or two days after occurrence of heavy rain and interaction with local residents, different areas have been identified which may be considered as major water logging pockets within the sub-project area. The major water logged areas are Purbaputiari, Baganpara, Sath Bigha, Kobordanga, Thakurpara.

Package- Tr-2/SD-10 & SD-11

47. The present study area which is a part of the 'Added Areas' but not covered under KEIP is almost devoid of any organized sewerage and drainage system except for some segregated parts of Brahmpur South Road, Panpara Road, Nath Para Road, Naskar Para, Pora Khola Road, Bandipur Road, Guru Charan Naskar Road etc. At present there is no existing sewerage system in this sub-basin. It is observed that the sub project area depends largely on septic tank arrangement. However there are few drainage lines which were either laid by KMC or by some other agencies. These existing lines not only carry storm water but also carry DWF to Rania canal, Western channel extension and Western channel which ultimately leads to River Hooghly. In the process, not only the canals but also the river water is getting polluted.

48. The sub project area depends largely on septic tank arrangement for household sanitary systems and open surface drainage systems mainly for storm water and effluents of septic tanks. In many cases the drains do not have any proper outlet and terminated into low land/ canal. All these existing practices need to be controlled by providing a comprehensive waste water (DWF + SWF) collection system with defined drainage outlet to Rania canal and Western channel and diversion of the entire quantum of DWF generated from the subproject area to the proposed Jiadagor STP.

49. Based on the first hand information collected and supplemented by findings of extensive site visits during medium to heavy showers as well as one or two days after occurrence of heavy rain and interaction with local residents, different areas have been identified which may be considered as major water logging pockets within the sub-project area. The major water logged areas within the study area are Sardar Park, Pragati Park, Ujjal Park, Seik Para, Bhattacharjee Para, Congress Pally, Saradamoni Park, Vivekananda Road, Vidyasagar Park, Niranjan Pally, Sonali Park, Dinesh nagar, Southern part of Bandipur Road etc.

Package - Tr -2/SD-12

50. The project area has problem for disposal of sewage and insufficient drainage facilities. Several locations within the study area are low-lying and are vulnerable to flooding even with moderate rainfall.

51. Major portion of the areas are devoid of any organized sewerage and drainage system and served only by surface drainage system carrying both sullage and storm runoff. In several places the drains culminate into low lands. Underground conduits exist in certain area which carry combined flow and discharge to nearby canal systems (Churial canal, Churial extension canal) which ultimately leads to River Hooghly. In the process, not only the canals but also the river water are getting polluted.

52. Under the present sub project, two sewers exist along either flank of James Long Sarani below footpath. These two rider sewers discharge combined flow to Churial canal/ Churial extension canal through the drains or closed conduit at several locations.

Package - Tr-2/SD-13

53. The present study area has problem for disposal of sewage and insufficient drainage facilities. Several locations within the study area are low-lying and are vulnerable to flooding even with moderate rainfall. It is learnt with discussion of local people that there are areas where the period of water-logging ranges from a few hours to several days, causing not only inconvenience to residents but also poses a serious health threat.

54. Major portion of the areas are devoid of any organized sewerage and drainage system and served only by surface drainage system carrying both sullage and storm runoff. The sub project area also depends largely on septic tank arrangement. In several places the drains discharge into low lands. Open surface drains carrying sullage water are a potential health threat. Underground conduits (about 11% subproject area covered by underground conduits) exist in certain area which carry combined flow and discharge to nearby canal systems (Churial canal, Churial extension canal) which ultimately leads to River Hooghly. In the process, not only the canals but also the river water is getting polluted. Apart from this, the major inadequacies of the existing system as mentioned below within the study area are observed.

55. The major water logged areas within Churial basin are as follows:

(i) Santosh Roy Road by-lanes near LS 2, Kalipada Mukherjee Road, Netaji Sangha bye lane, near Baidyapara High School (Borough XIV, ward 123)

(ii) Almost the entire portion of the ward no. 124 (Borough XIV)

Package - Tr-2/SD-14

Existing S & D system in part of Borough XIII

56. The subproject area in Borough XIII falls within Tolly's Nullah basin and Monikhali basin. Under KEIP, combined system has been developed, incorporating GAP sewers as much as possible in the design. The scheme as developed for the Borough XIII under KEIP, aimed at disposing the storm water to Tolly's Nullah, CPT canal & small part of SWF to Chetla Boat canal and diverting DWF to STP. Based on S&D network as developed under KEIP, subproject area in Borough XIII could be divided into 4 zones. For conveying combined flow, a number of major trunk sewers have been laid in this Borough as mentioned below.

(i) **Trunk sewers for Zone 1 (covering part of ward no. 118 & 119)**
Joy Krishna Paul Road – Ramtanu Lahari sarani – S&D network of Borough X
Rajani Mukherjee Road – Nalini Sarker Avenue - S&D network of Borough X

(ii) **Trunk sewers for Zone 2 (covering part of ward no. 119 & 120)**
James Long sarani – S.N Roy. Road – DH Road- CPT canal PS & Outfall

(iii) **Trunk sewers for Zone 3 (covering Ward no -117, part of ward no. 116 & 118 to 120)**
S.N. Roy Road – Roybahadur Roy Road - canal Road PS & Outfall

(iv) **Trunk sewers for Zone 4 (covering Ward no -121, part of ward no. 116, 120 to 123)**
Pashupati Bhattacharjee Road – Raja Ram Mohan Roy Road – LS3 & outfall

57. SWF generated from the Zone 1 gets drained out to Chetla Boat canal through the S&D network of Borough X. SWF generated from zone 2 is disposed off to CPT canal with aided of gravity outfall and CPT canal PS. SWF generated from Zone 3 & 4 is discharged to Tolly's Nullah with aided of gravity outfalls.

58. Major portion of DWF generated from the area (Zone 3 & zone 4), is conveyed to SSE STP with aided of numbers of lifiting stations, namely LS1 (Buro shibtala), Canal Road PS, LS3 (Siriti) and Keorapukur MPS. LS3 is the terminal PS for this area. From LS3, DWF is transported to Keorapukur MPS through gravity main along Mahatma Gandhi Road. Thereafter, DWF is taken upto SSE STP by dedicated pumping main. Treated effluent from the SSE STP is passed to Churial extension canal by dedicated pumping main. DWF generated from Zone no 1 is conveyed to S&D network of Borough X. DWF generated from other small part (Zone 2) is taken to sewer along DH Road for onward transmission to CPT canal PS. Thereafter, DWF is conveyed to Garden Reach STP through S&D network of Borough XIV**.**

59. Salient details of existing system
- (i) Length of sewer line – 141 km
- (ii) Nos. of outfalls – 5 nos.
- (iii) Nos. of pumping stations – 3

Existing S & D system in part of Borough XIV

60. The subproject area in Borough XIV falls within Monikhali basin. Under KEIP, combined system has been developed with utilization of sewerage system developed under GAP.

61. The scheme as developed under KEIP, aimed at disposing the storm water to Monikhali canal through its tributaries viz. Begore canal, CPT canal, Parnashee canal and Jinjira canal and diverting DWF to Garden Reach STP. Based on S&D network as developed under KEIP, entire area could be divided into 5 zones. For conveying combined flow, a number of major trunk sewers have been laid in this borough as mentioned below.

- (i) **Trunk sewers for Zone 1 (Covering ward – part of 128)**
  Dr. A. K. Paul Road – Biren Roy Road West – Behala Node C PS & Outfall
- (ii) **Trunk sewers for Zone 2 (Covering ward - part 130 to 132)**
  Kedar chatterjee lane – Diamond Harbour Road – CPT canal PS & Outfall
- (iii) **Trunk sewers for Zone 3 (Covering ward – part of 131 & 132)**
  Banamali Naskar Road – Upendra Nath Banerjee Road – CPT canal (through nos. of outfalls)
- (iv) **Trunk sewers for Zone 4 (Covering Ward – part of 129 & 130)**
  Netaji Subhas Road – Sarat Chatterjee Road - Brahmo Samaj Road - Khudiram Bose Sarani – Behala Flying Club PS & Outfall at Parnashree canal
- (v) **Trunk sewers for Zone 5 (covering ward – part of 128 & 129)**
  Parui Katcha Road – Trenching Ground Road – Joy Rampur Jala Road – Mahendra Banerjee Road - Begore Khal PS & outfall

62. Entire SWF generated from zone 1 is disposed off to the Begore Khal through gravity outfall. Entire DWF generated from the zone is conveyed to Behala Node C. From Behala Node C, DWF is transported to Begore Khal PS through S&D network of Zone 5

63. Entire SWF generated from zone 2 is disposed off to the CPT canal with aided of outfall at CPT canal and CPT canal PS. Entire DWF generated from the zone is conveyed to the CPT canal PS. DWF is then conveyed to Jinjira Bazar PS through the sewer along Upendra Nath Banerjee Road.

64. SWF generated from the Zone 3 is discharged to CPT canal through nos. of gravity outfalls. Entire DWF generated from Zone 3 is collected to the sewer along Upendranath

Banerjee Road and it is then conveyed to Jinjira Bazaar PS. From Jinjira bazaar PS, it is transported to Garden Reach STP through dedicated pumping main.

65. Entire combined flow generated from zone 4 is taken to a location near Behala Flying Club. From here, part of SWF is discharged to Parnashree canal through gravity outfall and part of SWF is discharged to the same canal with aided of storm water pumps installed at Behala Flying Club. Entire DWF is taken to the Behala Flying Club PS and it is then conveyed to Garden Reach STP through dedicated pumping main.

66. Entire combined flow generated from zone 5 gets conveyed to a location near Begore Khal PS (under construction). Entire SWF is then to be disposed off to Begore Khal with aided of outfall and SWF pumps. Entire DWF is to be taken to Begore Khal PS for onward transmission to Behala Flying club PS. In this context, it is worth to mention that downstream facilities (i.e. Begore khal PS, Outfall) are under construction under KEIIP Tranche 1.

67. Salient details of existing system
- (i) Length of sewer line – 149 Km
- (ii) Nos. of outfalls – 8 (one under construction)
- (iii) Nos. of pumping stations – 5 (one under construction)

Package - Tr-2/SD-19

68. The present study area which is a part of the 'Added Areas' but not covered under KEIP is almost devoid of any organized sewerage and drainage system except for some segregated parts in Purbaputiary, Banerjee para Road, Taramoni Ghat Road, Karunamayee, Banamali para, Baroda Sarani, Dhalipara, etc. A major trunk sewer, constructed under GAP carries DWF and runs along Mahatma Gandhi Road. It collect all cumulated DWF generated under the command area of SSE STP, such as LS3 from Borough X, LS5 from Borough X and XI. It terminates to existing Keorapukur MPS at Dhalipara Road. This is a sewage pumping station, basically function as an ultimate lifting station before entering to STP. It pump SWF to SSE STP.

69. At present there is no existing organised sewerage and drainage system in this basin. It is observed that the sub project area depends largely on septic tank arrangement. However there are few surface drainage lines which were mostly laid by KMC. These existing lines not only carry storm water but also carry DWF to Keorapukur Canal. In the process, not only the canals but also the river water is getting polluted. Some drainage lines are also connected to the GAP sewer line. Apart from this, other major inadequacies of the existing system observed within the study area are mentioned below.

70. The sub project area depends largely on septic tank arrangement for household sanitary systems and open surface drainage systems mainly for storm water and effluents of septic tanks – In many cases the drains do not have any proper outlet and terminated into low land/ canal. All these existing practices need to be controlled by providing a comprehensive waste water (DWF + SWF) collection system. This system needs to be proposed for the basin with defined drainage outlet to Keorapukur canal through gravity overflows of SWF and diversion of the entire quantum of DWF generated and parts of SWF, to the existing SSE STP in Borough XIII. Combined pumping stations are required to be proposed. SWF will be discharged from the pumping stations to Tolly nullah and Keorapukur canal at suitable location to reduce water logging from the catchment.

Package - Tr-2/SD-22

71. The present study area which is a part of the 'Added Areas' but not covered under KEIP is almost devoid of any organized sewerage and drainage system except for some segregated parts within the catchment. Most of the sewers are directly discharging waste to Churial extension canal.

72. At present there is no existing organised sewerage and drainage system in this basin. It is observed that the sub project area depends largely on septic tank arrangement. However there are few surface drainage lines which were mostly laid by KMC. These existing lines not only carry storm water but also carry DWF to Churial extension canal. In the process, not only the canals but also the river water is getting polluted. Apart from this, other major inadequacies of the existing system observed within the study area are mentioned below.

73. **System Inadequacies**

(i) Poor drainage networks & absence of organised drainage network in many areas.
(ii) Inadequate capacities of drains
(iii) Poor or no maintenance of drains resulting in heavy siltation and substantial reduction in carrying capacities
(iv) Chockage of drains at different stretches due to indiscriminate dumping of solid wastes.
(v) Surface drains laid through inaccessible areas in many cases virtually not allowing any maintenance access.
(vi) Connection of drains to sewers, which was previously designed to carry only DWF load.

74. The sub project area depends largely on septic tank arrangement for household sanitary systems and open surface drainage systems mainly for storm water and effluents of septic tanks – In many cases the drains do not have any proper outlet and terminated into low land/ canal. All these existing practices need to be controlled by providing a comprehensive waste water (DWF + SWF) collection system. This system needs to be proposed for the basin with defined drainage outlet to Churial Extension canal through gravity overflows and pumping of SWF and diversion of the entire quantum of DWF generated to the Joka Pumping station for onward pumping to Kalagachi STP.

Package - Tr-2/SD-23

75. Sewerage & drainage system (S&D) was developed under KEIP for Borough I (ward 1 to 6). SWF generated from the part of Ward no 3 & 4, is conveyed to Beerpara Pumping station through gravity sewers along Nilmoni Dey lane / Raja Manindra Raod / Paikpara 1 st Row. From Beerpara pumping station, SWF is disposed to Lalababunikashi for ultimate disposal to Bagjola canal.

(i) Need for Development of S&D network including one combined pumping station-Package No. Tr 2/SD-09

- The subproject area is very fast growing in terms of population, but these areas remain water logged during the rainy season. There are areas which get flooded at the beginning of monsoon and the situation prevails for months. Development of an adequate sewerage and drainage system in sub project area is urgently required. A number of site visits has been conducted in the months of October, November and December 2014 in

the sub-project areas to understand the existing drainage pattern of the area. This was being done to develop a proper sewerage & drainage system to cater the waste water and storm water generated within the sub project area. It is understood from the local people that accumulation of waste water and storm water is a common phenomenon in this area; therefore, removal / disposal of the same is urgently required to improve the quality of life.

- To improve water quality of River Hooghly by treating waste water before discharging for fulfilling Government Policy and one of the objectives of Ganga Action Plan.
- Water logging creates conditions suitable for spreading diseases. To improve public health, alleviation of flooding is needed. Further, waterlogged areas often become breeding grounds for mosquitoes, which transmit malaria, filaria and other diseases.

(ii) Need for Development of S&D network- Package no. Tr 2/SD-10 & SD-11

- The subproject area is very fast growing in terms of population, but these areas remain water logged during the rainy season. There are areas which get flooded at the beginning of monsoon and the situation prevails for months. Development of an adequate sewerage and drainage system in this area is urgently required particularly for the below mentioned reasonsTo improve water quality of River Hooghly by treating waste water before discharge in order to fulfill Government Policy and one of the objectives of the Ganga Action Plan.
- To improve public health through elimination of flooding and water logging which create breeding grounds for mosquitoes transmitting vector borne diseases.

(iii) Need for Development of S&D network- Package No. - Tr 2/SD-12

- Sewer proposed along James Long Sarani will not only cater combined flow generated from this subproject area, but also, will cater combined flow generated from the sub project area considered under package TR-2/14. Therefore, laying of sewer along James Long Sarani is needed to dispose off combined flow generated from the sub project areas considered under package TR-2/SD-05 & TR -2/SD-04.

(iv) Need for Development of S&D network- Tr 2/SD-13

- During monsoon the sub project area is subject to frequent and prolonged flooding mainly due to lack of adequate drainage system. There are areas within the project area which get flooded at the beginning of monsoon and the situation prevails for months. Some of the areas within the sub project experiencing frequent and prolonged instances of water logging are Niranjan Pally, Santosh Roy Road by-lanes near LS 2, Kalipada Mukherjee Road, Netaji Sangha bye lane, near Baidyapara High School in Ward 123 and almost the entire portion of the Ward 124. The sub project area belongs to part of wards 123 and 124 of KMC area where the population is growing fast. Development of an adequate sewerage and drainage system in this area is urgently required. It is understood from the local people that waste water and storm water accumulation is a common phenomenon in this area therefore, removal / disposal of water is urgently required. Development of an adequate sewerage and drainage system in this area is urgently required particularly for the below mentioned reasons:

- To improve water quality of River Hooghly by treating waste water before discharge in order to fulfill Government Policy and one of the objectives of the Ganga Action Plan.
- To improve public health through elimination of flooding and and water logging which create breeding grounds for mosquitoes transmitting vector borne diseases.

(v) Need for Development of S&D network- Tr 2/SD-14

- The subproject area is very fast growing in terms of population and the area needs a comprehensive S&D system to improve the living condition. Under, KEIP, only trunk S&D network has been developed in the subproject area. However, outfalls, pumping stations and STPs have been also constructed taking contribution from entire area. Therefore, trunk S&D network along with the facilities for disposal of SWF to the canals and for treatment of wastewater for the entire area has been developed under KEIP. But, the entire area is not getting desired benefit of the woks, done under KEIP, due to absence of secondary sewers in major portion of the area. Major portion of the area is devoid of secondary sewers although some secondary sewers have been laid by KMC in some areas. Therefore, extension of sewerage system in non sewered area in subproject area is essentially required to provide the desired benefit of the works as done under KEIP. This is also in the line with the recommendations and priorities of the Sewerage and Drainage Master Plan.

(vi) Need for Development of S&D network- Tr 2/SD-19

- To improve water quality of River Hooghly by treating waste water before discharging for fulfilling Government Policy and one of the objectives of Ganga Action Plan.
- Water logging creates conditions suitable for spreading diseases. To improve public health, alleviation of flooding is needed. Further, waterlogged areas often become breeding grounds for mosquitoes, which transmit malaria, filaria and other diseases.

(vii) Need for Development of S&D network- Tr 2/SD-22

- The subproject area is very fast growing in terms of population, but these areas remain water logged during the rainy season. There are areas which get flooded at the beginning of monsoon and the situation prevails for months. Development of an adequate sewerage and drainage system in this area is urgently required. A number of site visit has been conducted in the months of October, November and December 2015 in the sub-project areas to understand the existing drainage pattern of the area. This was being done to develop a proper sewerage &drainage system to cater the waste water and storm water generated within the sub project area. It is understood from the local people that waste water and storm water accumulation is a common phenomenon in this area, therefore, removal / disposal of the same is urgently required to improve the quality of life.
- To improve water quality of River Hooghly by treating waste water before discharging for fulfilling Government Policy and one of the objectives of Ganga Action Plan.
- Water logging creates conditions suitable for spreading diseases. To improve public health, alleviation of flooding is needed. Further,

waterlogged areas often become breeding grounds for mosquitoes, which transmit malaria, filaria and other diseases.

(viii) Need for Development of S&D network- Tr 2/SD-23

- The subproject area is very fast growing in terms of population, but these areas remain water logged during the rainy season. There are areas which get flooded at the beginning of monsoon and the situation prevails for months. Development of an adequate sewerage and drainage system in this area is urgently required. A number of site visit has been conducted in the sub-project areas to understand the existing drainage pattern of the area. This was being done to develop a proper sewerage &drainage system to cater the waste water and storm water generated within the sub project area. It is understood from the local people that waste water and storm water accumulation is a common phenomenon in this area, therefore, removal / disposal of the same is urgently required to improve the quality of life.
- Water logging creates conditions suitable for spreading diseases. To improve public health, alleviation of flooding is needed. Further, waterlogged areas often become breeding grounds for mosquitoes, which transmit malaria, filaria and other diseases.
- Based on preliminary investigation, it was found that areas on either side of the nikashi within South Dum Dum Municipality are low-lying and prone to get waterlogged for a considerable period of time. With development of organized S&D network and construction of Beerpara Pumping Station within Borough I under KEIP, storm runoff flows through Lalababu Nikashi much faster. SWF discharge from Beerpara pumping station also increases the top water level of the said nikashi. Situation becomes worse when water level of Bagjola canal is high. In the process, evacuation of storm runoff generated from the portion of South Dum Dum Municipality has also been affected.
- This problem can be effectively minimized if water level in the Nikashi can be lowered, which is possible only through construction of a storm water pumping station close to the outfall point of the Nikashi. This will, in addition ensure that storm runoff can effectively be discharged even if water level in Bagjola canal is relatively high. Therefore, construction of Lalababu pumping station is urgently required to make the S&D system, developed under KEIP, most effectively functional.

D. Salient features of the Subproject

76. The design norms adopted for preparation of various components of project are generally in line with CPHEEO Manual (2013), KMC practices, KEIP practices & standard practices. Whenever felt necessary guide lines laid down in other internationally accepted manuals are followed.

77. Pipe Laying details under different packages.

Table 3: Details of pipeline under different packages

Description of subproject component	Diameter of trunk sewer, pumping mains mm	Length of the trunk sewer, pumping mains in m	Remarks from environmental point of view
Sewerage & Drainage Work and Construction of 1 Pumping Station in Ward No. 114 (Part) in Borough XI	Trunk sewer Length of proposed sewer (600 mm & above) – 8.0 km Length of proposed sewer (250-500 mm dia.) to be – 4.6 km	12600 m	Routine construction work; No land acquisition. Construction job involved open trenching in narrow roads except canal crossing part, which will be done by Trenchless technology
	Laying of DWF Pumping main (500 mm dia., DI, K-9) including MS bridge for crossing of the canal.	2300 m	
	Laying of SWF Pumping main (1400 mm dia. MS)	50 m	
Sewerage and Drainage Network in Rania Box catchment (Part of Ward 111, 112 & 113) in Borough XI	Laying of sewer 600 mm & above	11700 m	Routine construction work; No land acquisition required as civil works will be on public roads in stretches at a time. Construction job involved open trenching in narrow roads.
	Laying of sewer - below 600 mm dia.	50 m	
	Construction of RCC Box drain	800 m	
	Length of sewer by Jack pushing method	60m	
Sewerage and Drainage Network in Vivekananda Road Catchment (Part of Ward 113 & 114) & construction of 1 Pumping Station in Borough XI	Laying of S&D network 600 mm & above	8800 m	Routine construction work; Land acquisition is required for construction of Vivekananda Road PS. Construction job involved open trenching in narrow roads. From the end of Rania box drain, 2000 mm dia. RCC pipe upto Vivekananda Road PS is proposed and considered to be laid by Jack Pushing Method.
	Laying of S&D network 250 to 500 mm	1050 m	
	Laying of DWF Pumping main (800 mm dia., DI, K-9) Including MS bridge for crossing of canal	1000 m	
	Laying of SWF Pumping main 1250 mm dia. MS pipe	500 m	
	Laying of SWF Pumping main 1400 mm dia. MS pipe including MS bridge for 1400 mm dia. for crossing of Western channel.	1700 m	
Laying of Trunk sewer along James Long Sarani by Micro-tunneling method	Trunk sewer dia 1400 – 2400 mm	3800 m	Routine construction work; No land acquisition.

Description of subproject component	Diameter of trunk sewer, pumping mains mm	Length of the trunk sewer, pumping mains in m	Remarks from environmental point of view
			Pipe laying by Micro tunneling – less impact Utility shifting may required
Sewerage & Drainage Network within James Long Sarani and Mahatma Gandhi Road catchment in Borough XIII & XIV (Part of Ward no. – 123 & 124)	Proposed sewer dia. 600 mm & above	11500 m	Routine construction work; No land acquisition required as civil works will be on public roads in stretches at a time. Construction job involved open trenching in narrow roads.
	Proposed sewer dia. 250- 500 mm	2500 m	
Laying of lateral sewers in Borough XIII & Borough XIV (Part of Ward no. -122&123 and 128 to 132)	Laying of S&D network 600 mm & above	800 m	Routine construction work; No land acquisition. Construction job involved open trenching in narrow roads
	Laying of S&D network 250 to 500 mm	60500 m	
	Brick cover drain (400 mm x 600 mm)	500 m	
	Restoration of drain along DH Road	2700 m	
S & D Mains and 2 pumping stations (Augnentation of Keorapukur MPS) in Tolly's Nullah/ Keorapukur Sub-basin in Borough- XIII (Ward no. 115 & Part of Ward no. 122)	Trunk sewer (600 mm & above dia)	9130 m	Routine construction work; No land acquisition. Construction job involved open trenching in narrow roads Micro tunneling through jack pushing
	Trunk sewer (below 600 mm dia.)	160 m	
	Laying of pipe below canals, jacking pushing method is considered • 1800 mm dia in ward 114	Size of Pit (6.0 x 5.0 x 7.5) 35 m	
	DWF Pumping main – From Kudghat PS- 500 mm dia, DI K9	320 m	
	SWF Pumping main From Kudghat PS to Tollys nullah – 1400 mm dia MS pipe	50 m	
	SWF Pumping main Keorapukur MPS to Keorapukur canal – 1400 mm dia MS	170 m	
S & D Mains and Pumping station in Churial Extension catchment in Borough XIII and XVI (Part of Ward no. 122,123 & 124)	Trunk sewer (600 mm & above dia)	12000 m	Routine construction work; Acquisition of land is required for PS Construction job involved open
	Trunk sewer (below 600 mm dia	3300 m	
	MS bridge for pipe crossing		

Description of subproject component	Diameter of trunk sewer, pumping mains mm	Length of the trunk sewer, pumping mains in m	Remarks from environmental point of view
	DWF Pumping main – 300 mm dia From Vidyasagar Palli PS	45 m	trenching in narrow roads
	SWF Pumping main- 1200 mm dia. MS pipe From Vidyasagar Palli PS	20 m	
Construction of New Pumping Station at Lalababu Nikashi/ Bagjola Canal	Pumping main 1600mm dia (MS pipe)	60 m	Routine construction work; No land acquisition. Construction job involved open trenching in road

78. **Keorapukur Pumping Station**. The main civil structural components of the combined flow pumping station as proposed are as follows (**Table 4**).

Table 4: Salient Features of Keorapukur Pumping Station

Details of Keorapukur Pumping Station		
1	Type	Combined PS (SWF + DWF)
2	Flow	DWF + SWF
3	Design period for Civil Structural units	30 years (2045)
4	Design period for E & M equipments	15 years (2030)
5	DWF (in lps)	178 lps (2030)
6	Screen	Motorized Screens
7	Wet well dia (m)	12.0 m
Details of DWF		
1	DWF Pumps	2W + 2S (2030). Each having capacity 89 lps
2	DWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	320.4 cum/hr, TDH = 22.7 m
3	DWF pump motor rating (KW)	45 KW each
4	DWF transmission main dia (mm)/length (m)	500 mm (DI), L = 2300 m
Details of SWF		
1	SWF (in lps)	3400 lps
2	SWF Pumps	4W + 2S (2030). Each having capacity 850 lps
3	SWF pump discharge capacity (Cu.m/hr) and Head	3060 cum/hr, TDH = 17.8 m

Details of Keorapukur Pumping Station		
	(m) of each pump	
4	SWF pump motor rating (KW)	310 KW each
5	SWF transmission main dia (mm)/length (m)	1400 (MS), L = 50 m

79. **Vivekananda Road Pumping Station**. A salient feature of Vivekananda Road Pumping Station as proposed is given in the **Table 5.**

Table 5: Salient Features of Vivekananda Road Pumping Station

Details of Vivekananda Road Pumping Station		
1	Type	Combined PS (SWF + DWF)
2	Flow	DWF + SWF
3	Design period for Civil Structural units	30 years (2045)
4	Design period for E & M equipments	15 years (2030)
5	DWF (in lps)	400 lps (2030)
6	Screen	Motorized Screen
7	Wet well size (m)	16 m x 8m
Details of DWF		
1	DWF Pumps	2W + 2S (2030). Each having capacity 200 lps
2	DWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	720 cum/hr, TDH = 15.5 m
3	DWF pump motor rating (KW)	65 KW each
4	DWF transmission main dia (mm)/length (m)	800 mm (DI), L = 1000 m
Details of SWF		
1	SWF (in lps)	5400 lps
2	SWF Pumps	1st Set: 3 W+ 2S(2030), each having capacity 900 lps 2nd Set: 3 W+ 2S(2030), each having capacity 900 lps
3	SWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	1st set: 3240 cum/hr, TDH = 18 m 2nd set: 3240 cum/hr, TDH = 18 m
4	SWF pump motor rating (KW)	1st set: 335 KW each 2nd set: 320 KW each
5	SWF transmission main dia (mm)/length (m)	1st set: 1400 mm (MS), L = 700 m 2nd set 1250 mm(MS), L= 500 m

80. **Kudghat Pumping Station**. A salient feature of Kudhghat Pumping Station as proposed is given in the **Table 6.**

Table 6: Modified Kudghat Pumping Station (Package Tr 2/ SD 19)

Details of Kudghat Pumping Station		
1	Type	Combined PS (SWF + DWF)
2	Flow	DWF + SWF
3	Design period for Civil Structural units	30 years (2045)
4	Design period for E & M equipments	15 years (2030)
5	DWF (in lps)	170 lps (2030)
6	Screen	Motorized Screens
Details of DWF		
1	DWF Pumps	2W + 2S (2030). Each having capacity 85 lps
2	DWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	306 cum/hr, TDH = 22 m
3	DWF pump motor rating (KW)	20 KW each
4	DWF transmission main dia (mm)/length (m)	300 mm (DI), L = 320 m
Details of SWF		
1	SWF (in lps)	2000 lps
2	SWF Pumps	2W + 1S (2030). Each having capacity 1000 lps
3	SWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	3600 cum/hr, TDH = 12 m
4	SWF pump motor rating (KW)	22 KW each
5	SWF transmission main dia (mm)/length (m)	1400 (MS), L = 50 m

81. **Modified Keorapukur Main Pumping Station**. A salient feature of Keorapukur Pumping Station as proposed is given in the **Table 7.**

Table 7: Salient Features of Modified Keorapukur Main Pumping Station (Package Tr 2/ SD 19)

Details of Keorapukur Main Pumping Station		
1	Type	Combined PS (SWF + DWF)
2	Flow	DWF + SWF
3	Design period for Civil Structural units	30 years (2045)
4	Design period for E & M equipments	15 years (2030)
5	Screen	Motorized Screens
Details of SWF		
1	SWF (in lps)	2400 lps
2	SWF Pumps	3W + 1S (2030). Each having capacity 800

Details of Keorapukur Main Pumping Station		
		lps
3	SWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	2880 cum/hr, TDH = 17 m
4	SWF pump motor rating (KW)	240 KW each
5	SWF transmission main dia (mm)/length (m)	1400 (MS), L = 170 m

82. **Churial Pumping Station**. A salient feature of Churial Pumping Station as proposed is given in the **Table 8.**

Table 8: Salient Features of Churial Pumping Station (Package Tr 2/ SD 22)

Details of Churial Pumping Station		
1	Type	Combined PS (SWF + DWF)
2	Flow	DWF + SWF
3	Design period for Civil Structural units	30 years (2045)
4	Design period for E & M equipments	15 years (2030)
5	DWF (in lps)	200 lps (2030)
6	Screen	Motorized Screens
Details of DWF		
1	DWF Pumps	2W + 2S (2030). Each having capacity 100 lps
2	DWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	360 cum/hr, TDH = 23 m
3	DWF pump motor rating (KW)	40 KW each
4	DWF transmission main dia (mm)/length (m)	400 mm (DI), L = 150 m
Details of SWF		
1	SWF (in lps)	8000 lps
2	SWF Pumps	8W + 2S (2030). Each having capacity 1000 lps
3	SWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	3600 cum/hr, TDH = 13 m
4	SWF pump motor rating (KW)	260 KW each
5	SWF transmission main dia (mm)/length (m)	1400 (MS), L = 600 m

83. **Vidyasagar Palli Pumping Station**. A salient feature of Vidyasagar Palli Pumping Station as proposed is given in the **Table 9.**

Table 9: Salient Features of Vidyasagar Palli Pumping Station (Package Tr 2/ SD 23)

Details of Vidyasagar Palli Pumping Station		
1	Type	Combined PS (SWF + DWF)
2	Flow	DWF + SWF
3	Design period for Civil Structural units	30 years (2045)
4	Design period for E & M equipments	15 years (2030)
5	DWF (in lps)	94 lps (2030)
6	Screen	Motorized Screens
Details of DWF		
1	DWF Pumps	2W + 2S (2030). Each having capacity 47 lps
2	DWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	169 cum/hr, TDH = 15 m
3	DWF pump motor rating (KW)	25 KW each
4	DWF transmission main dia (mm)/length (m)	300 mm (DI), L = 80 m
Details of SWF		
1	SWF (in lps)	2100 lps
2	SWF Pumps	3W + 1S (2030). Each having capacity 700 lps
3	SWF pump discharge capacity (Cu.m/hr) and Head (m) of each pump	2520 cum/hr, TDH = 13 m
4	SWF pump motor rating (KW)	460 KW each
5	SWF transmission main dia (mm)/length (m)	1200 (MS), L = 60 m

84. **Lalababu Nikashi Pumping Station**. A salient feature of Lalababu Nikashi Pumping Station as proposed is given in the **Table 10.**

Table 10: Salient Features of Lalababu Nikashi Pumping Station (Package Tr 2/ SD 23)

Details of mechanical equipment/ items proposed for this pumping station is given below: • Estimated storm water flow (SWF) : 5000 lit/sec (18000 m3/hr) • Each of capacity 1000 lps , (3600 m3/hr) (5 working + 1 standby), 12 m , 220 KW • Delivery size of each pump- 800 mm dia. • Semi course and fine screen Capacity of pumps provided - SWF pumps : 1000 lps (3600 m3/hr.)arrangement : 12 nos. in 3 channels complete with motorized lift arrangement : 1 no. with 2 sections • Manual lifting type bar screens (medium) : 6 nos. for 3 channels • Sluice gate : 7 nos. • Electrical & substation arrangement
Details of screens and sluice gates proposed for the pumping station is as follows : • Inlet box size : 2000 x 2000 mm dia. • Screens (upon consideration of clogging) : 3 nos. channel (each 2.0m width) • Sluice gate : 6 nos. (1.5m x 1.5m) + 1 no. 2000 x1500 m (flap shutter)

Pumping Mains
The proposed pumping station will have SWF pump to discharge SWF directly to Bagjola canal. The common manifold is proposed of MS pipe of 1600 mm diameter and length is 60 m.

85. **Figure 4 to 18** shows project locations and proposed plan. Google map for the location of pumping stations is shown in **Figure 19.**

86. **Excess Earth**. Excess earth from construction sites will be disposed at pre-approved sites. For Tranche 1 packages disposal sites have been selected by contractors and after approval from KMC and DSC they started disposal of excess earth, road crust and slurry. For Tranche 2 those sites will be not used by new contractors. It is decided under Tr-2 that part of excess earth and road crust will be utilized for filling up low land of Vivekananda road Pumping Station land (package Tr-2/ SD-11). For rest of the excess earth contractor will arrange suitable disposal site land and after approval they will dispose the waste in arranged sites. This condition will be included in BID document. Google map and site photographs of proposed Vivekananda Road PS land are attached as **Appendix 7.**

87. Water from pits will be disposed in nearest drains or in pre-approved nearby water bodies. Supernatant liquid from waste slurry of micro-tunneling will be similarly disposed.

88. Estimated solid wastes to be handled and disposed under the S & D subproject are given in the following **Table 11.**

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Table 11: Estimate of solid wastes to be generated under S & D subproject

Component	Pack Tr 02/09 (Both PS & SD)	Pack Tr 02/10 (S& D)	Pack Tr 02/11 (Both PS & SD)	Pack Tr 02/12 (S& D)	Pack Tr 02/13 (S & D)	Pack Tr 02/14 (S & D)	Pack Tr 02/19 (Both PS & SD)	Pack Tr 02/22 (S& D)	Pack Tr 02/23 (PS)
Estimated approx. volume of soil to be excavated (m^3)	116895.90	118837.50	126109.24	28299.74	107423.80	238694.49	100160.0	146984.65	40707.61
Estimated approx. volume of excess excavated soil to be disposed (m^3)	20026.60	63187.23	67053.69	24903.77	14711.40	40893.13	53256.19	78153.38	21644.69
Estimated approx. volume of road crust to be removed and disposed (m^3)	10225.60	6969.24	7395.69	916.0	9078.30	20775.0	8262.0	9029.0	2387.30

E. Implementation Schedule

89. Construction work is likely to commence in 2016 and will be completed in 36 months for the total S & D Subprojects under **Tranche 2.** However, individual components will be taken up phase wise in an average of 36-30 months construction period.

90. This is Sub project appraisal report stage, implementation schedule will be finalized after finalization of DPR. Tentative schedule is given below.

Table 12: Package-wise Implementation Schedule

Activity	Tr 02/SD-09	Tr 02/ SD-10	Tr 02/SD-11	Tr 02/ SD-12	Tr 02/ SD-13	Tr 02/ SD-14	Tr 02/SD-19	Tr 02/ SD-22	Tr 02/ SD-23
Submission by contractor of Site Environmental Plan (SEP) by Contractor	Within 28 days after receiving notice under commencement of work	Within 28 days after receiving notice under commencement of work	Within 28 days after receiving notice under commencement of work	Within 28 days after receiving notice under commencement of work	Within 28 days after receiving notice under commencement of work	Within 28 days after receiving notice under commencement of work	Within 28 days after receiving notice under commencement of work	Within 28 days after receiving notice under commencement of work	Within 28 days after receiving notice under commencement of work
Review and approval by KMC of contractor's SEP, proposed locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes.	Within 21 days	Within 21 days	Within 21 days	Within 21 days	Within 21 days	Within 21 days	Within 21 days	Within 21 days	Within 21 days
Construction period	36 months (April 2016 to March 2019)	36 months (April 2016 to March 2019)	36 months (April 2016 to March 2019)	30 months (April 2016 to September 2018)	36 months (April 2016 to March 2019)	30 months (April 2016 to September 2018)	36 months (April 2016 to March 2019)	30 months (April 2016 to September 2018)	36 months (April 2016 to March 2019)
Commissioning period									

Figure 4: Area considered to be taken up under Package 02/SD-09

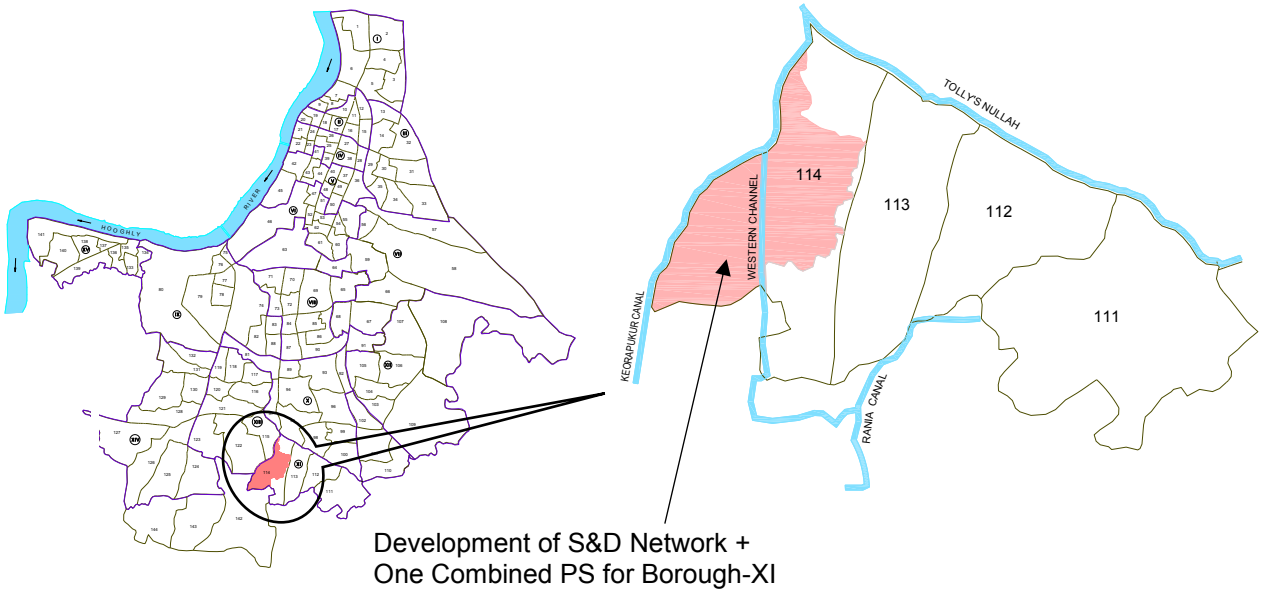


Figure 5: Area considered to be taken up under Package 02/SD-10

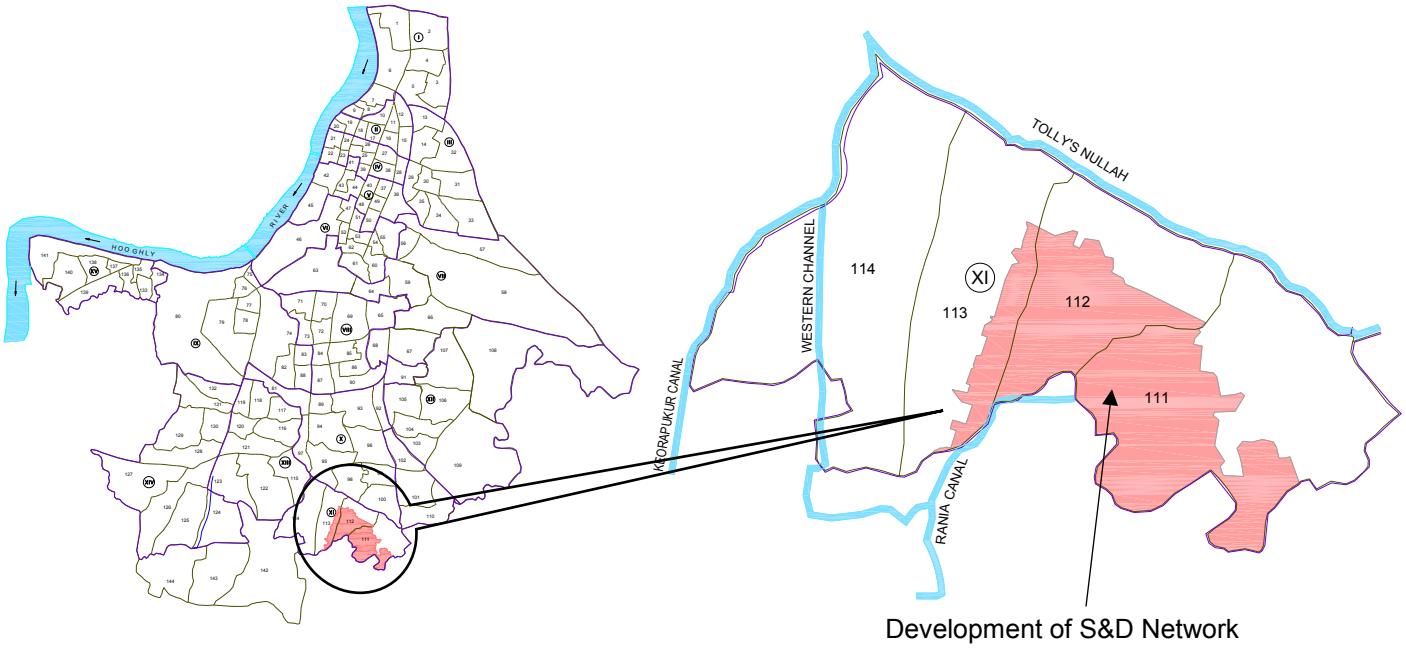


Figure 6: Area considered to be taken up under the Package 02/SD-11

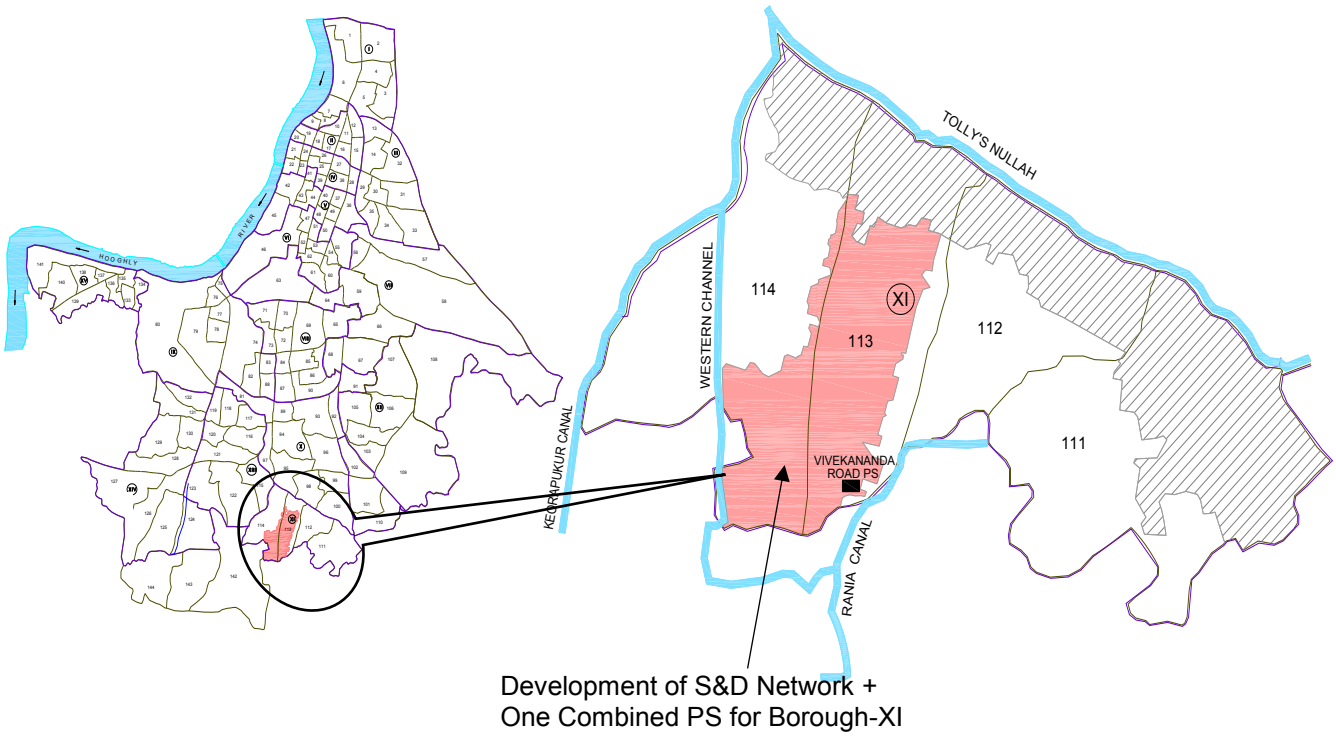
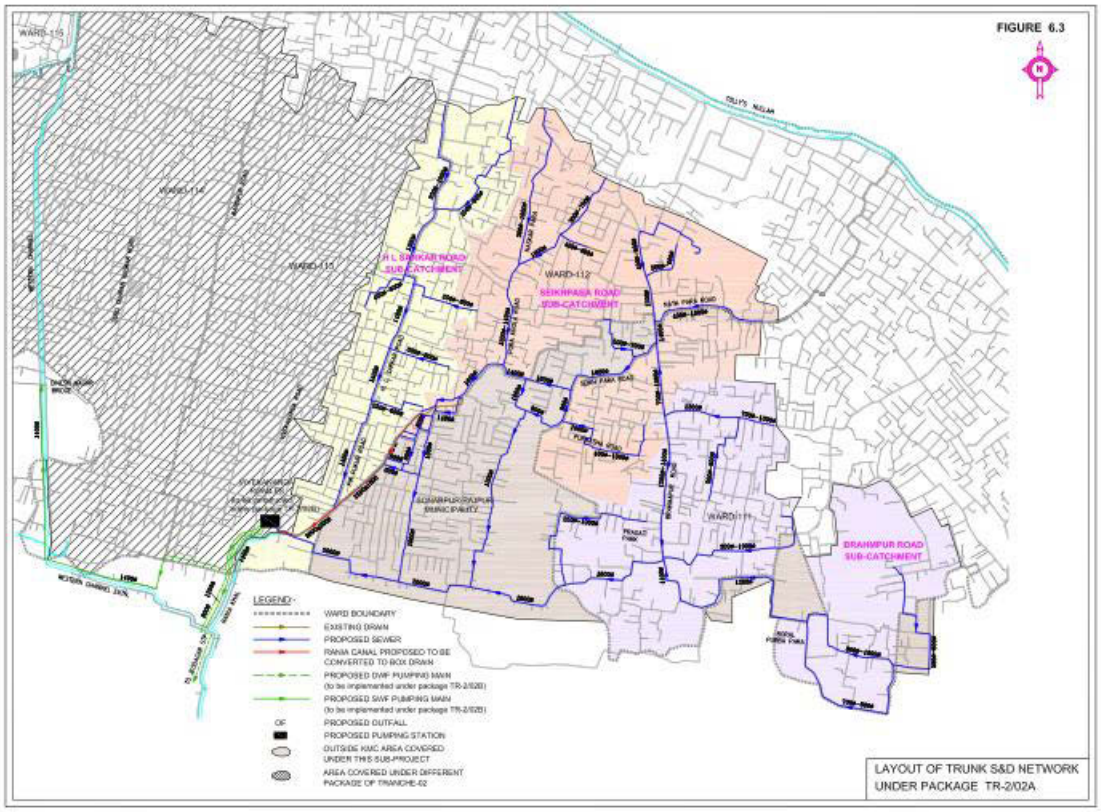


Figure 7: Layout Trunk main and network for package 02/SD-10



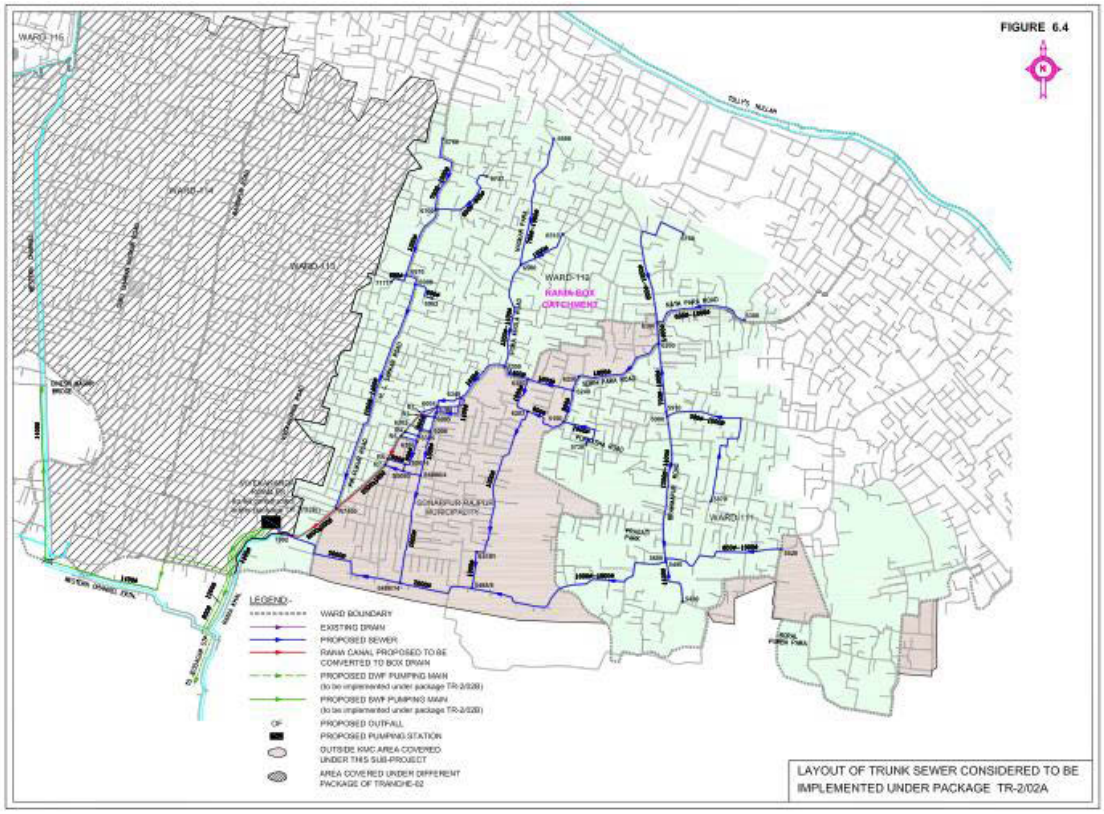
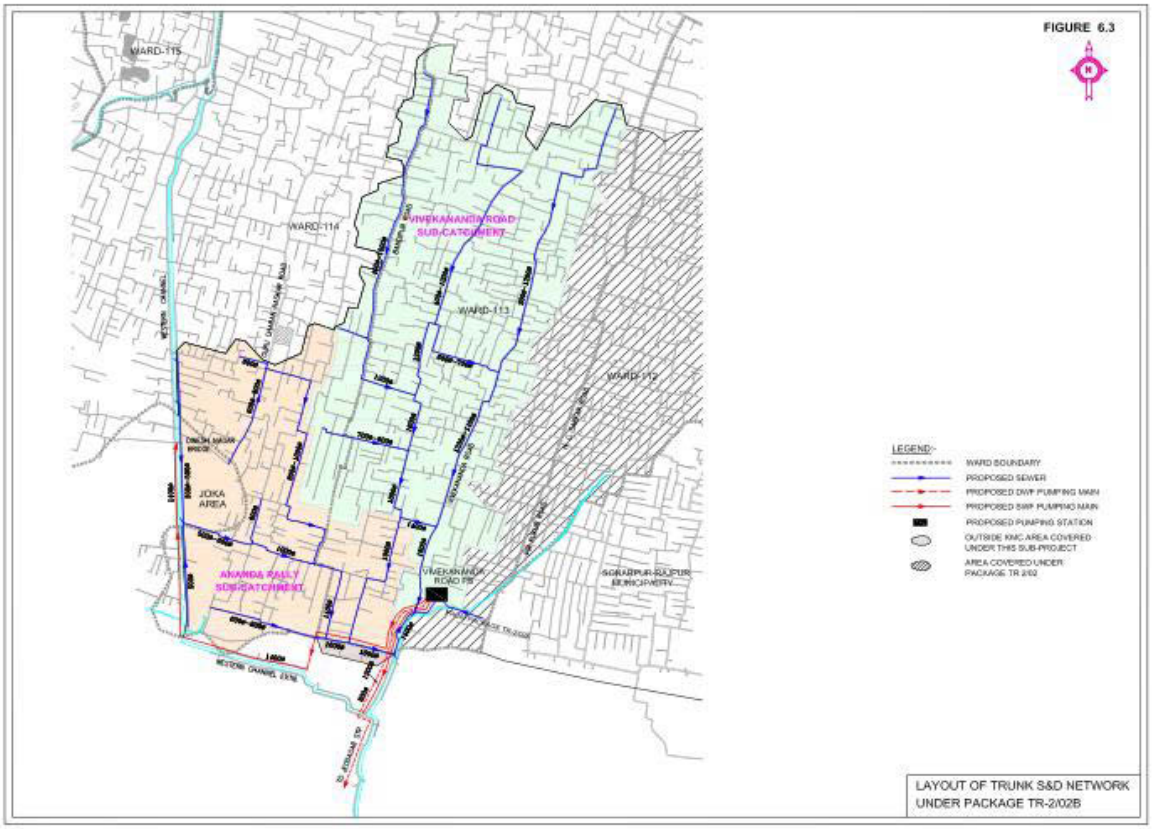


Figure 8: Area Considered for Development of S&D System under Package –TR -02/SD-12 and 02/SD-13



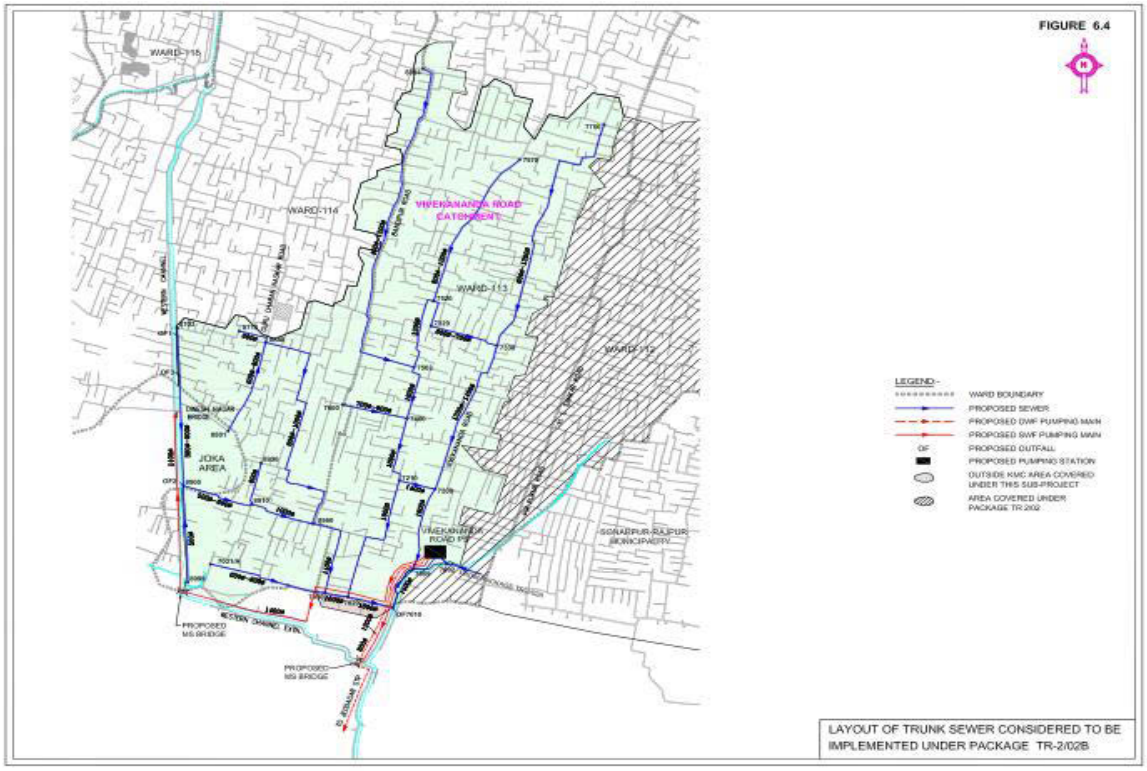


Figure 9: Area considered to be taken up under the package Tr 2/SD-13

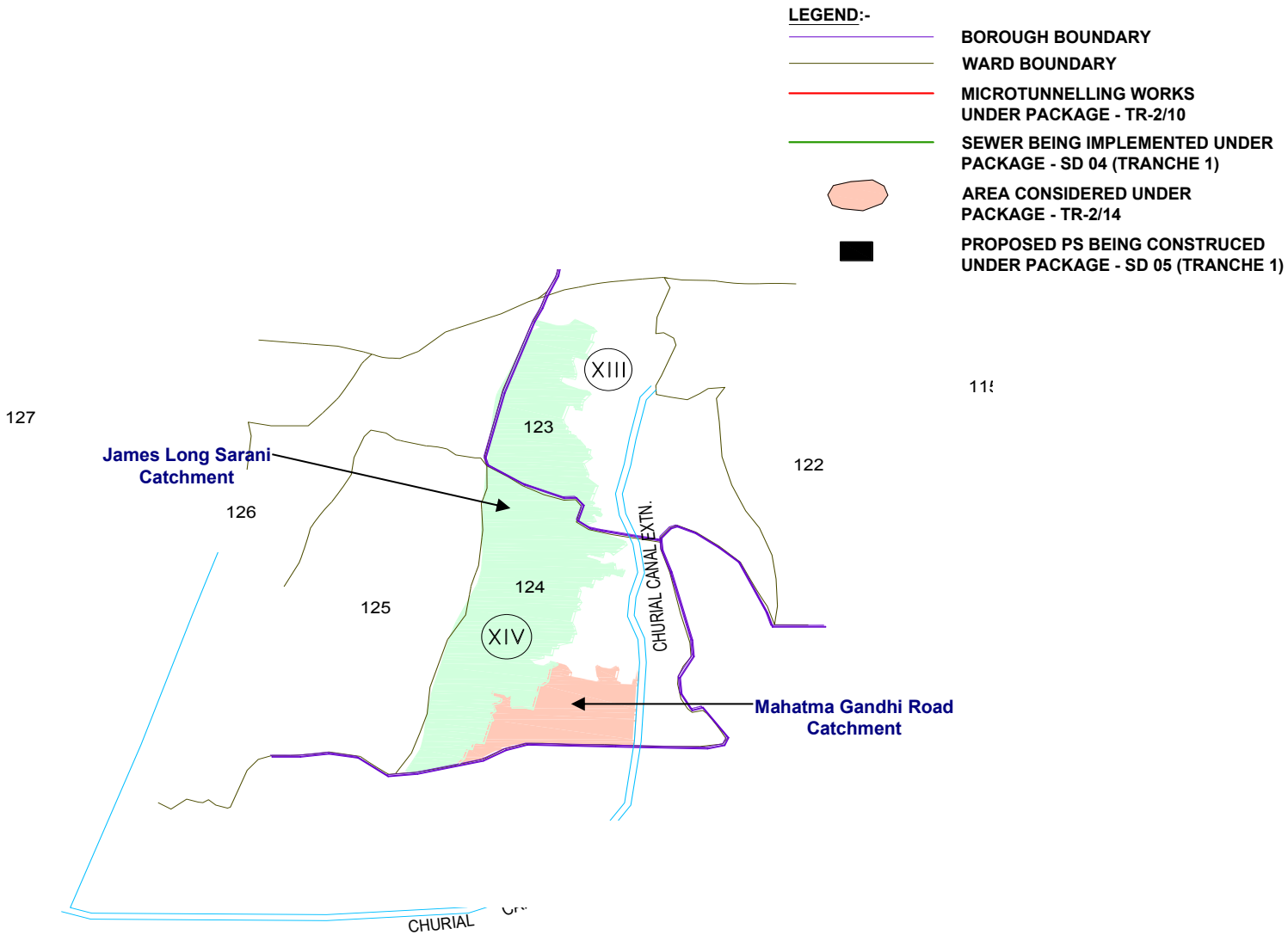


Figure 10: Show the area contributing DWF under the sub project

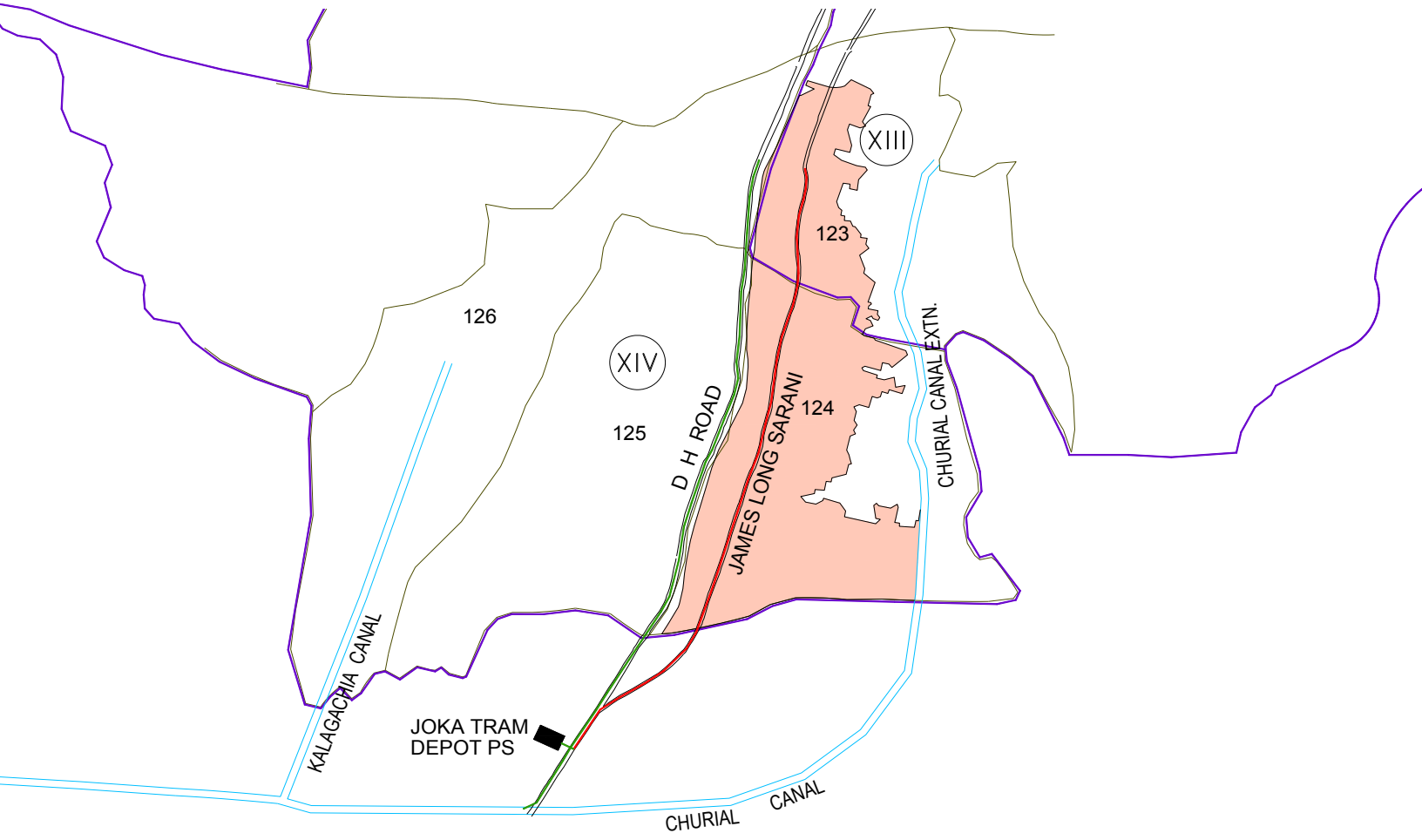
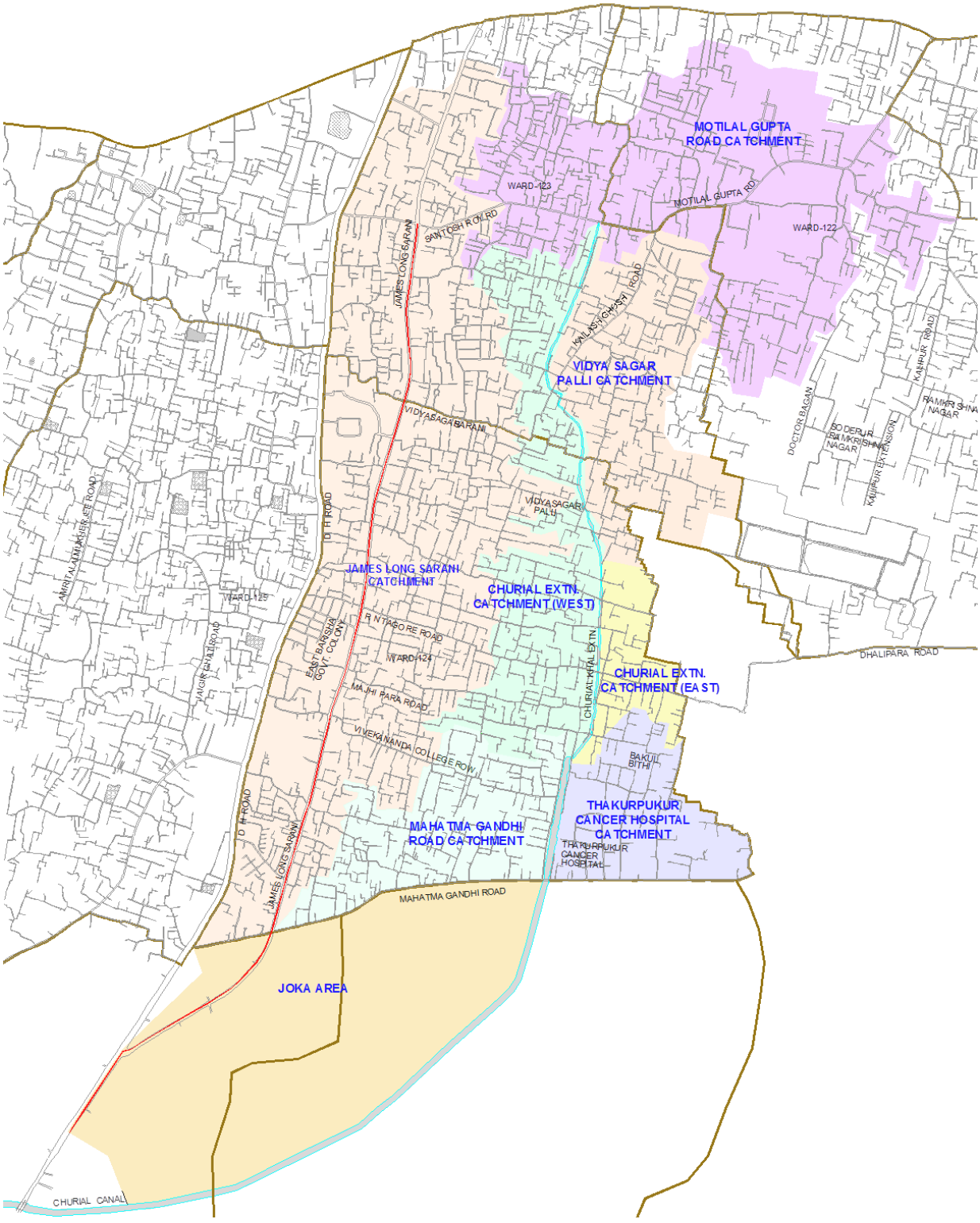


Figure 11: Show the area contributing SWF under the sub project

LEGEND:-

WARD BOUNDARY

MICROTUNNELLING WORKS UNDER THIS PACKAGE



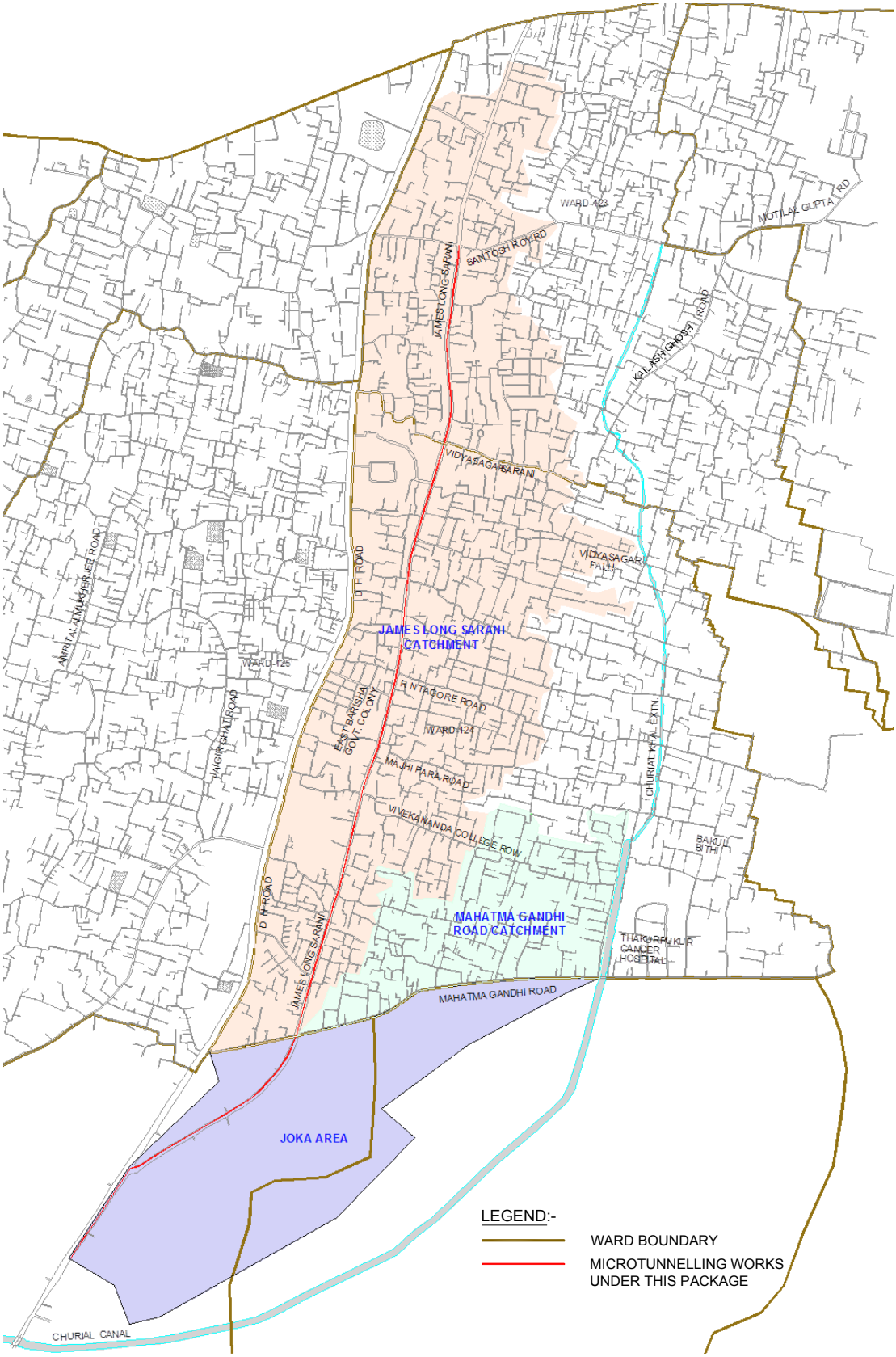

WARD-123
MOTILAL GUPTA RD
SANTOSH ROY RD
JAMES LONG SARANI
KAILASH GHOSH ROAD
VIDYASAGAR SARANI
VIDYASAGAR PALLY
AMRITLAL MUKHERJEE ROAD
D H ROAD
JAMES LONG SARANI CATCHMENT
WARD-125
JAGIR GHATA ROAD
EAST BARISHA GOVT. COLONY
R N TAGORE ROAD
WARD-124
MAJHI PARA ROAD
VIVEKANANDA COLLEGE ROW
CHURIAL KHAL EXTN
BAKUL BITHI
MAHATMA GANDHI ROAD CATCHMENT
THAKURPUKUR CANCER HOSPITAL
MAHATMA GANDHI ROAD
JOKA AREA
CHURIAL CANAL
LEGEND:-
WARD BOUNDARY
MICROTUNNELLING WORKS UNDER THIS PACKAGE

Figure 12: Line Diagram showing SWF and DWF disposal arrangement under Package 02/SD-14

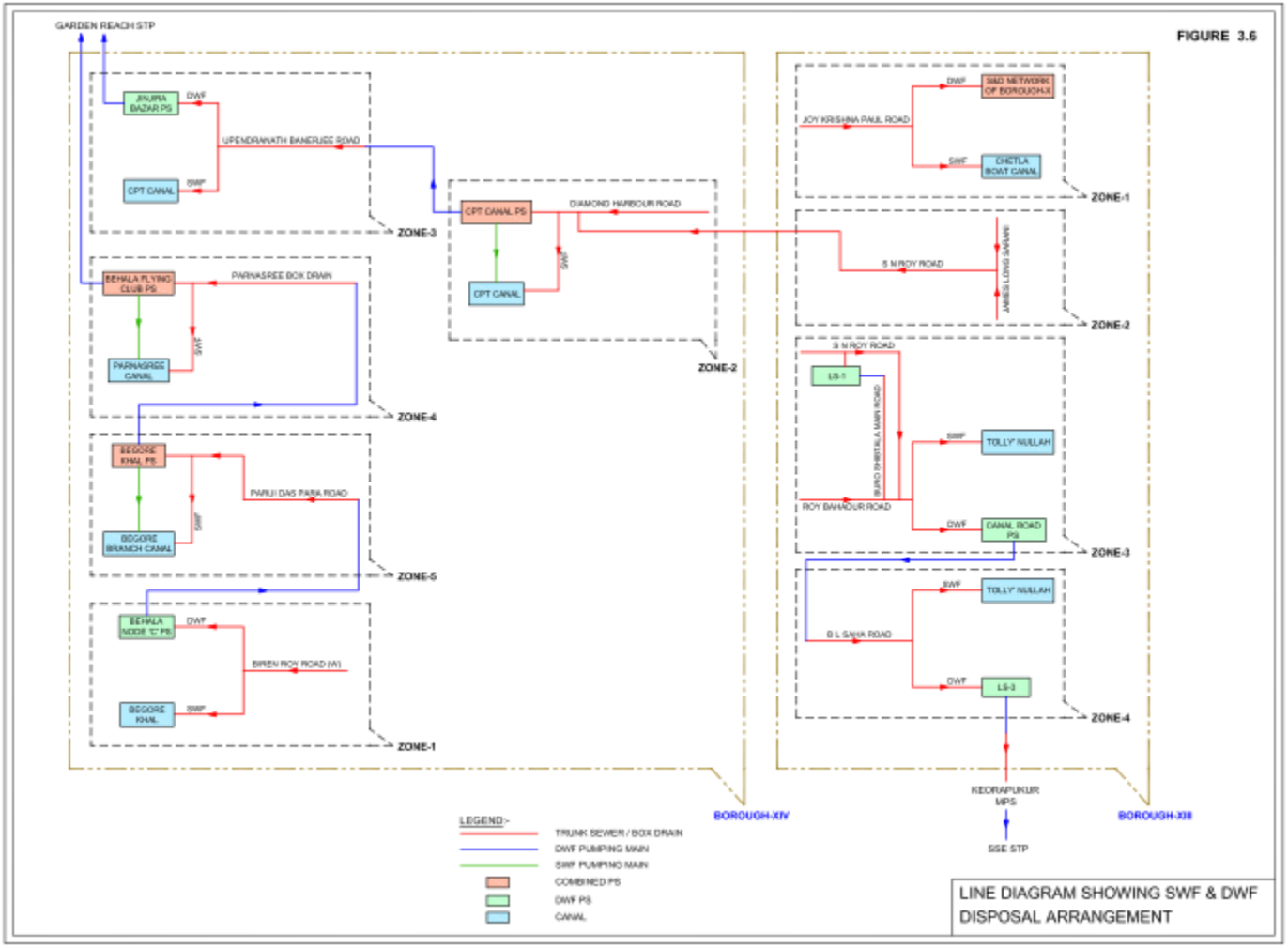


Figure 13: Lateral sewer locations proposed under Borough XIII under Package Tr2/SD-14

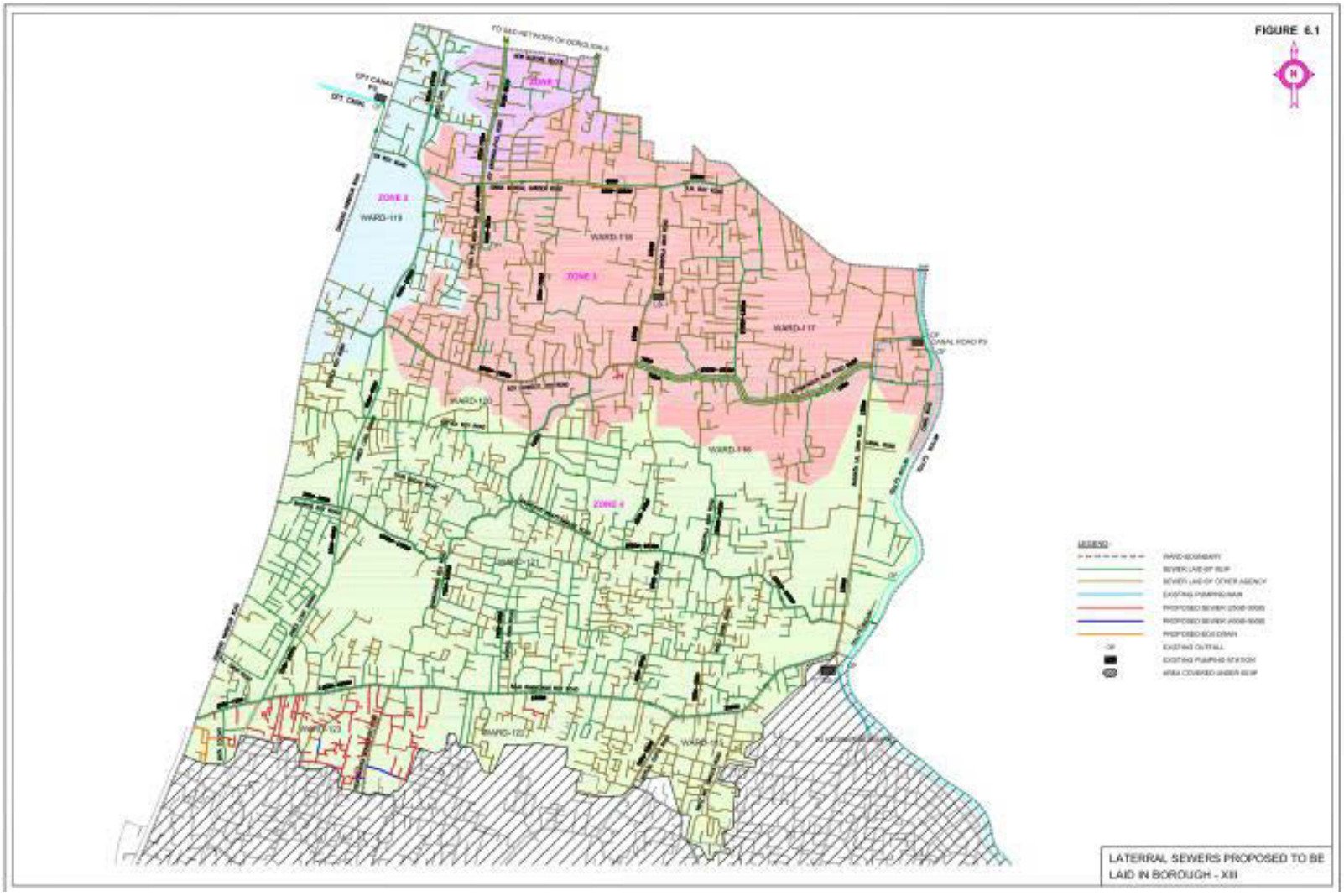


Figure 14: Lateral sewer locations proposed under Borough XIV under Package Tr2/SD-14

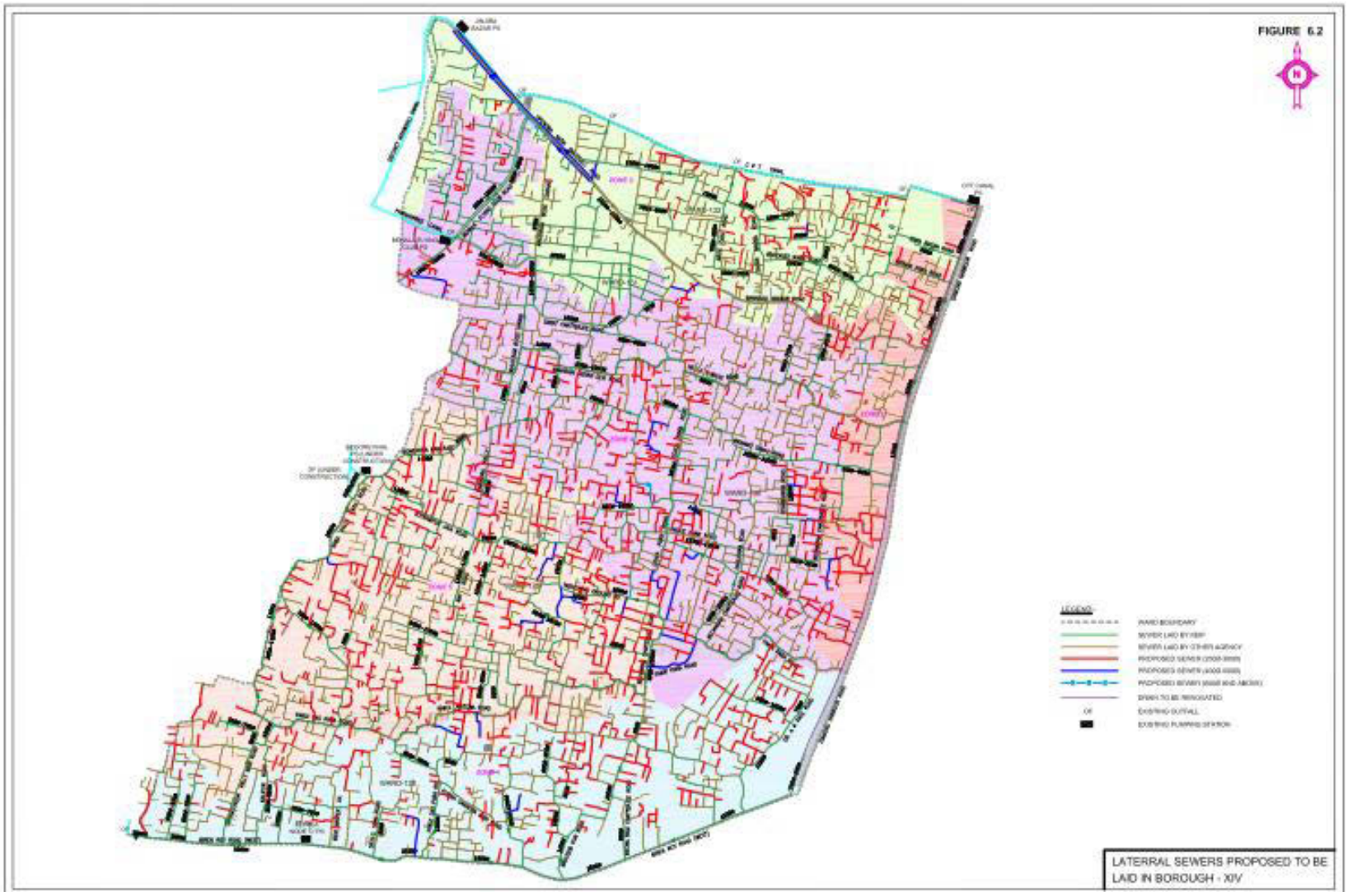


Figure 15: Trunk Sewer and PS under Package SD-19

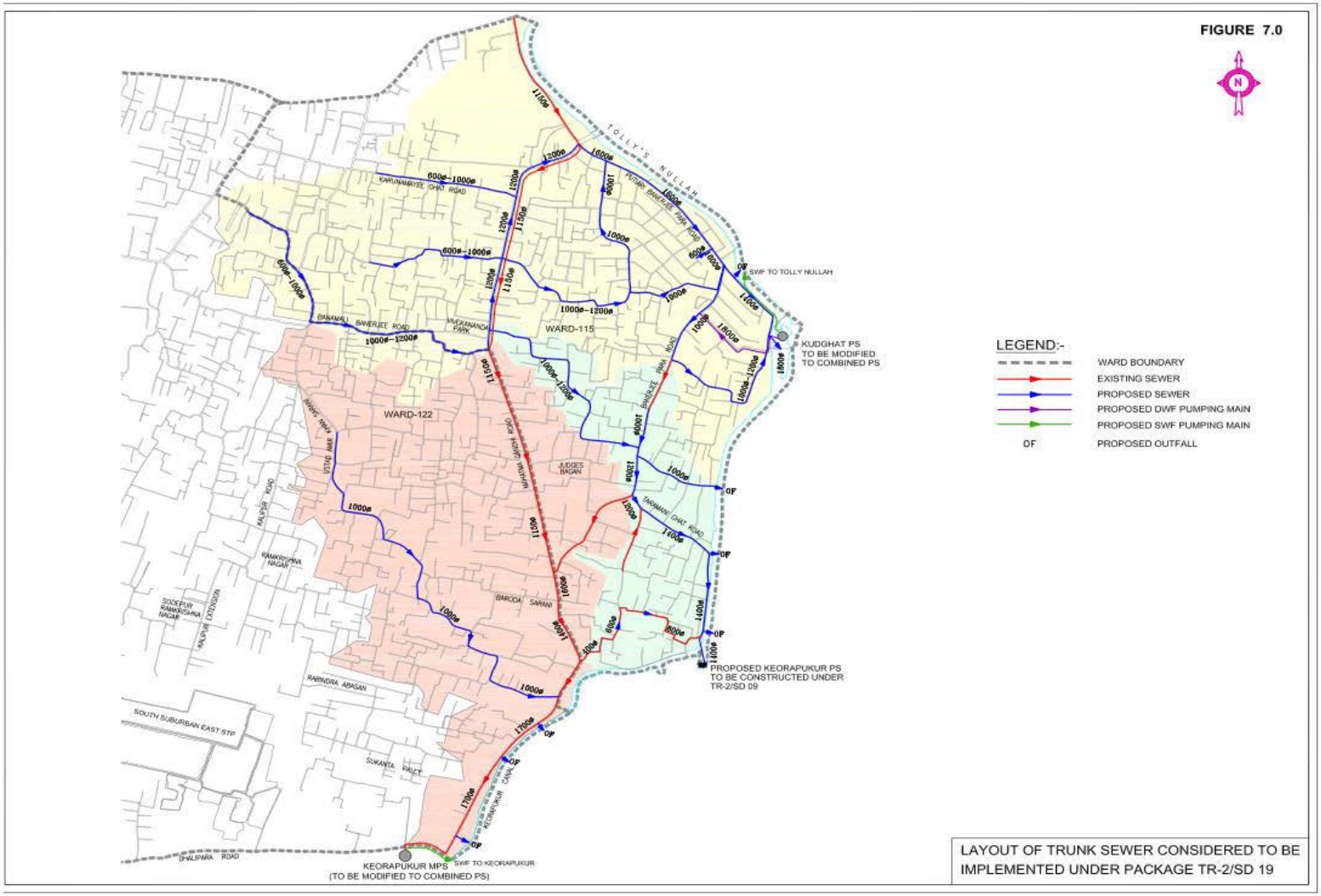


Figure 16: Trunk Sewer and PS under Package SD-22

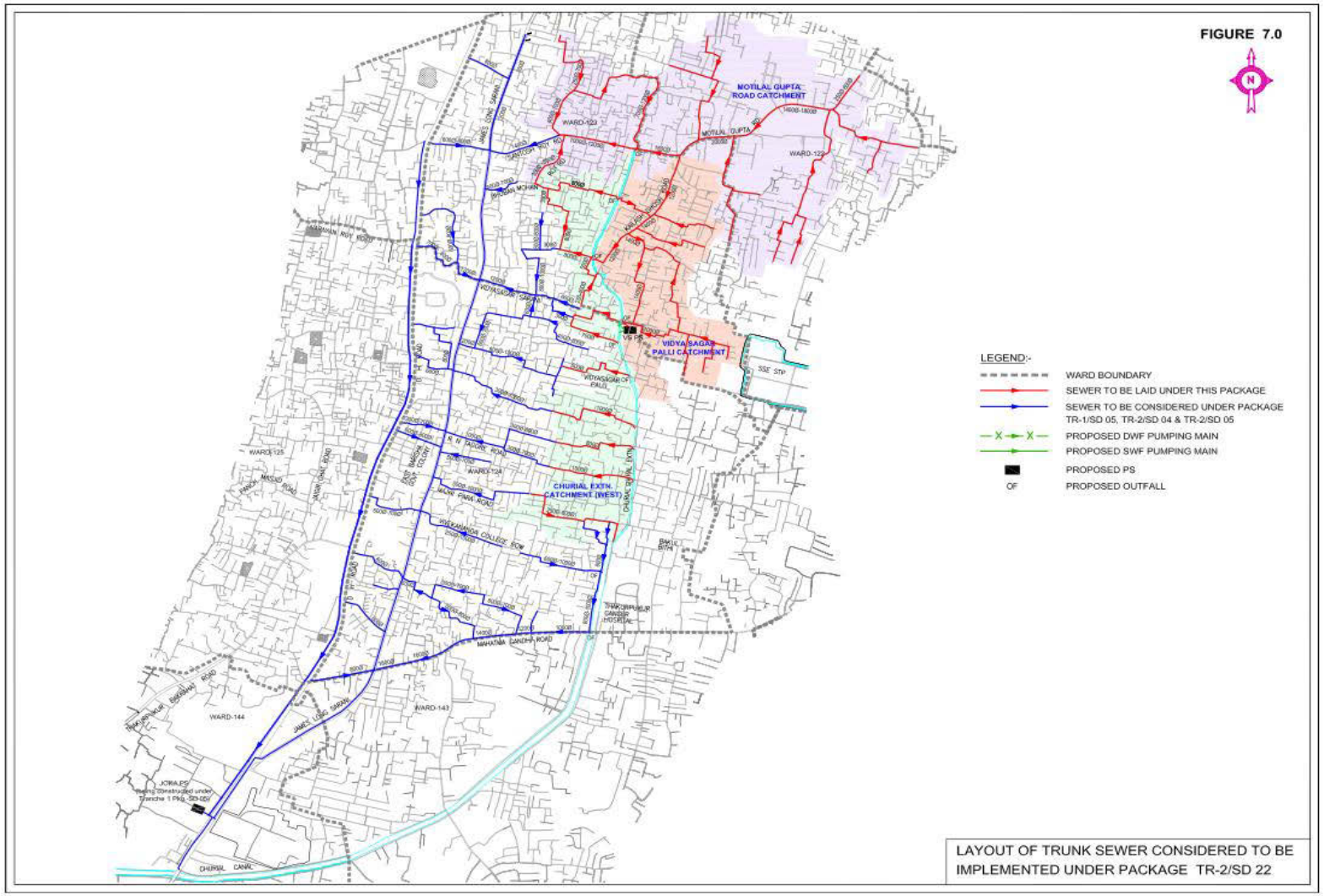


Figure 17: Pumping station for Package SD-23

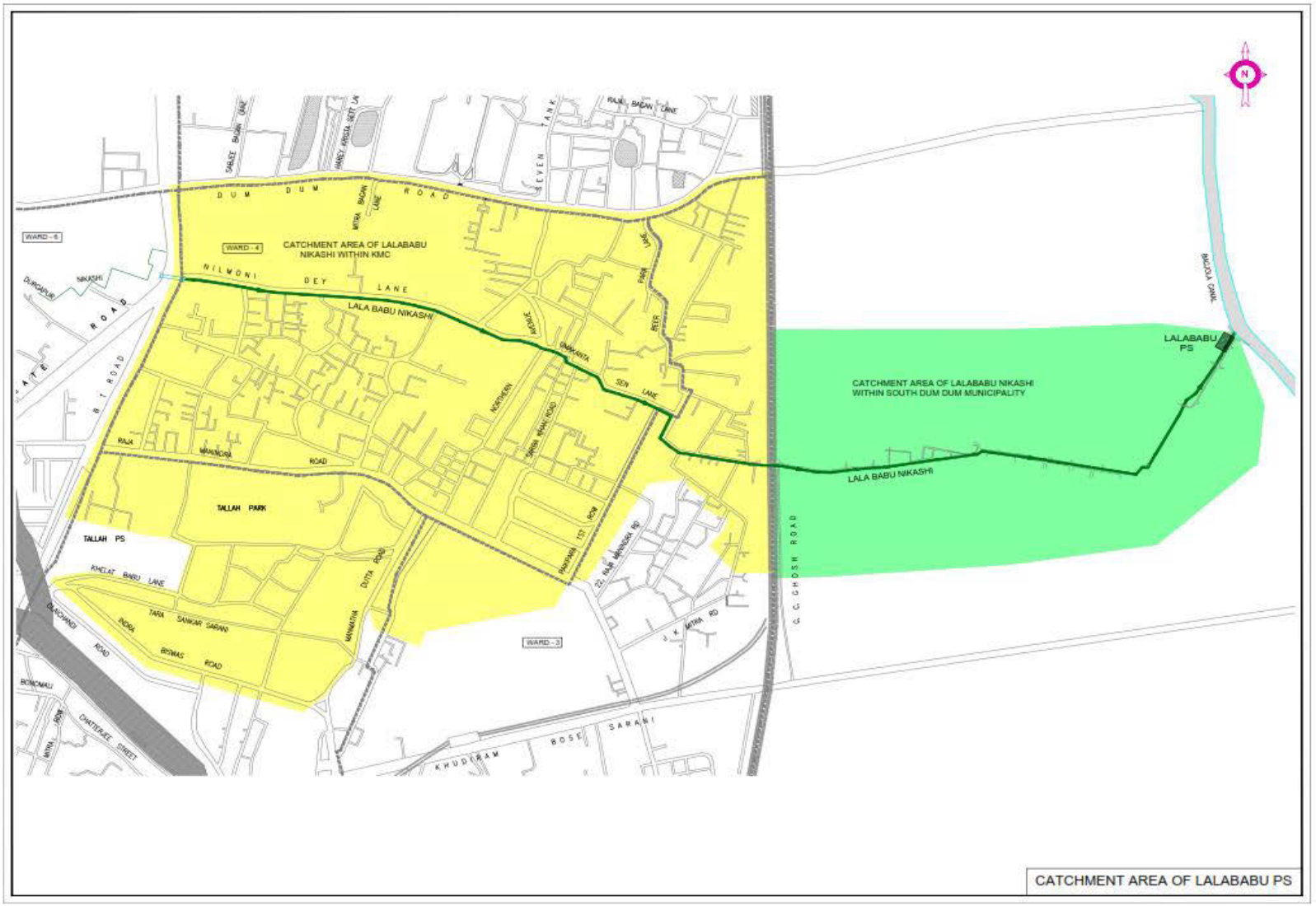


Figure 18: Location of proposed pumping stations

IV. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

A. Physical Resources

91. **Topography, drainage, and natural hazards**. Regionally KMC area is mostly flat and sloping in general from north to south and from west to east. The southern portion of the subproject area within Boroughs XI, XIII and XIV are low lying and marshy. Similarly, the southwestern part of Borough XV and different parts of Borough XII are low lying. The broad topographical features of the subproject area are given in **Table 13**.

Table 13: Topographical information of Boroughs XI-XV, KMC

Basin	Ground level	General slope
XI	Varying from 6.34 m to 2.16 m	Generally in north to south direction
XII	Varying from 5.69 m to 1.02 m	Topography of the area is generally flat with a ridge along EM bypass. A portion of northern part of the area slopes towards Tolly's *nullaha* and the balance area slopes towards north east direction.
XIII	Varying from 7.09 m to 1.15 m	Generally in north to south and east to west direction
XIV	Varying from 5.79 m to 1.04 m	Generally in north to south and east to west direction
XV	Varying from 5.50 m to 1.50m	Generally in north to south and west to east direction

92. The primary surface water resource for Kolkata is the Hooghly River. In addition, the city has a large number of water bodies and canals that are heavily used for everything from water supply, bathing, washing, aquaculture, and recreation to waste disposal. Hooghly river forms the western boundary of the KMC area. Bidyadhari and Kulti rivers meander along the eastern boundaries of KMC and discharge directly in to the Bay of Bengal. These rivers, along with an elaborate network of canal systems connected to these rivers are the recipients of entire drainage from KMC and its adjacent areas. Drainage of KMC area is generally divided in to the following drainage basins according to the topography and land use: Kolkata Basin; Bagjola Basin; Tollys Nullah Basin; Manicktala Basin; Tollygunge – Panchanagram (T-P) Basin; Keorapukur Basin; Monikhali Basin; and Churial Basin.

93. The KMC area, with its generally flat terrain condition, receives more than 1,582 mm of rainfall yearly mainly spread over a 4 months period and comprised of mainly medium density – high frequency long duration storms. Due to the absence of an efficient drainage system to cater such an adverse condition, large areas of KMC suffer from prolonged inundation during monsoon causing severe health and economic hazards to the inhabitants.

94. The waste and storm water of the KMC area is carried by a system of natural and man-made canal system as follows:

(i). Bagjola Canal system – flowing in easterly direction
(ii). Kestopur Canal system – flowing in southerly direction
(iii). Beliaghata (Circular) Canal system
(iv). Storm Water Flow (SWF) – Dry Weather Flow (DWF) canal system flowing in easterly direction towards East Kolkata Wetlands carrying the pumped storm and sewage water of Kolkata
(v). Tolly's nala system

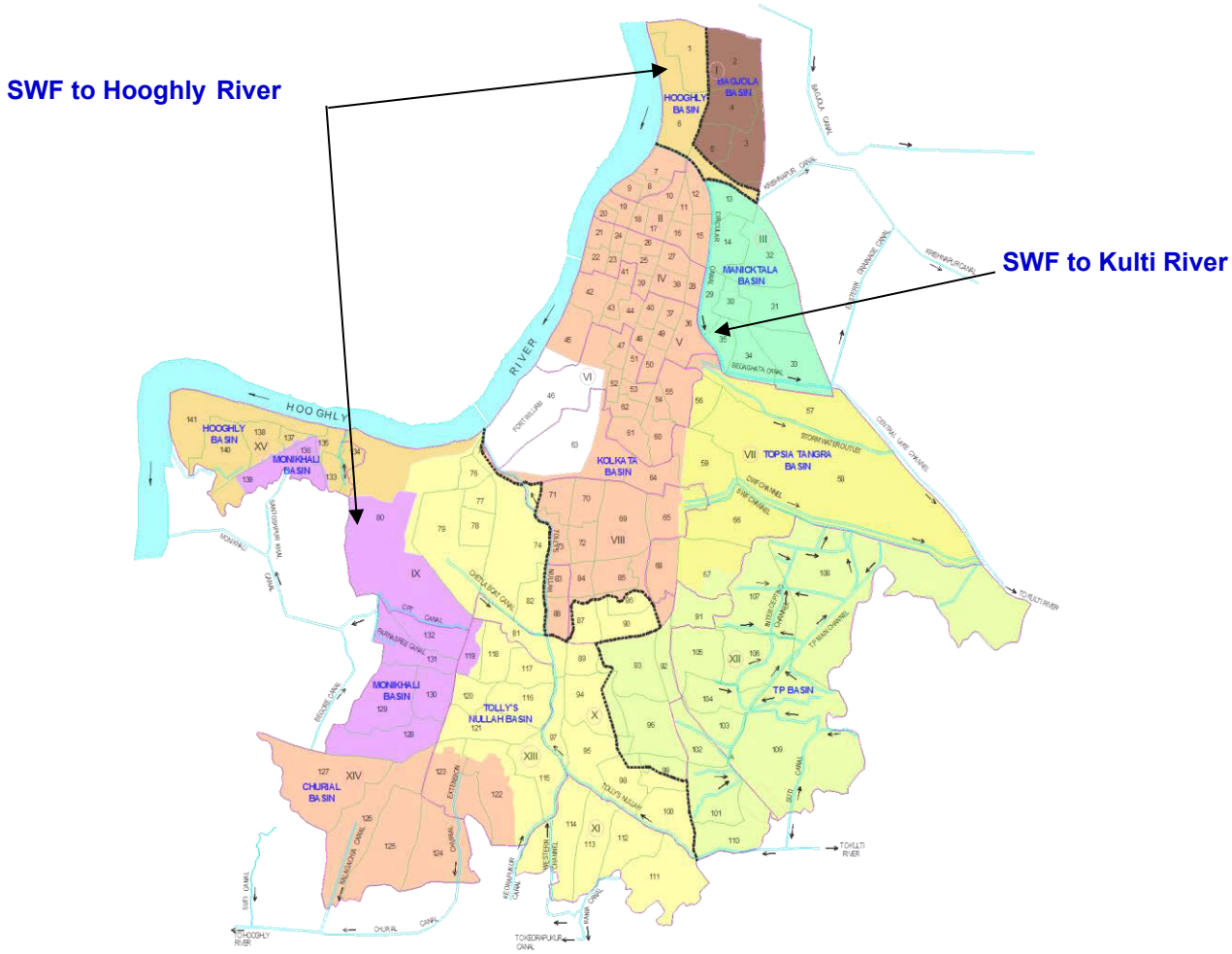
(vi). T-P system
(vii). Monikhali system
(viii). Churial system

95. Drainage basin and catchment area map of KMC is presented in **Figure 20.**

96. The principal features of the existing drainage basin layout for the KMC area were delineated in the Master Plan for Water Supply, Sewerage & Drainage in Calcutta Metropolitan District (1966-2000) prepared by CMPO. In the S&D Master Plan prepared for the Kolkata City in 2007 under KEIP, certain changes in basin boundaries have been identified from the earlier recommendations due to alterations arising out of changes in the existing drainage network of the areas.

97. The KMC area is divided into nine major drainage basins namely Kolkata basin, Manicktala basin, Tolly's Nullah basin, Topsia - Tangra basin, Hooghly basin, Tollygunge - Panchannagram (TP) basin, Bagjola basin, Monikhali basin and Churial basin. Out of these, the sub-project area comprising parts of Boroughs XIII and XIV come under Churial Basin. **Figure 19** shows the catchment delineation of the different drainage basins within KMC area.

Figure 19: Catchment delineation of Different Drainage Basins within KMC Area



98. Natural hazards in Kolkata include water logging and flooding during monsoon months. Sample socio-economic survey conducted in Borough XI-XV during preparation of DPR of KEIP II revealed that streets in the vicinity of households remained under water four times on an average during the year 2008. In areas like Behala, Tollygunge and Garden Reach a medium to heavy shower causes water logging in some localities which takes considerable period to evacuate. Some pockets remain partially inundated for even 3 to 4 months in a year. All these result due to inadequate drainage facility in such selected areas. In many cases, newly constructed roads are in embankment and higher than the built-up areas causing stagnation of water in pockets. However, with the completion of KEIP S & D subprojects situations have improved to a great extent.

99. Duration of flooding varies from hours to days, depending on the facility available, nature of topography and outfall conditions in and around different localities. However, July is the worst month, followed by June and August.

100. In revised seismic zones map of India (IS 1893; Part 1, 2002) eastern part of Kolkata falls in Zone IV while the area to the west falls in Zone III. No seismic micro-zonation map has yet been prepared for the KMC area.

101. **Geology and Mineral Resources.** The subproject area is underlain by Quaternary sediments consisting of clay, silt, and various grades of sand, gravel, and pebbles. Lithological logs show the presence of a clay bed at the top, with a thickness of 10 to 40m. There is a further clay bed 250 to 650 m below ground level. There is a group of granular aquifers between these layers, and these are being tapped as a ground water resource. Regional subsoil data covering a large area in subproject area reveal six levels of strata up to a depth of about 50 m below ground level. Near surface stratigraphy of Kolkata Region is given in **Table 14.**

Table 14: Near Surface Stratigraphy of Kolkata Region

Horizon I	Stratum I	Brownish grey/ light brown, silty clay/ clayey silt/ sandy silt with occasional lenses of silty fine sand; encountered from the top ground surface to a depth of about 3 to 4 m; occasionally only fill material of widely varying characteristics (about 4 m).
	Stratum II	Grey/ dark gray silty clay with semi-decomposed timber pieces, having lenses of silt and peaty clay; encountered between depths 3-4m and approximately 15m below ground level (about 10m).
Horizon II	Stratum III	Bluish grey and mottled brown/ grey, silty clay with kankar nodules and minute pockets of silt and sand (about 5.5m).
	Stratum IV	Brown/ yellowish brown, sandy silt/ silty fine sand/ clayey silt with lenses and pockets of brown/ grey silty clay (about 6m).
	Stratum V	Mottled brown/ grey, grey silty clay and brown silty clay frequently showing laminar character (about 18m).
	Stratum VI	Brown/ light brown, silty fine to medium sand (9m +).

102. The Horizon I comprising Strata I and II represents generally soft sediments. The second horizon comprising Strata III to VI have two clay layers (Stratum III and V) separated by a predominantly cohesionless layer (Stratum IV). Stratum VI is definitely water bearing and shallow tube wells in Kolkata region draw water from this stratum. The sediments of the second horizon are oxidized and are consolidated. The sequence is intercepted at several locations by deposits of the recent river system, parts of which are now dry.

103. There no mineral occurrence in the area.

104. **Soil.** The Kolkata area may be divided into two groups based on the soil types : Entisols and Alfisols. The Entisols are present at the western part of the area and the other part is represented by Alfisols. These soils are typically deltaic alluvial soils. The agro-climatic zone characterization of the area is Gangetic alluvium group of soils rich in calcium. Free calcium carbonate occurs in surface soils and the soil profile shows low to medium levels of organic matter and medium levels of available phosphate and potash. Kolkata and the neighboring areas are represented predominantly by clayey soils. **Table 15** lists the physical and chemical characteristics of soil sampled and analyzed from the five selected Boroughs of KMC in the southern part of the city.

Table 15: Soil Quality in Five Boroughs of Kolkata Municipal Council

Sl. No.	Parameters	Sample (S1)	Sample (S2)	Sample (S3)	Sample (S4)	Sample (S5)
1	Sand (%)	14.0	15	20	22.0	24.0
2	Silt (%)	32.0	30	40	44.0	30.0
3	Clay (%)	54.0	65.0	60.0	34.0	46.0
4	pH	8.5	9.3	6.9	9.7	9.47
5	Available nitrogen (mg/kg)	1250	1428.0	1071.0	2356.2	904.4
6	Available phosphorus (mg./kg)	180	230	190	280	210
7	Available potassium (mg./kg)	58	80	62.5	90	52.0
8	Iron (mg/kg)	326.0	266.9	250.0	5433.57	3125.87
9	Zinc (mg/kg)	29.1	25.0	28.5	31.1	31.48
10	Copper (mg/kg)	5.81	7.69	8.5	21.94	<0.4
11	Hexavalent chromium (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
12	Trivalent chromium (mg/kg)	11.67	8.33	5	28.33	25.0
13	Nickel (mg/kg)	10.0	13.2	8	14.8	14.0
14	Arsenic (mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
15	Lead (mg./kg)	12.35	12.8	8.5	25.19	13.33
16	Cadmium (mg./kg)	<0.4	<0.4	<0.4	<0.4	<0.4

Notes: S1 - HL Sarkar Road, Borough XI, Ward 113; S2 - Near Chowbagha, Borough XII, Ward 108; S3 - Motilal Gupta Road, Borough XIII, Ward 122; S4 - Near Kalitala Market, Borough XIV, Ward 125; and S5 - Near Badartala, Borough XV, Ward 141

105. **Climate.** The climate is hot and humid from March to October. It is somewhat cool from November to February. Rains are received principally from June to September with frequent pre-monsoon showers and nor'westers during April and May. The winter season begins in November and continues to February, followed by the summer season which continues until mid-June. The monsoon starts in mid-June and goes up to mid-September, sometimes extending up to October.

106. April and May are the hottest months with monthly mean maximum temperature above 35 degree Celcius (deg C). Mean maximum temperature is above 30 deg C from March to October. Relatively low monthly mean minimum temperatures occur during December (15.2 deg C), January (14.1 deg C) and February (18.1 deg C). Mean monthly minimum temperature is relatively high and is between 26 deg C and 27 deg C during the months of May, June, July and August.

107. The average annual rainfall is about 1919 mm with the four monsoon months (June to September). Rainfall peaks in July. Average number of rainy days is about 146 days per annum. During monsoon months it is not uncommon to receive 75 mm to 100 mm of rainfall in a 24 hour period. Such heavy rainfall may occur from 4 to 10 times in a year.

108. Wind is light to gentle with maximum monthly average speed 7.22 kilometer per hour (km/hr). The post-monsoon and winter months (October-February) experience very light wind. The average monthly wind speed during pre-monsoon and monsoon are 6.10 and 5.03 km/hr respectively. The mean annual wind speed is 4.28 km/hr. The prevalent wind direction was from southwest during most of the time in the year, except during winter when the northerly wind became significant. However, during cyclonic storms and depressions especially those occurring in September to October, high wind speed reaching around 100 km/hour is not uncommon.

109. **Air Quality.** The concentrations of air pollutants in Kolkata are highly variable over the seasons. They are at their highest during winter months (November to February) and at their lowest during monsoon months (June to September). 24-hourly suspended particulate matter (SPM) concentration in the winter months generally ranges between 300 and 400 microgram per cubic meter ($\mu g/m^3$), sometimes reaching values in excess of 500 $\mu g/m^3$. 24-hourly respirable particulate matter (RPM) concentration in those months is mostly in the range of 150 to 200 $\mu g/m^3$ but often exceeds 200 $\mu g/m^3$. During monsoon months, the 24-hourly SPM and RPM concentrations come down to around 100 $\mu g/m^3$ and around 50 $\mu g/m^3$ respectively. Similarly, 24-hourly nitrogen oxides (NO_X) concentrations are around 50 $\mu g/m^3$ during the monsoon months but rises to around 90 $\mu g/m^3$, sometime exceeding 100 $\mu g/m^3$, during the winter months. Except for a slight build-up during the winter months, 24-hourly sulphur dioxide (SO_2) concentrations are mostly around 5 to 7 $\mu g/m^3$ during most months of the year. The month of October generally shows a rapid transition from low concentrations of all pollutants to the succeeding high concentration months. But the transition from high concentration in winter months to that of low in monsoon months is rather gradual through the months of March, April and May. Seasonal variations in temperature, wind, rainfall, and other factors account for this.

110. **Table 16** presents the monthly average ambient air quality of Kolkata for the year 2008 calculated from daily measurement data as reported by WBPCB. When compared with national air quality standard for residential areas the ambient air quality of Kolkata does not meet the national standard in respect of RPM (PM_{10})and NOX in terms of both arithmetic annual average and also percent of time the daily concentration exceeding the prescribed standard. However, the concentration of SO_2 adequately meets the national standard on both counts.

Table 16: Monthly average ambient air quality of Kolkata in 2008

Month	SPM		RPM (PM_{10})		SO_2		NO_X	
	A	B	A	B	A	B	A	B
January	352	27/31	178	27/31	9	0/31	91	24/31
February	287	25/29	140	25/29	7	0/29	81	16/29
March	189	10/31	85	10/31	6	0/31	69	1/31
April	139	0/30	55	0/30	5	0/30	62	0/30
May	126	0/31	45	0/31	5	0/31	52	0/31
June	104	0/30	39	0/30	5	0/30	44	0/30
July	107	0/31	37	0/31	5	0/31	47	0/31
August	88	0/31	32	0/31	5	0/31	43	0/31
September	99	0/30	39	0/30	6	0/30	43	0/30
October	177	8/31	81	4/31	7	0/31	62	1/31
November	250	25/30	123	25/30	8	0/30	85	24/30
December	329	31/31	173	31/31	11	0/31	93	25/31
Whole Year	187	126/366	86	122/366	7	0/366	64	91/366
		34.40%		33.30%		0%		24.90%

Source: WBPCB, www.wbpcb.gov.in

Notes: SPM = Suspended Particulate Matter ; RPM = Respirable Particulate Matter; SO_2 = Sulphur dioxide; NOX = Nitrogen Oxides

A = Arithmetic mean concentration in microgram/cum from 24-hourly data

B = Number of days the daily value exceeded the standard out of total days monitored based on 24-hourly data

111. Ambient air quality at Behala Chowrasta, Tollygunge and Kolkata average close to the subproject sites showed the same pattern from April, 2011 to March, 2012 as given in **Table 17.** Concentration of PM_{10} is above the standard.

Table 17: Month-Wise Average Ambient Air Quality at Behala Chowrasta

April, 2011 to March, 2012 (Arithmetic Mean Concentration in $\mu g/m^3$ from 24-Hourly Data)

Months	Behala Chowrasta			Tollygunge			Kolkata Average		
	NO_2	PM_{10}	SO_2	NO_2	PM_{10}	SO_2	NO_2	PM_{10}	SO_2
March'12	NA	NA	NA	NA	NA	NA	24.5	152.0	2.5
February'12	NA	NA	NA	NA	NA	NA	48.0	237.0	5.7
January'12	NA	NA	NA	NA	NA	NA	34.6	188.0	5.0
December'11	88.0	250	10.0	72.4	181	8.2	75.2	207.0	8.2
November'11	67.7	165	8.9	56.0	144	6.9	58.0	161.0	7.3
October'11	65.3	125	9.4	59.4	87	8.4	57.1	107.0	8.1
September' 11	47.1	52	7.2	35.7	33	5.6	37.3	42.0	5.7
August'11	37.8	40	6.4	29.9	25	4.9	31.9	31.0	5.3
July' 11	40.0	40	5.8	30.7	31	4.8	31.0	33.0	4.9
June' 11	42.7	45	5.5	37.9	38	4.9	36.2	39.0	4.7
May' 11	44.8	50	6.0	42.3	39	5.8	40.4	45.0	5.3
April' 11	48.7	70	6.0	42.5	61	5.4	43.7	67.0	**5.4**
Yearly Mean	**53.6**	**93.0**	**7.2**	**45.2**	**71**	**6.1**	**43.2**	**109.0**	**5.7**

NA: Not Available

{Standard = 1. PM_{10} for industrial, Residential and Rural and other areas: 60 $\mu g/m^3$ (Annual); 100 $\mu g/m^3$ (24 Hour); 2. NO_2 for industrial, Residential and Rural and other areas: 40 $\mu g/m^3$ (Annual); 80 $\mu g/m^3$ (24 Hour); 3. SO_2 for industrial, Residential and Rural and other areas: 50 $\mu g/m^3$ (Annual); 80 $\mu g/m^3$ (24 Hour)}

Source: WBPCB Annual Report 2011-2012- Latest report disclosed by WBPCB, www.wbpcb.gov.in

Notes: NO_2 = Nitrogen oxides; PM_{10} = Particulate Matter with diameter of 10 micron or less; SO_2 = Sulphur dioxide

112. Results of limited time air quality monitoring carried out by KEIIP near Joka tram depot are reproduced in **Table 18**. The values are comparable with the general air quality level of Kolkata and surrounding areas.

Table 18: Ambient Air Quality at Diamond Park Club, near Joka Tram depot

Date	Shift wise sample no.	Pollutants level in $\mu g/m^3$				
		PM_{10}	SPM	SO_2	NO_2	CO
21.10.2011	1/1	139.2	268.5	6.8	38.5	<125
to	1/2	126.0	237.2	5.2	26.5	<125
22.10.2011	1/3	137.2	241.8	5.8	30.0	<125
24.10.2011	2/1	143.8	278.2	7.2	40.0	<125
to	2/2	130.8	236.5	5.6	26.5	<125
25.10.2011	2/3	136.8	247.2	6.5	35.0	<125
31.10.2011	3/1	136.8	260.1	6.7	36.5	<125
to	3/2	120.8	228.5	5.8	28.7	<125
01.11.2011	3/3	128.3	237.2	6.1	32.8	<125
03.11.2011	4/1	130.8	256.2	6.5	35.0	<125
to	4/2	112.9	218.5	5.6	25.0	<125

Date	Shift wise sample no.	Pollutants level in µg/m^3				
		PM_{10}	SPM	SO_2	NO_2	CO
04.11.2011	4/3	120.5	224.8	5.8	31.6	<125
07.11.2011	5/1	143.8	280.5	7.2	42.5	<125
to	5/2	132.5	256.7	6.2	32.5	<125
08.11.2011	5/3	123.7	238.2	6.0	31.2	<125
10.11.2011	6/1	123.5	237.2	5.9	32.8	<125
to	6/2	116.3	210.5	5.6	25.0	<125
11.11.2011	6/3	126.5	228.1	5.6	31.5	<125
14.11.2011	7/1	168.2	273.5	7.8	45.0	<125
to	7/2	130.8	236.2	7.0	35.0	<125
15.11.2011	7/3	162.5	258.7	7.0	38.2	<125
18.11.2011	8/1	162.5	261.8	6.8	38.2	<125
to	8/2	123.8	232.5	5.8	26.5	<125
19.11.2011	8/3	138.5	248.2	6.2	32.8	<125

Source: Primary data generated under KEIIP preparation

Notes: NO_2 = Nitrogen oxides; PM_{10} = Particulate Matter with diameter of 10 micron or less; SO_2 = Sulphur dioxide, SPM = Suspended Particulate Matter, CO = Carbon Monoxide

113. Air quality monitoring has been carried out recently for packages under implementation (KEIIP Tranche 1) near project locations. Results are shown in **Table 19** below. Like other locations concentration of PM_{10} is above the standard.

Table 19: Ambient Air Quality monitoring data under KEIIP

Location	Date	Parameters- level in µg/m^3			
		PM_{10}	$PM_{2.5}$	SO_2	NOx
Sakherbazar	08.04.2015	76.97	28.68	15.08	38.94
Joka (near Metro station)	09.06.2015	139.96	59.85	27.34	59.84

(Source: KEIIP Tranche 1 monitoring, 2015)

114. **Surface Water Quality**. The primary surface water resource for Kolkata is the Hooghly River that skirts the western margin of Kolkata. In addition, the project area has a large number of water bodies and canals that are heavily used for everything from bathing, washing, aquaculture and waste disposal. A large quantity of water is drawn from the Hooghly River for various uses and returns as wastewater to the river without little treatment. Industrial and domestic pollution along with runoff from adjoining areas has led to deterioration in river water quality. Summary chemical analysis Hooghly river water at Garden reach are given below in **Table 20.**

Table 20: Water quality of Hooghly river at Garden Reach

	Parameter	Unit	Test result (dated 11.01.11)	Test result (dated 07.04.11)	Test result (dated 08.07.10)
1	Conductivity	µs/cm	336	371	214
2	Dissolved O2(DO)	mg/l	12.2	4.4	5.7
3	pH	Unit	8.27	8.03	7.4
4	Temperature	^{0}C	16	29	27
5	BOD	mg/l	5.55	3.8	5.9
6	Nitrate-N	mg/l	0.04	1	0.31
7	Fecal Coliform	MPN/100ml	250000	8000	22000

	Parameter	Unit	Test result (dated 11.01.11)	Test result (dated 07.04.11)	Test result (dated 08.07.10)
8	Total Coliform	MPN/100ml	350000	11000	33000
9	Ammonia-N	mg/l	BDL	0.164	0.225
10	Phosphate - P	mg/l		0.25	0.04
11	Chloride	mg/l		29.14	14.56
12	Lead	microgram/l		7.48	

Source: WBPCB, www.wbpcb.gov.in

Notes: us/cm = micro siemen per centimetr; mg/l = milligram per litre; MPN/100 mL = Most Probable Number per one hundred millilitre; BDL = Below Detection Limit; ug/l = Microgram per litre; There are no government standards for (tidal) river water

115. The drainage canals in the southern part of the city are Kalagachia, Suti, Churial, Manikhali, Begore, Keorapukur, Western channel joining Keorapukur, Rania, TP Main canal, Intercepting channel, Suti khal (eastern part), different Lead canals to TP Main, Mundapara khal etc. Chemical analysis of water of Churial and Keorapukur canals shows that concentration of TDS is high. Also BOD and COD are high in both the samples. Concentrations of heavy metals [Pb, Cd, Hg, As, Cr (III) & Cr (VI)] were always below their respective detection limits (ref **Table 21**). Water of these canals does not meet the primary water quality criteria for even bathing water.

Table 21: Quality of canal water from five selected boroughs of KMC

Sl. No.	Parameters	Sample (CW 1)	Sample (CW 2)
1	pH	7.23	7.12
2	Total suspended solid (mg/l)	30.0	32.5
3	Total dissolved solid (mg/l)	741.0	650.0
4	DO (mg/l)	4.6	5.2
5	COD (mg/l)	109.92	67.96
6	BOD_3 days, 27^0C (mg/l)	35.0	18.0
7	Chloride (mg/l)	131.87	138.0
8	Sulphate (mg/l)	12.0	26.5
9	Nitrate (mg/l)	25.0	19.0
10	Sodium (mg/l)	80.5	70.0
11	Potassium (mg/l)	20.0	18.5
12	Calcium (mg/l)	66.77	51.06
13	Magnesium (mg/l)	28.22	23.52
14	Phosphorus (mg/l)	8.54	4.5
15	Lead (mg/l)	<0.3	<0.3
16	Cadmium (mg/l)	<0.04	<0.04
17	Mercury (mg/l)	<0.9	<0.9
18	Arsenic (mg/l)	<0.01	<0.01
19	Trivalent Chromium (mg/l)	<0.2	<0.2
20	Hexavalent Chromium (mg/l)	<0.1	<0.1

Sl. No.	Parameters	Sample (CW 1)	Sample (CW 2)
21	Zinc (mg/l)	0.04	0.8
22	Phenolic Compound (mg/l)	<0.1	<0.1
23	Cyanide (mg/l)	<0.05	<0.05
24	Ammoniacal Nitrogen (mg/l)	6.8	3.0
25	Kjeldahl Nitrogen (mg/l)	23.5	8.5
26	Total Nitrogen (mg/l)	35	15.0
27	Total Ammonia (mg/l)	8.22	3.63
28	Total Coliform (CFU/100 ml)	4.5×10^3	3.2×10^3

CW 1: Churial canal (Borough XIV, Ward 124)
CW 2: Keorapukur canal (Borough XIII, Ward 122)
Source: KEIP Phase 1
Notes: DO = Dissolved Oxygen, BOD = Biochemical Oxygen Demand, mg/l = milligram per litre, CFU = Colony Forming Unit

116. Chemical analysis of water of surface water bodies (ponds/ jheels/ lakes) from the from southern parts of the city generally shows the following characteristics : Total Dissolved Solid (345-977 mg/l), Dissolved Oxygen (5.0-8.0 mg/l), Chemical Oxygen Demand (18.88-79.04 mg/l), Biochemical Oxygen Demand 3 days (4.0-18.0 mg/l), Chloride (61.54-325.29 mg/l), Total Nitrogen (4.1-19.5 mg/l), Total coliform (1.1-4.5x103 CFU/ml). Concentrations of heavy metals like Lead (Pb), Cadmium (Cd), Mercury (Hg), Arsenic (As), Chromium (Cr) (III) & Chromium (Cr) (VI) were always below their respective detection limits. Water of these water bodies may not always meet the primary water quality criteria for bathing.

117. Chemical analysis of Churial canal water and Tolly's nullah was carried out under KEIP Phase 2 (during KEIIP project preparation) which shows high BOD, TVS, Odour threshold and coliform pollution (**Table 22**).

Table 22: Chemical analysis of canal water

Parameters	SW1 Tolly's Nullah	SW-2 Churial Khal near Diamond Harbour Road Crossing
Temperature(^{0}C)	32.5	21.50
Colour unit	2.0	2.0
Turbidity(NTU)	16.78	11.50
Odour (TON)	8.0	8.0
pH	6.52	7.47
Total solids(mg./l)	1078.0	582.0
TDS(mg./l)	950.0	365.0
TSS(mg./l)	68.0	67.0
TVS(mg./l)	165.0	128.0
DO(mg./l)	4.8	3.8
B.O.D. (mg./l)	40.0	45.0
C.O.D. (mg./l)	150.0	160.0
Oil & Grease(mg./l)	4.5	5.0
Lead(mg./l)	-	<0.03
Chromium (III) (mg./l)	-	<0.20
Chromium (VI) (mg./l)	-	<0.05

Parameters	SW1 Tolly's Nullah	SW-2 Churial Khal near Diamond Harbour Road Crossing
Arsenic(mg./l)	-	<0.01
Cadmium(mg./l)	-	<0.01
Nickel(mg./l)	-	<0.20
Copper(mg./l)	-	<0.05
Zinc(mg./l)	1.1	0.24
Iron(mg./l)	0.93	1.8
Ammoniacal Nitrogen(mg./l)	11.0	16.5
Kjeldahl Nitrogen(mg./l)	20.5	30.0
Total Nitrogen(mg./l)	32.67	58.5
Total Ammonia(mg./l)	13.31	19.96
Free Ammonia(mg./l)	0.00	0.75
Sulphide(mg./l)	3.2	3.60
Mercury(mg./l)	-	<0.0001
Salinity (ppt)	-	0.025
Faecal coliform (MPN/100ml)	3.4×10^6	3.2×10^6

Source:: Primary data generated during present IEE preparation for KEIIP, Date of sampling 01.06.2012
Notes: NTU = Nephelometric Turbidity Units; TON = Threshold Odor Number; mg/l = milligram/litre; ppt = parts per thousand; MPN/100 ml = Most Probable Number per one hundred millilitre; BOD = Biochemical Oxygen Demand COD = Chemical Oxygen Demand

118. **Groundwater.** The aquifers that are tapped for ground water in Kolkata are under confined condition because of the presence of a thick clay layer near the surface. Such aquifers occur at various depths separated by other clay layers. Generally the first aquifer is encountered at a depth of about 15 m followed by other aquifers with a principal one at about 90 m depth. The shallow aquifer is not used for bulk water tapping purposes, and is generally only tapped for spot supply of through hand pumps. A further deep aquifer occurs at depths approximately between 150 and 200m, and majority of deep tube wells for organized supply of drinking water tap this aquifer. The earliest geohydrological data for the configuration of the piezometric surface beneath Kolkata are available for the post-monsoon period of 1956. It shows that in the northern part of the city, the piezometric surface was about 0.5-1.0 m above sea level and progressively declined below mean sea level towards the south. There was a drastic change in the pattern in the pre-monsoon of 1958 when a small depression in the piezometric surface was created with the center near Park Street lying at 5 m below mean sea level. The piezometric surface contour plan therefore defined a centripetal ground water flow pattern changing from an open north to south to a closed one. This ovoid ground water trough with long axis trending northwest-southeast persisted since then progressively going down with the central part having piezometric surface lying at (-) 13 m below the mean sea level in the pre-monsoon of 1998. The fall in elevation of the piezometric surface over a period of 40 years is of the order of at least 5 m at the extreme eastern part of Kolkata. The fall of piezometric surface in Command Hospital (Alipore), Kudghat and Tiljala area are 2.08, 3.06 and 3.24 m respectively. The area of depression is roughly bounded by the triangle formed by Narkeldanga, Park Circus and Alipore National Library.

119. As part of KEIP II DPR preparation for added area geohydrological investigations were carried out in January, 2009 in seventeen wards distributed in Borough XI to XV. In these areas, ground water occurs mainly under confined to semi-confined conditions in 13 wards (108, 109, 111, 115, 122, 123, 124, 125, 126, 127, 139, 140 & 141). Depths of piezometric surface from

ground level in these wards varied between 9.3m to 14.11m. In wards 110, 112, 113 & 114, due to presence of near surface aquifers under water table conditions the depths to water level in the tube wells in these wards are between 1.3m to 2.9m. An aquitard occurs near surface over the entire studied area and ground water from this aquitard is tapped by dug wells. The depths to water table varied between 0.50m to 7.95m in these dug wells. With most areas reporting water levels within 1 to 2m from the ground surface.

120. The relevant ground water level data are given in the following **Table 23.**

Table 23: Ground water level data as measured during December, 2011

Sl. No.	Location	Type of Structure	Sector	SWL (m bgl)
1	57/6/2, Santosh Roy Road, Kolkata-8	Dug Well	Behala	0.85
2	210, James Long Sarani, Opposite to Fire Brigade Depo, Kolkata-63	Dug Well	Behala	0.6
3	46, A. J. C. Bose Road, Barabagan, Kolkata-63	Dug Well	Behala	0.27
4	P-21, J. L. Sarani, Majher Para, Thakurpukur, Kolkata-63	Dug Well	Behala	1.0
5	Diamond Park, behind Vaishnawi Garden, 444, J. L. Sarani, Kolkata-104	Dug Well	Behala	0.5
6	12/1A, Roy Bahadur Roy, Kolkata-34	Tube Well	Behala	13.85
7	N/214, Biren Roy Road (E), Kolkata-8	Tube Well	Behala	14.85
8	Primary School, Barisha Purba Para, Kolkata-63	Tube Well	Behala	13.32
9	Thakurpukur, Maheshtola, J. L. Sarani, Kolkata-108	Tube Well	Behala	12.07

Notes: SWL = Static Water Level, m bgl = Meter Below Ground Level

121. Ground water in KMC area under two principal types, viz. a) Bicarbonate type and b) Chloride type. Ground Water in the area west of a line connecting BBD Bag, Park Street and Jadavpur is of Biocarbonate type whereas in the area east of this line ground water is of Chloride type. The two anionic types were further subdivided each into two types on the basis of predominance of cation concentration. These are (i) Calcium – magnesium bicarbonate, (ii) Sodium bicarbonate; (iii) Calcium –Magnesium chloride; and (iv) Sodium chloride.

Table 24: Ground water facies at project area of KMC

Type	Facies	Distribution and characteristics of ground water facies	Borough
Bicarbonate	**Ca-Mg- HCO_3**	Occurrence in the entire western and south-central part of the city, south of Taltala- Kasba-Santoshpur tract in the NNW- SSE direction concentration of chloride low, in some places around New Alipore, Khidirpur, Elgin Road and Harish Park etc., chloride concentration as low as 11mg/l to 67 mg/l. Sodium concentration from 14 to 32 mg/l and average total dissolved solid 500mg/l	IX, XI, XII, XIII, XIV, and XV
	Na- HCO_3	Occurrence in the southern part of the city and particularly Behala, Tollygunge, Jadavpur and Putiari Soft with total hardness less than 150 mg/l;	X, XII

Type	Facies	Distribution and characteristics of ground water facies	Borough
		softening of ground water probably due to base exchange of calcium- magnesium ion with sodium ion from sodium montmorrilonite clay	

122. Ground water quality was monitored around the project sites during November, 2011 -12 and the results are reproduced in **Table 25** below. Water quality is rather high in TDS but within acceptable limit. Fe concentration is also high. No heavy metal pollution especially that of arsenic has been detected.

Table 25: Ground water quality around S & D subproject sites

Parameters	GW – 1 Diamond Park, Joka (Tube Well)	GW – 2 Janakalyan Vidyapit, James Long Sarani	GW – 3 Krishnayan Cooperative Housing, Behala (Tube Well)	GW – 4 Thakurpukur, James Long Sarani (Tube Well)	National drinking water standard Permissible limit
Temperature(^{0}C)	19.50	18.5	18.0	18.5	-
Colour unit	1.0	1.0	1.0	1.0	5
Turbidity(NTU)	2.65	5.2	4.8	6.8	1
Odour	No odour observed	No odour observed	No odour observed	No odour observed	Agreeable
pH	7.78	7.87	7.71	7.8	6.5-8.5
TSS (mg./l)	<10	<10	<10	<10	-
TDS(mg./l)	556.0	559.0	879.0	580.0	500
Total hardness(mg./l)	228.0	252.0	232.0	240.0	200
Chloride(mg./l)	79.12	70.33	219.79	76.93	250
Sulphate(mg./l)	5.0	6.0	9.75	3.5	200
Nitrate(mg./l)	12.5	21.5	35.80	25.0	45
Sodium(mg./l)	138.5	138.5	212.0	180.0	-
Potassium(mg./l)	30.0	26.5	42.10	25.0	-
Calcium(mg./l)	56.11	54.51	72.14	60.92	75
Magnesium(mg./l)	21.12	27.84	12.48	21.12	30
Iron(mg./l)	0.64	1.57	1.61	2.34	0.3
Zinc(mg./l)	0.65	0.82	0.65	0.28	5.0
Phosphorus(mg./l)	0.14	0.08	0.04	0.06	-
Fluoride(mg./l)	<0.02	<0.02	<0.02	<0.02	1.0
Lead(mg./l)	<0.03	<0.03	<0.03	<0.03	0.01
Cadmium(mg./l)	<0.01	<0.01	<0.01	<0.01	0.003
Arsenic(mg./l)	<0.01	<0.01	<0.01	<0.01	0.01
Chromium (III) (mg./l)	<0.20	<0.20	<0.20	<0.20	-
Chromium(VI) (mg./l)	<0.01	<0.01	<0.01	<0.01	0.05
Phenolic compound(mg./l)	<0.001	<0.001	<0.001	<0.001	0.001
Cyanide(mg./l)	<0.05	<0.05	<0.05	<0.05	0.05
Mercury(mg./l)	<0.0001	<0.0001	<0.0001	<0.0001	0.001
Total coliform (MPN/100 ml)	<2	<2	<2	<2	Not detectable

Source: Primary data generated under KEIIP

Notes: NTU = Nephelometric Turbidity Units; TON = Threshold Odor Number; mg/l = milligram/litre; MPN/100 ml = Most Probable Number per one hundred millilitre; TSS = Total Suspended Solid TDS = Total Dissolved Solid

123. **Noise.** Noise level in Kolkata high and exceeds the national standard. As part of DPR preparation of KEIP II a noise level survey was carried out in the seventeen wards during day time (**Table 26**). Average noise level in typical residential areas away from the busy streets varies between 47.9 to 66.9 dBA with only 22% of the measurement sites have noise level conforming to the prescribed noise level of 55 dBA (residential area; day time). Noise level near busy roads of the area expectedly have relatively high but variable noise level depending on the density of vehicle moving on the roads at the time of measurements. The range of measured noise levels was between 58.7 and 88.7 with more than 85% of the measurements show a value above 70 dBA. The measurement sites included some roads in front of school/college/hospital.

Table 26: Noise level measurement within seventeen wards in Borough XI-XV

Sl. No.	Ward	Location	Land use	Mean noise level in db(A)
1	108	Martin Para	Residential area	58.1
			Busy road	83.3
		Dr B R Ambedkar School	Busy road near school	78.0
2	109	R N Tagore Hospital	Busy road near hospital	71.5
		Netaji Nagar	Busy road side	81.8
			Residential area	56.1
3	110	Andrews College	Busy road near college	77.8
		BRWS Hospital	Busy road near hospital	61.2
		Sreerampur road	Busy road	82.4
			Residential area	66.7
4	111	Satindra Palli	Residential area	56.2
			Busy road	74.3
5	112	Rishi Rajnarayan Road	Residential area	63.0
			Busy road	81.6
6	113	Niranjan Palli	Residential area	59.7
			Busy road	72.9
7	114	Purba Putiary	Busy road near school	73.3
			Busy road	88.7
			Residential area	62.5
8	114	Pudirhati PS	Busy road	72.0
9	114 &15	Keorapukur PS	Residential area	55.3
10	115	Paschim Putiary Road	Busy road	70.3
			Residential area	51.4
				55.2
11	122	Ustad Amir Khan Sarani	Residential area	61.3
			Busy road	79.5
12	123	Santal Palli	Busy road	74.2
			Residential area	57.0
13	124	Purba Para Road	Residential area	66.9
			Busy road	77.7
14	125	Subodh Kr Mukherjee Road	Busy road	58.7
			Residential area	49.8
15	126	Sabarna para Road	Busy road	81.9
			Residential area	47.9
16	127	Nanda Gopal Mukherjee Road	Busy road	80.3
			Residential area	62.5

Sl. No.	Ward	Location	Land use	Mean noise level in db(A)
17	132	CPT canal pumping station	Open area	53.70
18	139	Halder Para	Busy road	79.3
			Residential area	61.3
		Parchur College	Inside college	78.0
			Busy road in front of college	80.9
19	140	Mullick Para Lane	Residential area	56.4
			Busy road	70.8
20	141	Bagdi Para	Residential area	52.7
			Road side	61.9

Source : KEIP data
Notes: dBA = decibal in A network

124. Ambient noise level monitoring was carried out in the subproject area and the results are reproduced in **Table 27**. The day and night Leq level is generally above 70 dBA (maximum value above 80 in most of the cases) due to heavy traffic movement.

Table 27: Noise along Diamond Harbour Road & James Long Sarani

Station No.	Location	Date & time	Minimum dB(A)	Maximum dB(A)	L_{eq} dB(A)
N1	Diamond Park	24.10.2011 (day time)	55.3	61.5	58.79
		24.10.2011 (Night time)	51.2	60.8	56.18
N2	ESIC Hospital	24.10.2011 (day time)	79.8	85.3	82.56
		24.10.2011 (Night time)	64.2	69.8	67.20
N3	Kolkata Model School. James Long Sarani	24.10.2011 (day time)	74.2	83.5	77.87
		24.10.2011 (Night time)	62.8	71.5	67.89
N4	Thakurpukur Police Station	24.10.2011 (day time)	80.9	89.5	83.69
		24.10.2011 (Night time)	64.8	72.5	70.67
N5	Birsha High School (Sakher Bazar)	24.10.2011 (day time)	79.2	88.9	82.45
		24.10.2011 (Night time)	63.8	72.5	70.67
N6	Joka Tram Depot	24.10.2011 (day time)	78.3	85.2	82.47
		24.10.2011 (Night time)	67.2	74.8	72.50

Source: Primary data generated during preparation of this IEE
Notes: dBA = decibal in A network; Leq = Equivalent noise level

B. Ecological Resources

125. **East Kolkata Wetlands**. The East Kolkata Wetlands (EKW), located on the eastern fringes of Kolkata city, is a part of the extensive inter-distributory wetland regimes formed by the

Gangetic delta. The total area is 12,500 ha. The subproject is not within EKW area. Only a small part of KMC area falls within the limits of EKW. The improved S&D system will not impact as the sewage and stormwater to be treated in the STP do not flow into EKW. The EKW area includes one of the largest assemblages of sewage fed fish ponds. The importance of this wetland lies in the fact that these sustain the world's largest and oldest integrated resource recovery practice based on a combination of agriculture and aquaculture, and provide livelihood support to a large, economically underprivileged population of around 27,000 families which depend upon various wetland products, primarily fish and vegetables for sustenance. Based on its immense ecological and socio cultural importance, the Government of India, declared East Kolkata Wetlands as Wetland of International Importance under Ramsar Convention in 2002. EKW is a classical example of harnessing natural resources of the wetland system for fisheries and agriculture through ingenuity of local communities with their traditional knowledge. The wetland has been included by the Ramsar Convention as one of the 17 case studies on wise use of wetlands at the global level. The wetland provides strong arguments for integration of traditional knowledge of local communities into conservation and management practices. More than 1000 MLD of untreated sewage from Kolkata are discharged in to the fisheries of EKW for natural treatment in the fish ponds.

126. The ecology of the EKW area has undergone a dramatic change since the beginning of the 19th century due to cessation of tidal (brackish water) influx from Bidyadhari and Matla rivers in to the then saline marshy area with brackish water fisheries. The change is not only due to natural causes like siltation but also due to developmental activities and hydrological interventions. The brackish water fisheries of earlier years were converted in to sewage fed fisheries bringing in a changed ecosystem and establishing a new biodiversity in the EKW areas.

127. There is no forest patch within EKW. There are no endangered species but there are a number of rare mammals, reptiles, fish and bird species. According to the Ramsar information database, there are rare mammals such as Marsh mongoose, small Indian mongoose, Palm civet and small Indian civet which are significant in and around the EKW.

128. The representative aquatic flora and fauna of the EKW are listed in **Table 29** and **Table 28** respectively.

Table 28: Representative Aquatic Flora of the EKW

Type of flora	Species
Free floating forms	*Eichhornia sp., Spirodella sp., Pistia sp.,Ceratophyllum/Utricularia sp.,Axolla sp.,*
Fixed anchored forms	*Vallisneria sp., Hydrilla sp., Najas sp., Nymphea sp.,Nymphoides sp*
Emergent amphibious forms	*Marsilea sp., Impomoea sp., Enhydra sp., Colocasia sp.,*
Facultative forms	*Typha sp., Cyperus sp.,*
Algal forms	*Synandra sp., Spirogyra sp., Zygnema sp., Nitelea sp.,*

Source: Utilization scenario of Kolkata Wetlands (1996) 2. Urban Ecology, Ghosh A.K 1988.

Table 29: Representative Fauna of the EKW

Type of Fauna	Species
Waterfowl	*Phalacrocdax niger, Ardeola gravii; Babulcus ibis; Egretta garzatta*
Waders	*Tringa hypoleucos; Calibris minuta*
Kingfisher	*Ceryle rudies; Alcedo athhis; Pelargopsis capensis; Halcyon Smyrnesis*
Aquatic reptiles	*Lissemys punctata, Enhydris enhydris, xenochrophis piscator*
Amphibians	*Rana cyanophyctis; Rana tigerina, Rana limnocharis, Microphyla ornata; Bufo melanostictus*
Fish	*Catla catla; Labeo rohita; L.calbasu; L.bata; Cirrhinus mrigala, Hypophthalmich thysmolitrix, Microvertebrates Puntius sarana, P.ticto, Amblypharygodon mola; etc.*
Mollusca	*Bellamya bengalensis; Pila globosa; Diagnostoma sp., Lymnea sp., Gyrulus sp., Thiara sp., etc.*
Annelida	*Oligochaeta; Brachuria; Limno drilus sp., Hirudines – Glassophonia sp.,*
Insecta	*Hemiptera : Anisops sp., Limnogonus sp., Plea sp., Hydrometra sp., Micronecta sp.,*

Source: Utilization scenario of Kolkata Wetlands (1996) 2. Urban Ecology, Ghosh A.K 1988.

129. **Vegetation.** The Kolkata region, except a small part that is falling in East Kolkata Wetlands to the east is in a region of moist tropical deciduous vegetation with fresh water aquatic plants. Because of the continuous expansion of human habitation and heavy population pressure, the nature of the vegetation is rapidly changing and there are fewer herbaceous plants in some parts of the area. The few undisturbed areas along canal banks, road sides and small orchards within the residential area offer more varied vegetation. There is no demarcated forest.

130. A primary field survey was organised under KEIIP to record tree species present along major roads of the subproject area and the results of the survey is given in the following **Table 30.**

Table 30: List of trees along James Long Sarani *having more than 1 % occurrence*

No.	Name of Plant	Percentage (%)
1	Krishnachura	17.34
2	Kadam	15.15
3	Chatim	10.91
4	Debdaru	8.27

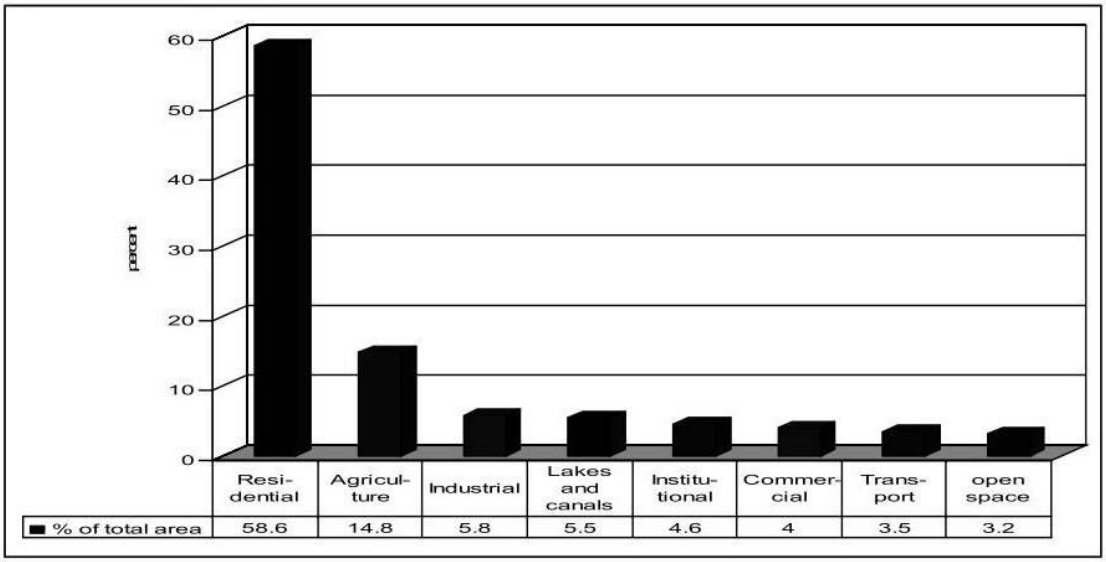
No.	Name of Plant	Percentage (%)
5	Bot	6.77
6	Radhachura	5.51
7	Asathwa	5.40
8	Bokul	4.36
9	Sirish	3.67
10	Neem	2.76
11	Kathbadam	2.07
12	Mango	1.72
13	Mahogani	1.61
14	Sajne	1.61
15	Jum	1.49
16	Jarul	1.26
17	Kanchan	1.15

131. **Wildlife.** Common jungle cats, foxes (*Vulpes bengalensis*), house rats (*Rattus rattus*), and mice (*Mus muscatus*), kingfisher (Alcedo sp.) are present. Of the reptiles, garden lizards (*Calotes versicolor*), snakes (Natrix sp., Viper sp.), and kraits (*Bungarus caeruleus*) are common. The bird life includes house crows (*Acridotheres tristis*), house sparrows (*Paser domesticus*), and pigeons (*Coluamba livia*). Amphibians such as Indian bullfrogs (*Rana tigrina*), annelids such as earthworms (*Eisenia foetida*), and arthropods such as cockroaches (*Periplanata americana*), butterflies and ants (*Tapinoma sessile*) are common. There are no endangered faunal species in the subproject area.

132. **Aquatic Flora and Fauna**. Anchored and free floating and submerged hydrophytes like Kachuri pana (*Eichhornia crassipes*), Azolla (*Azolla pinnata*), Sagittaria (Sagittaria sp.), Hogla (*Typha angustifolia*) etc can be seen in the many open water bodies other than Hooghly river. Such water bodies often contain fishes such as Rohu (*Labeo rohita*), Catla (*Catla catla*), and Bata (*Labeo bata*). Phytoplankton like Spirogyra sp., Zygnema sp., Navicula sp., Nostoc sp., Hydrodistyom sp., etc and zooplankton like Cyclops sp., Paramecium sp., Euglena sp., Diaptomus sp., larvae of culex sp. etc are ubiquitous.

C. Economic Development

133. **Land use.** The metropolitan area of Kolkata has grown from a few small villages to its present status as India's most populous city. The predominant land use in the KMC is residential, as shown in Figure below. However, for most residential areas a more exact description will be mixed use. There are industrial sites throughout the city, in all 15 Boroughs and in 71 of the 141 wards. Urban planning is one of the responsibilities of the KMC. The KMDA also has a role in land planning, with a broader geographic scope than KMC.



134. Land use 3 km around proposed Keorapukur PS and Vivekananda road PS are shown below.

Table 31: Land use percentage around Keorapukur PS

Sr. No.	Land use/Land cover	Land use type	Percentage
1	Settlement	Urban	35%
2	Plantation and habitation	Plantation around habitation	20%
3	Grassland/barren	Grassland/barren	10%
4	Water bodies	Pond/tank/river	25%
5	Canal	Water body	10%
			100.00

Source: KEIIP data

Table 32: Land use percentage around Vivekananda road PS

Sr. No.	Land use/Land cover	Land use type	Percentage
1	Settlement	Urban	30%
2	Plantation and habitation	Plantation around habitation	25%
3	Grassland/barren	Grassland/barren	15%
4	Water bodies	Pond/tank/river	20%
5	Canal	Water body	10%
			100.00

Source: KEIIP data

Table 33: Land use percentage around Churial PS

Sr. No.	Land use/Land cover	Land use type	Percentage
1	Settlement	Urban/ semi urban	25%
2	Plantation and habitation	Plantation around habitation	30%
3	Grassland/barren	Grassland/barren	15%
4	Water bodies	Pond/tank/river	18%
5	Canal	Water body	12%
			100.00

Source: KEIIP data

Table 34: Land use percentage around Vidyasagar Palli PS

Sr. No.	Land use/Land cover	Land use type	Percentage
1	Settlement	Urban/ semi urban	20%
2	Plantation and habitation	Plantation around habitation	35%
3	Grassland/barren	Grassland/barren	15%
4	Water bodies	Pond/tank/river	18%
5	Canal	Water body	12%
			100.00

Source: KEIIP data

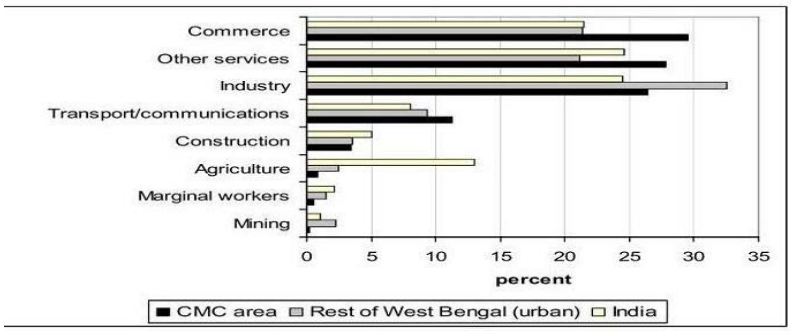
Table 35: Land use percentage around Lalababu PS

Sr. No.	Land use/Land cover	Land use type	Percentage
1	Settlement	Urban	65%
2	Plantation and habitation	Plantation around habitation	10%
3	Grassland/barren	Grassland/barren	15%
4	Water bodies	Pond/tank/river	5%
5	Canal	Water body	5%
			100.00

Source: KEIIP data

135. **Commerce and industry**. Kolkata is a service center rather than an industrial center. As shown on Figure below, the proportion of the population working in industry is similar to the India urban average, but below that of the rest of urban West Bengal.

136. Industrial growth has been accelerating in West Bengal with the introduction of the New Economic Policy (1992), the average annual growth of industrial production has moved up to 5.05%. While the organized industries are located in Cossipore area (Borough I), small scale industries as lead recycling, tanneries etc. are located in the Tiljala/Topsia area (Borough VII). It may be noted that all the tanneries are being relocated to a specially designated site at Karaidanga about 25 km away with all environmental safeguards. Only green i.e. non-polluting industries are permitted to be set up in KMC area. Permission from WBPCB is mandatory for discharging of waste in to municipal sewer or land or inland surface water body. For discharge to municipal sewer, industries must treat the effluent to the acceptable discharge limit as prescribed. Port related industries such as oil handling facilities etc. are found in the Garden Reach area viz Borough XV.



137. **Water supply.** The water supply system of Kolkata is very old, operated from 1865. Present average per capita supply is 134 lpcd, which is very near to desired supply of 150 lpcd

(for metropolitan cities). But the supply is very uneven, ranging from 310 lpcd to 40 lpcd. Unaccounted for water (UFW) is 40%. Average supply period is 8 hours a day. Residual pressure is very low. The average terminal pressure at consumer end is around 2.5 m of water head. In some areas it ranges around 0.5 m-1.0 m of water head. About 10% of supply in Kolkata is from ground water. The source is affected by arsenic in some locations and TDS and Fe values are often above permissible values. From quality and health point of view the ground water source needs to be replaced. Coverage by piped water supply is 92% which is nearing 100%. But the rest 8% is near the periphery of the study area and far from surface water source. The two main water works are Palta and Garden Reach.

138. **Transportation.** The Kolkata's transportation system is multi-modal and highly heterogeneous. Public transportation comprises everything from human-powered rickshaws to a subway system. Main thoroughfares in Kolkata are crowded with taxis, buses, two-wheelers, three-wheelers, hawkers, and a myriad of pedestrians all vying for limited space on the streets.

139. **Electrical Power.** Power supply in Kolkata dates back to 1898, when Calcutta Electric Supply Corporation was formed for generation, transmission and distribution of electrical energy in and around the city of Kolkata. From about 100 kw demand in 1898, the system has grown to about 1200 MW in 1998. Apart from its own generation, CESC Limited, presently a licensee of WBSEB, purchases power from the latter and also from Damodar Valley Corporation (DVC). The generating stations that operate in Kolkata area are: Mulajore, capacity 150 MW, New Cossipore 160 MW, Titagarh 240 MW, Southern 135 MW, and Budge-budge 250 MW. In addition, 300-400 MW of power is supplied by West Bengal State Power Development Corporation and Damodar Valley Corporation. All these power plants are coal-based.

140. **Sanitation and Sewerage**. In the core city area all properties, except the slums, are directly connected to the underground sewer network, meaning a total number of 358,750 households directly connected which is equivalent to 75% of all households in the core city area. The slum areas are in general served by communal toilets connected to septic tanks. In the outer areas served by KEIP a total number of 70,000 house connections would be constructed once the project is finalized in June 2012. This means a coverage of 22% of the total population in the KEIP areas. In the outer areas not yet served house connections to underground sewers don't exist by lack of any underground sewer system, meaning 0% coverage. This brings the average total for the entire KMC area at 44% as compared to the national target level of 100% but nevertheless it is way above the national average of 28%.

141. According to the 2001 Census 96% of the KMC population has access to individual or community toilets within walking distance in the service area. This compares favorably with the national average of 82% and is near the national benchmark of 100%. Most of the KMC slum areas are provided with communal toilet facilities within walking distance. Only 4% of the KMC population has no sanitation facilities and uses gutters, open drains, channels or vacant land for sanitation. This is mostly in the urban fringe areas where population densities are still relatively low. The 2011 Census results in this respect are not yet available but it is likely that the percentage of the population without toilets would further decrease over the years.

142. The collection efficiency of sewage is 71%, which is higher than the percentage of people with direct sewer connections because it also includes sewage collected through the interceptor sewer system. The collection efficiency is around 90% in the core city area as well as in the KEIP areas. The remaining outer areas have no formal sewer system yet and collection is zero.

143. The treatment capacity of the existing treatment plants and the East Kolkata Wetlands (EKW) is sufficient to serve the entire central city (100%) and the KEIP areas (100%). The total average for KMC is 88% because the outer areas not yet served by KEIP generate 12% of the waste water for the entire KMC. The effluent quality at the outlets of the East Kolkata Wetlands and the existing treatment plants fully comply with national norms.

144. The extent of re-use is very high because 90% of all sewage from KMC ends up in the fisheries of the EKW where it serves as quality food for the fisheries. Effluent from other treatment facilities is partially re-used for agricultural purposes before it finally discharges into the Hooghly River. On average 93% of waste water generated in KMC is re-used, comparing very favourable to the national target of 20%.

145. **Solid Waste Management**. The solid waste management system consists of three main components: Collection, Transportation and Disposal.

146. The majority (90%) of collection is done by KMC and 10% is contracted out to private contractors. House-to-house (doorstep) collection has been introduced in 75% of the KMC area. Other areas are served by street sweepers who operate manually. Many roads are too narrow to allow access for motorized collection vehicles. Primary collection is mostly by open hand carts and delivery at secondary collection sites (vats). There are 694 such collection points – 392 open vats and 302 bulk containers or direct loading. Open vats are generally poorly managed with spillage of disposed waste from the bulk containers or from open vat boundaries creating in most cases an unhygienic environment. In 2011 source segregation has been introduced as a pilot project in 7 wards.

147. In 2011 75% of the KMC area is served by a door-to-door collection system and 25% by street sweeping. This compares favorably to the national average of 51% but is still far below the 100% benchmark target. In the core city area 80% of the population is served by door-to-door collection. In the outer areas this is less (60% - 70%). Collection frequency also differs. The central city and most of the surrounding outer areas are served daily, but some of the lower density fringe areas are only served once or twice per week.

148. KMC estimates that only 3% of waste generated is not collected but (illegally) disposed in channels, vacant land and used for infill, meaning that collection efficiency is close to the national benchmark target of 100%.

149. From secondary collection sites the waste is transported in trucks to the final disposal site. KMC transports 30% of waste, while 70% of solid waste transportation is contracted out to the private sector. Private contractors mostly use open trucks with a tarpaulin covering the waste. They make about 600 trips per day carrying an average of about 5.5 MT per trip. The remaining 30% of the total collected waste is transported by municipal vehicles making about 315 daily trips carrying on average about 3.5-4.9 MT per trip. KMC has 125 tipper trucks and 137 dumper placers, 15 tractor trailers, 17 wheel loaders and 12 mechanical sweepers, 32 street sweeping/washing vehicles and 8 wrecker vans daily in operation. KMC has eight garages where transportation vehicles are stationed. Major vat points that accommodate garbage more than 30 MT are serviced from Dhapa garage with Pay loaders and 11 m^3 capacity Tipper Trucks. Other vats are serviced by manual loading vehicles and Dumper placers. The street washing vehicles clean major thoroughfares every day. Three of the refuse collector vehicles are engaged for cleaning wastes from 300 trash bins along sixteen major roads.

150. KMC has two waste disposal sites. The Garden Reach dumping ground is a small facility with little remaining capacity. It receives currently about 10 MT/day of waste mainly from borough XV nearby. The main dumping ground is at Dhapa in the east of KMC at approximately 8 km from the city centre. This dump site is nearing its maximum capacity and has been authorized by West Bengal Pollution Control Board to operate for one more year only. It received an average of 4286 MT/day solid waste in 2011 out of which 300 MT/day was diverted to the privately operated Dhapa composting plant.

151. The extent of scientific disposal of solid waste is currently zero and should become 100% in accordance with the national benchmark target. Both the Dhapa and the Garden Reach dump site are not operated as sanitary landfill in accordance with national standards. There is no formal leachate treatment, no proper soil cover and informal, unorganized rag pickers operate at the sites. KMC has an interim permit from WBPCB to operate the Dhapa landfill facility for one year.

152. West Bengal has one Common Hazardous Waste Treatment, Storage and Disposal Facility (CHWTSDF) at Haldia (about 100 km south of Kolkata) that commenced operations in 2005. The facility was jointly developed by the Haldia Development Authority and the Hyderabad based private company, M/s Ramky Enviro Engineers Ltd. who formed a joint venture company named M/s West Bengal Waste Management limited (WBWML) for the development and operation of the facility. The CHWTSDF at Haldia operated by M/s WBWML has completed almost four years of successful operation. The facility caters to units in the entire state of West Bengal.

D. Social and Cultural Resources

153. **Communities and Population**. The population of the KMC area is 4.45 million with a growth rate -1.93% (2001 to 2011). Approximately one third (32%) of the KMC population lives in bustees and substandard housing. The Project team prepared population projections to 2022 based on the using previous census data of 2001, 1991 and 1981. These projections show a declining population trend for the KMC area, increasing from 4.38 million in 1991 to 4.56 million in 2022. This hike will indicate a general growth of population in the south and south-eastern part of Kolkata which has a tremendous growth potential. The average household no. for the total KMC area is 972,264 and the average household size of Kolkata Municipal Corporation is 4.61 in 2011. Population density of KMC is very high 24,783 persons/sq.km. in 2011. Household numbers are 972,264 and average household size is 4.61 in 2011.

154. **Institutions**. A number of institutions are present in the KMC area and may have a role in the Project's development. These can be classified in to several categories, as follows: government administration and services, police and security, urban development, and environmental protection.

155. **Government administration and services.** . The agency with the most important role in the Project is KMC. Municipal administration in Kolkata dates from 1727. The functions of the first Corporation were then limited to provision of local roads and drainage and conservancy service. The present system of municipal government has come through an evolutionary process over a long period, resulting in KMC being assigned the responsibility for the following services: regulation of land use; regulation of construction of buildings; planning for economic and social development; roads and bridges; water supply; public health, sanitation, conservancy and solid waste management; urban forestry, protection of the environment and promotion of ecological aspects; safeguarding interests of weaker sections of society, including the

handicapped; slum improvement; urban poverty alleviation; provision of urban amenities such as parks gardens, playgrounds; promotion of cultural, educational and aesthetic aspects; burials and burial grounds, cremation and cremation grounds; cattle grounds, prevention of cruelty to animals; vital statistics including registration of births and deaths; public amenities including street lighting, parking lots, bus stops and public conveyance; and regulation of slaughterhouses and tanneries.

156. **Environmental protection.** The WBPCB has the overall responsibility to set policy and standards for the protection of the environment, following the lead of the Central Pollution Control Board. This includes air, noise, hazardous waste, and water quality standards, and the requirement for the preparation of EIAs. The WBPCB also carries out water and air quality monitoring, and might be involved in the environmental quality monitoring program that will be a part of this project. No designated protected area lies within 10 km radius of the S & D subproject sites. Kolkata does not fall under the Coastal Regulation Zone (CRZ).

157. **Education**. The population of is fairly literate, around 90% of males and females being literate. School enrollment is moderately for all segments of the population. 85% of males and 80% of females report at least a primary school education. 27% of the population has completed secondary school and 9% have graduated from college.

158. **Religion.** About 80% of the residents of KMC are Hindus. Most belong to general castes (84%), with the balance belonging to scheduled caste or scheduled tribes. There are significant concentrations of Muslims in the bustees.

159. **Languages.** The mother tongue reported by 74% of the population is Bengali, with Hindi and Urdu represented by 14% and 12% of the population respectively. Interestingly, those living in standard residential housing report 91% Bengali, while those in sub-standard housing reporting only 58% Bengali and 25% Hindi.

160. **Occupation.** About 6% of households report unemployment: 5% for those living in standard residential areas and 7% for those in bustees and refugee colonies. Of those employed, there is a broad variety of employment types, with no single category predominating over others.

161. **Education, Health and Health Care Facilities**. A listing for Boroughs XI-XV indicated that there are more than 150 government and private educational institutes within the Boroughs. The list includes primary, secondary and higher secondary schools, degree colleges, technical and professional institutes. A number of reputed institutions has recently been established in ward 108. Public health varies according to socio-economic level and location. As of 2008, there are more than forty health centers, government hospitals/dispensaries, private hospitals and nursing homes within the study area. Mention may be made of Ruby General Hospital (ward 108), Manovikash Kendra (ward 108), R N Tagore International Institute for Cardiac Sciences (ward 109), Peerless Hospital and B K Roy Research Centre (ward 109) and Thakurpukur Cancer Hospital (ward 124). Health care facilities appear to be on the low side in wards 112, 113 and 122. Malaria is seasonally prevalent. Cardio-vascular diseases are increasingly prevalent among people over 40, while waterborne diseases such as gastrointestinal diseases are common among children less than 15 years of age.

162. **Aesthetic Resources.** The main aesthetic resources of Kolkata as a whole consist of historic buildings and many small lakes and other water bodies. Both of these resources are recognized as being in need of restoration, and a number of efforts are under way to accomplish

this. Foreign tourism is not yet a well-developed industry in Kolkata, and there are opportunities for making tourism a profitable industry while still conserving the urban beauty of the area.

163. **Cultural Resources.** The buildings of north Kolkata reflect the traditional culture of the zamindar and rajas, whereas the structures in central Kolkata reflect the British colonial style. The buildings and churches in this area are around 50 to 100 years old. Most of the archaeological monuments are maintained either by the Department of Archaeology or by private concerns like Rama Krishna Mission or Trusts. Some of the valuable monuments are: Metcalfe Hall, Gwalior Monument, Victoria Memorial, Shahid Minar, Indian Museum, Cossipore, Club, Town Hall, Tagore's Baitak Khana, Fort William, Vivekananda's house, and Roy's Naroial – Cossipore. There are also a few monuments at Tollygunge and Kalighat areas.

164. As the subproject is concentrated primarily in the added areas of KMC, the project will not hamper any precincts of cultural or historical significance.

165. **Recreational and other facilities.** More than twenty large play grounds are present in Boroughs XI to XV area. There are innumerable temples, maths, mosques and a few churches scattered over the area. Housing complexes with their own recreational areas have come up especially in wards, 108, 109 and 110.

V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

166. **Methodology.** Issues for consideration have been raised by the following means: (i) input from interested and affected people; (ii) desktop research of information relevant to the proposed subproject; (iii) site visit, limited measurements by specialized agency and professional assessment by Environment Specialist engaged by the implementing agency; and (iv) evaluation of proposed design scope and potential impacts based on the environment specialist's past experience.

167. The methodology used to rate the impacts was qualitative. Each category was divided into a number of different levels. These levels were then assigned various criteria as indicated in **Table 36.**

Table 36: Summary of Quantifiers and Qualifiers Used for Assessment Purposes

Duration (time-scale)	Short-term	Impact restricted to construction (0-18 months).
	Medium-term	Impact will continue throughout operation (after construction 30 years).
	Long-term	Impacts will exist beyond the life of the S & D works (>50 years)
	Permanent	Impacts will have permanent potential
Geographic spatial scale	Site	The impact will be limited to within the site boundaries.
	Local	The impact will affect surrounding areas.
	Regional	The impact will affect areas far beyond the site boundary but limited to the State of West Bengal.
Significance rating before mitigation (positive / negative)	Low	The impact will have a minimal effect on the environment.
	Medium	The impact will result in a measurable deterioration in the environment.
	High	The impact will cause a significant

		deterioration in the environment.
Mitigation	n/a	No mitigation necessary.
	Full	Full mitigation/reversal of the impact is possible.
	Partial	Only partial mitigation/reversal of the impact is possible
	None	No mitigation or reversal of the impact is possible
Degree of Certainty	Definite	(>90%)
	Possible	(50%)
	Unsure	(<40%)

168. Categorization of the subproject has been undertaken using ADB's REA Checklist for Sewerage & Drainage (**Appendix 8).**

A. Planning and Design Phase

169. The subproject components will be located mostly in properties held by KMC and through public ROWs and existing roads. Only construction of Vivekananda road PS will require acquisition of private land. Process has been initiated for acquisition of that land.

170. The plan and technical design of the S & D subproject are based on the specifications of the Manual on Water Supply and Treatment developed by the Ministry of Urban Development's Central Public Health and Environmental Engineering Organization (CPHEEO). Engineering decisions considered the results of the population to be served, design period, the nature and location of facilities to be provided, the optimum utilization of the existing network and wastewater disposal. S & D management aims at improving the S & D system.

171. The salient design features are presented in **Table 37.**

Table 37: Salient Design Considerations of S&D Works

Parameter	Design Consideration
Design Period	The subproject is designed to meet the requirements over 2015 to 2045 for Package TR02/SD-09, TR-02/SD-10 & SD-11, TR-02/SD-12 and TR-02/SD-13, Package Tr 2/ SD 19 to SD 23 The subproject is designed to meet the requirements over 2015 to 2035 for Package TR-02/SD-14.
Design Population	The forecasted beneficiary population of 389872 is estimated with due regard to all the factors governing the future growth and development of KMC until year 2045 for Package TR02/SD-09, TR-02/SD-10, TR-02/SD-11, TR-02/SD-12 and TR-02/SD-13 The forecasted beneficiary population of 59792 is estimated with due regard to all the factors governing the future growth and development of KMC until year 2045 for Package TR02/SD-14. The forecasted beneficiary population of 502170 is estimated with due regard to all the factors governing the future growth and development of KMC until year 2045 for Package TR02/SD-19 to TR-02/SD-23
Design to meet S&D bench mark target	95% sewerage coverage, 95% sewage collection efficiency, and 95% sewage treatment

Parameter	Design Consideration
Other technical Pressure requirements	Gravity system to be designed for modified RCC NP3 pipe, , pressure main to be designed for K9 for DI, MS pipe with thickness minimum 6mm and HDPE PE 10
Quality standards	pH = 5.5 to 9.0, SS = 100 mg/L, BOD = 30 mg/L (Effluent to inland surface water)
Pumping Stations	Rectangular or circular sump with submersible pumps and pump house to be constructed at ground level
Design of pumps and accessories Alignment of transmission mains	Pumps and accessories has been designed for the year of 2030 Alignment of the S&D lines is guided by existing road alignment
Design of the Pipe work	Trunk sewer to be designed as gravity system, SWF and DWF pipes to be designed as pressure mains
Pipe materials	RCC for gravity main, MS and DI for SWF and DWF pumping mains
Pipe laying	Two types of method have been proposed for laying of pipe. • The pipe will be laid for trunk sewers using micro-tunneling. Micro-tunneling is a process that uses a remotely controlled Micro-tunnel Boring Machine (MTBM) combined with pipe jacking technique to directly install the pipelines underground in a single pass. This process avoids the need to have long stretches of open trench for pipe laying. • The pipe will be laid for trunk sewers and pumping main by conventional open trenching method in stretches along the ROW.
DWF Management	The subproject includes treatment facility which will be implemented under separate package at later stage.
SWF Management	SWF to be disposed off in Rania canal, Western channel extension and Western channel under Keorapukur canal System for Package TR-02/SD-09 and TR-02/SD-10 & SD-11. SWF to be disposed off in Churial canal under Churial Canal System for Package TR-02/SD-12 and TR-02/SD-13. SWF to be disposed off in Begore *khal*, Begore branch canal, Parnashree canal, CPT canal under New Monikhali canal System and Chetla boat canal, Tolly's Nulla for Package TR-02/SD-14. For package Tr 2/ SD 19 outfall arrangement is proposed for S&D Network to Keorapukur Canal and Tolly'sNullah at suitable location for discharging SWF to the said Canal / nullah. In case of Package Tr2/ SD 22, Outfall arrangement is proposed for S&D Network to Churial Extension Sub-basin at suitable location for discharging SWF to the said Canal. Under package Tr-02/ SD-23 the proposed pumping station will have SWF pump to discharge SWF directly to Bagjola canal.
Sanitation systems	100% coverage of sewer connection from household is targeted and to be provided by KMC

Parameter	Design Consideration
Drainage and hydrology	The subproject has been designed to drain freely to the pumping station in order to prevent water logging in streets, roads, and open places. Pollutants settling on the road surface and litter will be washed off during rain. Run-off from the subproject will produce a highly variable discharge in terms of volume and quality and in most instances will have no discernible environmental impact.
Ecological diversity	The subproject is situated within an existing build up area and no areas of ecological diversity occur within the subproject. The nature and locality of the subproject is such that its implementation is unlikely to have any impact on biodiversity of the area. However the subproject may affect existing roadside trees. Permission will be obtained from the Forest Directorate for felling trees, if required prior to start of civil works. Any landscaping to be undertaken will be done with locally indigenous species and low maintenance requirements
Land use and livelihoods	The key efforts undertaken to minimize impacts are: (i) before the preparation of engineering design, a survey of the properties of the pipe laying alignment is to be conducted with regard to their ownership with the objective that minimum proprietary land is utilized for the subproject; (ii) diverting the alignment towards the available government land and ROWs to avoid land acquisition; (iii) use of micro-tunneling, as it is particularly suited for the urban environment where the disruption of business, traffic and other utilities is not acceptable for commercial, political and safety reasons. In case of canal crossing either micro tunneling or MS bridge will be planned. A. Resettlement Plan has been prepared to address involuntary resettlement impacts
Traffic flow and access	A traffic Management Plan will be developed to provide vehicle and pedestrian access and maintain community linkages. Local communities along the alignment will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signages, etc. The implementation of the road detours will also be dependent on advance road signages indicating the road detour and alternative routes. KMC will coordinate with the traffic police for the implementation of the Traffic Management Plan.
Infrastructure and services	There are a number of existing infrastructure (roads, telecommunication lines and various pipelines along the alignment of the trunk mains). To mitigate the adverse impacts due to relocation of the utilities, PMU will (i) identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) require construction contractors to prepare a contingency plan.
Environmental Monitoring	The environmental laws place a responsibility on KMC not to pump untreated DWF in the canal and the DWF pumping will commence only when arrangement of monitoring outflows from the STP is constructed and transmission of the results of such monitoring to WBPCB is in place. The regulations also specify the parameters to be monitored, the frequency of monitoring and the method of sampling. The WBPCB can independently sample the quality of the receiving waters, and this data can be used to assess whether the STPs are discharging effluents of acceptable quality

172. The design considerations were discussed with the specialists responsible for the engineering aspects, and as a result measures have already been included in the subproject design for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design. Alternatives of project components in respect to location, technology and design are discussed in **Tables 38.** In case of canal crossing, trenchless technology will be applied. Laying of pipeline along James Long Sarani will be done through micro tunneling. Laying of lateral sewers will be by open trenching process. Mitigation measures will be applied as per site condition and type of activities.

Table 38: Design Considerations for the Pipe laying Methodology

	Parameters	Micro-Tunneling	Open Trenching
1	Construction methodology	Modern; boring with pipe jacking technique	Primitive; manual
2	Accidental damage to utilities	Below utility lines	Invasive through or avoiding the utility lines; often utility lines are required to be shifted
3	Waste (solid and liquid) handling and disposal during construction	Solid waste handling volume is less; disposal of waste is somewhat complicated	Handling volume is more; some part of the excavated material need to be put back again to fill up the trench after pipe is placed; construction method is hazardous
4	Pollution potential (air, noise, vibration, surface water, etc) during construction	Less severe as operation is below the ground without disturbing the surface	Open trenching gives rise air, water and noise pollution
5	Relative hazards during construction	Same degree	Same degree
6	Relative loss of business due to construction	Loss of business is minimal	Loss of business is likely to be more if the roads are narrow and traffic is heavy
7	Inconvenience to people using ROW	Less likely	More likely
8	Cost	More compared to trenching	Much less
9	Construction time	Less	More
10	Maintenance	Same effort is required	Same effort is required
	Recommendation	Micro-tunneling	

B. Construction Phase

173. **Package-Tr-2/SD-09**. – Open trenching for the pipe laying and excavation for pumping station. The works will be along or adjacent to roads' un-used ROWs below the level of utilities avoiding properties. The works will involve earth-moving and excavation; mostly those involved in common and simple construction works. Materials will be brought in on trucks and offloaded by hand. Excavation, if necessary will be by backhoe and supplemented by manual digging. Excess spoils will be loaded into trucks for disposal. For canal crossing jack pushing technology will be applied. Pathways and other local infrastructure will be reinstated to at least their pre-project condition upon completion of construction.

174. **Package-Tr-2/SD-10**. – Open trenching for the pipe laying. The works will be along or adjacent to roads' un-used ROWs below the level of utilities avoiding properties. The works will involve earth-moving and excavation; mostly those involved in common and simple construction works. Materials will be brought in on trucks and offloaded by hand. Excavation, if necessary will be by backhoe and supplemented by manual digging. Excess spoils will be loaded into trucks for disposal. For canal crossing jack pushing technology will be applied. Pathways and other local infrastructure will be reinstated to at least their pre-project condition upon completion of construction.

175. **Package-Tr-2/SD-11**. – Open trenching for the pipe laying and excavation for pumping station. The works will be along or adjacent to roads' un-used ROWs below the level of utilities avoiding properties. The works will involve earth-moving and excavation; mostly those involved in common and simple construction works. Materials will be brought in on trucks and offloaded by hand. Excavation, if necessary will be by backhoe and supplemented by manual digging. Excess spoils will be loaded into trucks for disposal. Pathways and other local infrastructure will be reinstated to at least their pre-project condition upon completion of construction.

176. **Package Tr-2/SD-12-** Micro tunneling technology will be applied for laying of 3.8 km pipeline within busy road. Intermittent shafts of access will be dug using a backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed alongside the shafts and the pipes will be brought to shaft sites on trucks and stored on unused land nearby. Excess spoils will be loaded into trucks for disposal. Slurry will be collected, stored in a container and disposed of to permitted low laying area. Pathways and other local infrastructure will be reinstated to at least their pre-project condition upon completion of construction.

177. **Package-Tr-2/SD-13**. – Open trenching for the pipe laying. The works will be along or adjacent to roads' un-used ROWs below the level of utilities avoiding properties. The works will involve earth-moving and excavation, mostly those involved in common and simple construction works. Materials will be brought in on trucks and offloaded by hand. Excavation, if necessary will be by backhoe and supplemented by manual digging. Excess spoils will be loaded into trucks for disposal. Pathways and other local infrastructure will be reinstated to at least their pre-project condition upon completion of construction.

178. **Package-Tr-2/SD-14**. – Open trenching for the pipe laying. The works will be along or adjacent to roads' un-used ROWs below the level of utilities avoiding properties. The works will involve earth-moving and excavation; mostly those involved in common and simple construction works. Materials will be brought in on trucks and offloaded by hand. Excavation, if necessary will be by backhoe and supplemented by manual digging. Excess spoils will be loaded into trucks for disposal. Pathways and other local infrastructure will be reinstated to at least their pre-project condition upon completion of construction.

179. **Package-Tr-2/SD-19**. – Open trenching for the pipe laying. For laying of pipe below canals, jacking pushing (micro tunneling) method is considered. The works will be along or adjacent to roads' un-used ROWs below the level of utilities avoiding properties. The works will involve earth-moving and excavation; mostly those involved in common and simple construction works. Materials will be brought in on trucks and offloaded by hand. Excavation, if necessary will be by backhoe and supplemented by manual digging. Excess spoils will be loaded into trucks for disposal. Pathways and other local infrastructure will be reinstated to at least their pre-project condition upon completion of construction.

180. **Package-Tr-2/SD-22**. – Open trenching for the pipe laying. The works will be along or adjacent to roads' un-used ROWs below the level of utilities avoiding properties. The works will involve earth-moving and excavation; mostly those involved in common and simple construction works. Materials will be brought in on trucks and offloaded by hand. Excavation, if necessary will be by backhoe and supplemented by manual digging. Excess spoils will be loaded into trucks for disposal. Pathways and other local infrastructure will be reinstated to at least their pre-project condition upon completion of construction.

181. **Table 39** presents an indication of what activities and facilities are likely to be undertaken during construction of the subproject, including the associated inputs and outputs.

Table 39: Summary of activities and facilities, resource use, and produced outputs during Construction Phase (Common for all packages)

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
Construction camp and its associated facilities (including lay-down areas) Storage camps and lay-down areas Materials and equipment stockpiles Handling and storage of hazardous materials including chemicals additives, gravel, cement, concrete and lubricants Source of water Vegetation clearance Bulk earthworks, grading and contouring. Drilling and blasting Movement of construction staff, equipment and materials Importation of selected materials Temporary detours Noise and vibrations Dust suppression Waste production and temporary storage/disposal i.e. used fuels, waste concrete and bitumen, spoil materials and general waste Use of asphalt/bitumen (and associated storage and mixing areas, chemicals) Concrete batching plan (and associated storage and mixing areas, chemicals) Rehabilitation of disturbed areas Interaction between construction workforce and local communities Management of the passing pedestrians and points of congestion Implementation of the Resettlement Plan prior to start of construction Reminders to affected people of construction with time frames	Cement Chemical additives used in concrete / asphalt (i.e. retarders) Paving blocks/bricks Aggregate (sand and stone) Gravel Water Drinking, cooking and sanitation at construction camps Water for dust suppression Water applied to base and sub-base layers during compaction Water for application to sub-base and base layers prior to compaction Petrochemicals Other chemicals/lubricants/paints Construction vehicles, machinery and equipment Temporary energy supply to construction camps Topsoil used during re-vegetation and rehabilitation Plant material for re-vegetation (seeds, sods, plant specimens) Labor Recruitment of construction work force Skills training Control of movement of public needs barriers (not just danger tape) to prevent people from felling in trenches during	Old asphalt (removed from road carriageway during road restoration)[5] Waste concrete and other construction rubble Used fuels, lubricants, solvents and other hazardous waste General waste Contaminated soil Soil contaminated with petrochemicals (i.e. oils and lubricants) and other chemicals Sewage and grey water (temporary construction camp sanitation) Spoil material (excess soil removed during excavations) Noise and vibrations (construction vehicles and machinery) Lighting at construction camps, equipment yards and lay-down areas Plant material removed from servitude/right-of-way during vegetation clearance Smoke and fumes Burning of waste Burning of vegetation cover Fires used for cooking and space heating (construction camps) Vehicle exhaust emissions

[5] The opening of small portions of the roads for micro-tunnelling may involve the stripping and demolition of old asphalt layers. Ideally, old asphalt shall be reused during restoration of the road in order to avoid large quantities of waste being produced. However, depending on the availability and cost of virgin aggregate in the area through which the road is aligned, reusing the old asphalt may be more costly than using virgin aggregate.

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
	construction	

182. The following table (**Table 40**) outlines potential impacts during the construction phase gathered from a process that included a review of available documentation, verified during the site visit, i.e. how, where and when the proposed development can interact and affect the environment significantly, and details what mitigation measures may be taken to counteract these impacts.

Table 40: Summary of anticipated potential environmental impacts during Construction Phase (Common for all packages)

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
Climate	The nature and intensity of rainfall events in an area, has implications for storm water management. Smoke from burning activities could have wider spread on windy days especially when dust could be blown off site.	Consider seasonal climatic variations during scheduling of construction activities in the area. Do excavations and other clearing activities only during agreed working times and permitted weather conditions. Implement storm water control as per method approved by PMU. No open fires permitted on site	Low (negative)	Site	Short-term	Full Mitigation Possible
Air Quality	Sensitive receptors (e.g. hospitals, schools, churches) may be affected temporarily by increased traffic and related impacts during the construction phase (from the proposed detour). Fugitive dust can also impact on roadside air quality during construction. Exhaust fumes from construction machinery, and potential smoke from cooking fires. Burning of waste and cleared vegetation Odors from use of toilet 'facilities' other than provided facilities.	Guidelines that deal with the control of air pollution and dusts on site have been outlined in the Environmental Management Plan (EMP) Ensure compliance with the Air Act. Ensure compliance with emission standards Undertake monitoring of air pollution levels in potential problem areas. Manage (including storage, transport, handling and disposal) hazardous substances used. Avoid dust generating construction activities during strong winds. Cover soil loads in transit. Cover stockpiles of soil or apply suitable dust palliative such as water or commercial dust suppressants. Regularly service vehicles off-site in order to limit gaseous emissions. No open fires permitted on site Place portable toilets on-site and maintain on a daily basis.	Medium (negative)	Local	Short-term	Partial Mitigation Possible
Geology and	Strong water flows into open	The design of the site drainage system	Medium	Site	Short-	Full

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
soil	excavations below the water table will occur, causing micro-tunnel collapse. Layers of mixed fill cover natural ground surface in many places. Contamination from spillage of petroleum products, spent engine oil and oil leaks from construction vehicle maintenance taking place on site.	is adequate to control runoff from the micro-tunnels and open areas in line with topographical features of the site. Rehabilitate all sites during construction including construction camps, stockpile area, temporary access and hauling routes, as soon as possible after the disturbance has ceased. Contractor to exercise strict care in the disposal of construction waste, with proof of disposal at an approved site provided after offloading each waste load and this logged/registered. Contain contaminated water and dispose off site at an approved disposal site in consultation with WBPCB. Dispose of waste from the oil interceptors only through suitable waste-handling contractor and request for safe disposal certificates. Mix cement, concrete and chemicals on a concrete plinth and contain spillages or overflows into the soil. Do not allow vehicle maintenance on site. If oil spills occur, dispose contaminated soil at a disposal site in consultation with WBPCB. Stockpile subsoil and overburden in all construction and lay down areas. Protect topsoil and subsoil from contamination. Return for backfilling in the correct soil horizon order.	(negative)		term	Mitigation Possible
Drainage and hydrology	The proposed development is situated within an existing	The site surface has been engineered and shaped in such a way that rapid	Medium (negative)	Site	Short-term	Full Mitigation

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	built up area. Due to the nature and locality of the subproject there is unlikely any significant impacts on water resources within the immediate area.	and efficient evacuation of runoff is achieved. Provide containment areas for potential pollutants at construction camps, refueling, depots, asphalt plants and concrete batching plants. Implement waste management practices. Control and manage transport, storage, handling and disposal of hazardous substances.				Possible
Biodiversity Fauna and Flora	The proposed development is situated within an existing built up area. No areas of ecological diversity occur within the subproject location. Due to the nature and locality of the subproject, the proposed development is unlikely to cause any significant impact on biodiversity within the area As per preliminary design there will be no requirement for tree felling. This will be further assessed during detail design stage	Permission will be obtained (if required) from the KMC for the cutting/felling of trees prior to start of civil works. Ensure any landscaping to be undertaken will be done with locally indigenous species and low maintenance requirements.	Low (negative)	Site	Short-term	Full Mitigation Possible
Land Uses	Due to the location and nature of the subproject, there will be interference with access. Most of the roads/ lanes are narrow Existing public transport facilities and operations will be affected by the road closure and detours. Shops and establishments are	KMC has consulted with various organizations, departments, etc within the area and will be continued during the construction phase. Put a sign of “Keep Clear” near critical roads (e.g. in front of fire and police stations and hospitals). Consult with local departments, organizations, etc regarding location of	Medium (negative)	Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	located along the pipeline alignment therefore will need to be relocated during construction. This may impact on livelihoods. There will be disruptions to health services, education services, local businesses, transport services, pedestrian movements, due to traffic and construction related noise, visual, and air pollution.	construction camps, access and hauling routes, and other likely disturbances during construction. Provide clear and realistic information regarding detours and alternative accesses for local communities and businesses in order to prevent unrealistic expectations. Provide clear and realistic information regarding employment opportunities and other benefits for local communities in order to prevent unrealistic expectations. Make use of local labor, materials, goods and services as far as possible Provide walkways and metal sheets where required to maintain access across for people and vehicles. Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. Consult businesses and institutions regarding operating hours and factoring this in work schedules. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints. Reinstate pathways and other local infrastructure immediately to at least their pre-project condition upon completion of construction.				
Infrastructure and Services	There is likely to have temporary disruption of infrastructure and services	Undertake utility shifting prior to commencing pipe laying/micro-tunneling.	Low (negative)	Local	Short-term	Full Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	during the pipe laying There are a number of existing infrastructure and services (roads, telecommunication lines, power lines and various pipelines within the vicinity of the subproject.	Keep construction-related disturbances to a minimum. Consult with affected service providers regarding impacts on access to infrastructure and services and alternatives. Consult with affected communities or businesses prior to foreseeable disruptions, for example notifying residents of a temporary severance of water supply. Provide backup or alternative services during construction-related disruptions, for example by providing generators for power supply. Provide access points to infrastructure and services. Monitor complaints by the public. Reinstate pathways and other local infrastructure immediately to at least their pre-project condition upon completion of construction.				
Traffic	Increased volume of construction vehicles on the roads may lead to increased wear and tear of roads in the vicinity of the subproject site. Road safety concerns due to slow moving construction vehicles. Traffic flow within the vicinity will be affected. The temporary road closure will result in a decrease in overall network performance in terms of queuing delay,	Reroute traffic and close roads according the Traffic Management Plan (TMP). The objective of the TMP is to ensure safety of all the road-users along the work zone and to address: (i) protection of work crews from hazards associated with moving traffic; (ii) mitigation of the adverse impact to the road capacity and delays to the road-users; (iii) maintenance of access to adjoining properties; and (iv) issues that may delay the subproject works. Negotiate with privately-owned public transport operators regarding the	High (negative)	Regional	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	**Mitigation**	**Significance before Mitigation**	**Geographic Spatial Scale**	**Duration**	**Mitigation**
	travel times/speeds. The road closure will impact on a public transport operations and routing. On street parking and loading bays will be affected by the proposed road closure. Pedestrian movements will be affected by the road closure.	affected public transport facilities and routing. Negotiate with business owners and social service operations regarding the loss of parking and loading bays. Clear roads signs will be erected for the full length of the construction period. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints. Ensure the City Traffic Police will be available on site. Communicate road closure together with the proposed detour via advertising, pamphlets, radio broadcasts, road signage, etc. The implementation of the road detour is also dependent on advance road signage indicating the road detour and alternative routes. Define clearly construction routes. Strictly control access of all construction and material delivery vehicles. Enforce speed limits. Do not allow deliveries during peak traffic hours Template for traffic management plan is attached as **Appendix 9.**				
Health and Safety	Construction related activities may lead to injuries. . Open fires in construction camp can result in accidents Safety of workers and general public may be compromised	Implement good housekeeping practices at the construction camp. Strictly implement health and safety measures and audit on a regular basis. Secure enclosed construction site. Use reputable contractors.	High (negative)	Site and Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	due to difficult site conditions. Poor waste management practices and unhygienic conditions at temporary ablution facilities can breed diseases. Standing water due to inadequate storm water drainage systems, inadequate waste management practices, pose a health hazard to providing breeding grounds for disease vectors such as mosquitoes, flies and snails. The use of hazardous chemicals in the micro-tunneling and restoration of roads can pose potential environmental, health and safety risks. Road safety may be affected during construction, especially when traffic is detoured.	Provide warning signs of hazardous working areas. Clearly demarcate excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches. Thoroughly train workers assigned to dangerous equipment. Workers have the right to refuse work in unsafe conditions. Undertake waste management practices (Planned disposal of sludge from pumping stations within surrounding areas of PS) particularly for Pumping Station Control speed and movement of construction vehicles Exclude public from the site Ensure all workers are provided with and use Personal Protective Equipment. Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site; Provide medical insurance coverage for workers. Provide clean eating areas where workers are not exposed to hazardous or noxious substances; Provide visitor orientation if visitors to the site can gain access to areas where				

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
		hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; Ensure moving equipment is outfitted with audible back-up alarms; Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate. Health and Safety Plan is attached as **Appendix 10**				
Noise and Vibrations	Sensitive receptors (hospitals, schools, churches) may be affected temporarily by increased traffic and related impacts Use of heavy vehicles and equipment may generate high levels of noise. Vibrations resulting from bulk earthworks, micro-tunneling and compaction may create significant disturbances to nearby people and businesses. Disturbance from afterhours work.	Locate concrete batching, asphalt, crushing plants, lay down areas and construction camps away from sensitive receptors. Restrict construction activities to reasonable working hours where near sensitive receptors. Keep adjacent landowners informed of unusually noisy activities planned. Regulate roadworthiness of vehicles. Ensure that machinery in a good state of maintenance. Fit and maintain silencers to all machinery on site. Monitor noise levels in potential problem areas.	High (negative)	Local	Short-term	Partial Mitigation Possible
Aesthetics, Landscape	The presence of heavy duty vehicles and equipment,	Properly fence off storage areas. Collect all domestic solid waste central	Medium (negative)	Local	Short-term	Partial Mitigation

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
Character, and Sense of Place	temporary structures at construction camps, stockpiles, may result in impacts on aesthetics and landscape character	point of disposal and feed into the city waste collection system. Contractor to exercise strict care in disposing construction waste. Identify suitable waste disposal site with enough capacity to hold additional waste to be generated by the construction activities. Retain mature trees on and around the site where possible. Remove unwanted material and litter on a frequent basis. Reinstate pathways and other local infrastructure immediately to at least their pre-project condition upon completion of construction.				Definite
Workers Conduct	Construction workers on site disrupting adjacent land uses by creating noise, generating litter, and possible loitering.	Ensure strict control of laborers Minimize working hours to normal working times Control littering Ensure no overnight accommodation is provided.	Low (negative)	Local	Short-term	Full Mitigation Definite
Employment Generation	The subproject will provide employment opportunities for local people during construction. Expectations regarding new employment will be high especially among the unemployed individuals in the area. Labor gathering at the site for work can be a safety and security issue, and must be avoided. The training of unskilled or	Employ local (unskilled) labor if possible Training of labor to benefit individuals beyond completion of the subproject. Ensure recruitment of labors will take place offsite. Ensure at least 50% of all labor is from surrounding communities in the contractual documentation.	Medium (positive)	Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	**Mitigation**	**Significance before Mitigation**	**Geographic Spatial Scale**	**Duration**	**Mitigation**
	previously unemployed persons will add to the skills base of the area.					
Archaeological and Cultural Characteristics	The proposed development will not require demolition of ASI- or state-protected monuments and buildings	Ensure that construction staff members are aware of the likelihood of heritage resources being unearthed and of the scientific importance of such discoveries. Contact ASI or the State Department of Archaeology if any graves be discovered and all activities will be ceased until further notice. Contact ASI or the State Department of Archaeology if any heritage resources or objects, defined in the Act, be discovered and all activities will be ceased until further notice. Cease all activities immediately and do not move any heritage object found without prior consultation with ASI or the State Department of Archaeology No structures older than 100 years will be allowed to be demolished, altered or destructed without a permit from ASI or the State Department of Archaeology.	Low (negative)	Local	Short-term	Full Mitigation Definite

C. Operation and Maintenance Phase

183. The system have a design life of 30 years, during which shall not require major repairs or refurbishments and shall operate with little maintenance beyond routine actions required to keep the pumps and other equipment in working order. The stability and integrity of the system will be monitored periodically to detect problems and allow remedial action if required. Repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

184. The main requirement for maintenance of the S & D conveyance system will be for the detection and repair of leaks. The generally flat topography and the usage of good quality pipes shall mean that pipeline breaks are very rare, and that leaks are mainly limited to joints between pipes. Periodic removal of sludge from pumping stations is essential. Sludge will be stored in open spaces within pumping stations and later it will be disposed of to Dhapa dumping ground, permission from WBPCB already exists for such disposal. Spoil and sludge disposal plan template is shown in **Appendix 11.**

185. Expected sludge generation from Pumping station is given below. This is tentative, final volume can be assessed during preparation of detail project report.

Sludge Generation for Vivekananda Road PS and Keorapukur PS						
Sludge generation for 2045						
Type of Flow	**Average Flow (2045) (lps)**	**TSS (mg/lt)**	**Dry Sludge (t/day)**	**Wet Sludge (t/day)**	**Total Volume of Wet Sludge Generated (cum/Year)**	**Volume of Wet Sludge for PS (Cum/Year)**
DWF	340	400	11.7504	293.76	105120.00	5256.00
SWF	8800	400	304.128	7603.2	111811.76	5590.59
Total	9140		315.8784	7896.96	216931.7647	10846.59
Sludge generation for 2030						
Type of Flow	**Average Flow (2030) (lps)**	**TSS (mg/lt)**	**Dry Sludge (t/day)**	**Wet Sludge (t/day)**	**Total Volume of Wet Sludge Generated (cum/Year)**	**Volume of Wet Sludge for PS (Cum/Year)**
DWF	264	400	9.12	228.10	81622.59	4081.13
SWF	8800	400	304.13	7603.20	111811.76	5590.59
Total	9064		313.25	7831.30	193434.35	9671.72

186. **Table 41** presents an indication of what activities and facilities are likely to be undertaken during operation and maintenance of the subproject, including the associated inputs and outputs.

Table 41: Summary of Activities and Facilities, Resource Use, and Produced Outputs during Operation and Maintenance Phase (Common for all packages)

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
Operation activities Wastewater flow and pumping Storm water flow and pumping Maintenance activities Upkeep and repair of pumps Sludge removal from pumping stations and sewer lines	Labor Vehicles and equipment used for inspections and maintenance Fuels and lubricants Electricity	Wastewater Storm water Sludge Potential for water source contamination

187. The following **Table 42** outlines potential impacts during the operation and maintenance phase gathered from a process that included a review of available documentation, verified during the site visit, i.e. how, where and when the proposed development can interact and affect the environment significantly, and details what mitigation measures may be taken to counteract these impacts.

Table 42: Summary of Anticipated Potential Environmental Impacts During Operation and Maintenance (including defect liability) Phase (Common for all packages)

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
Air Quality	Sensitive receptors (e.g. hospitals, schools, churches) may be affected temporarily by increased traffic and related impacts during S & D network maintenance.	Ensure compliance with the Air Act. Ensure compliance with emission standards Regularly service vehicles off-site in order to limit gaseous emissions.	Low (negative)	Local	Short-term	Partial Mitigation Possible
Biodiversity Fauna and Flora	The proposed development is situated within an existing built up locality. No areas of ecological diversity occur within the subproject location. Due to the nature and locality of the subproject, the proposed development is unlikely to have any significant impact on biodiversity within the area during maintenance works	Ensure no accidental damage to local flora and fauna.	Low (negative)	Site	Short-term	Full Mitigation Possible
Land Uses	Due to the location and nature of the subproject, there will be interference with access during maintenance works Existing public transport facilities and operations will be affected by the road closure and detours. There will be disruptions to health services, education services, local businesses, transport services, pedestrian movements, due to traffic and maintenance-related noise, visual, and air pollution.	Put a sign of “Keep Clear” near critical roads (e.g. in front of fire and police stations and hospitals). Consult with local departments, organizations, etc regarding location of construction camps, access and hauling routes, and other likely disturbances. Provide clear and realistic information regarding detours and alternative accesses for local communities and businesses in order to prevent unrealistic expectations. Provide walkways and metal sheets where required to maintain access	Low (negative)	Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	**Mitigation**	**Significance before Mitigation**	**Geographic Spatial Scale**	**Duration**	**Mitigation**
		across for people and vehicles. Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. Consult businesses and institutions regarding operating hours and factoring this in work schedules. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints. Reinstate pathways and other local infrastructure immediately to at least their pre-project condition upon completion of construction.				
Health and Safety	Danger of operations and maintenance-related injuries. Safety of workers and general public must be ensured. Poor waste management practices and unhygienic conditions at the improved facilities can breed diseases. Standing water due to inadequate storm water drainage systems, inadequate waste management practices, pose a health hazard to providing breeding grounds for disease vectors such as mosquitoes, flies and snails. Fire and electrocution hazards in the pumping stations.	Implement good housekeeping practices at pumping stations. Strictly implement health and safety measures and audit on a regular basis. Provide warning signs of hazardous working areas. Clearly demarcate excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches. Thoroughly train workers assigned to dangerous equipment. Workers have the right to refuse work in unsafe conditions. Undertake waste management practices- specifically periodic removal of sludge from pumping stations. Ensure all workers are provided with Personal Protective Equipment. Ensure the visibility of workers through	Low (negative)	Site and Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	**Mitigation**	**Significance before Mitigation**	**Geographic Spatial Scale**	**Duration**	**Mitigation**
		their use of high visibility vests when working in or walking through heavy equipment operating areas Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site; Provide medical insurance coverage for workers. Provide clean eating areas where workers are not exposed to hazardous or noxious substances; Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; Ensure moving equipment is outfitted with audible back-up alarms; Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate. Health and Safety Plan is attached as **Appendix 10**				
Noise and Vibrations	Sensitive receptors (hospitals, schools, churches) may be affected temporarily by increased traffic and related	Restrict maintenance activities to reasonable working hours where near sensitive receptors. Keep adjacent landowners informed of	Low (negative)	Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	**Mitigation**	**Significance before Mitigation**	**Geographic Spatial Scale**	**Duration**	**Mitigation**
	impacts Disturbance from afterhours work.	unusually noisy activities planned. Fit and maintain silencers to all machinery on site. Monitor noise levels in potential problem areas.				
Workers Conduct	Maintenance workers on site disrupting adjacent land uses by creating noise, generating litter, and possible loitering.	Ensure strict control of laborers Minimize working hours to normal working times Control littering	Low (negative)	Local	Short-term	Full Mitigation Definite
Solid Waste	Solid waste/sludge from screens in the pump house	Regular removal through municipal system and approved disposal (preferably within pumping station area initially and then to Dhapa dumping ground after due permission from WBPCB)	High (negative)	Local	Medium-term to Long-term	Partial Mitigation Possible
Wastewater	Excess accumulation of sewage due to various reasons Excess accumulation of storm water	Ensure adequate pumping	High (negative)	Local	Medium-term to Long-term	Partial Mitigation Possible

D. Summary of Site Specific Mitigation Measures

188. Apart from the generalized mitigation measures common to all package, as outlined in the previous sections, the required important site specific mitigation/safeguard measures due to the below mentioned site situations are summarized as in table (**Table 43**) below:

Table 43: Site Specific Mitigation Measures for the S & D Subproject

Work Component	Mitigation measures
Package- Tr-2/SD-09: Sewerage & Drainage Work and Construction of 1 Pumping Station in Ward No. 114 (Part) in Borough XI	1. The location of the proposed pumping station is within the existing Keorapukur pumping station – as sufficient land is available no additional land acquisition is required 2. Alignment of S & D network is within govt. ROW – no land acquisition is required 3. Roads/ lanes are narrow;; therefore extra care is to be taken for traffic and pedestrian movement management during construction 4. Joining of pipes is to be planned such that the site is not flooded 5. A school is located nearby - construction noise is to be kept at minimum avoiding work at night 6. For crossing of the canal in the site a MS bridge is to be provided 7. Also to minimize impact – canal crossing is to be by jack pushing 8. Pathways and other local infrastructure should be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-10: Sewerage and Drainage network in Rania Box catchment (Part of Ward 111, 112 & 113) in Borough XI	1. Alignment of S & D network is within govt. ROW – no land acquisition is required 2. Roads/ lanes are narrow; therefore extra care is to be taken for traffic and pedestrian movement management during construction 3. Joining of pipes is to be planned such that the area does not get flooded 4. A school is located nearby - construction noise is to be kept at minimum avoiding work at night 5. For crossing of the canal in the site a MS bridge is to be provided. 6. Also to minimize impact – canal crossing is to be by jack pushing 7. Pathways and other local infrastructure should be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-11: Sewerage and Drainage Network in Vivekananda Road Catchment (Part of Ward 113 & 114) & construction of 1 Pumping Station in Borough XI	1. The proposed location of the pumping station is within private land - therefore land acquisition is required 2. Alignment of S & D network is within govt. ROW – no land acquisition is required 3. Roads/ lanes are narrow; therefore extra care is to be taken for traffic and pedestrian movement management during construction 4. Joining of pipes is to be planned without flooding the area 5. A school is located nearby - construction noise is to be kept at minimum avoiding work at night 6. For crossing of the canal in the site, a MS bridge is to be provided. 7. Also to minimize impact – canal crossing is to be by jack pushing. 8. Pathways and other local infrastructure should be be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-12: Laying of Trunk sewer along James Long Sarani by Micro-tunneling method	1. Entry shafts for the micro-tunnels are to be located at places on the road where there are least encroachment on the ROW and least chances of inconveniences to pedestrians and people living in the neighborhood. 2. A traffic management plan as approved by the DSC and PMU is to be in place before construction work commences 3. Suitable bill boards are to be put up at strategic points on the DH road giving salient information on the work component, time schedule and name & contact

Work Component	Mitigation measures
	numbers of responsible persons of PMU and Contractor 4. Security fencing is to be provided throughout the construction period of the shafts 5. Excess solid waste is to be disposed at sites pre-approved by PMU 6. Slurry is to be stored in container and needs to be disposed of at sites with due permission. 7. Pathways and other local infrastructure should be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-13: Sewerage & Drainage Network within James Long Sarani and Mahatma Gandhi Road catchment in Borough XIII & XIV (Part of Ward no. – 123 & 124)	1. Alignment of S & D network is within govt. ROW – no land acquisition is required 2. Roads/ lanes are narrow. Therefore appropriate traffic and pedestrian movement management plan is to be in place during construction 3. Joining of pipes is to be planned without flooding the area 4. Working sites are in part congested with shops; a school is located nearby. Construction noise is to be kept at minimum avoiding work at night 5. Excess solid waste from civil constructions is to be disposed of at sites pre-approved by PMU 6. Pathways and other local infrastructure should be reinstated imediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-14: Laying of lateral sewers in Borough XIII & Borough XIV (Part of Ward no. -122&123 and 128 to 132)	1. Alignment of S & D network is within govt. ROW – no land acquisition is required 2. Roads/ lanes are narrow. Therefore appropriate traffic and pedestrian movement management plan is to be in place during construction 3. Joining of pipes is to be planned without flooding the area 4. Working sites are in part congested with shops; a school is located nearby. Construction noise is to be kept at minimum avoiding work at night. 5. Pathways and other local infrastructure should be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-19: S & D Mains and 2 pumping stations in Tolly's Nullah/ Keorapukur Sub-basin in Borough-XIII (Ward no. 115 & Part of Ward no. 122)	1. Alignment of S & D mains is within govt. ROW – no land acquisition is required 2. 2 nos. pumping stations will be modified no land acquisition is required. 2. Roads/ lanes are narrow. Therefore appropriate traffic and pedestrian movement management plan is to be in place during construction 3. Joining of pipes is to be planned without flooding the area 4. Working sites are in part congested with shops; a school is located nearby. Construction noise is to be kept at minimum avoiding work at night 5. Excess solid waste from civil constructions is to be disposed of at sites pre-approved by PMU. 6. Pathways and other local infrastructure should be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-22: S & D Mains and Pumping station in Churial Extension catchment in Borough XIII and XVI (Part of Ward no. 122,123 & 124)	1. The proposed location of the pumping station is within private land - therefore land acquisition is required 2. Alignment of S & D network is within govt. ROW – no land acquisition is required. Only for construction of PS land acquisition is required 3. Roads/ lanes are narrow; therefore extra care is to be taken for traffic and pedestrian movement management during construction 4. Joining of pipes is to be planned without flooding the area 5. Construction noise is to be kept at minimum avoiding work at night 6. MS pipe bridge is required for crossing of canal. 7. Pathways and other local infrastructure will be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-23: Construction of	1. Land belongs to Govt. 2. Alignment of Pumping main at Govt. RoW. 3. Joining of pipes is to be planned without flooding the area

Work Component	Mitigation measures
New Pumping Station at Lalababu Nikashi/ Bagjola Canal	4. Construction noise is to be kept at minimum avoiding work at night 5. Traffic management plan to be maintained at site. 6. Pathways and other local infrastructure should be reinstated immediately to at least their pre-project condition upon completion of construction.

E. Cumulative *Impact Assessment*

189. The Keorapukur pumping station which is additional within the same campus of existing pumping station will be an isolated civil construction work. No other major civil construction activities are known to be taking place in the area. Construction of Vivekananda Road PS is also at isolated place. Construction of S & D lines along James Long Sarani will be through areas where traffic flow is high. Other pipe laying works are in areas where no major civil constructions are in progress. In brief there are no major construction activities within the present sub project areas. The cumulative impact is less significant.

190. **Table 44** summarizes the cumulative impacts resulting from the subproject when added to other present, and reasonably future actions within reasonably foreseeable (30-year) period. During this time period, it is expected that many other actions will be implemented that will affect the environmental conditions.

Table 44: Cumulative Impact Assessment of S & D subproject

	Summary of Implications and Mitigation		**Assessment of Environmental Impacts**			
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Significance before Mitigation**	**Geographic Spatial Scale**	**Duration**	**Mitigation**
Improvement in S & D infrastructure	Increase in amount of pumping and treatment	KMC undertaking sewerage and drainage improvement subproject	High (negative)	Site/Local	Long-term	Full Mitigation Definite
Cumulative land use and growth-inducing impacts	With sufficient S & D facilities, development can proceed to the degree that sewerage and drainage is not a constraint	KMC to develop additional facilities beyond the design year to accommodate growth if it is to occur	High (negative)	Site/Local	Long-term	Full Mitigation Possible
Growth and development will result in the replacement of open space areas with residential and commercial development.	This development will substantially change the visual character of the area from existing	KMC to implement City Land Use plan and Zoning	High (negative)	Site/Local	Long-term	Full Mitigation Possible

	Summary of Implications and Mitigation		Assessment of Environmental Impacts			
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Significance before Mitigation**	**Geographic Spatial Scale**	**Duration**	**Mitigation**
	conditions. This will be a significant and unavoidable cumulative aesthetic impact.					
Cumulative Air Quality Impacts	The subproject can collectively generate construction-related air emissions.	See mitigation measures in the EMP	Low (negative)	Site/Local	Short-term	Partial Mitigation Possible
Cumulative Noise Impacts	Noise is a localized issue that diminishes in intensity with distance from the source. Construction of the proposed facilities along with construction activities of other development in the subproject area can potentially increase construction-related noise impacts on land uses directly adjacent to the construction sites.	Such cumulative noise impacts will be temporary and will not likely occur during sensitive nighttime hours. See mitigation measures in the EMP	Low (negative)	Site/Local	Short-term	Partial Mitigation Possible
Cumulative Transportation Impacts	The subproject in combination with future growth and development could result in potentially	The impacts will be temporary in nature, and standard traffic controls and notifications	Low (negative)	Site/Local	Short-term	Partial Mitigation Possible

	Summary of Implications and Mitigation		Assessment of Environmental Impacts			
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Significance before Mitigation**	**Geographic Spatial Scale**	**Duration**	**Mitigation**
	significant construction-related traffic impacts. These include adding traffic to local roadways and lane closures when facilities (pipelines) are being installed in roadways. Minor amount of employee trips will be generated	will be implemented during project construction Minor employee trips will not contribute substantially to cumulative long-term operational traffic impacts				

VI. ANALYSIS OF ALTERNATIVES

191. Alternative analyses has been done for Packages TR-02/11 and TR-02/13.

TR-02/11:

192. Alternative Scheme: Re-sectioning of entire stretch of Rania canal to carry SWF only, laying gravity sewers on either sides of the canal to arrest DWF and construction of PS to lift sewage and effective disposal of SWF to the canal.

193. This alternative scheme has been discarded due to the following reasons -

- Canal sectioning with design section requires RCC U-trough as space is not available for trapezoidal lined section increasing many fold the construction cost
- It is difficult to lay gravity sewers along either banks of the canal to arrest DWF due to space restriction at stretches.
- Additional pumping station is required for effective disposal of combined flow
- Moreover, approach road to the pumping station is very narrow
- The canal gets frequently silted up due to indiscriminate dumping of solid wastes.

Tr-02/13:

194. In option I, entire quantum of SWF generated from catchment area is proposed to be discharged to Churial canal through proposed gravity outfall and DWF is proposed to be discharged to the sewer along James Long Sarani by DWF pumping station proposed near crossing of Churial canal & MG Road through pumping main.

195. In option II, entire DWF and part of SWF generated from catchment area is proposed to be conveyed to the sewer along James Long Sarani.

196. The second option distinctly holds edge over the first option as in this case, pumping station including pumping main is not required to divert DWF from this catchment to James Long Sarani.

197. Practically in all the isolated subproject locations government land and ROWs are considered and therefore displacement of any community will not arise. Laying of pipeline will be within ROW with no encroachment on any private land and with no eviction of squatters. In the screening exercise, areas of concern - congested market place on the sides of the road, existence of sensitive area, extent of physical displacement if any, etc. was studied. The findings have been used as inputs for engineering design within the technical requirements and cost effectiveness. A Comparative analysis of "with project" and "no project" scenario is given in **Table 47.**

Table 45: Comparative analysis of With Project and No Project scenario

Sl. No.	Parameter	'With-Project' Scenario	'No-Project' scenario
	Services		
1	Water logging /flooding – extent and duration	Substantially reduced	Suffering from long duration water-logging/flooding
2	Sanitation	Organized management of sewage including scientific treatment	Spot management through individual septic tanks with possible overflow of untreated sewage from septic tanks during rains
3	Maintenance of sewage and drainage system	Organised and better maintenance and therefore efficient operation of the created system	Individual maintenance of the system at source
	Environment		
4	Public health	Clean surroundings eliminating bad odour and mosquito breeding from open drains	Mosquito menace due to presence of open drains with low flow velocity
5	Effect on aquatic ecology of discharging canal	No effect	Polluted waste water draining in to the canal
	Social		
6	Inconveniences to people	During construction phase only	Inconvenience especially during rains
7	Quality of life	Improvement with availability of organized S & D system	No change; negative with increase of population
	Economic		
8	Economic development	Increase in property value	No effect
9	Business	Attract more business due to improved infra structure	No change
10	Roads	With elimination of side open drains roads will become wide	No effect
11	Risks	Wide roads means safe transport and pedestrian movement	No change (narrow roads) will continue to pose transport hazards and risk of accident to pedestrians
	Recommendation	Present level of S & D service will improve after implementation of the project. No permanent impact on environmental parameters is envisaged in case of "with project" scenario, only short term negative	

Sl. No.	Parameter	'With-Project' Scenario	'No-Project' scenario
	Services		
		impact and long term positive impact may result. Hence "With Project" scenario is much more preferable than "No-Project" scenario.	

VII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Public participation during the preparation of the IEE

198. The public participation process included identifying interested and affected people (stakeholders); informing and providing the stakeholders with sufficient background and technical information regarding the proposed development; creating opportunities and mechanisms whereby they can participate and raise their viewpoints (issues, comments and concerns) with regard to the proposed development; giving the stakeholders feedback on process findings and recommendations; and ensuring compliance to process requirements with regards to the environmental and related legislation.

199. The primary stakeholders are: (i) local residents, shopkeepers and business people who live and work alongside the roads where pipeline will be laid and facilities will be provided; and (ii) custodians and users of socially- and culturally-important buildings in affected areas.

200. The secondary stakeholders are: (i) KMC as the executing agency; (ii) KEIIP officials as implementation agency; (iii) WBPCB, government department (like Environment department, Government of West Bengal, Forest Directorate, Government of West Bengal, Ministry of Environment & Forests, Government of India) and relevant government agencies (like CPCB, NEERI), including state and local authorities responsible for land acquisition, ,(iv) non-government organizations, university professors, and community-based organizations (CBOs) working in the affected communities; (v) other community representatives (prominent citizens, religious leaders, elders, women's groups); (vi) beneficiary community in general; and (vii) ADB, the government, and Ministry of Finance.

201. The following methodologies will be used for carrying out public consultation:

- Local communities, Individuals affected, traders and local shopkeepers who may be directly affected to be given priority while conducting public consultation.
- Walk-through informal group consultations along the proposed S & D pipe laying stretch.
- The local communities to be informed through public consultation with briefing on project interventions including its benefits.
- The environmental concerns and suggestions made by the participants to be listed out, discussed and suggestions to be noted for consideration during implementation.

202. Formal consultations have been carried out with concerned Minister of Govt. Of West Bengal and engineers of KMC on 28.03.2015 and 13.05.2015 to priority and finalize items of work to be taken under the Project. Minutes of the meeting is attached as **Appendix 12.** These were supplemented by series of informal discussions by the PMC engineering Consultants with Chief Engineers of KMC and Director General (Projects), PMU mainly on understanding current situation and optimum design to be adopted in order to attain the objectives of taking up the work items. On specific environmental fronts Team Leader, Deputy Team Leader and

Environmental Expert, PMC arranged a meeting at the WBPCB office on 13 September, 2011 in which Chairman, Member Secretary, Chief Engineer (Planning), Chief Scientist and other engineers of WBPCB were present, The officials of WBPCB were appraised about the proposed work program of KEIIP (2nd phase of KEIP) at it stood on that date.

203. On environmental issues of KEIIP a meeting at the WBPCB office was held on 1st December 2015 in which Chairman, Member Secretary, Chief Engineer and other engineers of WBPCB were present. The officials of WBPCB were appraised about the proposed work program of Tranche 1 and 2 of KEIIP. **Appendix 13** shows Minutes of the Meeting.

204. Discussion has been carried out with Chief Engineer West Bengal Pollution Control Board on different safeguard issues on 10.04.2015, 29.06.2015 and 17.08.2015. WBPCB opined that,

- Consent to operate for sub projects under Tranche 1 and 2 should be taken in single composite manner along with other facilities with KMC requiring consent to operate authorization
- Public liability insurance as per MoEFCC notification should be taken for all KMC facilities including tranche 1 and 2 sub projects requiring consent to operate authorization
- Consent to establish (NOC) authorization for relevant subprojects should be taken under orange category in serial tiltled infrastructure facility development
- WBPCB wanted presentation from KEIIP for the benefit of its engineers and officers covering all sub projects under Tranche 1 and 2 so that the engineers of WBPCB are appraised about details of the work plan of the sub projects in Tranche 1 and 2 of KEIIP.

205. On 15.11.14 at Mission Anchal, on 16.11.14 at Satbigha, on 16.11.14 at Baganpara, on 18.11.14 at Sukanta Pally, on 03.12.14 at Sarat Pally, Rifle Club Road, on 03.12.14 at Niranjan Pally (Block A) and Ananda pally east, on 09.12.2014 at Purba Putiary Thakurtala pump house, on 09.12.2014 at Purba Putiary Dakshin Para, on 09.12.2014 at Ramkantapur local level consultation have been conducted. Also consultation with local shopkeepers have been done at Chandra Roy Road. They all pointed out water logging during rainy seasons is a usual phenomenon. Some of the houses become flooded during that period. Many residents have to leave their houses. They informed that existing drainage system is absolutely inadequate. Issues related to consultation and design consideration is shown in Table below.

Location & Date	Issues/ Implication	Consideration in design
15.11.14 at Mission Anchal	• Water logging during rainy seasons is normal phenomenon. • Some of the houses become flooded during that period. Many residents have to leave their houses. • Existing drainage system is absolutely inadequate • Absence of proper solid waste management makes the situation worse. There is no enclosed collection point in the roads • Mosquito nuisance is a tremendous problem. People recurrently suffer from diseases like Malaria, Dengue.	✓ Underground sewerage and drainage system will be considered under the project ✓ Coverage of entire area under proposed S & D ✓ Proper solid waste management needs to be taken up as separate project ✓ To check mosquito nuisance management of drainage system until commissioning of the project is necessary.
16.11.14 at Satbigha	• The drainage system is poor.	✓ Coverage of entire area

Location & Date	Issues/ Implication	Consideration in design
	• Drains are clogged • Water logged roads during rainy seasons	under proposed S & D ✓ Cleaning of drain to be done until commissioning of new drainage system
16.11.14 at Baganpara	• Municipal water supply is not regular. The quality of water is bad, it is not transparent • In some houses there is no water connection. • Water logging is a regular occurrence • Some houses are flooded every year; they are forced to leave their houses. • Due to inappropriate drainage system drains become over flown. • People welcomed the proposed S & D work and informed they would cooperate in the venture.	✓ Sufficient water supply from separate project ✓ Coverage of entire area under proposed S & D ✓ Sufficient width of S & D pipeline
18.11.14 at Sukanta Pally	• Over flown of drains • Flooding of roads • No waste disposal properly • People suffer from deadly disease like Malaria, Dengue etc • People welcomed the project.	✓ Coverage of entire area under proposed S & D ✓ Proper solid waste management needs to be taken up as separate project ✓ To check mosquito nuisance management of drainage system until commissioning of the project is necessary.
03.12.14 at Sarat Pally, Rifle Club Road	• During rainy season water logging (up to 1-2 feet usually) is a common phenomenon • They told that KMC is trying their best for these areas. • Furthermore they informed these areas are added areas, naturally it will take some more time to develop. • Canals should be rehabilitated.	✓ Underground sewerage and drainage system will be considered under the project at earliest ✓ Complete coverage of entire area will be taken up under proposed S & D ✓ Canals rehabilitation work should be taken up as separate project
03.12.14 at Niranjan Pally (Block A)	• No proper drainage facility. • The place is mosquito infested, even Dengue larvae were found and Malaria is frequent. • They informed that they will cooperate fully during construction work though they know there will be temporary interruptions.	✓ Underground sewerage and drainage system will be considered under the project at earliest ✓ Mitigation measures will be considered to minimize the impact ✓ To check mosquito nuisance management of drainage system until commissioning of the project is necessary.
03.12.14 at Ananda pally east	• During rainy seasons there is knee deep water on the road which is a regular phenomenon.	✓ Underground sewerage and drainage system will be considered under the

Location & Date	Issues/ Implication	Consideration in design
	• Sometime when the situation gets worsened by water logging people have to leave their houses and stay in others' places • Drainage system is very poor. • No regular maintenance of drain. Drains are clogged most of the time. • Malaria even Dengue is reported because the places are mosquito infested throughout the year. • During rainy seasons Nearby ponds get overflowing with the drain water	project at earliest ✓ Open drain needs to be close after commissioning of underground S & D system ✓ Regular maintenance of new S & D system within design ✓ Drainage of pond water through nearby nallaha – will not affect proposed S & D system ✓ To check mosquito nuisance management of drainage system until commissioning of the project is necessary.
09.12.2014 at Purba Putiary Thakurtala pump house	• Water logging. Though from the last year it is less • Drainage system is poor • Solid waste problem is there • Dengue death reported recently • Area is mosquito infested	✓ Proper solid waste management needs to be taken up as separate project ✓ Complete coverage of entire area will be considered under proposed S & D
09.12.2014 at Purba Putiary Dakshin Para	• Regular water logging problem • Provision of S & D network in un- sewer areas	✓ Complete coverage of entire area will be considered under proposed S & D
09.12.2014 at Ramkantapur	• Water logging • Improper solid waste disposal • Scarcity of drinking water • No proper roads • Over flown of canal water • No electricity	✓ Sufficient water supply from separate project ✓ Proper solid waste management needs to be taken up as separate project ✓ Canals rehabilitation work should be taken up as separate project ✓ Complete coverage of entire area will be considered under proposed S & D

B. Future Consultation and Disclosure

206. The public consultation and disclosure program will remain a continuous process throughout the subproject implementation and shall include the following:

1. Consultation during detailed design

207. Focus-group discussions with affected persons and other stakeholders to hear their views and concerns, so that these can be addressed in subproject design wherever necessary.

Regular updates on the environmental component of the subproject will kept available at the PMU office of KMC.

208. KMC will conduct information dissemination sessions at major intersections and solicit the help of the local community leaders/prominent citizens to encourage the participation of the people to discuss various environmental issues.

209. The PMU, with assistance of DSC will conduct information dissemination sessions in the subproject area. During EMP implementation PMU and DSC will organize public meetings and will apprise the communities about the progress on the implementation of EMP in the subproject works.

2. Consultation during construction:

210. Public meetings with affected communities (if any) to discuss and plan work programs and allow issues to be raised and addressed once construction has started; and

211. Smaller-scale meetings to discuss and plan construction work with local communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation;

212. Consultation and participation plan of Sewerage and Drainage Subproject is given in **Appendix 14.**

3. Project disclosure

213. A communications strategy is of vital importance in terms of accommodating traffic during road closure. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, road signages, etc.

214. One public information campaigns via newspaper/radio/TV is proposed to explain the subproject details to a wider population. Public disclosure meetings at key project stages will be organized to inform the public of progress and future plans.

215. For the benefit of the community a summary of the IEE will be translated in the local language and made available at the offices of KMC, PMU and DSC. Hard copies of the English version of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE will be placed in the official website of the KEIIP and the official website of ADB after approval of the IEE by Government and ADB. The PMU will issue Notification on the start date of implementation of the S & D subproject in KEIIP web site ahead of the implementation works.

VIII. GRIEVANCE REDRESS MECHANISM

216. **Common Grievance Redress Mechanism:** A common grievance redress mechanism (GRM) has been established during Project 1 implementation for social, environmental or any other subproject related grievances.

217. **Grievance Redress Process.** PMU will maintain a Complaint Cell at KEIIP office located in 206 A J C Bose Road Kolkata 700017 headed by a designated Grievance Officer (currently the Administrative Officer) under Project Director. The Complaint Cell will also serve as Public Information Centers, where, apart from grievance registration, information on the Project, subprojects, social and environmental safeguards, etc can be provided.

218. At every Borough of KMC under which works are in progress, a Public Relations & Grievance Redressal Unit is to be established for information disclosure on request from public and for receipt of complaints.

219. At Contractors' site offices, complaint and suggestion books will be available for lodging any complaint. The concerned Executive Engineers of KEIIP will monitor these books and if possible take necessary actions for redressal of minor complaints with intimation to the complainant.

220. The Grievance Registration/Suggestion Form will be available at the Complaints Cell and in Borough Offices and will also be downloadable from the KEIIP/KMC websites. Grievances/ suggestions of affected persons can be dropped in suggestion boxes or conveyed through phone or mail. Affected Persons will also be able to register grievances - social, environmental or other, personally at the Complaint Cell and at Borough offices of KMC. The Grievance Officer and designated official at the Boroughs will be able to correctly interpret/record verbal grievances of non-literate persons and those received over telephone.

221. All complaints (unresolved at local site/Borough level) relating to KEIIP will be sent to the Project Director, KEIIP including those received in the KMC/KEIIP website for redressal The Grievance Officer will resolve simple unresolved issues and in case of complicated issues, consult/seek the assistance of the Environment/Social Specialist of the DSC/PMU. Grievances not redressed through this process within one month of registration will be brought to the notice of the Project Director, KEIIP. Action taken in respect of all complains will be communicated to the complainant by letter, over phone or e-mail or whatsap as the case may be.

222. Periodic community meetings with affected communities to understand their concerns and help them through the process of grievance redress (including translation from local dialect/language, recording and registering grievances of non-literate affected persons and explaining the process of grievance redress) will be conducted if required. The above Grievance Redress Process will be discussed with the stakeholders at the proposed disclosure workshop.

223. **Grievance Redressal Committee (GRC):** A PMU level GRC has already been constituted by the Project Director to address grievances. Grievances not resolved at borough level are referred to PMU level. However grievances that cannot be resolved at PMU level will be referred to an apex grievance redress committee (GRC).[6] Still unresolved issues will be referred to an appropriate court of law.

224. The time limit for grievance redressal will be as follows,

- Site level – 7 days
- Borough level – 7 days

[6] The apex GRC will have the following members: KMC Commissioner as Chairperson, KEIIP Project Director, Director General (P), KEIIP, Environment/Social Safeguard Officer, Administrative Officer as the convener, representatives of APs, Community Based Organizations (CBOs), and eminent citizens. The GRC must have at least two women members.

- GRC – PMU level – 15 days
- Apex GRC- 15 days

225. **Appendix 15** shows office order related to set up of PMU level GRC.

226. **Consultation Arrangements.** This will include group meetings and discussions with affected persons, to be announced in advance and conducted at the time of day agreed on with affected persons and conducted to address general/common grievances; and if required with the Environment/Social Specialist of PMU/DSC for one-to-one consultations. Non-literate affected persons/ vulnerable affected persons will be assisted to understand the grievance redress process, to register complaints and with follow-up actions at different stages in the process.

227. **Record-keeping.** Records will be kept by PMU/Borough Office/Contractors' site office of all grievances received including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were in effect, and final outcome.

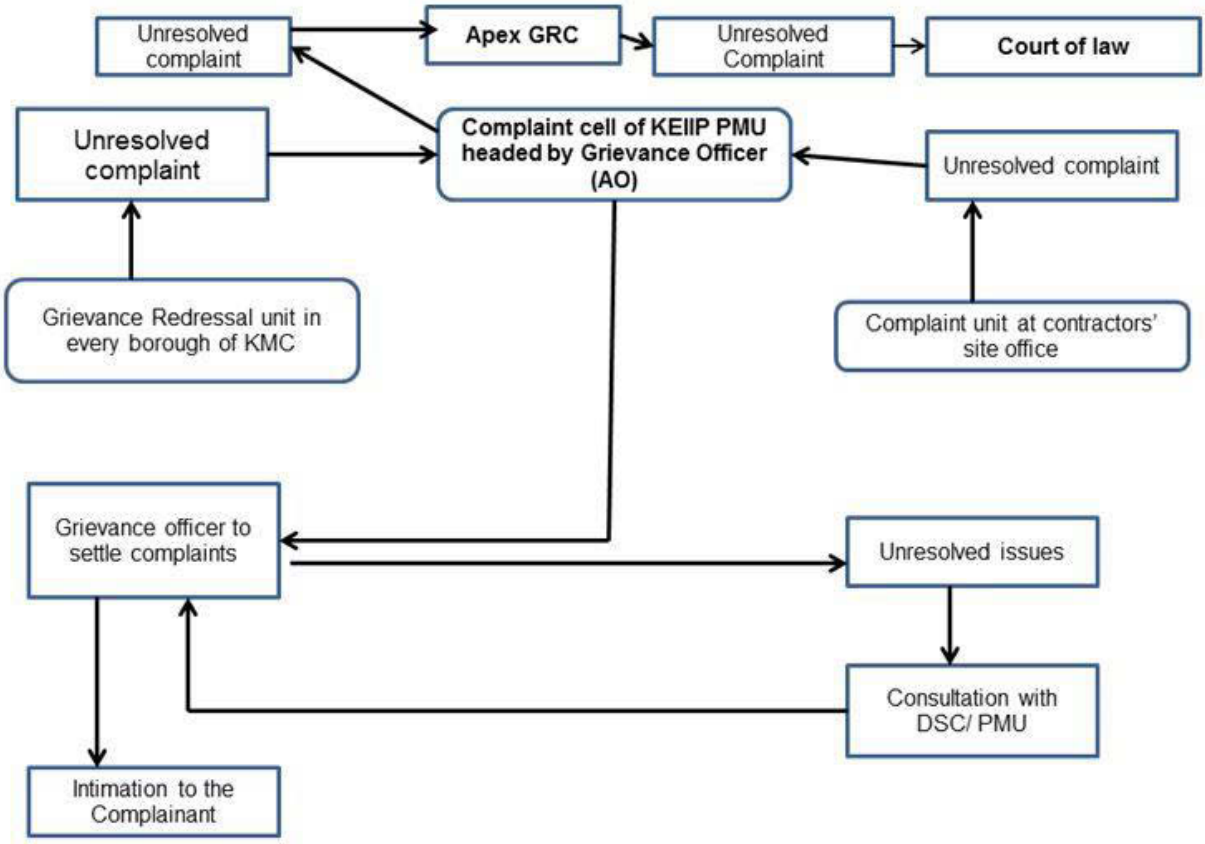
228. **Information Dissemination Methods of the GRM.** Grievances received and responses provided will be documented and reported back to the affected persons. (**Appendix 16** -Sample Grievance Registration Form). The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the offices of the different Boroughs of KMC and web. The phone number where grievances are to be recorded will be prominently displayed at the construction sites.

229. **Periodic Review and Documentation of Lessons Learned.** PMU will periodically review the functioning of the GRM and effectiveness of the mechanism, especially on the Project's ability to prevent and address grievances.

230. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting / information dissemination) will be borne by PMU.

231. **Figure 20** shows GRM flow chart.

Figure 20: GRM System in KEIIP



IX. ENVIRONMENTAL MANAGEMENT PLAN

232. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between the PMU, DSC, and the contractors. The EMP identifies activities according to the following three phases of development: (i) Site Establishment and Preliminary Activities; (ii) Construction Phase; and (iii) Post Construction/Operational Phase.

233. The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with. The contractor for each package will be required to submit to PMU for review and approval site environmental plan (SEP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following **Tables 51 to 54** of the EMP to ensure no significant environmental impacts; (iii) monitoring program as per SEP; and (iv) budget for SEP implementation. No physical works are allowed to commence prior to approval of SEP.

234. A copy of the EMP/ approved SEP must be kept on site during the construction period at all times. The EMP will be made binding on all contractors operating on the site and will be included within the Contractual Clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance. It shall be noted that the Supreme Court of India[7] mandates those responsible for environmental damage must pay the repair costs both to the environment and human health and the preventative measures to reduce or prevent further pollution and/or environmental damage. (The polluter pays principle).

235. The Contractor is deemed not to have complied with the EMP/approved SEP if:

(i). Within the boundaries of the site, site extensions and haul/ access roads there is evidence of contravention of clauses.
(ii). If environmental damage ensues due to negligence.
(iii). The contractor fails to comply with corrective or other instructions issued by the PMU/DSC within a specified time.
(iv). The Contractor fails to respond adequately to complaints from the public.

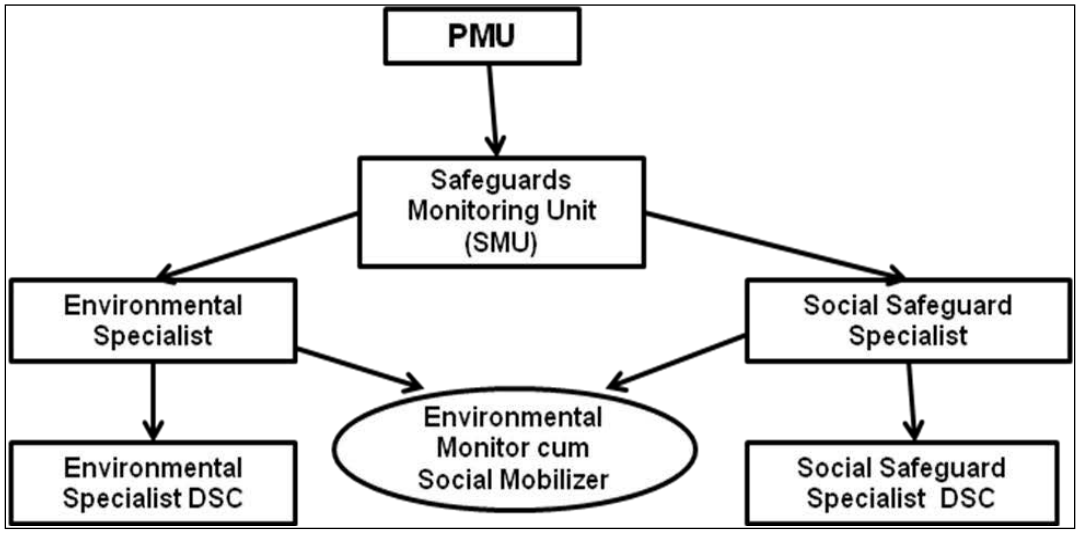
A. Institutional Arrangement

236. The institutional arrangement will follow KEIIP's organizational structure and functions established in Project 1 (**Figure 21**). The subproject will be implemented and monitored by the Project Management Unit (PMU). The KEIIP's PMU Environment Specialist is overall in-charge on Environmental safeguard of the program. The responsibilities of the Environmental Specialist will ensure that (i) environmental safeguard issues are addressed; (ii) EMP/approved SEP is implemented; (iii) physical and non-physical activities under the subproject are monitored; and (iv) monitoring reports are prepared on time and submitted to ADB.

237. PMU- SMU will be supported by the Design and Supervision Consultants (DSC). An Environment Specialist will be engaged to ensure: (i) EMP/ approved SEP is implemented; (ii) surveys and measurements are undertaken; (iii) inspections and observations throughout the construction period are recorded to ensure that safeguards and mitigation measures are provided as intended; and . (iv) statutory clearances and permits from government agencies/other entities are obtained prior to start of civil works.

[7] Writ Petition No. 657 of 1995. The Supreme Court, in its order dated Feb.4, 2005, that "The Polluter Pays Principle means that absolute liability of harm to the environment extends not only to compensate the victims of pollution, but also to the cost of restoring environmental degradation. Remediation of damaged environment is part of the process of sustainable development."

Figure 21: Institutional Arrangement – Safeguards



Notes: PMU = Project Management Unit; DSC = Design and Supervision Consultants; R & R = Relocation and Rehabilitation

238. **Table 46** gives the institutional roles and responsibilities in all phases of the subproject.

Table 46: Institutional Roles and Responsibilities: Environmental Safeguard

Phase	PMU/ SMU	DSC	ADB
Subproject identification stage		• DSC to screen subprojects with inputs based on the EARF subproject selection guidelines	
Subproject appraisal stage	• PMU to review the REA checklists and draft IEE. • PMU to disclose on its website the approved IEE. • PMU to ensure disclosure of information throughout the duration of the subproject.	• DSC to conduct REA for each subproject using checklists and to prepare IEE	• ADB to review the REA checklists and reconfirm the categorization. • ADB will review and approve EIA reports (Category A) and IEE reports (Category B) subprojects. • ADB to disclose on its website the submitted EIA/IEE report.
Detailed Design Phase	• SMU of PMU with the assistance of DSC to incorporate the EMP, environmental mitigation and monitoring measures into contract documents.	• DSC to revise the IEE and EMP in accordance with detailed design changes if warranted. • DSC to ensure incorporation of EMP in bid documents and contracts. • DSC to prepare inventory of utilities to be affected by the subproject.	• ADB will review and approve updated EIA reports (Category A) and IEE reports (Category B) subprojects. • ADB to disclose on its website updated EIA/IEE report.

Phase	PMU/ SMU	DSC	ADB
		• DSC to conduct baseline environmental conditions and inventory of affected trees	
Pre-construction Phase	• DSC to conduct public consultation and disclosure during IEE process and comments will be reflected in the IEE report. • PMU to monitor the disclosure and public consultation. • PMU and DSC to approve contractor's proposed locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes	• DSC to ensure statutory clearances and permits from government agencies/other entities are obtained prior to start of civil works. • DSC to consult affected people and ensure RP is implemented prior to start of civil works. • DSC to ensure disclosure of information prior to start of civil works and throughout the duration of the construction period. • DSC to approve contractor's site-specific environmental plan (such as traffic management plan, waste management plan, locations for camp sites, storage areas, lay down areas, and other sites/plans specified in the EMP).	
Construction Phase	• SMU will review 6-monthly monitoring and EMP implementation report including the status of Project compliance with statutory clearances and with relevant loan covenants and submit the 6-monthly report to ADB and seek permission to disclose the same in the Project web site.	• DSC to monitor the implementation of mitigation measures by Contractor. • DSC to prepare monthly progress reports including a section on implementation of the mitigation measures (application of EMP and monitoring plan) • DSC (as per EMP) will conduct environmental quality monitoring during construction stage (ambient air and noise, and water quality). • DSC to prepare the 6 monthly (semi-annual) monitoring report on environment by focusing on the progress in implementation of the EMP and issues encountered and measures adopted, follow-up actions required, if any.	ADB to review the 6 monthly report, provide necessary advice if needed to the PMU and approve the same. • ADB to disclose on its website environmental monitoring reports.
Pre-operation	PMU to review monitoring	• DSC to monitor	

Phase	PMU/ SMU	DSC	ADB
Phase (Commissioning and Defect Liability Period)	report of DSC on post-construction activities by the contractors as specified in the EMP	post-construction activities by the contractors as specified in the EMP.	
Operation Phase	• KMC to conduct monitoring, as specified in the environmental monitoring plan. • WBPCB to monitor the compliance of the standards regarding drinking water quality, ground water, ambient air, effluent quality from treatment plant, as applicable.		

Notes: WBPCB = West Bengal State Pollution Control Board, KMC = Kolkata Municipal Corporation, CTE = Consent to Establish, CTO = Consent to Operate, DSC = Design and Supervision Consultant, EIA = Environmental Impact Assessment, EMP = Environmental Management Plan, IEE = Initial Environmental Examination, PMU = Project Management Unit; REA = Rapid Environmental Assessment, SMU= Safeguard Monitoring Unit.

239. The Safeguards Monitoring Unit will:

(i) prepare the REA checklist, to draft the EIA/IEE and to disclose the approved EIA/IEE in the website
(ii) ensure that Environmental Clearance (EC), Consent to Establishment and Consent to Operate and other certificates, as required, are obtained in time from appropriate authorities and to ensure compliances with conditions imposed.
(iii) ensure incorporation of the EMP, environmental mitigation and monitoring measures into the contract documents
(iv) monitor disclosure and public consultation arranged by DSC during IEE process and to ensure that comments are reflected in the IEE report
(v) ensure disclosure of information throughout the duration of the subproject through suitable visual means and publications
(vi) provide necessary input for grievance redress
(vii) approve contractor's proposed locations for construction work camps, storage areas, hauling roads, lay-down areas, and disposal areas for solid and hazardous wastes on recommendations of DSC
(viii) guide the Contractor for drawing up of Site Environmental Management Plan and to approve the same
(ix) induct the Contractor for taking up the construction following environmental and social safeguards
(x) facilitate scheduled monitoring during implementation of the project.
(xi) carry out regular onsite monitoring and guide the Contractor to adopt the required site management standard.
(xii) ensure the required health and safety measures at work sites
(xiii) obtain in time and to review the monthly monitoring report of the Contractors
(xiv) prepare 6-monthly monitoring and EMP implementation report, including the status of project compliance, statutory clearances and relevant loan covenants, and submit the approved 6-monthly report to ADB and seek permission to disclose the same in the investment program website
(xv) prepare monitoring report on post-construction activities by the contractors as specified in the EMP

240. The Contractor will be required to:

(i). Submit Site environmental plan (SEP) covering proposed sites / locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes
(ii). Comply with all applicable legislation, is conversant with the requirements of the EMP/ approved SEP;
(iii). Brief his staff, employees, and laborer about the requirements of the EMP/ approved SEP;
(iv). Ensure any sub-contractors/ suppliers who are utilized within the context of the contract comply with the environmental requirements of the EMP/ approved SEP. The Contractor will be held responsible for non-compliance on their behalf;
(v). Supply method statements for all activities requiring special attention as specified and/or requested by the DSC Environment Specialist during the duration of the Contract;
(vi). Provide environmental awareness training to staff, employees, and laborers;
(vii). Bear the costs of any damages/compensation resulting from non-adherence to the EMP/ approved SEP or written site instructions;
(viii). Conduct all activities in a manner that minimizes disturbance to directly affected residents and the public in general, and foreseeable impacts on the environment.
(ix). Ensure that the PMU Environment Coordinators are timely informed of any foreseeable activities that will require input from the DSC Environment Specialist.

B. Environmental Management and Mitigation Measures

241. **Table 47** outlines the site establishment and preliminary activities.

Table 47: Site Establishment and Preliminary Activities (to be revised by contractors for package-specific SEP)

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
1.	Legislation, Permits and Agreements	In all instances, KMC, service providers, contractors and consultants must remain in compliance with relevant local and national legislation.	PMU and DSC	Prior to moving onto site and during construction
		DSC to obtain statutory clearances and permits from government agencies/other entities	PMU	Prior to start of civil works
		Contractor to submit proof of compliance to Air Act (in relation to hot mixing, stone crushers, diesel generators)	DSC Environment Specialist	Prior to moving onto site and during construction
		A copy of the EMP/approved SEP must be kept on site during the construction period	PMU Environment Specialist and DSC Environment Specialist	At all times
2.	Access to Site	Access to site will be via existing roads. The Contractor will need to ascertain the existing condition of the roads and repair damage shall not occur due to construction.	DSC Environment Specialist	Prior to moving onto site and during construction
		The Local Traffic Department shall be involved in the planning stages of the road closure and detour and available on	DSC Environment Specialist	Prior to moving onto site

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		site in the monitoring of traffic in the early stages of the operations during road closure		
		The Local Traffic Department must be informed at least a week in advance if the traffic in the area will be affected.	DSC Environment Specialist	Prior to moving onto site
		The location of all affected services and servitudes must be identified and confirmed.	DSC Environment Specialist	Prior to moving onto site
		All roads for construction access must be planned and approved ahead of construction activities. They shall not be created on an ad-hoc basis.	PMU Environment Specialist and DSC Environment Specialist	Prior to moving onto site and during construction.
		No trees/shrubs/groundcover may be removed or vegetation stripped without the prior permission.	PMU Environment Specialist and DSC Environment Specialist	Before and during construction.
		Contractors shall construct formal drainage on all temporary haulage roads in the form of side drains and miter drains to prevent erosion and point source discharge of run-off.	DSC Environment Specialist	Prior to moving onto site.
3.	Setting up of Construction Camp[8]	Choice of site for the contractor's camp requires the DSC Environment Specialist's permission and must take into account location of local residents, businesses and existing land uses, including flood zones and slip / unstable zones. A site plan must be submitted to the DSC Environment Specialist for approval.	DSC Environment Specialist and PMU Environment Specialist	During surveys and preliminary investigations and prior to moving onto the site
		The construction camp may not be situated on a floodplain or on slopes greater than 1:3.	PMU Environment Specialist and DSC Environment Specialist	During surveys and preliminary investigations and prior to moving onto the site
		If the Contractor chooses to locate the camp site on private land, he must get prior permission from both the DSC Environment Specialist and the landowner.	PMU Environment Specialist and DSC Environment Specialist	During site establishment and ongoing – weekly inspections
		In most cases, on-site accommodation will not be required. The construction camp can thus be comprised of: • site office • toilet facilities • designated first aid area • eating areas • staff lockers and showers (where	DSC Environment Specialist	During set-up

[8] Careful planning of the construction camp can ensure that time and costs associated with environmental management and rehabilitation are reduced.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		water and waterborne sewers are available) • storage areas • batching plant (if required) • re-fuelling areas (if required) • maintenance areas (if required) • crushers (if required)		
		Cut and fill must be avoided where possible during the set up of the construction camp.	DSC Environment Specialist	During site set-up
		The contractor shall make adequate provision for temporary toilets for the use of their employees during the construction phase. Such facilities, which shall comply with local authority regulations, shall be maintained in a clean and hygienic condition. Their use shall be strictly enforced.	DSC Environment Specialist	During site establishment and ongoing – weekly inspections
		Under no circumstances may open areas or the surrounding bush be used as a toilet facility.	DSC Environment Specialist	Ongoing
		Bins and/or skips shall be provided at convenient intervals for disposal of waste within the construction camp.	DSC Environment Specialist	During site set-up and ongoing
		Bins shall have liner bags for efficient control and safe disposal of waste	DSC Environment Specialist	Ongoing
		Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged.	DSC Environment Specialist	During site set-up and ongoing
4.	Establishing Equipment Lay-down and Storage Area[9]	Choice of location for equipment lay-down and storage areas must take into account prevailing winds, distances to adjacent land uses, general on – site topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary	PMU Environment Specialist and DSC Environment Specialist	During site set-up
		Storage areas shall be secure so as to minimize the risk of crime. They shall also be safe from access by children / animals etc.	DSC Environment Specialist	During site set-up
		It is very important that the proximity of residents, businesses, schools etc is taken into account when deciding on storage areas for hazardous substances or materials. Residents living adjacent to the construction site must be notified of the existence of the hazardous storage are	PMU Environment Specialist and DSC Environment Specialist	During site set-up
		Equipment lay-down and storage areas must be designated, demarcated and	DSC Environment Specialist	During site set-up

[9] Storage areas can be hazardous, unsightly and can cause environmental pollution if not designed and managed carefully.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		fenced if necessary.		
		Fire prevention facilities must be present at all storage facilities	DSC Environment Specialist	During site set-up
		Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s). These pollution prevention measures for storage shall include a bund wall high enough to contain at least 110% of any stored volume. The contractor shall submit a method statement for approval	DSC Environment Specialist	During site set-up and ongoing
		These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm water from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources	DSC Environment Specialist	During site set-up and ongoing
		Fuel tanks must meet relevant specifications and be elevated so that leaks may be easily detected.	DSC Environment Specialist	During site setup and monitored
		Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances to be used on site. Where possible the available, MSDSs shall additionally include information on ecological impacts and measures to minimize negative environmental impacts during accidental releases or escapes	DSC Environment Specialist and Contractor	Ongoing
		Staff dealing with these materials/substances must be aware of their potential impacts and follow the appropriate safety measures. The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training	DSC Environment Specialist and Contractor	Ongoing
		Contractors shall submit a method statement and plans for the storage of hazardous materials and emergency procedures.	DSC Environment Specialist	Prior to establishment of storage area

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
5.	Materials Management – Sourcing[10]	Contractors shall prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, clay liners etc), and submit these to the DSC Environment Specialist for approval prior to commencement of any work.	PMU Environment Specialist and DSC Environment Specialist	On award of contract
		Where possible, a signed document from the supplier of natural materials shall be obtained confirming that they have been obtained in a sustainable manner and in compliance with relevant legislation	PMU Environment Specialist and DSC Environment Specialist	On receipt of natural materials
		Where materials are borrowed (mined), proof must be provided of authorization to utilize these materials from the landowner/material rights owner and the Department of Minerals	DSC Environment Specialist	On receipt of borrowed (mined) materials
6.	Education of site staff on general and Environmental Conduct[11]	Ensure that all site personnel have a basic level of environmental awareness training	PMU Environment Specialist, DSC Environment Specialist and Contractor	During staff induction and ongoing
		Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitized to any potential hazards associated with their task	DSC Environment Specialist and Contractor	During staff induction, followed by ongoing monitoring
		No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the Contractor and certified competent by DSC	DSC Environment Specialist and Contractor	During staff induction, followed by ongoing monitoring
		All employees must undergo safety training and wear the necessary protective clothing	DSC Environment Specialist and Contractor	During staff induction, followed by ongoing monitoring
		A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: • No alcohol / drugs to be present on site; • Prevent excessive noise • Construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g. fires for cooking, the use of surrounding bus as a toilet facility are	DSC Environment Specialist and Contractor	During staff induction, followed by ongoing monitoring

[10] Materials must be sourced in a legal and sustainable way to prevent offsite environmental degradation.
[11] These points need to be made clear to all staff on site before the subproject begin.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		forbidden) • No fires to be permitted on site • Trespassing on private / commercial properties adjoining the site is forbidden • Other than pre-approved security staff, no workers shall be permitted to live on the construction site • No worker may be forced to do work that is potentially dangerous or for what he / she is not trained to do		
6.	Social Impacts[12]	Open liaison channels shall be established between the site owner, the developer, operator, the contractors and interested and affected people such that any queries, complaints or suggestions can be dealt with quickly and by the appropriate person(s).	PMU Environment Coordinator and DSC Environment Specialist	Prior to moving onto site and ongoing
		A communications strategy is of vital importance in terms of accommodating traffic during road closure. The road closure together with the proposed detour needs to be communicated via advertising, pamphlets, radio broadcasts, road signage, etc	PMU Environment Specialist	Prior to moving onto site and ongoing
		Advance road signage indicating the road detour and alternative routes. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.	PMU Environment Specialist	Prior to moving onto site and ongoing
		Storage facilities, elevated tanks and other temporary structures on site shall be located such that they have as little visual impact on local residents as possible.	DSC Environment Specialist and PMU Environment Specialist	During surveys and preliminary investigations and site set-up.
		In areas where the visual environment is particularly important or privacy concerns for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction.	DSC Environment Specialist and PMU Environment Specialist	During surveys and preliminary investigations and site set-up.
		Special attention shall be given to the screening of highly reflective materials on site.	PMU Environment Specialist	During site set-up
7.	Noise Impacts	Construction vehicles are be to fitted with standard silencers prior to the beginning of construction	DSC Environment Specialist and PMU Environment Specialist	During site set-up

[12] It is important to take notice of the needs and wishes of those living or working adjacent to the site. Failure to do so can cause disruption to work.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		Equipment that is fitted with noise reduction facilities (e.g. side flaps, silencers, etc) will be used as per operating instructions and maintained properly during site operations	DSC Environment Specialist and PMU Environment Specialist	During site set-up
8.	Dust/Air Pollution[13]	Vehicles travelling along the access roads must adhere to speed limits to avoid creating excessive dust.	PMU Environment Specialist	Ongoing.
		Camp construction / haulage road construction – areas that have been stripped of vegetation must be dampened periodically to avoid excessive dust.	PMU Environment Specialist	Ongoing – more frequently during dry and windy conditions
		The Contractor must make alternative arrangements (other than fires) for cooking and / or heating requirements. LPG gas cookers may be used provided that all safety regulations are followed.	DSC Environment Specialist	Ongoing.
9.	Soil Erosion	The time that stripped areas are left open to exposure shall be minimized wherever possible. Care shall be taken to ensure that lead times are not excessive.	DSC Environment Specialist and PMU Environment Specialist	Throughout the duration of the subproject.
		Wind screening and storm water control shall be undertaken to prevent soil loss from the site.	DSC Environment Specialist and PMU Environment Specialist	During site set-up
		Procedures that are in place to conserve topsoil during the construction phase of the subproject are to be applied to the set up phase. i.e. topsoil is to be conserved while providing access to the site and setting up the camp.	DSC Environment Specialist and PMU Environment Specialist	Ongoing monitoring. during site set-up
10.	Storm water[14]	To prevent storm water damage, the increase in storm water run-off resulting from construction activities must be estimated and the drainage system assessed accordingly. A drainage plan must be submitted to the DSC Environment Specialist for approval and must include the location and design criteria of any temporary stream crossings (siting and return period etc).	DSC Environment Specialist	During surveys and preliminary Investigations.
		During site establishment, storm water culverts and drains are to be located and covered with metal grids to prevent blockages if deemed necessary by the DSC Environment Specialist. (e.g. due to demolition work).	DSC Environment Specialist	During site setup.
		Temporary cut off drains and berms may be required to capture storm water and promote infiltration.	PMU Environment Specialist	During site setup.

[13] Establishment of the camp site, and related temporary works can reduce air quality.
[14] Serious financial and environmental impacts can be caused by unmanaged stormwater.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
11.	Water Quality[15].	Storage areas that contain hazardous substances must be bunded with an approved impermeable liner	DSC Environment Specialist	During site setup.
		Spills in bunded areas must be cleaned up, removed and disposed of safely from the bunded area as soon after detection as possible to minimise pollution risk and reduced bunding capacity.	DSC Environment Specialist and PMU Environment Specialist	During site setup.
		A designated, bunded area is to be set aside for vehicle washing and maintenance. Materials caught in this bunded area must be disposed of to a suitable waste site or as directed by the DSC Environment Specialist	DSC Environment Specialist and PMU Environment Specialist	During site setup.
		Provision shall be made during set up for all polluted runoff to be treated to the DSC Environment Specialist's approval before being discharged into the storm water system. (This will be required for the duration of the project.)	DSC Environment Specialist and PMU Environment Specialist	During site setup and to be monitored weekly
12.	Conservation of the Natural Environment[16]	No vegetation may be cleared without prior permission from the DSC Environment Specialist.	DSC Environment Specialist and PMU Environment Specialist	During site setup and ongoing.
		Trees that are not to be cleared shall be marked beforehand with danger tape. The PMU Environment Specialist must be given a chance to mark vegetation that is to be conserved before the Contractor begins clearing the site	DSC Environment Specialist and PMU Environment Specialist	During site set-up
		Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material)	PMU Environment Specialist	Ongoing in camp Site, haulage Areas
13.	Set-up of Waste Management Procedure	The excavation and use of rubbish pits on site is forbidden	PMU Environment Specialist	Ongoing
		Burning of waste is forbidden.	PMU Environment Specialist	Ongoing
14.	Cultural Environment	Prior to the commencement of construction, all staff need to know what possible archaeological or historical objects of value may look like, and to notify the DSC Environment Specialist/Contractor shall such an item be uncovered.	PMU Environment Specialist	During site set-up and ongoing.
15.	Security and	Lighting on site is to be set out to provide	DSC Environment	During site set-up

[15] Incorrect disposal of substances and materials and polluted run-off can have serious negative effects on groundwater quality

[16] Alien plant encroachment is particularly damaging to natural habitats and is often associated with disturbance to the soil during construction activities. Care must be taken to conserve existing plant and animal life on and surrounding the site.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
	Safety	maximum security and to enable easier policing of the site, without creating a visual nuisance to local residents or businesses.	Specialist	
		Material stockpiles or stacks, such as, pipes must be stable and well secured to avoid collapse and possible injury to site workers / local residents.	PMU Environment Specialist	Ongoing
		Flammable materials shall be stored as far as possible from adjacent residents / businesses.	PMU Environment Specialist	Ongoing
		All interested and affected persons shall be notified in advance of any known potential risks associated with the construction site and the activities on it. Examples are: • stringing of power lines • excavation for the micro-tunnel equipment • earthworks/earthmoving machinery on beside houses/infrastructure/sensitive receptors • risk to residences/sensitive receptors along haulage roads / access routes	PMU Environment Specialist and DSC Environment	24 hours prior to activity in question

242. **Table 48** outlines management of construction activities and workforce.

Table 48: Management of Construction and Workforce Activities (to be revised by contractors for package-specific SEP)

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
1.	Access to Site	Contractor shall ensure that all side and miter drains and scour check walls on access and haul roads are functioning properly and are well maintained.	DSC Environment Specialist	Weekly and after heavy rains.
		Contractor shall ensure that access roads are maintained in good condition by attending to potholes, corrugations and storm water damage as soon as these develop.	DSC Environment Specialist	Weekly inspection.
		If necessary, contractor to employ a staff to clean surface roads adjacent to construction sites where materials have been spilt.	DSC Environment Specialist	When necessary
		Contractor to avoid unnecessary compaction of soils by heavy vehicles.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to restrict construction vehicles to demarcated access, haulage routes and turning areas.	DSC Environment Specialist	Ongoing monitoring.
2.	Maintenance of Construction Camp	Contractor to monitor and manage drainage of the camp site to avoid standing water and soil erosion.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure run-off from the camp	DSC Environment	Ongoing monitoring.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		site must not discharge into neighbors' properties.	Specialist	
		Contractor to maintain toilets in a clean state and shall be moved to ensure that they adequately service the work areas	DSC Environment Specialist	Weekly inspection
		Contractor to ensure that open areas or the surrounding bush are not being used as a toilet facility.	DSC Environment Specialist	Weekly inspection
		Contractor to ensure all litter is collected from the work and camp areas daily.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to empty bins and/or skips regularly, dispose wastes at the pre-approved sites, keep all disposal waybills for review.	DSC Environment Specialist	Weekly inspection
		Contractor to ensure eating areas are regularly serviced and cleaned to the highest possible standards of hygiene and cleanliness.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure that his camp and working areas are kept clean and tidy at all times.	DSC Environment Specialist	Weekly monitoring
3.	Staff Conduct	Contractor to monitor performance of construction workers, ensure points relayed during their induction have been properly understood and are being followed. If necessary, the DSC Environment Specialist and/or a translator shall be called to the site to further explain aspects of environmental or social behavior that are unclear.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure rules that are explained in the worker conduct section,[17] must be followed at all times	DSC Environment Specialist	Ongoing monitoring.
4.	Dust and Air Pollution[18]	Contractor to ensure vehicles travelling to and from the construction site adhere to speed limits so as to avoid producing excessive dust.	DSC Environment Specialist	Ongoing monitoring.
		A speed limit of 30km/hr must be adhered to on all dirt roads.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to dampen access and other cleared surfaces whenever possible and especially in dry and windy conditions to avoid excessive dust.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to utilize screening using wooden supports and shade cloth where dust is unavoidable in	DSC Environment Specialist	As directed by the DSC Environment Specialist.

[17] (i) no alcohol / drugs to be present on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g. fires for cooking, the use of surrounding bus as a toilet facility are forbidden); (iv) no fires to be permitted on site; (v) trespassing on private / commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; (vii) no worker may be forced to do work that is potentially dangerous or for what he / she is not trained to do

[18] Main causes of air pollution during construction are dust from vehicle movements and stockpiles, vehicle emissions and fires.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		residential/commercial/sensitive receptors areas		
		Contractor to keep vehicles and machinery in good working order and meet manufacturers specifications for safety, fuel consumption etc.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to check and repair equipment as soon as possible if excessive emissions are observed.	DSC Environment Specialist	As directed by the DSC Environment Specialist.
		No fires are allowed on site except for the burning of firebreaks.	DSC Environment Specialist	Ongoing monitoring.
5.	Soil Erosion	Once an area has been cleared of vegetation, the top layer (nominally 150mm) of soil shall be removed and contractor to stockpile in the designated area.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to commence top soiling and re-vegetation immediately after completion of an activity and at an agreed distance behind any particular work front.	DSC Environment Specialist	As each activity is completed.
		Contractor to ensure storm water control and wind screening to prevent soil loss from the site.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to dispose unusable soils and spoils to pre-approved disposal sites[19].	DSC Environment Specialist	Ongoing monitoring.
		Contractor to protect all embankments, unless otherwise directed by the DSC Environment Specialist, by a cut off drain to prevent water from cascading down the face of the embankment and causing erosion.	DSC Environment Specialist	Immediately after the creation of the embankment/stripping of vegetation.
6.	Storm water	Contractor shall not in any way modify nor damage the banks or bed of streams, rivers, wetlands, other open water bodies and drainage lines adjacent to or within the designated area, unless required as part of the construction project specification. Where such disturbance is unavoidable, modification of water bodies shall be kept to a minimum in terms of: (i) removal of riparian vegetation; and (ii) opening up of the stream channel	PMU Environment Specialist and DSC Environment Specialist	Ongoing monitoring.
		Contractor to dispose earth, stones, and rubbles and prevent obstruction of natural water pathway, i.e.: these materials must not be placed in storm water channels, drainage lines or rivers.	DSC Environment Specialist	Monitoring throughout the duration of the subproject.
		Contractor to check periodically sites' drainage system to ensure that the water flow is unobstructed.	DSC Environment Specialist	Monthly inspection.
		Contractor to control un-channeled flows. Where large areas of soil are left exposed, rows of straw/ hay or bundles of cut	DSC Environment Specialist	As surfaces become exposed.

[19] Estimated total volume of unused excavated earth material to be disposed is approx. 230776 cubic meters and road crust of approx. 55360 cubic metres

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		vegetation shall be dug into the soil in contours to slow surface wash and capture eroded soil.		
		Contractor to slow down flows where surface run-off is concentrated (e.g. along exposed roadways/tracks by contouring with hay bales or bundled vegetation generated during site clearance operation. If the area must be used for construction vehicles, berms may be used instead. The berms must be at least 30 cm high and well compacted. The berms shall channel concentrated flow into detention ponds or areas protected with hay bales for flow reduction and sediment capture	DSC Environment Specialist	Ongoing monitoring.
7.	Water Quality[20]	Contractor to ensure mixing/decanting of all chemicals and hazardous substances take place either on a tray or on an impermeable surface and dispose waste from these to pre-approved disposal sites.	DSC Environment Specialist	Regular monitoring (refer to the environmental monitoring program)
		Contractor to ensure every effort is made that any chemicals or hazardous substances do not contaminate the soil, Hooghly river, or groundwater on site.	DSC Environment Specialist	Regular monitoring (refer to the environmental monitoring program)
		Contractor to ensure run-off from vehicle or plant washing does not enter Hooghly river or the groundwater and ensure wash water passes through an oil-grease trap prior to discharge.	DSC Environment Specialist	Regular monitoring (refer to the environmental monitoring program)
		Contractor to prohibit site staff in using any stream, river, other open water body or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing or for any construction or related activities. Municipal water (or another source approved by the DSC Environment Specialist) shall instead be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, concrete mixing, compacting etc.	DSC Environment Specialist	Regular monitoring (refer to the environmental monitoring program)
		Contractor shall refer to emergency contact numbers of WBPCB in order to deal with spillages and contamination of aquatic environments.	PMU Environment Specialist and DSC Environment Specialist	As necessary
8.	Conservation of Natural Environment	Contractor is to check vegetation clearing and tree-felling have prior permission as the work front progresses.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure only trees that have been marked beforehand are to be removed.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to prohibit site staff from gathering	DSC Environment	Ongoing monitoring.

[20] Water quality is affected by the incorrect handling of substances and materials. Soil erosion and sediment is also detrimental to water quality. Mismanagement of polluted run-off from vehicle and plant washing and wind dispersal of dry materials into rivers and watercourses are detrimental to water quality.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		firewood, fruits, plants, crops or any other natural material on-site or in areas adjacent to the sites.	Specialist	
		Contractor to prohibit site staff from hunting of birds and animals on-site or in areas adjacent to the sites.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to immediately re-vegetate stripped areas and remove aliens species by weeding. This significantly reduces the amount of time and money that must be spent on alien plant management during rehabilitation.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure, where possible, cleared indigenous vegetation is kept in a nursery for use at a later stage (such as site rehabilitation process).	DSC Environment Specialist	As the work front progresses.
9.	Materials Management	Contractor to ensure stockpiles do not obstruct natural water pathways.	DSC Environment Specialist.	As necessary.
		Contractor to ensure stockpiles do not exceed 2m in height unless otherwise permitted by the DSC Environment Specialist.	DSC Environment Specialist	As necessary.
		Contractor to cover stockpiles exposed to windy conditions or heavy rain with vegetation, cloth, or tarps.	DSC Environment Specialist	As necessary.
		Contractor to ensure stockpiles are kept clear of weeds and alien vegetation growth by regular weeding	DSC Environment Specialist	Monthly monitoring
		Contractor to ensure all concrete mixing take place on a designated, impermeable surface.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure vehicles transporting concrete to the site are not washed on-site.	Contractor	Ongoing monitoring.
		Contractor to prohibit mixing of lime and other powders during excessively windy conditions.	DSC Environment Specialist	As necessary
		Contractor to store all substances required for vehicle maintenance and repair in sealed containers until they can be disposed of/removed from the sites.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure hazardous substances/materials are transported in sealed containers or bags	DSC Environment Specialist	Ongoing monitoring
		Contractor to prohibit spraying of herbicides/pesticides during windy condition	DSC Environment Specialist	As necessary.
10.	Waste Management	Contractor to place refuse in designated skips/bins, rubbles in demarcated areas, remove from the site, and transport to the pre-approved disposal sites. Waybills proving disposal at each site shall be provided for the DSC Environment Specialist's inspection.	DSC Environment Specialist	Checked at each site meeting.
		Contractor to prohibit littering on-site and clear the site of litter at the end of each working day.	DSC Environment Specialist	Ongoing monitoring.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		Contractor to encourage recycling by providing separate receptacles for different types of waste and make sure that staffs are aware of their uses.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to clean toilets regularly; and avoid contamination of soils, water, pollution and nuisance to adjoining areas.	DSC Environment Specialist	Weekly monitoring.
11.	Social Impacts[21]	Contractor to restrict activities and movement of staff to designated construction areas.	DSC Environment Specialist	Ongoing.
		Contractor to assist in locating DSC Environment Specialist and/or PMU Environment Specialist in the event a construction staff is approached by members of the public or other stakeholders.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure conduct of construction staff, when dealing with the public or other stakeholders, shall be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure disruption of access for local residents is minimized and approved by the DSC Environment Specialist.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to provide walkways and metal sheets where required to maintain access across for people and vehicles.	DSC Environment Specialist	Ongoing monitoring
		Contractor to increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools.	DSC Environment Specialist	Ongoing monitoring
		Contractor to consult businesses and institutions regarding operating hours and factoring this in work schedules.	DSC Environment Specialist	At least 1 week prior to the activity taking place.
		Contractor to inform affected persons in writing of disruptive activities at least 24 hours beforehand. This can take place by way of leaflets giving DSC Environment Specialist and Contractor's details or other method approved by the DSC Environment Specialist.	DSC Environment Specialist	At least 24 hrs prior to the activity taking place.
		Contractor to provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.	DSC Environment Specialist	At least 1 week prior to the activity taking place.
		Contractors to ensure lighting on the construction site is be pointed downwards and away from oncoming traffic and nearby houses.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure machinery and vehicles are in good working order to minimize noise	DSC Environment Specialist	Ongoing monitoring.

[21] Regular communication between the Contractor and the interested and affected parties is important for the duration of the contract.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		nuisance.		
		Contractor to restrict noisy activities to the daytime.	DSC Environment Specialist	Ongoing monitoring.
		A complaints register (refer to the Grievance Redress Mechanism) shall be housed at the site office. This shall be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the Contractor. This register is to be tabled during monthly site meetings.	DSC Environment Specialist	Monthly monitoring.
		Interested and affected people' need to be made aware of the existence of the complaints book and the methods of communication available to them.	PMU Environment Coordinator and DSC Environment Specialist	Ongoing monitoring.
		Contractor to initially handle and document queries and complaints; submit these for inclusion in complaints register; bring issues to DSC Environment Specialist's attention immediately; and take remedial action as per DSC Environment Specialist's instruction	PMU Environment Coordinator and DSC Environment Specialist	As necessary.
		Contractor to assign staff for formal consultation with the interested and affected people in order to explain and answer questions on the construction process.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to reinstate pathways and other local infrastructure immediately to at least their pre-project condition upon completion of construction.	DSC Environment Specialist	Ongoing monitoring.
12.	Cultural Environment	Contractor to note possible items of historical or archaeological value include old stone foundations, tools, clayware, jewellery, remains, fossils etc. If something of this nature be uncovered, contractor to stop work immediately and notify the DSC Environment Specialist which in turn inform the PMU and coordinate with ASI or State Department of Archaeology.	DSC Environment Specialist	As required.

Table 49: Site Specific EMP for the S & D Subproject

Work Component	Mitigation measures
Package- Tr-2/SD-01: Sewerage & Drainage Work and Construction of 1 Pumping Station in Ward No. 114 (Part) in Borough XI	1. Selection of pumping station within existing Keorapukur pumping station; no land acquisition required 2. Selection of alignment within govt. ROW 3. Locations – roads/ lanes are narrow. Planned traffic and pedestrian movement management during construction 4. Joining of pipes is to be planned without flooding the area 5. Partly congested areas – school located nearby. Construction noise is to be kept at minimum avoiding work at night 6. MS bridge for crossing of the canal. 7. Also to minimize impact – canal crossing by jack pushing 8. First aid boxes are to be available at the construction sites 9. PPE are to be provided to workmen 10. Diesel generator set, if used during the construction activities, is to comply with prescribed emission and noise standards 11. Pumps/motors are to comply with the prescribed noise standard and manufacturers' specification of noise level is to be checked when installed. 12. The pumping station is to be provided with fire extinguishers, first aid box, rubber mattings around the control panels and ear muffs for the operators 13.There are no site specific environmental issues connected with the construction. 14. Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-02: Sewerage and Drainage Network in Rania Box catchment (Part of Ward 111, 112 & 113) in Borough XI	1. Selection of alignment within govt. ROW; private land not to be affected 2. Locations –roads/ lanes are narrow. Traffic and pedestrian movement management during construction. Removal of excess earth at earliest 3. Joining of pipes is to be planned without flooding the area 4. Partly congested areas – school located nearby. Construction noise is to be kept at minimum avoiding work at night 5. Pipe laying - by jack pushing only 60 m 6. First aid boxes are to be available at the construction sites 7. PPE are to be provided to workmen 8. Diesel generator set, if used during the construction activities, is to comply with prescribed emission and noise standards 9.There are no site specific environmental issues connected with the construction. 10. Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-03: Sewerage and Drainage Network in Vivekananda Road Catchment (Part of Ward 113 & 114) & construction of 1 Pumping Station in Borough XI	1. Selection of pumping station at Vivekananda road within private land; land acquisition is required 2. Selection of alignment within govt. ROW; private land not to be affected 3. Locations – roads/ lanes are narrow. Planned traffic and pedestrian movement management during construction. Removal of excess earth at earliest 4. Joining of pipes is to planned without flooding the area 5. Partly congested areas – school located nearby. Construction noise is to be kept at minimum avoiding work at night 6. MS bridge for crossing of the canal. 7. First aid boxes are to be available at the construction sites 8. PPE are to be provided to workmen 9. Diesel generator set, if used during the construction activities, is to comply with prescribed emission and noise standards 10. Pumps/motors are to comply with the prescribed noise standard and manufacturers' specification of noise level is to be checked when installed.

Work Component	Mitigation measures
	11. The pumping station is to be provided with fire extinguishers, first aid box, rubber mattings around the control panels and ear muffs for the operators 12.There are no site specific environmental issues connected with the construction. 13. Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-04: Laying of Trunk sewer along James Long Sarani by Micro-tunneling method	1. Entry shafts for the micro-tunnels are to be located at places on the road where there are least encroachments on the ROW and least chances inconveniences to pedestrians and people living in the neighborhood. 2. A traffic management plan as approved by the DSC and PMU should be in place before construction work commences 3. Suitable bill boards are to be put up at strategic points on the DH road giving salient information on the work component, time schedule and name & contact numbers of responsible persons of PMU and Contractor 4. Required security fencing is to be in place throughout the construction period of the shafts 5. Excess solid waste is to be disposed at sites pre-approved by PMU 6. Slurry is to be stored in container and needs to be disposed of at sites with due permission 7. First aid boxes are to be available in the construction locations 8. PPE are to be provided to workmen 9. There are no site specific environmental issues connected with the construction. 10. Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-05: Sewerage & Drainage Network within James Long Sarani and Mahatma Gandhi Road catchment in Borough XIII & XIV (Part of Ward no. – 123 & 124)	1. Selection of alignment within government ROW 2. Roads/ lanes are narrow; planned traffic and pedestrian movement management is to be in place during construction 3. Joining of pipes is to be planned without flooding the area 4. Partly congested areas with shops and a school located nearby. Construction noise is to be kept at minimum avoiding work at night 5. First aid boxes are to be available at the construction sites 6. PPE are to be provided to workmen 7. Excess solid waste from civil constructions is to be disposed of at sites pre-approved by PMU 8.There are no site specific environmental issues connected with the construction. 9. Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-06: Laying of lateral sewers in Borough XIII & Borough XIV (Part of Ward no. -122&123 and 128 to 132)	1. Selection of alignment within government ROW 2. Roads/ lanes are narrow. Planned traffic and pedestrian movement management is to be in place during construction 3. Joining of pipes is to be planned without flooding the area 4. Partly congested areas with shops and a school located nearby. Construction noise is to be kept at minimum avoiding work at night 5. First aid boxes are to be available at the construction sites 6. PPE are to be provided to workmen 7. Excess solid waste from civil constructions is to be disposed at sites pre-approved by PMU 8.There are no site specific environmental issues connected with the construction. 9. Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-19: S & D Mains and 2	1. Alignment of S & D mains is within govt. ROW – no land acquisition is required

Work Component	Mitigation measures
pumping stations in Tolly's Nullah/ Keorapukur Sub-basin in Borough- XIII (Ward no. 115 & Part of Ward no. 122)	2. 2 nos. pumping stations will be modified no land acquisition is required. 2. Roads/ lanes are narrow. Therefore appropriate traffic and pedestrian movement management plan is to be in place during construction 3. Joining of pipes is to be planned without flooding the area 4. Working sites are in part congested with shops; a school is located nearby. Construction noise is to be kept at minimum avoiding work at night 5. Excess solid waste from civil constructions is to be disposed of at sites pre-approved by PMU 6.First aid boxes are to be available at the construction sites 7 PPE are to be provided to workmen 8.There are no site specific environmental issues connected with the construction. 9. Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-22: S & D Mains and Pumping station in Churial Extension catchment in Borough XIII and XVI (Part of Ward no. 122,123 & 124)	1. The proposed location of the pumping station is within private land - therefore land acquisition is required 2. Alignment of S & D network is within govt. ROW – no land acquisition is required. Only for construction of PS land acquisition is required 3. Roads/ lanes are narrow; therefore extra care is to be taken for traffic and pedestrian movement management during construction 4. Joining of pipes is to be planned without flooding the area 5. Construction noise is to be kept at minimum avoiding work at night 6. MS pipe bridge is required for crossing of canal 7. First aid boxes are to be available at the construction sites 8. PPE are to be provided to workmen 9. Excess solid waste from civil constructions is to be disposed at sites pre-approved by PMU 10.There are no site specific environmental issues connected with the construction. 11. Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.
Package- Tr-2/SD-23: Construction of New Pumping Station at Lalababu Nikashi/ Bagjola Canal	3. Land belongs to Govt. 4. Alignment of Pumping main at Govt. RoW. 3. Joining of pipes is to be planned without flooding the area 4. Construction noise is to be kept at minimum avoiding work at night 5. Traffic management plan to be maintained at site 6. First aid boxes are to be available at the construction sites 7. PPE are to be provided to workmen 8. Excess solid waste from civil constructions is to be disposed at sites pre-approved by PMU 9.There are no site specific environmental issues connected with the construction. 10. Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.

First aid boxes are to be available at the construction sites
6. PPE are to be provided to workmen
7. Excess solid waste from civil constructions is to be disposed at sites pre-approved by PMU
8.There are no site specific environmental issues connected with the construction

243. **Table 50** outlines the post-construction activities.

Table 50: Post-Construction Activities (Defects Liability Period)- (to be revised by contractors for package-specific SEP)

Sr. no.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
1.	Construction Camp	All structures comprising the construction camp are to be removed from site.	DSC Environment Specialist	Subproject completion
		The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint etc. and these shall be cleaned up.	DSC Environment Specialist	Subproject completion
		All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top-soiled and re-grassed using the guidelines set out in the re-vegetation specification that forms part of this document.	DSC Environment Specialist	Subproject completion
		The Contractor must arrange the cancellation of all temporary services.	DSC Environment Specialist	Subproject completion
2.	Vegetation	All areas that have been disturbed by construction activities (including the construction camp area) must be cleared of alien vegetation.	DSC Environment Specialist	Subproject completion
		Open areas are to be re-planted as per the re-vegetation specification.	DSC Environment Specialist	Subproject completion
		All vegetation that has been cleared during construction is to be removed from site or used as much as per the re-vegetation specification, (except for seeding alien vegetation).	DSC Environment Specialist	Subproject completion
		The Contractor is to water and maintain all planted vegetation until the end of the defects liability period and is to submit a method statement regarding this to the DSC Environment Specialist.	DSC Environment Specialist	Subproject completion
3.	Land Rehabilitation	All surfaces hardened due to construction activities are to be ripped and imported materials thereon removed.	Contractor	Subproject completion
		All rubble is to be removed from the site to an approved disposal site. Burying of rubble on site is prohibited.	Contractor	Subproject completion
		The site is to be cleared of all litter.	Contractor	Subproject completion
		Surfaces are to be checked for waste products from activities such as concreting or asphalting and cleared in a manner approved by the DSC Environment Specialist.	Contractor	Subproject completion
		All embankments are to be trimmed, shaped and replanted to the satisfaction of the DSC Environment Specialist.	DSC Environment Specialist and Contractor	Subproject completion
		Borrow pits are to be closed and rehabilitated in accordance with the pre-approved management plan for each borrow pit. The Contractor shall liase	DSC Environment Specialist	Subproject completion

Sr. no.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
		with the DSC Environment Specialist regarding these requirements.		
		The Contractor is to check that all watercourses are free from building rubble, spoil materials and waste materials.	Contractor	Subproject completion
		Pathways and other local infrastructure to be reinstated immediately to at least their pre-project condition upon completion of construction.	DSC Environment Specialist	Subproject completion
4.	Materials and Infrastructure	Fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the DSC Environment Specialist.	DSC Environment Specialist	Subproject completion
		All residual stockpiles must be removed to spoil or spread on site as directed by the DSC Environment Specialist.	DSC Environment Specialist	Subproject completion
		All leftover building materials must be returned to the depot or removed from the site.	Contractor	Subproject completion
		The Contractor must repair any damage that the construction works has caused to neighboring properties.	Contractors	As directed by the DSC Environment Specialist.
	General	A meeting is to be held on site between the DSC Environment Specialist, PMU Environment Specialist and the Contractor to approve all remediation activities and to ensure that the site has been restored to a condition approved by the DSC Environment Specialist.	DSC Environment Specialist and PMU Environment Specialist	On completion of the construction and maintenance phases
		Temporary roads must be closed and access across these blocked.	DSC Environment Specialist and PMU Environment Specialist	On completion of construction
		Access or haulage roads that were built across watercourses must be rehabilitated by removing temporary bridges and any other materials placed in/or near to watercourses. Re-vegetation of banks or streambeds must be as necessary to stabilize these and must be approved by the DSC Environment Specialist.	DSC Environment Specialist and Contractor	On completion of construction
		All areas where temporary services were installed are to be rehabilitated to the satisfaction of the DSC Environment Specialist	DSC Environment Specialist and Contractor	On completion of construction

Table 51: Operation and Maintenance Activities (covering defect liability period)

Sr. No.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
1.	Pollution monitoring	Monitor the environmental quality in terms of Pumps' discharge, sludge, ambient air and noise levels.	O & M contractor in association with Environmental Monitoring Laboratory of KMC	As necessary on regular basis
2.	Leaks detection and repairs	Conduct pipe repairs the soonest time possible to avoid disruption of service and disturbance to users/sensitive receptors.	O & M contractor in association KMC	As necessary.
3.	Sludge disposal from pumping station	Analyze for hazardous elements and accomplish safe disposal at pre-approved sites (preferably utilization after drying of sludge) Dhapa dumping ground may be used as disposal site after permission from WBPCB	O & M contractor in association KMC	As necessary
4.	Trees and landscaping maintenance	Young trees require sufficient water until their roots are able to tap available groundwater. Make every effort to water existing trees during periods of drought. When pruning cut as close as possible to the branch collar. Do not injure or remove the collar.	O & M contractor in association KMC	As necessary.

C. Environmental Monitoring Program

244. **Table 52** outlines the environmental monitoring program to ensure implementation of the management and mitigation measures specified in the EMP. The table shall be read within the context of the body of the entire EMP. The monitoring program will follow the established system in Project 1.

Table 52: Environmental Monitoring Program (to be revised by contractors for package-specific SEP)

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
1. Site establishment and preliminary activities						
Legislation, Permits and Agreements	CTE and CTO for the hot mix, stone crushers, and diesel generators)	Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	-	prior to moving onto site and during construction	Contractor	PMU / DSC
	Cutting Permit for Scheduled Trees	West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act,	-	prior to moving onto site	DSC	PMU

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
		2006				
	Copy of EMP	ADB SPS	subproject site, offices, website, library, etc.	At all times	Contractor	PMU/DSC
Access to site	Existing conditions	EMP	all access and haul roads	prior to moving onto site	DSC Environment Specialist	PMU
	Road closures and traffic rerouting	Traffic Management Plan and EMP	all affected roads	one week in advance of the activity	DSC Environment Specialist Contractor	PMU
	Notifications and road signages	Traffic Management Plan and EMP	all affected roads	one week in advance of the activity	DSC Environment Specialist Contractor	PMU
Construction camp	Approval of location and facilities	EMP	as identified	prior to moving onto site	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Equipment Lay-down and Storage Area	Approval of location and facilities	EMP	as identified	prior to moving onto site and during site set-up	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Materials management – sourcing	Approval of sources and suppliers	EMP	as identified	prior to procurement of materials	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Education of site staff	Awareness Level Training - Environment - Health and Safety	EMP and records	-	during staff induction, followed by scheduled as determined	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Social impacts	Public Consultations, Information Disclosure, Communication Strategy	EARF, ADB SPS and EMP	subproject site	prior to moving onto site and ongoing	Contractor with the DSC Environment Specialist, PMU Environment Specialist /DSC	Implementing Agency (KMC)
	GRM Register	EMP	subproject site	prior to moving onto site and	Contractor with the DSC Environment	Implementing Agency (KMC)

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
				ongoing	Specialist, PMU Environment Specialist, PMU/DSC	
Noise	Baseline Data for noise level in dB(A) L_{eq}	National Noise Standards	three locations near construction sites as specified by the engineer	prior to site set-up	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Air quality	Baseline ambient data for particulate matters 10 and 2.5 (PM_{10}, $PM_{2.5}$), sulfur dioxides (SO_2), nitrogen dioxide (NO_2), and hydrocarbons (HC)	National Ambient Air Quality Standards	three locations near construction sites as specified by the engineer	prior to site set-up	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Soil erosion	Soil erosion management measures	EMP	as identified by the engineer	during site set-up and throughout the duration of the subproject	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Storm water	Storm water management measures	EMP	as identified by the engineer	during site set-up and throughout the duration of the subproject	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Water quality	Baseline qualitative characteristics	EMP	subproject sites[22]	prior to site set-up	Contractor with DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Conservation of Natural Environment	Existing conditions	EMP	subproject sites	prior to site set-up	Contractor with DSC Environment Specialist and PMU Environment Coordinator	PMU/DSC
Waste	Disposal sites	EMP	as	prior to site	Contractor with	PMU/DSC

[22] Subproject sites include approved construction site, equipment lay-down and storage area, water cources along the subproject site, open drainages

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
management procedure			determined	set-up and ongoing throughout the subproject	DSC Environment Specialist and PMU Environment Coordinator	
Cultural environment	Chance finds	ASI Act and EMP	as determined	prior to site set-up and ongoing throughout the subproject	Contractor with DSC Environment Specialist and PMU Environment Coordinator	PMU/DSC
2. Construction phase						
Access to Site	Qualitative characteristics	Pre-subproject condition and EMP	all access and haul roads	refer to EMP table on management of construction and workforce activities	Contractor	DSC Environment Specialist
Construction camp	Qualitative characteristics	Pre-subproject condition and EMP	all access and haul roads	refer to EMP table on management of construction and workforce activities	Contractor	DSC Environment Specialist
Staff conduct	Site Records (Accidents, Complaints)	EMP	subproject sites	Ongoing	Contractor	DSC Environment Specialist
Air quality	PM_{10}, $PM_{2.5}$, SO_2, NO_2 and HC	National Ambient Air Quality Standards	three locations near construction sites as specified by the engineer (DSC).	once in four months (three times in an year)	Contractor with close coordination with the DSC Environment Specialist	PMU/DSC
Soil erosion	Soil erosion management measures	EMP	subproject sites	Ongoing	Contractor	DSC Environment Specialist
Storm water	Soil erosion management measures	EMP	subproject sites	Ongoing	Contractor	DSC Environment Specialist
Water quality	Qualitative characteristics	EMP and pre-existing conditions	subproject sites	Ongoing	Contractor	DSC Environment Specialist
Conservation of Natural	Number of scheduled trees	Tree-cutting permit and	subproject sites	Ongoing	Contractor	DSC Environment

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
Resources		EMP				Specialist
	Vegetation conditions	EMP	subproject sites	Ongoing	Contractor	DSC Environment Specialist
Materials management	Qualitative characteristics	EMP	subproject sites	Ongoing	Contractor	DSC Environment Specialist
Waste management	Qualitative characteristics	EMP	subproject sites	Ongoing	Contractor	DSC Environment Specialist
	Disposal manifests	EMP	subproject sites	Ongoing	Contractor	DSC Environment Specialist
Social impacts	Public Consultations, Information Disclosure, Communication Strategy	EARF, ADB SPS and EMP	subproject sites	Ongoing	Contractor with the DSC Environment Specialist, PMU Environment Specialist, PMU/DSC	Implementing Agency (KMC)
	GRM Register	EMP	subproject sites	Ongoing	Contractor with the DSC Environment Specialist, PMU Environment Specialist, PMU/DSC	Implementing Agency (KMC)
Cultural environment	Chance finds	ASI Act and EMP	subproject sites	Ongoing	Contractor	DSC Environment Specialist
Noise quality	Noise Level in dB(A) L_{eq}	National Noise standards	three locations near construction sites as specified by the engineer (DSC).	once in four months (three times in an year)	Contractor with close coordination with the DSC Environment Specialist	PMU/DSC
C. Post-construction activities						
Construction camp	Pre-existing conditions	EMP	construction camp	subproject completion	Contractor	DSC Environment Specialist
Vegetation	Pre-existing conditions	Tree-cutting Permit and EMP	subproject sites	subproject completion	Contractor	DSC Environment Specialist
Land rehabilitation	Pre-existing conditions	EMP	subproject sites	subproject completion	Contractor	DSC Environment Specialist
Materials and	Pre-existing conditions	EMP	subproject sites	subproject completion	Contractor	DSC Environment

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
infrastructure						Specialist
General	Records	EMP	subproject sites	subproject completion	Contractor with DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
D. Operation and maintenance (defect liability period)						
Air quality	PM_{10}, $PM_{2.5}$, SO_2, NO_2	National Ambient Air Quality Standards	three locations as specified by the era.	once in 6 months (defect liability period)	O & M contractor in association with Environmental Monitoring Laboratory of KMC	PMU/DSC
Noise quality	Noise Level in dB(A) L_{eq}	As per National Noise standards	three locations as specified by the era	once in 6 months (defect liability period)	O & M contractor in association with Environmental Monitoring Laboratory of KMC	PMU/DSC

245. A training program has been developed to build the capability of KMC and PMU in implementing the EMP. The suggested outline of the training program is presented in **Table 53.**

Table 53: Training Program on environmental safeguards and its implementation

Module	Frequency of sessions	Target participants	Conducting agency
Environmental Safeguards Requirements comprising (i) ADB's Safeguards Policy Statement of 2009, (ii) environmental documentation requirements and (iii) Environmental requirements of India particularly those applicable to KEIIP subprojects, international obligations (common for all subprojects)	Once in Pre-construction stage	Senior Construction Supervisors of DSC, Safety Officers of Contractors, KEIIP Senior Engineers	DSC and PMU with assistance from INRM, ADB, New Delhi and WBPCB
IEE and EMP of S & D subproject	Once during Pre-construction stage	Safety officers of Contractors and Construction supervisors of DSC	DSC and PMU
Workshop on implementation of EMP of S & D subproject of KEIIP: lessons learnt and way forward	Once during Construction stage	Senior Construction Supervisors of DSC, PMC Engineers, Safety Officers of Contractors, KEIP Senior Engineers	DSC with assistance from PMU

D. Environmental Management and Monitoring Cost

246. The Contractor's cost for site establishment, preliminary, construction, and defect liability activities will be incorporated into the contractual agreements, which will be binding on him for implementation. The air quality, surface water quality, and noise level monitoring of construction and defect liability phases will be conducted by the contractor.

247. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of implementing agency (KMC). The air quality and noise level monitoring during the operation and maintenance phase will be organized by the operating offices of KMC as part of their routine office expenses.

248. The activities identified in environmental monitoring programme mainly includes site inspections and informal discussions with workers and local people and this will be the responsibility of PMU and DSC, costs of which are part of project management. **Table 54** summarizes the indicative cost to implement the EMP. The contractors for each package will provide detailed costs as part of package-wise SEPs.

Table 54: Indicative Costs for EMP Implementation- pre construction and construction phase (to be revised at DPR stage and again by contractors for package-specific SEP)

Item	Parameters	Project Phase	Sampling Station	Duration and Frequency	Quantity	Unit cost (INR)	Total cost INR)	Source of funds
1. Survey and monitoring							**32,52,000**	Survey and Investigation /Contingency
Ambient air	PM10, PM2.5, SO2, NO2 and CO	Construction	Pumping station at proposed Keorapukur PS, Vivekananda road PS, Kudghat PS, Keorapukur MPS, Churial PS, Vidyasagar Palli PS 45 stations near pipe laying areas	2 years Once in a quarter for 3 quarter in a year	312 nos.	8,000	24,96,000	Contractor budget
Noise	Leq in dBA	Construction	Pumping station at proposed Keorapukur PS, Vivekananda road PS, Kudghat PS, Keorapukur MPS, PS, Churial PS, Vidyasagar Palli PS 45 stations near pipe laying areas	2 years Once in a quarter for 3 quarter in a year	312 nos measurements	500	1,56,000	Contractor budget
Ground water	As per Drinking water standard	Construction	As per requirement	Once in a quarter for 4 quarters in a year for 2 years	60 nos.	10,000	6,00,000	Contractor budget
2. Capacity building/ Training/							8,45,000	Survey and Investigation /Contingency

Item	Parameters	Project Phase	Sampling Station	Duration and Frequency	Quantity	Unit cost (INR)	Total cost INR)	Source of funds
workshop expenses								
3. Environmental Permits if any							100,000	Government Counterpart funds
Total (INR)							41,97,000	
Total (US$)							64569 (approx)	
Note/s: INR 65 = US$ 1								

E. Monitoring *and Reporting*

249. Prior to commencement of any civil work, the contractor will submit a compliance report to DSC ensuring that all identified pre-construction environmental impact mitigation measures as detailed in the EMP will be undertaken. DSC will review the report and thereafter PMU will allow commencement of civil works.

250. DSC will organize an induction course for the training of contractors preparing them on:
- (i). EMP/approved SEP implementation including environmental monitoring requirements related to identified mitigation measures; and
- (ii). taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation.

251. During the construction phase, results from internal monitoring by the contractor will be reflected in their weekly EMP/approved SEP implementation reports to the DSC Construction Supervisors. These weekly report will be retained in DSC office for reference.

252. Monthly reports will also be prepared by Contractors summarizing compliance with monitoring requirements, details on any noncompliance, remedial actions taken and additional environmental mitigation measures if necessary and will be duly authorized by the respective Construction Supervisors/ Managers. The format of the monthly environmental monitoring report is given in **Appendix 17 .**

253. Environmental monitoring activities involving measurements will require engagement of external agencies and will be organized by the Contractors. Based on monthly reports and measurements, DSC will draft a Semi-annual Environmental Monitoring Report (SEMR). The formats of suggested SEMR along with Sample Environmental Site Inspection Report and Sample Checklist for Construction Safety are given in **Appendix 18**.

254. The PMU will review, approve and submit to ADB the SEMR by 1st July and 1st January each year. Once concurrence from the ADB is received the report will be uploaded in the KEIIP website.

255. Based on review of environmental monitoring results, future modifications in the EMP/approved SEP could be undertaken with the concurrence of the ADB. These will be generally undertaken, if required, upon review of the SEMR by the PMU to ADB following agreed procedures and mechanisms.

256. For Projects likely to have anticipated adverse environmental impacts during operation, monitoring may continue at the minimum on an annual basis during the operation phase. Monitoring reports will be posted in a location accessible to the public.

257. For projects likely to have significant adverse environmental impacts, the KMC will retain qualified and experienced external experts to verify its monitoring information. The KMC external auditor will document significant monitoring results, identify the necessary corrective actions, and reflect them in a corrective action plan. The KMC, in each quarter, will study the compliance with the action plan developed in the previous quarter. Compliance with loan covenants will be screened by the KMC.

258. ADB will review project performance against the KMC's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be

commensurate with the subproject's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system.

X. RECOMMENDATIONS AND CONCLUSION

259. The process described in this document has assessed the environmental impacts of all elements of the sewerage and drainage subproject of KEIIP under Tranche 2 Phase 1 in the Kolkata City. Potential negative impacts were identified in relation to pre-construction, construction and operation of the improved infrastructure.. No environmental impacts were identified as being due to either the subproject design or location. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design.

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

261. The subproject's GRM established in Project 1 has provided the citizens with a platform for redress of their grievances and describes the informal and formal channels, time frame and mechanisms for resolving complaints about environmental performance. This will be continued in the implementation of Project 2.

262. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between KMC, PMU, DSC and the contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with.

263. A copy of the EMP/approved SEP will be kept on site during the construction period at all times. The EMP will be made binding on all contractors operating on the site and will be included within the Contractual Clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance. As being implemented in Project 1, the ccontractor of Project 2 shall: (a) comply with the measures relevant to the contractor set forth in this IEE, and any corrective or preventative actions set forth in the Safeguards Monitoring Report that KMC will prepare from time to time to monitor implementation; (b) make available a budget for all such environmental measures; (c) provide the KMC with a written notice of any unanticipated environmental risks or impacts that arise during construction, implementation or operation of the subproject that were not considered in this IEE and EMP, and prepare required actions; (d) adequately record the condition of roads, agricultural land and other infrastructure prior to starting to transport materials and construction; and (e) reinstate pathways, other local infrastructure, and agricultural land to at least their pre-project condition upon the completion of construction; and (f) submit to KMC monthly monitoring report on EMP implementation.

264. The subproject is unlikely to cause significant adverse impacts because: (i) most of the individual components involve straightforward construction and operation, so impacts will be mainly localized; (ii) in most cases the predicted impacts are likely to be associated with the construction process and are produced because the process is invasive, involving excavation, obstruction at specific construction locations, and earth movements; and (iii) being located mainly in built-up areas will not cause direct impact on terrestrial biodiversity values. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

265. Therefore, as per ADB SPS, the subproject is classified as environmental Category B and does not require further Environmental Impact Assessment.

Appendix 1: Standards Ambient Air, air emission, effluents, receiving water bodies, drinking water at consumer end

A) Notification by Ministry of Environment & Forests, Government of India
Environment (Protection) Seventh Amendment Rules, 2009
Ambient Air Quality Standards

Pollutant	Time Weighted Average	Industrial, Residential, Rural and Other Areas	Sensitive Area (Notified by Central Govt)	Method of Measurement
Sulphur Dioxide (SO_2), µg/m^3	Annual* 24 hours**	50 80	20 80	• Improved West & Gaeke method • Ultraviolet Fluorescence
Nitrogen Oxide (NO_2), µg/m^3	Annual* 24 hours**	40 80	30 80	• Jacobs & Hochheiser modified (NaOH – $NaAsO_2$) method • Gas Chemiluminiscence
Particulate Matter (PM_{10}) (Size <10 µm) µg/m^3	Annual* 24 hours**	60 100	60 100	• Gravimetric • TOEM • Beta Attenuation
Particulate Matter ($PM_{2.5}$) (Size <2.5 µm) µg/m^3	Annual8 24 hours**	40 60	40 60	• Gravimetric • TOEM • Beta Attenuation
Ozone (O_3) µg/m^3	8 hours** 1 hour**	100 180	100 180	• UV photometric • Chemiluminiscence • Chemical method
Lead (Pb) µg/m^3	Annual* 24 hours**	0.5 1.0	0.5 1.0	• AAS method after sampling using EPM 2000 or equivalent filter paper
Carbon Monoxide (CO), mg/m^3	8 hours** 1 hour**	2.0 4.0	2.0 4.0	• Non Dispersive Infrared Spectroscopy
Ammonia (NH_3),	Annual* 24 hours**	100 400	100 400	• Chemiluminiscence • Indophenol blue method
Benzene (C_6H_6) µg/m^3	Annual*	5	5	• Gas Chromatography continuous analyzer • Adsorption & desorption followed by GC analysis
Benzo(o)pyrene (BaP) particulate phase only ng/m^3	Annual*	1	1	• Solvent extraction followed by GC/HPLC analysis
Arsenic (As), ng/m^3	Annual*	6	6	• AAS/ICP method after sampling using EPM 2000 or equivalent filter paper
Nickel (Ni) ng/m^3	Annual*	20	20	• AAS/ICP method after sampling using EPM 2000 or equivalent filter paper

Source: Central Pollution Control Board, New Delhi, Notification dated 18th November 2009
Notes:
* Indicates Annual Arithmetic Mean of Minimum 104 measurement in a year measured twice a week, 24 hourly at uniform intervals
** 24 hourly/8 hourly/1 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed by not on two consecutive days

B) Emission standards for diesel generator sets

1) CPCB emission regulations, Part IV, COINDS/26/1986-87
Stack Height
The minimum height of stack to be provided with each generator set can be worked out using the following formula:

$$H = h + 0.2x\ (KVA)^{0.5}$$

where
H = Total height of stack in metre
h = Height of the building in metres where the generator set is installed
KVA = Total generator capacity of the set in KVA
Based on the above formula the minimum stack height to be provided with different range of generator sets may be as follows:

For Generator Sets	Total Height of stack in metre
50 KVA	Height of the building + 1.5 metre
50-100 KVA	Height of the building + 2.0 metre
100-150 KVA	Height of the building + 2.5 metre
150-200 KVA	Height of the building + 3.0 metre
200-250 KVA	Height of the building + 3.5 metre
250-300 KVA	Height of the building + 3.5 metre

Similarly for higher KVA ratings a stack height can be worked out using the above formula.

2) GSR 371(E) 17 May 2002, amendment to Environment (Protection) Rules 2002 and
(The Emission Limits for new diesel engines (up to 800 KW) for Generator Sets (GENSETS) were notified by the Environment (Protection) Amendment Rules 2002 vide GSR 371(E), dated 17th May 2002 at Sl. No. 95 and as amended vide GSR 520(E), dated 1st July 2003, GSR 448 (E) dated 12th July, 2004, GSR 520(E) dated 12th August 2004 and GSR 280(E) dated 11th April, 2008 under Environment (Protection) Act, 1986)

Para 95. Emission limits for new diesel engines (up to 800 W) for gen set application

The emission limits for new diesel engines up to 800 kw, for gen set applications shall be as follows:

Capacity of diesel engine	Date of implementation	Emission limits (g/kw-hr) for				Smoke limit (light absorption coefficient, m-1) (at full load)	Test cycle	
1	2	3				4	5	
		NO_x	HC	CO	PM		Torque %	Weight-ing factors
Up to 19 KW	1.7.2005	9.2	1.3	3.5	0.3	0.7	100 75	0.05 0.25
> 19 KW up to 176 KW	1.1.2004 1.7.2004	9.2 9.2	1.3 1.3	5.0 3.5	0.5 0.3	0.7 0.7	50 25	0.30 0.30
> 176 KW up to 800 KW	1.11.2004	9.2	1.3	3.5	0.3	0.7	10	0.10

3) Environment Protect third amendment rules 2002 vide 489(E) 9 July, 2002

Para 96. Emission standards for diesel engines (engine rating more than 0.8 Mw (800 Kw) for power plant, generator set applications and other requirements

Parameter		Area Category	Total engine rating of the plant (includes existing as well as new generator sets)	Gerator sets commissioning date		
				Before 1/7/2003	Between 1/7/2003 and 1/7/2005	On or after 1/7/2005
NO_x (as NO_2) (AT 15% O_2), dry basis, in ppmv		A	Up to 75MW	1100	970	710
		B	Up to 150MW			
		A	More than 75MW	1100	710	360
		B	More than 150MW			
NMHC (as C) (at 15% O_2), mg/Nm^3		Both A and B		150	100	
PM (at 15% O_2), mg/Nm^3	Diesel Fuels - HSD & LDO	Both A and B		75	75	
	Furnace Oils - LSHS & FO	Both A and B		150	100	
CO (at 15% O_2), mg/Nm		Both A and B		150	150	
Sulphur content in fuel		A		<2%		
		B		<4%		
Fuel specification		For A only	Up to 5MW	Only Diesel Fuels (HSD, LDO) shall be used.		
Stack height (for generator sets commissioned after 1/7/2003)		Stack height shall be maximum of the following, in meter: (i) 14 $Q^{0.3}$, Q = Total SO_2 emission from the plant in kg/hr (ii) Minimum 6 m above the building where generator set is installed. (iii) 30 m.				

Note:

1. Acronyms used: MW : Mega (106) Watt, FO : Furnace Oil, NO_x : Oxides of Nitrogen: HSD : High Speed Diesel, NO2 : Nitrogen Dioxide, LDO : Light Diesel Oil; O_2 : Oxygen, LSHS : Low Sulphur Heavy Stock, NMHC : Non-Methane Hydrocarbon kPa : Kilo Pascal, C : Carbon, mm : Milli (10^{-3}) metre, PM : Particulate Matter kg/hr : Kilo (10^3) gram per hour, CO : Carbon Monoxide, mg/Nm^3 : Milli (10^{-3}) gram per ; SO_2 : Sulphur Dioxide Normal metre cubic, ppmv : part per million (106) by volume
2. Area categories A and B are defined as follows:

Category A: Areas within the municipal limits of towns/cities having population more than 1million and also up to 5 km beyond the municipal limits of such towns/cities.
Category B: Areas not covered by category A.
4. Individual units with engine ratings less than or equal to 800 KW are not covered by this notification.
5. Only following liquid fuels viz. High Speed Diesel, Light Diesel Oil, Low Sulphur Heavy Stock and Furnace Oil or liquid fuels with equivalent specifications shall be used in these power plants and generator sets.
6. For expansion Project, stack height of new generator sets shall be as per total Sulphur Dioxide emission (including existing as well as additional load).
7. For multi engine plants, fuels shall be grouped in cluster to get better plume rise and dispersion. Provision for any future expansion should be made in planning stage itself.
8. Particulate Matter, Non-Methane Hydrocarbon and percent moisture (dry basis). Carbon Monoxide results -are to be normalized to 25^0C, 1.01 Kilo Pascal (760 mm of mercury) pressure and zero
9. Measurement shall be performed at steady load conditions of more than 85% of the rated load.
10. Continuous monitoring of Oxides of Nitrogen shall be done by the plants whose total engine capacity is more than 50 Mega Waft. However, minimum once in six month monitoring for other parameters shall be adopted by the plants.

ii) Effluent

A) Schedule VI of Environment (Protection) Rules, 1986
General standards for discharge of environmental pollutants: Effluents

Sl no	Parameter	Standards			
		Inland surface water	Public sewers	Land of Irrigation	Marine/ coastal areas
		(a)	(b)	(c)	(d)
1.	Colour and odour	remove as far as practicable			
2.	Suspended solids, mg/l. max.	100	600	200	(a) For process waste water100 (b) For cooling water effluent 10% above total suspended matter of influent.
3.	Particle size of suspended solids	shall pass 850 micron IS Sieve			(a)Floatable solids, max. 3mm. (b)Settable solids (max 850 micron)
4.	pH value	5.5. to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	shall not exceed 50°C above the receiving water temperature			shall not exceed 50°C above the receiving water temperature
6.	Oil and grease, mg./l, max.	10	20	10	20
7.	Total residual chlorine, mg/l. max.	1.0			1.0
8.	Ammonical nitrogen (as N.) mg/l max	50	50		50
9.	Total Kjeldahl Nitrogen (as NH_3) mg/l. max	100			100
10.	Free ammonia (as NH_3), mg/l.max	5.0			5.0
11.	Biochemical oxygen demand (3 days at 27^0C), mg/l. max.	30	350	100	100
12.	Chemical oxygen demand, mg/l, max.	250			250
13.	Arsenic (as As) mg/l, max.	0.2	0.2	0.2	0.2
14.	Mercury (as Hg), mg/l, max.	0.1	0.1	0.1	0.1
15.	Lead (as Pb) mg/l, max	0.1	1.0		2.0
16.	Cadmium (as Cd) mg/l. max	2.0	1.0		2.0
17.	Hexavalent chromium (as Cr. +6). Mg/l, max	0.1	2.0		1.0
18.	Total Chromium (as Cr) mg/l, max	2.0	2.0		2.0
19.	Copper (as Cu)	3.0	3.0		3.0

Sl no	Parameter	Standards			
	mg/l, max				
20.	Zinc (as Zn) mg/l, max	5.0	15		15
21.	Selenium (as Se) mg/l, max	0.05	0.05		0.05
22.	Nickel (as Ni) mg/l, max	3.0	3.0		5.0
23.	Cyanide (as CN) mg/l, max	0.2	2.0	0.2	0.2
24.	Fluoride (as F) mg/l, max	2.0	15		15
25.	Dissolved phosphates (as P) mg/l, max	5.0			
26.	Sulfide (as S) mg/l, max	2.0			5.0
27.	Phenolic compounds (as C_6H_5OH) mg/l, max	1.0	5.0		5.0
28.	Radioactive materials: (a)Alfa emitters microcurie/ml, max. (b)Beta emitters micro curie/ml, max.	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-8} 10^{-7}	10^{-7} 10^{-6}
29.	Bio-assay test	90% Survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
30.	Manganese (as Mn)	2 mg/l	2 mg/l		2 mg/l
31.	Iron (as Fe)	3 mg/l	3 mg/l		3 mg/l
32.	Vanadium (as V)	0.2 mg/l	0.2 mg/l		0.2 mg/l
33.	Nitrate Nitrogen	10 mg/l			20 mg/l

These standards shall be applicable for industries, operations or process other than those industries operations or process for which standards have been specified in schedule of the Environment Protection Rules, 1989

B) CPCB Primary Water Quality Criteria

The Central Pollution Control Board (CPCB), an apex body in the field of water quality management, has developed a concept of "designated best use". According to which, out of several uses a particular water body is put to, the use which demands highest quality of water is called its "designated best use", and accordingly the water body is designated. The CPCB has identified 5 such "designated best uses". All those water bodies, which are used for drinking without any treatment, but with disinfection (chlorination), are termed as "A" Class Water, those which are used for outdoor bathing are termed as "B" Class Water, those which are used for drinking after conventional treatment are termed as "C" Class Water, those which are used for propagation of wildlife and fisheries are termed as "D" Class Water and those which are used for irrigation, cooling and controlled waste disposal are termed as "E" Class Water. For each of these five "designated best uses", the CPCB has identified water quality requirements in terms of few

chemical characteristics, known as primary water quality criteria. The "designated best uses" along with respective water quality criteria is given in Table below.

Table 1: Best use based classification of surface waters in India

S.No.	Designated-Best-Use	Class of Water	Criteria
1	Drinking Water Source without conventional treatment but after disinfection	A	1. Total Coliform Organism MPN/100 ml: 50 or less
			2. pH: between 6.5 and 8.
			3. Dissolved Oxygen: 6mg/1 or more
			4. Biochemical Oxygen Demand 5 days 20°C: 2mg/1 or less
2	Outdoor bathing (Organised)	B	1. Total Coliform Organism MPN/100 ml: 500 or less
			2. pH: between 6.5 and 8.5
			3. Dissolved Oxygen: 5mg/1 or more
			4. Biochemical Oxygen Demand 5 days 20°C: 3mg/1 or less
3	Drinking water source after conventional treatment and disinfection	C	1. Total Coliform Organism MPN/100 ml: 5000 or less
			2. pH: between 6 to 9
			3. Dissolved Oxygen: 4mg/1 or more
			4. Biochemical Oxygen Demand 5 days 20°C: 3mg/1 or less
4	Propagation of Wild life and Fisheries	D	1. pH: between 6.5 to 8.5
			2. Dissolved Oxygen: 4mg/1 or more
5	Irrigation, Industrial Cooling, Controlled waste disposal	E	1. pH: between 6.0 to 8.5
			2. Electrical Conductivity at 25OC micro mhos/cm: Max 2250
			3. Sodium Absorption Ratio Max.: 26
			4. Boron Max.: 2mg/1

C) Drinking water standard at consumer end is under revision and the draft version is given in the following Table

Indian Standards for Drinking Water - Specification (BIS 10500: 1991) revised draft 2009

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
1. Organoleptic and physical parameters						
i)	Colour, Hazen units, Max	5	Above 5 consumer acceptance drcreases	15	3025 (Part 5)	
ii).	Odour	Agreeable	-	Agreeable	3025 (Part 5)	a)Test cold when heated b)Test at several dilutions
iii)	Taste	Agreeable	-	Agreeable	3025 (Part 7 & 8)	Test to be conducted only after safety has

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
						been established
iv)	Turbidity, NTU, Max	1	Above 5 consumer acceptance decreases	5	3025 (Part 10)	-
v)	Dissolved solids, mg/l, Max	500	Beyond this palatability decreases and may cause gastrointestinal irritation	2000	3025 (Part 16)	-
vi)	pH Value	6.5 to 8.5	Beyond this range the water will affect the mucous membrane and/or water supply system	No Relaxation	3025 (Part 11)	-
vii)	Total hardness (as $CaCO_3$), mg/l., Max	200	Encrustation in water supply structure and adverse effects on domestic use	600	3025 (Part 21)	
Note 1: It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under the water not acceptable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under permissible limit in the absence of alternate source in col (5), above which the sources will have to be rejected.						
General parameters concerning substances undesirable in excessive amounts						
i)	Iron (as Fe) mg/l, Max	0.3	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria	No relaxation	3025 (Part 53)	Total concentration of Manganese (as Mn) and Iron (as Fe) shall not exceed 0.3 mg/l
ii)	Aluminium (as Al), mg/l, Max	0.1	Beyond this limit taste/ appearance are affected, has adverse effect on domestic uses and water supply structures	0.3	IS 3025 (Part 59)	-
iii)	Copper (as Cu), mg/l, Max	0.05	Astringent taste, discoloration and corrosion of pipes, fittings and utensils will be caused beyond this	1.5	IS 3025 (Part 42)	-
iv)	Manganese	0.1	Beyond this limit	0.3	IS 3025	Total

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
	(as Mn), mg/l ,Max		taste/ appearance are affected, has adverse effect on domestic uses and water supply structures		(Part 59)	concentration of Manganese (as Mn) and Iron (as Fe) shall not exceed 0.3 mg/l
v)	Zinc (as Zn), mg/l, Max	5	Beyond this limit it can cause astringent taste and an opalescence in water	15	IS 3025 (Part 49)	-
vi)	Magnesium (as Mg), mg/l, Max.	30	Encrustation in water supply structure and adverse effects on domestic use	No relaxation	IS 3025 (Part 46)	-
vii)	Barium (as Ba), mg/l, Max	0.7	May lead to cardiovascular problem	No relaxation	Annex F of IS 13428*/ S 15302	-
viii)	Calcium (as Ca) mg/l, Max	75	Encrustation in water supply structure and adverse effects on domestic use	200	3025 (Part 40)	-
ix)	Silver (as Ag), mg/l, Max	0.1	-	No relaxation	Annex J of IS 13428	-
x)	Selenium (as Se), mg/l, Max	0.01	Beyond this the water becomes toxic	No relaxation	3025 (Part 56) or IS 15303*	-
xi)	Molybdenum (as Mo), mg/l, Max	0.07	Beyond this it may cause osteoporosis/bone disorders	No relaxation	3025 (Part 2; 2002)/ ISO 11885: 1996	-
xii)	Boron (as B), mg/l, Max	0.5	-	1.0	3025 (Part 57)	-
xiii)	Nitrate (as NO_3) mg/l, Max	45	Beyond this methaemoglobinamia takes place/may be indicative of pollution	No relaxation	3025 (Part 34)	
xiv)	Sulfate (as SO_4) mg/l, Max	200	Beyond this causes gastro intestinal irritation when magnesium or sodium is	400	3025 (Part 24)	May be extended to 400 provided that Mg does not exceed

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
			present			30
xv)	Sulphide (as H_2S), mg/l, Max	Below detectable limit	Beyond this it may cause objectionable taste and odour	No relaxation	3025 (Part 29)	-
xvi)	Fluoride (as F) mg/l, Max	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	3025 (Part 60)	-
xvii)	Chlorides (as Cl) mg/l, Max.	250	Beyond this taste corrosion and palatability are affected	1000	3025 (Part 32)	-
xviii)	Ammonia (as total ammonia – N), mg/l, Max	0.5	Toxicological effect about 200 mg per kg of body weight	No relaxation	3025 (Part 34)	-
xix)	Chloramines (as Cl_2), mg/l, Max	0.2	Eyes, nose irritation, anaemia, stomach discomfort	No relaxation	3025 (Part 26) or APHA 4500-ClG	-
xx)	Residual, Free chlorine, mg/l, Min	0.2	-	-	3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be minimum 0.5 mg/l.
xxi)	Total alkalinity in Calcium carbonate, mg/l, Max	200	Beyond this limit taste becomes unpleasant	600	3025 (Part 23)	-
xxii)	Phenolic Compounds (as C_6H_5OH) mg/l, Max.	0.001	Beyond this may cause objectionable taste and odour	0.002	3025 (Part 43)	-
xxiii)	Mineral Oil mg/l, Max	Below detectable limit	Beyond this limit undesirable taste and odour after chlorination takes	No relaxation	3025 (Part 39) Infra red partition	-

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
			place		method	
xxiv)	Anionic detergents (as MBAS) mg/l, Max	0.2	Beyond this limit it can cause a light froth in water	1.0	Annex K to IS 13428-	-
Note 2: in case of dispute, the method by '*' shall be referee method. Note 3: It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under Acceptable render the water not acceptable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under permissible limit in the absence of alternate source in col (5), above which the sources will have to be rejected.						
Parameters concerning toxic substances						
i)	Total Chromium (as Cr_{6+}), mg/l, Max	0.05	May be carcinogenic above this limit	No relaxation	3025 (part 52)	-
ii)	Total Arsenic (as As) mg/l, Max	0.01	Beyond this the water becomes toxic	0.05	3025 (part 37)	
iii)	Mercury (as Hg) mg/l, Max	0.001	Beyond this the water becomes toxic	No relaxation	3025 (part 48)/Mercury Analyser	-
iv)	Cadmiun (as Cd) mg/lit, Max	0.003	Beyond this the water becomes toxic	No relaxation	3025 (part 41)	
v)	Lead (as Pb) mg/l, Max	0.01	Beyond this the water becomes toxic	No relaxation	3025 (part 47)	
vi)	Nickel (as Ni), mg/l, Max	0.02	Beyond this the water becomes toxic	No relaxation	3025 (part 54)	
vii)	Cyanide (CN), mg/l, Max	0.05	Beyond this the water becomes toxic	No relaxation	3025 (part 27)	
viii)	Polynuclear Aromatic Hydrocarbons (as PAH), mg/l, Max	0.0001	May be carcinogenic	No relaxation	APHA 6440	-
ix)	Polychlorinated biphenyls, mg/l. Max	0.0005	May be carcinogenic	No relaxation	ASTM 5175/APHA 6630	-

Bacteriological quality of drinking water	
Organisms	Guidelines
E. coli or thermotolerent coliform bacteria	Must not be detectable in any 100 ml sample
Total coliform bacteria	Must not be detectable in any 100 ml sample

Appendix 2: Noise standards

A). Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010

Rule 3. Ambient air guality standards in respect of noise for different areas/zones

(1) The ambient air quality standards in respect of noise for different areas/zones shall be such as specified below

(2) The State Government shall categorize the areas into industrial, commercial, residential or silence areas/zones for the purpose of implementation of noise standards for different areas.

(5) An area comprising not less than 100 metres around hospitals, educational institutions and courts may be declared as silence area/zone for the purpose of these rules.

Area Code	Category of Area	Limit in dB(A) Leqa	
		Day Time	Night Time
A.	Industrial area	75	70
B.	Commercial area	65	55
C.	Residential area	55	45
D.	Silence zone	50	40

Notes:

1. Day time is reckoned in between 6 a.m. and 10 p.m.

2. Night time is reckoned in between 10 PM and 6 AM.

3. Silence zone is an area comprising not less than 100 m around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority

4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

** dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.*

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq is an energy mean of the noise level over a specified period.

Rule 5. Restrictions on the use of Loud Speakers/Public Address system and sound producing instruments

(2) Any sound producing instrument shall not be used at night time except in closed premises for communication within, like auditoria, conference rooms, community halls, banquet halls or during a public emergency;

(4) The noise level at the boundary of the public place, where any noise source is being used shall not exceed 10 dB (A) above the ambient noise standards for the area or 75 dB (A) whichever is lower;

Rule 5A. Restrictions on the use of sound emitting construction equipments.

(3) Sound emitting construction equipments shall not be used or operated during night time in residential areas and silence zones.

B) Noise limit for generator sets run with petrol or kerosene

The noise limit for generator sets run with petrol or kerosene notified by Environment (Protection) (Amendment) Rules, 2000, vide G.S.R. 742 (E), dated 25th September, 2000, at serial no. 91, and as amended by Environment (Protection) (Amendment) Rules, 2001, vide G.S.R. 628 (E), dated 30th August, 2001 and Environment (Protection) (Amendment) Rules,

2011, vide G.S.R. 215 (E), dated 15th March, 2011, under the Environment (Protection) Act, 1986 is as follows:

	Noise Limit from September 1, 2002	September 1, 2003
Sound Power Level LWA	90 dBA	86 dBA

C) Noise limit for generator sets run with diesel

Noise limit for Generator Sets run with Diesel notified by Environment (Protection) second Amendment Rules vide GSR 371(E), dated 17th May 2002 at serial no.94 and its amendments vide GSR No 520(E) dated 1st July 2003; GSR 448(E), dated 12th July 2004; GSR 315(E) dated 16th May 2005; GSR 464(E) dated 7th August 2006; GSR 566(E) dated 29th August 2007 and GSR 752(E) dated 24th October 2008; G.S.R. 215 (E), dated 15th March, 2011 under the Environment (Protection) Act, 1986) is as follows:

Para 50. Noise limit for diesel generator sets (up to 1000 KVA) manufactured on or after the 1st January, 2005

The maximum permissible sound pressure level for new diesel generator (DG) sets with rated capacity up to 1000 KVA, manufactured on or after the 1st January, 2005 shall be 75 dB(A) at 1 metre from the enclosure surface. The diesel generator sets should be provided with integral acoustic enclosure at the manufacturing stage itself.

The implementation of noise limit for these diesel generator sets shall be regulated as given in paragraph 3 below.

2. Noise limit for DG sets not covered by paragraph 1.

Noise limits for diesel generator sets not covered by paragraph 1, shall be as follows:-

2.1 Noise from DG set shall be controlled by providing an acoustic enclosure or by treating the room acoustically, at the users end.

2.2 The acoustic enclosure or acoustic treatment of the room shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/acoustic treatment. Under such circumstances the performance may be checked for noise reduction up to actual ambient noise level, preferably, in the night time). The measurement for Insertion Loss may be done at different points at 0.5 m from the acoustic enclosure/ room, then averaged.

2.3 The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A).

2.5 Guidelines for the manufacturers/ users of Diesel Generator sets shall be as under:-

01. The manufacturer shall offer to the user a standard acoustic enclosure of 25 dB (A) insertion loss and also a suitable exhaust muffler with insertion loss of 25 dB(A).

02. The user shall make efforts to bring down the noise levels due to the DG set, outside his premises, within the ambient noise requirements by proper citing and control measures.

03. Installation of DG set must be strictly in compliance with the recommendations of the DG set manufacturer.

04. A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.

GSR.7 dated 22 December 1998 amendment to Environment Protection Rules 1986

83. Standards/guidelines for control of Noise Pollution from Stationary Diesel Generator (DG) Sets.

(i) Noise Standards for DG Sets (15-500 KVA)

The total sound power level, Lw, of a DG set should be less than, 94+10 log10 (KVA), dB(A), at the manufacturing stage, where, KVA is the nominal power rating of a DG set. This level should fall by 5 dB(A) every five years, till 2007, i.e. in 2002 and then in 2007.
(ii) Mandatory acoustic enclosure/acoustic treatment of room for stationary DG sets (5 KVA and above)
Noise from the DG set should be controlled by providing an acoustic enclosure or by treating the room acoustically.
The acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB(A) Insertion Loss or for meeting the ambient noise standards, which ever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/acoustic treatment. Under such circumstances the performance may be checked for noise reduction up to actual ambient noise level, preferably, in the night time). The measurement for Insertion Loss may be done at different points at 0.5m from the acoustic enclosure/room, and then averaged.
The DG set should also be provide with proper exhaust muffler with Insertion Loss of minimum 25 dB(A).
(iii) Guidelines for the manufacturers/users of DG sets (5KVA and above)
01 The manufacturer should offer to the user a standard acoustic enclosure of 25 dB(A) insertion Loss and also a suitable exhaust muffler, with insertion loss of 25dB(A).
02. The user should make efforts to bring down the noise levels due to the DG set, outside his premises, within the ambient noise
03 The manufacturer should furnish noise power levels of the unsilenced DG sets as per standards prescribed under (A).
04. The total sound power level of a DG set, at the user's end, shall be within2 dB(a) of the total sound power level of the DG set, at the manufacturing stage as prescribed under (A).
05. Installation of a DG set must be strictly in compliance with the recommendations of the DG set manufacturer.
06. A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.

D) GSR 742(E) dated 30.08.1990 amended GSR 422 (E) dated 19 May, 1993
Noise limits for domestic appliances and construction equipments at the manufacturing stage in dB(A)

Window air conditioners of 1 -1.5 tonne	68
Air coolers	60
Refrigerators	46
Compactors (rollers), front loaders, concentrate mixers, cranes (movable), vibrators and saws	75

E) ADB SPS Requirement

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

WHO Ambient Air Quality Guidelines

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

World Bank Group's EHS Noise Level Guidelines

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

Appendix 3: Occupational noise exposure

National Institute of Occupational Safety and Health
Criteria for a recommended standard: occupational noise exposure
NIOSH Publication no. 98-126
Combination of noise exposure levels and duration that no worker exposure shall equal or exceed

Exposure Level (dBA)	Duration		
	Hours	Minutes	Seconds
80	25	24	-
81	20	10	-
82	16	-	-
83	12	42	-
84	10	5	-
85	8	-	-
86	6	21	
87	5	2	-
88	4	-	-
89	3	10	-
90	2	31	-
91	2	-	-
92	1	35	-
93	1	16	
94	1	-	-
95	-	47	37
96	-	37	48
97	-	30	-
98	-	23	49
99	-	18	59
100	-	15	-
103	-	7	30
105	-	4	43
110	-	1	29

Appendix 4: Hazardous Wastes (Management Handling and Transboundary Movement) Rules, 2008

S.O. 2265 (E) dated 24 September, 2008

Rule 3. Hazardous waste means waste which by reasons of any of its physical, chemical, reactive, toxic, inflammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances, and shall include wastes having constituents specified in Schedule II if their concentration is equal to or more than the limit indicated in the said schedule.

5. Grant of authorization for handling hazardous wastes

(a) Every person who is engaged in generation, processing, treatment, packaging, storage, transportation, use, collection, destruction, conversion offering for sale, transfer or the like of the hazardous waste shall require to obtain an authorization from the WBPCB.

(b) The hazardous waste shall be collected, treated, re-cycled, re-processed, stored or disposed of only in only in such facilities as may be authorized by the WBPCB for the purpose.

Schedule 2

List of Waste Constituents with Concentration Limits*

Class A

Concentration limit: □ 50 mg/kg

A1 Antimony and antimony compounds
A2 Arsenic and arsenic compounds
A3 Beryllium and beryllium compounds
A4 Cadmium and cadmium compounds
A5 Chromium (VI) compounds
A6 Mercury and mercury compounds
A7 Selenium and selenium compounds
A8 Tellurium and tellurium compounds
A9 Thallium and thallium compounds
A10 Inorganic cyanide compounds
A11 Metal carbonyls
A12 Napthalene
A13 Anthracene
A14 Phenanthrene
A15 Chrysene, benzo (a) anthracene, fluoranthene, benzo (a) pyrene, benzo (K) fluoranthene, indeno (1, 2, 3-cd) pyrene and benzo (ghi) perylene
A16 halogenated compounds of aromatic rings, e.g. polychlorinated biphenyls, polychloroterphenyls and their derivatives
A17 Halogenated aromatic compounds
A18 Benzene
A19 Organo-chlorine pesticides
A20 Organo-tin Compounds

Class B

Concentration limit: □ 5, 000 mg/kg

B1 Chromium (III) compounds
B2 Cobalt compounds
B3 Copper compounds
B4 Lead and lead compounds
B5 Molybdenum compounds
B6 Nickel compounds
B7 Inorganic Tin compounds
B8 Vanadium compounds
B9 Tungsten compounds
B10 Silver compounds
B11 Halogenated aliphatic compounds
B12 Organo phosphorus compounds

B13 Organic peroxides
B14 Organic nitro-and nitroso-compounds
B15 Organic azo-and azooxy compounds
B16 Nitriles
B17 Amines
B18 (Iso-and thio-) cyanates
B19 Phenol and phenolic compounds
B20 Mercaptans
B21 Asbestos
B22 Halogen-silanes
B23 Hydrazine (s)
B24 Flourine
B25 Chlorine
B26 Bromine
B27 White and red phosphorus
B28 Ferro-silicate and alloys
B29 Manganese-silicate
B30 Halogen-containing compounds which produce acidic vapours on contact with humid air or water, e.g. silicon tetrachloride, aluminium chloride, titanium tetrachloride

Class C
Concentration limit; □ 20, 000 mg/kg

C1 Ammonia and ammonium compounds
C2 Inorganic peroxides
C3 Barium compounds except barium sulphate
C4 Fluorine compounds
C5 Phosphate compounds except phosphates of aluminium, calcium and iron
C6 Bromates, (hypo-bromites)
C7 Chlorates, (hypo-chlorites) ,
C8 Aromatic compounds other than those listed under A12 to A18
C9 Organic silicone compounds
C10 Organic sulphur compounds
C11 Iodates
C12 Nitrates, nitrites
C13 Sulphides
C14 Zinc compounds
C15 Salts of per-acids
C16 Acid amides
C17 Acid anhydrides

Class D
Concentration limit: □ 50, 000 mg/kg

D1 Total Sulphur
D2 Inorganic acids

D3 Metal hydrogen sulphates
D4 Oxides and hydroxides except those of hydrogen, carbon, silicon, iron, aluminum, titanium, manganese, magnesium, calcium
D5 Total hydrocarbons other than those listed under A12 to A18
D6 Organic oxygen compounds
D7 Organic nitrogen compounds expressed as nitrogen
D8 Nitrides
D9 Hydrides

Class E

Regardless of concentration limit, Classified as hazardous wastes if the waste exhibits any of the following Characteristics.

E1 Flammable
Flammable wastes with flash point 65.6°c or below.

E2 Explosive
Wastes which may explode under the effect of flame, heat or photochemical conditions. Any other waste of explosive materials included in the Indian Explosive Act.

E3 Corrosive
Wastes which may be corrosive, by chemical action, will cause severe damage when in contact with living tissue.

E4 Toxic
Wastes containing or contaminated with established toxic and or eco- toxic constituents.

E5 Carcinogenicity, Mutagenecity and Endocrine disruptivity
Wastes contaminated or containing established carcinogens, mutagens and endocrine disruptors.

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*Waste constituents and their concentration limits given in this list are based on erstwhile BAGA (the Netherlands Environment Protection Agency) List of Hazardous Substances. In order to decide whether specific wastes listed above is hazardous or not, following points be taken into consideration:

(i) If a component of the waste appears in one of the five risk classes listed above (A,B,C,D or E) and the concentration of the component is equal to or more than the limit for the relevant risks class, the material is then classified as hazardous waste.
(ii) If a chemical compound containing a hazardous constituent is present in the waste, the concentration limit does not apply to the compound, but only to the hazardous constituent itself.
(iii) If multiple hazardous constituents from the same class are present in the waste, the concentrations are added together.
(iv) If multiple hazardous constituents from different classes are present in the waste, the lowest concentration limit corresponding to the constituent(s) applies.
(v) For determining the concentration of the hazardous constituents in the waste "Toxicity Characteristics Leaching Procedure (TCLP) as per ASTM-D5233-92 should be adopted.

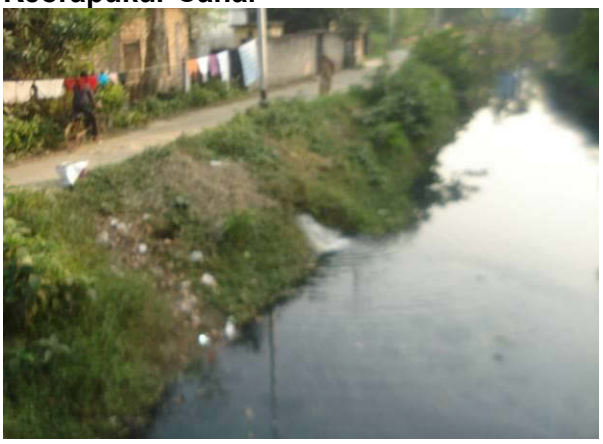
Appendix 5: Photo illustration and Google map Western canal and Keorapukur canal

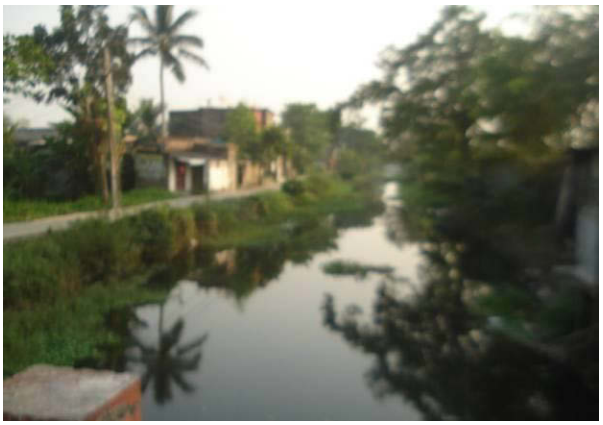
Western Canal

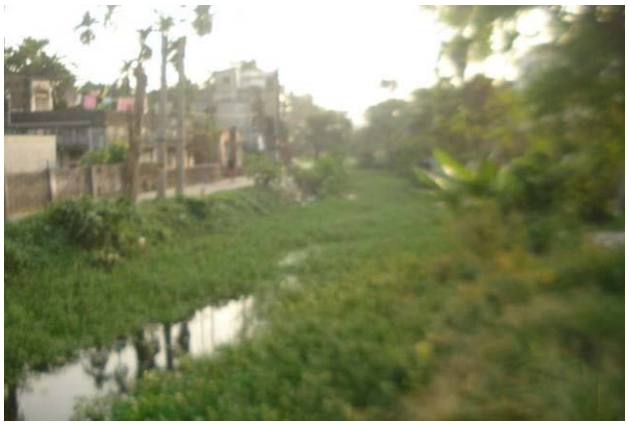


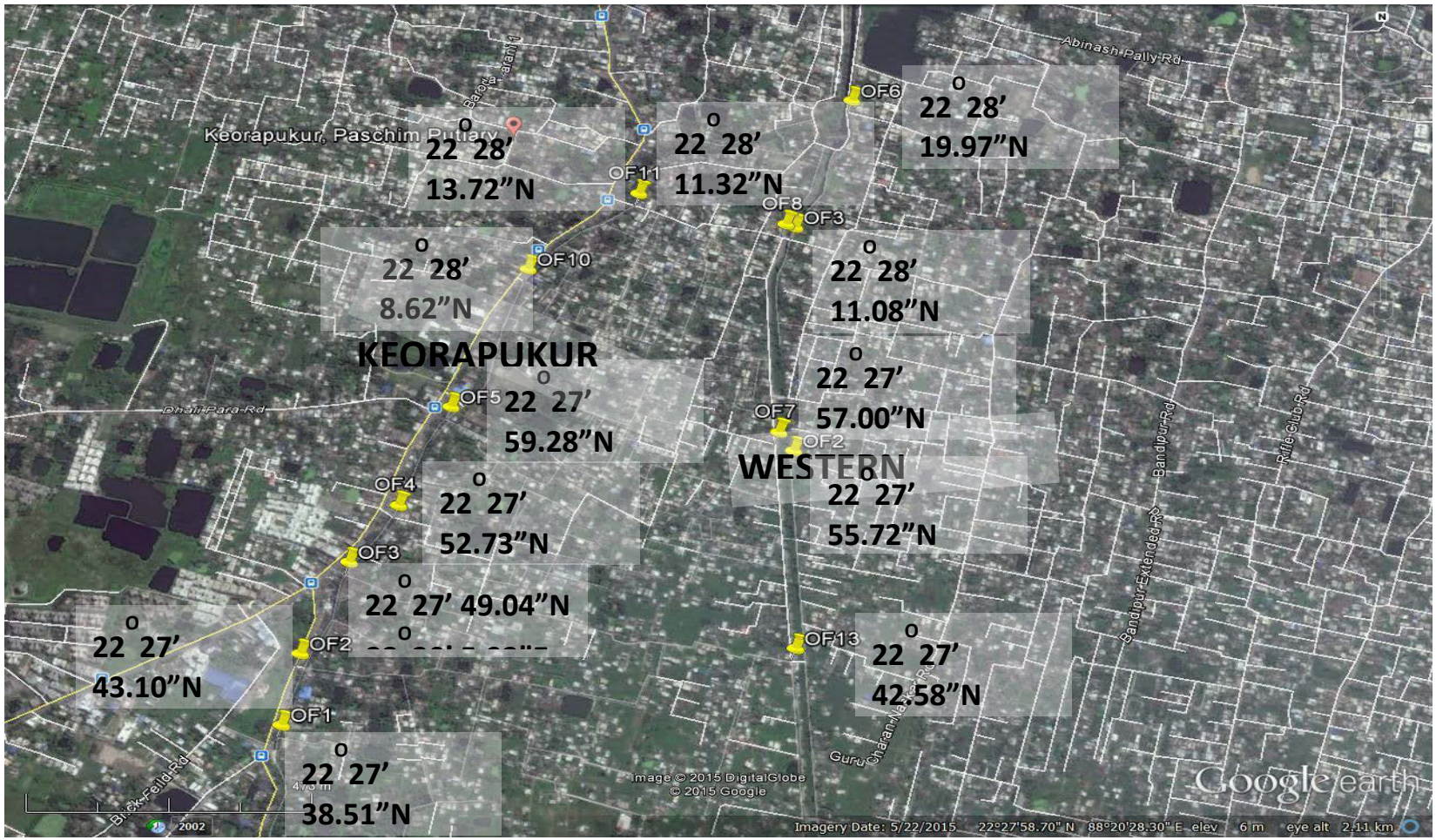



Keorapukur Canal



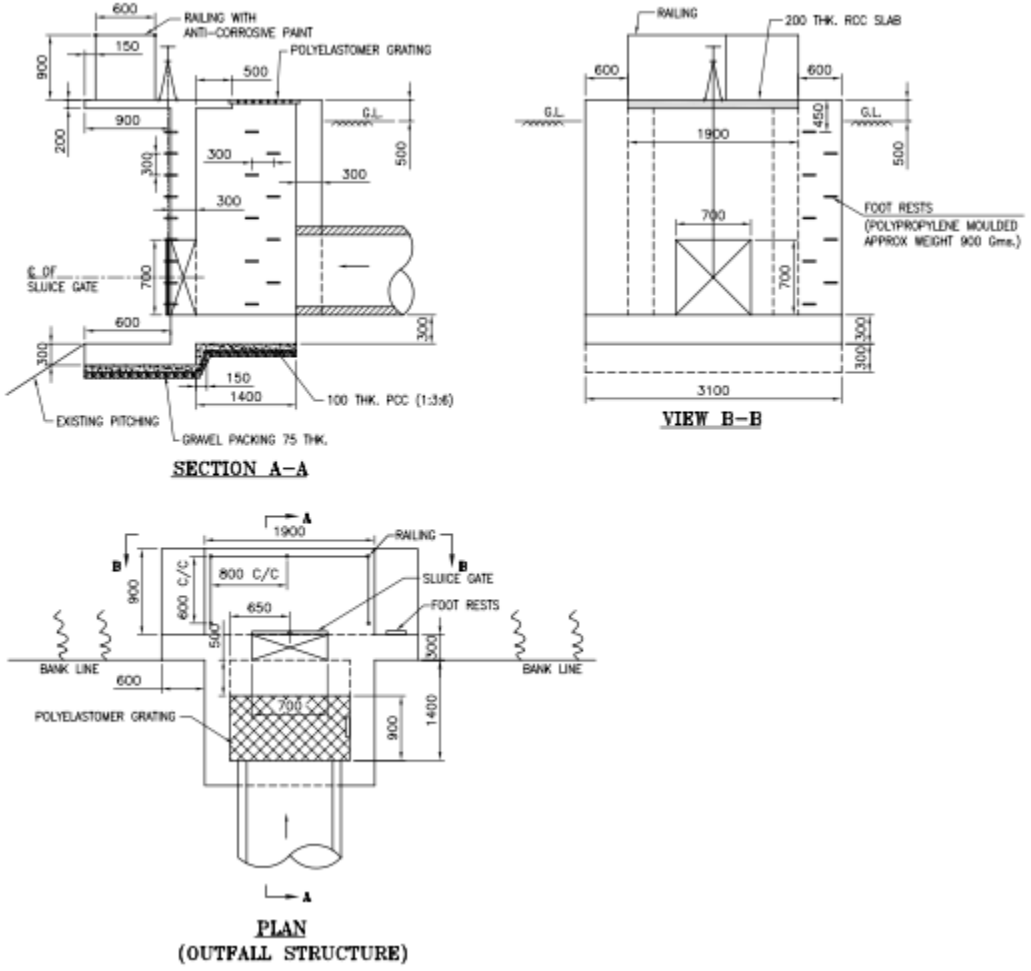






Different outfall at Canals

Appendix 6: Sluice Gate drawing



Appendix 7: Google and photo Vivekanada Road Pumping station – Proposed land

VIVEKANANDA ROAD PS

Appendix 8: Rapid Environmental Assessment (REA) Checklist

Sewerage & Drainage Subproject

Under KEIP, sewers and drainage in core city areas (comprising of Wards 1 to 100) are already being carried out. Following the KEIP master plan recommendations and detailed studies, the works included construction/refurbishment of major sewers, canals, pumping stations and sewage treatment plants (STPs). For KEIIP Tranche 1 & 2 (proposed), the subproject will concentrate on the primary and secondary sewer-drainage system development and associated structures in the outer "added" urban areas that were annexed to KMC in 1984 (covering Wards 101 to 141). The collected wastewater will be treated in Garden Reach STP which has adequate capacity to receive the design dry weather and storm water flows.

The specific objectives of this subproject are to: (i) improve the overall sanitary conditions in the subproject area; (ii) improve environmental conditions in the subproject area by reducing direct and indirect health risks and economic loss to the citizens; and (iii) provide quick relief from water logging conditions in the subproject area.

KMC in consultation with stakeholders has prioritized and proposed sewerage and drainage improvement in Monikhali, Tolly and Churial basins since these areas are expected to grow at a rapid pace due to recent improvements in road connectivity to the core city.

Categorization (Environment) – Category B. No significant impacts. Potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed readily. An IEE with EMP was prepared.

Rapid Environmental Assessment (REA) Checklist

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:	**India/ Kolkata Environmental Improvement Investment Program (KEIIP) Tranche 2 - Sewerage and Drainage development (phase 1)**
Sector Division:	Urban Development

Screening Questions	Yes	No	Remarks

Screening Questions	Yes	No	Remarks
A. PROJECT SITING IS THE PROJECT AREA…	✓		Kolkata is densely populated. As per 2011 census, the urban population of Kolkata is 4.45 million and population density is 24,783 persons per square kilometer. Churial basin serves a present population of 132,504 and Monikhali basin 56,878. Churial basin is moderately populated but currently growing very fast.
▪ Densely populated?		✓	About 60% of KMC area is residential. Industries occupy only about 5% of the area. Infrastructural development is however picking up.
▪ Heavy with development activities?		✓	The subproject sites are not within locations or near sensitive and valuable ecosystems, including protected areas and forests.
▪ Adjacent to or within any environmentally sensitive areas?			
▪ Cultural heritage site		✓	
▪ Protected area		✓	
▪ Wetland		✓	
▪ Mangrove		✓	
▪ Estuarine		✓	
▪ Buffer zone of protected area		✓	
▪ Special area for protecting biodiversity		✓	
▪ Bay		✓	
B. POTENTIAL ENVIRONMENTAL IMPACTS WILL THE PROJECT CAUSE…			
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	Not anticipated. The subproject will improve/prevent degradation of cultural property, loss of cultural heritage and tourism revenue.
▪ interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.
▪ dislocation or involuntary resettlement of people?		✓	No displacement of communities is required in this subproject.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	Not applicable.
▪ impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		✓	Collected sewage will be treated at the sewage treatment plant constructed under KEIP Phase 1 and under KEIIP
▪ overflows and flooding of neighboring properties with raw sewage?		✓	The subproject will improve current situation of discharging sewage to open drains.

Screening Questions	Yes	No	Remarks
▪ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?		✓	The EMP ensures measures are included to manage sludge. KMC to ensure only domestic sewage will be disposed in the sewer network.
▪ noise and vibration due to blasting and other civil works?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?	✓		Not anticipated. The EMP ensures occupational health and safety measures are included. Chemicals will not be used during construction and operation activities.
▪ discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		✓	Not anticipated. The subproject sites are predominantly residential areas. Thus discharge of hazardous materials into sewers are unlikely.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		✓	The STP and pumping station sites (KEIP Phase 1) includes buffer zone. For new Pumping stations buffer zone has been considered
▪ road blocking and temporary flooding due to land excavation during the rainy season?		✓	Not anticipated. Construction activities will be conducted during non-monsoon season.
▪ noise and dust from construction activities?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.
▪ traffic disturbances due to construction material transport and wastes?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts. Construction contractors will be required to coordinate with the local traffic police and they will prepare Traffic Management Plan
▪ temporary silt runoff due to construction?	✓		Run-off during construction will be more. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts. Construction contractors will be prohibited from stockpiling loose materials along drain channels and will be required to immediately dispose any waste materials.

Screening Questions	Yes	No	Remarks
▪ hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		✓	Not anticipated. Design life of the subproject is 30 years.
▪ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		✓	Not anticipated. The EMP ensures measures are included to manage sludge. The STP (under KEIP Phase 1) includes an Operation and Maintenance (O&M) Manual to ensure effluent complies with government standards.
▪ contamination of surface and ground waters due to sludge disposal on land?		✓	Not anticipated. The EMP ensures measures are included to manage sludge.
▪ health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?	✓		Not anticipated. The EMP ensures measures are included to mitigate the impacts.
▪ large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		✓	Priority in employment will be given to local residents. Construction contractors will be required to provide workers camp with water supply and sanitation. KMC will provide manpower to operate the improved system.
▪ social conflicts between construction workers from other areas and community workers?		✓	Priority in employment will be given to local residents.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		✓	Not applicable. Construction will not involve use of explosives and chemicals. Trenching will be done manually.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		✓	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the operational sites.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: India/
Sector : Urban Development
Subsector: Waste water
Division/Department: Kolkata Municipal Corporation

Screening Questions		Score	Remarks[23]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	Low lying areas of Kolkata are subject to flooding during heavy rainfall in monsoon.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.
Result of Initial Screening (Low, Medium, High): Medium

Other Comments:_____
_____

Prepared by: PMU, Kolkata Municipal Corporation

[23] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Appendix 9: Sample Traffic Management Plan (TMP)

A. Principles

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

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

B. Operating Policies for TMP

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

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

C. Analyze the impact due to street closure, if required

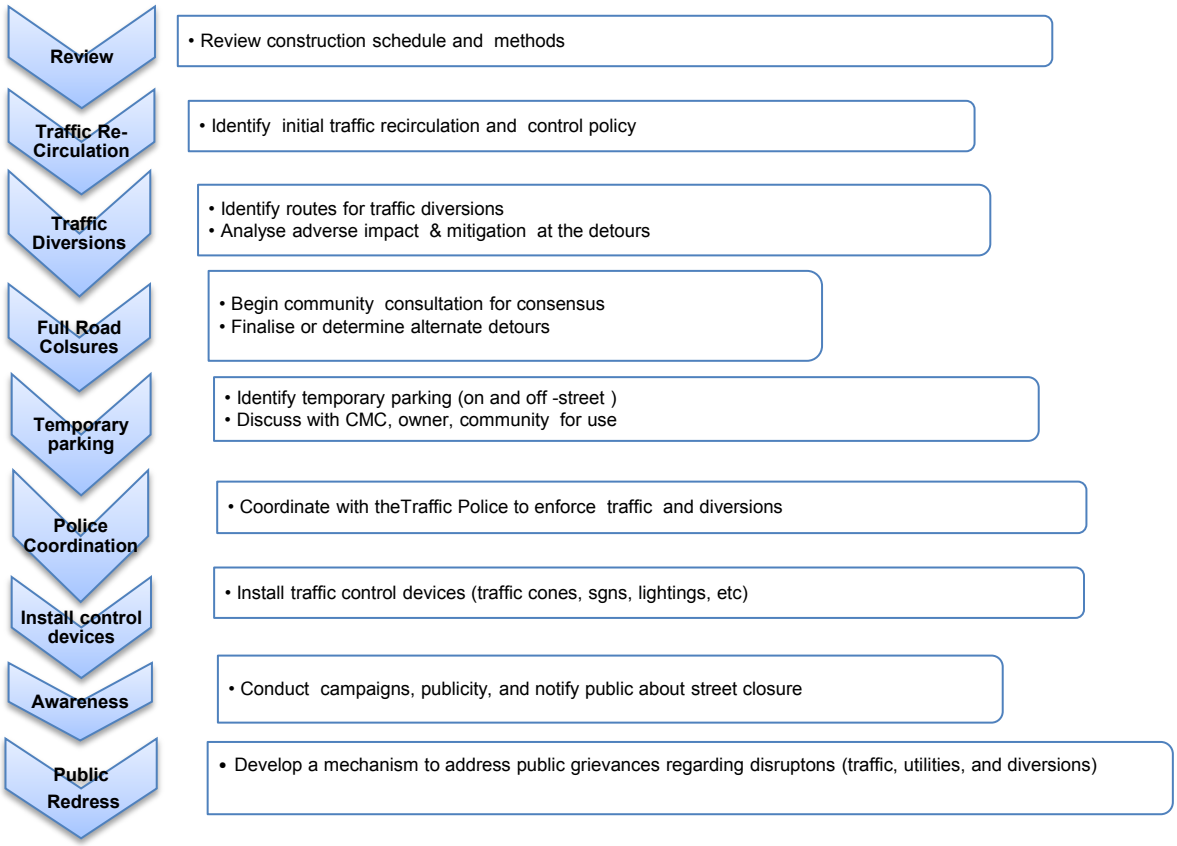
3. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) approval from the PMU, local administration to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, PWD, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
(iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
(iv) determining if additional traffic control or temporary improvements are needed along the detour route;

(v) considering how access will be provided to the worksite;
(vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
(vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

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

Figure: Policy Steps for the TMP



D. Public awareness and notifications

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

6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the

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

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

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

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

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

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

E. Vehicle Maintenance and Safety

10. A vehicle maintenance and safety program shall be implemented by the construction contractor. The contractor should ensure that all the vehicles are in proper running condition and it comply with roadworthy and meet certification standards of West Bengal Govt./ GoI. All vehicles to be used shall be in perfect condition meeting pollution standards of West Bengal Govt./ GoI. The vehicle operator requires a pre state of shift checklist. Additional safety precautions will include the requirement for:

- Driver will follow the special code of conduct and road safety rules of Government of India
- Drivers to ensure that all loads are covered and secured drivers to ensure operation equipment can’t leak materials hauled
- Vehicles will be cleaned and maintained in designed places.

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

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

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

12. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

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

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

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

16. The PMU, DSC and contractor will coordinate with the local administration and traffic police regarding the traffic signs, detour, and any other matters related to traffic. The contractor will prepare the traffic management plan in detail and submit it along with the EMP for the final approval.

Appendix 10: Health and Safety Plan

(To be implemented by the Construction contractor)

RESPONSIBILITY AND AUTHORITY FOR EHS MANAGEMENT

Project In charge (PI)

- ✓ The project PI will have overall responsibility of Health & Safety (H & S) Management at the site and improving safety and health in all areas. He/ She shall:
- ✓ Comply with Client's requirements, HS-Policy of the company and relevant statutory requirements that are applicable to the relevant work.
- ✓ Ascertain that all plants and machinery utilized at the project site meets the safety standard and are safe for use.
- ✓ Get familiar with and demonstrate his commitment to continual improvement in HS performance;
- ✓ Ensure that all personnel are aware of commitment to environmental protection and worker safety;
- ✓ Monitor HS performance of the personnel and activities under his control;
- ✓ Ensure that safe system of work are implemented and maintained by the project Engineers / Supervisors / Foreman and employees at the work site.
- ✓ Ensure that Site HS Plan is accessible to all relevant parties;
- ✓ Ensure that sufficient induction training for all employees and workers is given before commencement of work at site and subsequently for new inductees;
- ✓ Undertake program of regular HS Inspection at site.
- ✓ Arrange and chair monthly Site HS Management Review Meeting.

Site/Front In-charge

The Site/Front In-charge will be responsible to the PI for implementation of HS operational control procedures. In the absence of PI, he/she would take control of the Site. His/Her duties are similar to that of the PI.

Site Engineers/Supervisors

- They will be responsible to the PI / Site / Front In-charge for implementing the requirements of this plan. In particular they are required to: -
- Be familiar with Site HS Plan;
- Maintain safe working conditions and good housekeeping in all areas under his supervision.
- Enforce use of PPE as requested by Project Specific Rules and regulations.
- Liaise and cooperate with Site Safety HS Officer and ensure that defects brought to attention are corrected.
- Immediately Inform & report to the HS-Officer while any accident, near misses, dangerous occurrence, occupational poisoning or diseases shall be noticed within the project sites.
- Plan safety in accordance with the approved work methodology for daily work activities.
- Prepare Standard Operating Procedure (S.O.P) and General Risk Assessment (GRA) for each activity and it should be explained to employee before begins work.
- Establish and maintain proper communication with all workers with regard to EHS; and
- Provide proper supervision for the work.

Health & Safety (HS) Officer

He will be accountable to the PI for fulfilling the duties assigned to him and ensure implementation of HS Plan.

His / Her duties will include:

- Monitor and advise relevant personnel on compliance with HS statutory obligations at the site;
- Facilitate inclusion of safety elements into work Method Statement.
- Highlight the requirement of safety through Tool-Box / other meetings.
- Conduct investigation of all accident/dangerous occurrences and recommend appropriate safety measures.
- Advice & co-ordinate for implementation of operational control procedures etc.
- Convene safety meeting & minute the proceeding for circulation & follow-up action.
- Provide copies of site / office inspection report to relevant managers
- Plan procurement of PPEs and safety devices and inspect their healthiness.
- Report to PI/Divisional Manager on all matters pertaining to status of safety and promotional program at site level.
- Facilitate administration of FIRST – AID.
- Facilitate screening of workman and safety induction.
- Conduct fire drill and facilitate emergency preparedness.
- Design campaigns, competitions and other special emphasis programs to promote safety in the work place.
- Notify site personnel non-conformance to safety norms observed during site visits / site inspections.
- Attend and participate in Site HS Management Review Meetings;
- Access and advise PI on the perceived HS training needs of project personnel;
- Monitor HS performance of subcontractors and make appropriate recommendations for performance improvement.

Employees

All employees will be accountable for conforming to the requirement of the HS Plan and statutory requirements. In particular every employee will be required to: -

- Take care of environmental protection and safety of himself & others;
- Co-operate to fulfill statutory HS obligations;
- Co-operate in pursuit of continuous HS performance Improvement; and
- Conform to requirement of Project HS plan.
- Report defects in lifting appliances, lifting gears, transport equipments and any other equipments or tools & tackles to your immediate superior.
- Not to remove or interfere with any fencing, gangway, ladder, covering, life saving appliances, lighting and other things whatsoever required by site safety rules & regulations.
- Take care of personal protective equipment
- Don't let your work put another worker in danger.
- Use only means of access provided for specific work at site.
- Avoid horseplay, practical jokes or other activities to create a hazard.
- Don't use drugs or alcohol on the job.
- Keep the latrines, urinals, wash points, canteen and other facilities provided in a clean and hygienic condition
- Report any unsafe work practice and any injury or accident to your supervisor.

SAFETY AND HEALTH OPERATIONAL CONTROL PROCEDURES

To minimize hazards and risks, control measures shall be introduced in the following order of priority: -

- ☞ Engineering controls
- ☞ Administrative controls
- ☞ PPE

SITE SAFETY RULES

- No one (including staff and workers etc.) will be allowed to enter the work site without prior induction training & without required PPE.
- Before start of work every day, five minutes pre work briefing shall be conducted by each respective front engineers / supervisor with subcontractor's job supervisor present. The job to be undertaken that day shall be explained.
- Once every week toolbox talks on specific topics will be conducted by the front engineer/supervisor in the presence of safety officer, all talks will be documented on the company's specified format. Toolbox talks will also be given whenever a new activity is taken up or a new gang turns up for work.
- No Staff or workers will be allowed to enter the work site or to start his everyday activity without necessary job related PPE's. If there is any non compliance, Safety Officer or Site Management will issue a warning and if it is repeated impose fine on the concerned person and concerned Sub contractors.
- Smoking is strictly prohibited in all parts of the worksites except specific smoking zone as authorized by the site safety dept.
- Working under influence of drugs, alcohol etc. is strictly prohibited on worksite.
- Carrying unwanted flammable items, explosives etc. strictly prohibited at site.
- No vehicle shall be permitted to enter the work site or introduced into the job without prior induction by the plant and safety dept.
- It is mandatory that all vehicle driver and operator of lifting equipments etc. (heavy Vehicles like JCB, Tipper, and Crane etc.) should possess valid authorization certificates from the site plant dept. before starting of their respective job.
- It is mandatory that all electrical operated machinery's, equipments etc. (like Vacseal Pump, water pump, welding rectifiers/ transformers, diesel welding generators, panels, Switch gear, starter switch, D G Shed etc.) should be duly certified by Contractor's Electrical dept. prior to introduce into operation.
- Prior to introduction of any lifting tools, tackles, machinery's etc. in operation it is mandatory to conduct Third Party Competent Persons checking as per requirement and the Safe Working Load (SWL) should be marked on the equipment.
- All employees including workers must know about the exact location and use of fire Fighting equipments. Never restrict the access towards the firefighting equipment, always keep the access free from any obstructions.
- Considering emergency situation always keep the access around the work site area free from any obstruction for rescue operation.
- Everyone including workers should inform about the accident / incident and dangerous Occurrence to Site In charge, Site Engineer & Safety Officer.
- Always stay alert and keep your mind on the work, when you are engaged in the site work.
- Before starting of everyday work, routine checking of lifting equipments, Tools & Tackles, Winch, all types of pumps etc. to be done by concern Engineer, Supervisor and Worker.

- Don't carry out unfamiliar work without proper instruction. Any error due to ignorance can cause serious damage.
- When working at site especially around the moving machinery's, operating winch machine etc., wearing of loose clothing like dhoti, lungi, open sleeve shirt etc. are strictly prohibited.
- Don't leave any tools or materials haphazardly, where they can cause obstruction and create tripping hazards.
- All platforms, walkways, gangways, ramp, work area etc. must be kept clear at all time.
- During gas cutting uses of FLASH BACK ARRESTOR / non return valve are mandatory on each cylinder s & torch side.
- It is mandatory to use of Earth Leakage Circuit Breaker (ELCB) / Miniature Circuit Breaker (MCB) / Residual Current Circuit Breaker (RCCB) etc. on all site temporary electrical facilities.
- Always use minimum three cores double insulated cables for site electrification job.
- During lifting a load by a crane use of guy rope on both ends is mandatory
- Never use compressed air for cleaning of your clothes or getting relief from excessive heat.
- It is mandatory to install Reverse Horn on all vehicles (Like JCB, Tipper and site vehicle) and swing horn & over hoist limit switches for lifting equipments like Cranes.
- All materials must be stored in a safe manner and height of stacking should be maintained (below the man height) to protect collapsing of the stack and when material shifting work is carried out manually
- Horseplay inside the site during or after the job is strictly prohibited.
- Never roll the compressed gas cylinders (DA & O_2) at site, either shift it manually or by gas trolley. Use of gas trolley is mandatory for all cutting sets.
- Keep all gas cylinders inside proper shed in upright condition and lock it properly.
- Keep Diesel / Oil in its tank under the shed. Use oil spill trays below diesel tanks.
- Follow the speed limit of 20 Km/hr inside the work premises religiously.
- Maintaining hygienic environment at camp site
- Consideration of women worker health at working place

FIRST - AID FACILITIES AND MEDICAL TREATMENT

a) Each worksite/area shall be equipped with it's a first aid box catering to the needs of particular workfront.
b) Medical causality evacuation and treatment procedures involving the nearest clinic / Hospitals shall be instituted.
c) Appointment of trained first aider.

EMERGENCY PREPAREDNESS AND RESPONSE PLAN

Approach

The aim of this emergency preparedness and response plan is to guide personnel in an accident or emergency situation to prevent or minimize injury, damage and material loss and also to prevent or mitigate environmental impact from the accident or emergency.

Emergency Preparedness facility

Following emergency preparedness facilities have been provided at the site:

- All the buildings and structures are well supplied with fire fighting devices.
- Proper security arrangements are functioning round the clock.
- There is quick and efficient transport as well as communication system.
- Smoking is prohibited throughout the flammable premises.
- Water is kept available for firefighting purpose.
- Sufficient number of trained manpower is available to extinguish any fire and attend emergency.
- Sufficient number of Personal Protective Equipment like helmet and gloves are available
- Audible emergency alarm/whistles are provided.
- First Aid Kit is available.
- All key personnel have been provided communication mean such as telephone / walkie-talkie / mobiles. Any message can be communicated immediately.
- All work fronts / floating crafts will have emergency lights and Torches.
- All exit doors are kept unobstructed
- It is ensured that access to fire extinguishers is not obstructed.
- Proper containers are used for flammable liquids.
- Safe distance of POL is maintained from any point of ignition.
- Welding and cutting equipment is checked before and after use.
- Main electrical equipment is switched off when not in use.
- All workers and staff are familiarized with the fire fighting system.
- Escape routes are well defined.
- The POL dumps and gas cylinders are barricaded.
- Fire extinguishers are refilled on time.

Sr. No.	Item	Nos.	Location
1	First aid kits	01 each	In all work fronts
3.	Sand / Fire buckets	As required	Store/workshop/office/ Site office container/ All DG Rooms / casting Yard etc.,
4	Fire Extinguishers	As required	Store/workshop/office/ Site office container/ All DG Rooms / casting Yard etc.,
5	Safety Helmets	Depends on no. of labour	Site Store
6	Safety Shoes Pairs	10 Nos. (Each sizes)	Site Store
7	STRETCHERS	4-6 Nos.	First Aid room / Ambulance / Store
8	OIL SPILL ABSORBENT MATERIALS (HESIAN CLOTH / FOAM)	Sufficient Quantity	Site Store

Reporting System for Emergency
Important Telephone Numbers of Persons at Corporate /Division Level

Local Fire Station
Private Hospital
Police Station

Appendix 11: Outline of Spoil and Sludge Management Plan (SSMP)

1.0 Purpose and application:

SMP is to describe how the project will manage the spoil generated and reuse related to design and construction works. This is an integral part of EMP. The objective of SMP is to reuse of spoil from works in accordance with the spoil management hierarchy outlined in this document.

2.0 Objectives of SMP:

The objectives of SMP are:

- To minimize spoil generation where possible
- Maximize beneficial reuse of spoil from construction works in accordance with spoil management hierarchy
- Mange onsite spoil handling to minimize environmental impacts on resident and other receivers
- Minimize any further site contamination of land, water, soil
- Manage the transportation of spoil with consideration of traffic impacts and transport related emissions

3.0 Structure of SMP:

Section 1: Introduction of SMP
Section 2: Legal and other requirements
Section 3: Roles and responsibilities
Section 4: Identification and assessment of spoil aspects and impacts
Section 5: Spoil volumes, characteristics and minimization
Section 6: Spoil reuses opportunities, identification and assessment
Section 7: On site spoil management approach
Section 8: Spoil transportation methodology
Section 9: Monitoring, Reporting, Review, and Improvements

4.0 Aspects and Potential Impacts

The key aspects of potential impacts in relation to SMP are listed in table below

Aspects	Potential Impacts
Air Quality	Potential for high winds generating airborne dust from the stock piles
Sedimentation	Potential for sediment laden site runoff from spoil stockpiles and potential for spillage of spoil from truck on roads
Surface and Groundwater	Contamination of water (surface and ground water)
Noise	Associated with spoil handling and haulage and storage
Traffic	Impacts associated with spoil haulage
Land Use	Potential for spoil to be transported to a receivable site that doesn't have permission for storage/disposal
Design specifications	Limitations on opportunities to minimize spoil generation
Sustainability	Limited sites for storage, reuse opportunities

5.0 Spoil volumes, characteristics and minimization

5.1 Spoil volume calculations: Estimate the volumes of spoils produced from each of the construction sites.

5.2 Characterization of spoil: Based on the type of spoil; characterization is done (sand stone, mud mix materials, reusable materials

5.3 Adopt Spoil Reduce, Reuse Opportunities

An overview of the assessment methodology to be used is mentioned below.

- Consideration of likely spoil characteristics

- Identification of possible reuse sites
- Screening of possible reuse opportunities

5.4 Identification of possible safe disposal sites for spoil: Those spoils which can't be reuse shall be properly disposed in designated areas, such disposal areas should be identified in project locations. Such disposal areas should be safe from environmental aspects and there should be any legal and resettlement related issues. Such areas need to be identified and prior cliental approval should be obtained to use it as spoil disposal area. The local administration must be consulted and if required permission should be obtained from them.

5.5 Storage and stock piling

5.6 Transportation and haulage route

6.0 Based on the above, the contractor will prepare a SMP as an integral part of EMP and submit it to the DSC for their review and approval.

Appendix 12: Stakeholders Minutes of the Meeting

Dy CE(I)

MINUTES OF MEETING HELD AT BOROUGH XI OFFICE ON 28TH MARCH 2015 REGARDING CONCEPT PLAN FOR S & D WORK TO BE TAKEN UP UNDER KEIIP IN BOROUGH XI

MEMBERS PRESENT

1. Tarakeswar Chakraborty , Chairman, Borough XI
2. Anita Kar Majumdar, Councillor -113, KMC
3. S. Ganguly, DG (P), KEIIP
4. P.K. Dhua, DG (C), KMC
5. Amit Kr. Ray, SO (S&D), KMC
6. K. Sarkar, Dy CE(C)/S
7. J.K. Sen, Dy CE (C)
8. S. Dasgupta, Dy. CE (P)-I /KEIIP
9. S. Das, Dy. CE (P)-II /KEIIP
10. Goutam Banerjee, A.E. (C),Borough XI
11. Pradip Kumar Dasgupta, A.E. (C) Dr/S
12. Prasenjit Ray, A.E. (C),Borough XI
13. Swapan Kumar Roy, A.E. (CE) Borough XI
14. Dipak Kumar Ghosh, SAE (C), Borough XI
15. Sudip Chakraborty, SAE(CE),Borough XI
16. Rajib Mondal, SAE (C),Borough XI
17. Saikat Banerjee, SAE (C),Borough XI
18. Krishna Padakar, SAE (C),Borough XI
19. Aloke Ghosh, SAE CE/ Borough XI
20. Ranjit Banerjee, Team Leader, PMC, KEIIP
21. Diptarup Kahali, Dy TL, DSC, KEIIP.
22. Dr. Manas Bandyopadhyay, Drainage Specialist DSC,KEIIP
23. Soumitra Sen, Drainage Engineer, DSC,KEIIP
24. Chandranath Bera, Jr. Design Engineer, DSC, KEIIP

413

8/5/15

DSC/KEIIP
Inward No. 1200
RECEIVED
Date 14.05.15 Signature

Chairman of Borough – XI took the chair.

The meeting commenced with DG (P) welcoming Borough Chairman with Councillors, engineers of KMC and representatives of all consultants. DG (P) explained the objective of the meeting that was the presentation of concept developed to address the combined wastewater disposal of the selected parts of Borough XI. He then handed over the session to Dr. Manas Bandhopadhyay, Drainage Network Specialist of DSC, KEIIP, to present power point presentation of the concept plan for S&D work to be taken up under KEIIP in Borough XI comprising part of wards 111, 112,113 & 114.

1

DSC proposed combined sewerage system for development of S&D network in Borough XI. Two pumping stations, Keorapukur PS within premise of old Keorapukur canal PS and Vivekananda Road PS at near chainage 720 m of Rania Canal, have been proposed for effective disposal of SWF and DWF from the S&D system. Outfall structures have been also proposed to dispose off SWF to the Keorapukur canal / Western channel /Rania canal. DSC also proposed conversion of initial portion of Rania canal (0-720 chainage) into RCC box drain. Trunk S&D network including pumping stations have been proposed to be developed under two packages – TR-02/01 (covering part of Ward 114) & TR-02/02 (covering part of ward 111 to 114).

From package –TR-02/01, DWF will be pumped to SSE STP. Part of the SWF generated from the package – TR-02/01, will be disposed off to Keorapukur canal / Western channel through overflow outfalls and remaining part of SWF will be collected to Keorapukur PS and it will be pumped out to Keorapukur canal.

DWF generated from the area considered under package TR-02/02, will be pumped to proposed Jiadagor STP at Jiadagor which will be constructed in the subsequent packages. DSC proposed three alternatives to dispose off part of storm water from Vivekananda Road PS to avoid over topping of the canal / channels – A) At two locations i) Near confluence of Rania canal and Western Extension channel, ii) Western Channel near Dinesh Nagar Bridge (Chainage -1200 m). B) near confluence of Western Extension channel & Western Channel, C) near confluence of Keorapukur canal & Western Channel.

After the presentation, a detailed interaction session was held from which the following points have been emerged for further necessary actions and incorporating in the concept plans and the subsequent reports for implementation of the sub-projects:

1. **Combined system:** KEIIP proposed combined system for Borough – XI. It was agreed by all the participants that due to narrow road width separate S&D system would not be not viable in Borough – XI. KEIIP also informed that the project area is primarily residential in nature.

   It was suggested by Drainage department of KMC to ensure (a) pollution level in the canals after discharging combined flow through outfalls and pumping system (b) operation and maintenance of drainage outfall gates and storm pumps (c) to avoid backflow from the canals through drainage outfall, re-sectioning of canals as per design section and periodical maintenance of canals. DG (P), KEIIP explained that under the project, there is no provision for canal resectioning. Hence, KMC /KEIIP may only request the concerned department (I & WD) to take such actions.

2. **Pollution level at Tolly's Nulla:** Drainage department of KMC informed that KMC would take up a project funded by World Bank to prevent pollution to Tolly's nullah which would in turn reduce pollution load in River Hooghly. Therefore, KEIIP should ensure the quality of combined flow from Keorapukur canal to Tolly's nullah as per prevailing Indian norms and standards. KEIIP confirmed that combined flow disposed through the system proposed will be in conformity with Indian Standard.

3. **Outfall Structures:** Drainage department of KMC enquired the necessity of outfall structures, while pumping stations was proposed for disposal of storm water. KEIIP stated that it might not be possible to convey entire SWF to the pumping stations due to the narrow road width in the area which would be inadequate to accommodate larger diameter pipes. The overflow system would not be justified to be eliminated, otherwise size of sewer line and capacity of drainage pumping station would be very large and extremely non cost effective.

4. **Disposal of Storm water from Vivekananda Road PS.**

KEIIP proposed 3 options for discharging SWF from the PS. Drainage department of KMC suggested (a) to reduce diameter of pumping main (b) to reduce length of pumping main (c) to dispose off SWF to nearby location. DG(P), KEIIP informed to the participants that the condition of canal was not adequate to carry enormous discharge at nearby location of this PS, as this may invite conflict between wards / localities (as huge discharge may overtop canal bank, increase duration of water logging due to back flow), therefore, he suggested to discharge the SWF at least 2 locations (i) at near confluence of Keorapukur canal & Western Channel. (ii) at nearby location to Rania / Western channel extension.

5. **Meeting with Sonarpur-Rajpur Municipality:** KEIIP informed that for collection of combined waste water from Borough-XI, some roads of the municipality would need to be used. KEIIP also informed that entire Rania basin within this Municipality has been considered in the S&D system. The Chairman Borough-XI suggested discussing the proposal with the municipality.

6. **Conversion of Rania Canal into RCC Box drain.**

Drainage department of KMC expressed concern about the collection of SWF from adjoining area of Sonarpur - Rajpur Municipality. KEIIP explained that trunk S&D network has been considered to be developed in the adjoining area of Sonarpur-Rajpur Municipality under KEIIP

After threadbare discussion, the following decisions were taken:

(a) The entire scheme prepared and presented by KEIIP with 2 nos. of combined pumping stations is accepted.

(b) Gravity overflow outfalls with sluice gates to be provided.

(c) A meeting to be arranged in presence of Hon'ble Minister Sri. Aroop Biswas and I&WD Engineers to decide on

(i) Conversion of Rania canal into Box drain * (Pl. discuss)

(ii) Construction of a combined PS within the premises of Old Keorapukur canal PS

(iii) Canal re-sectioning program and frequency of canal cleaning

(iv) Discharge location of SWF in the canals

The meeting ended with a vote of thanks to and from the chair.

CHAIRMAN
BOROUGH XI
TARAKESWAR CHAKRABORTY
CHAIRMAN
BOROUGH NO-XI
KOLKATA MUNICIPAL CORPORATION

Meeting on Concept Plan for S&D Improvement Works to be taken up under KEIIP in Borough XI

ATTENDANCE SHEET

Place : Borough XI – Office , Kolkata
Date : 28.03.2015

Sl. No.	Name	Designation	Signature
1.	Tarakeswar Chakraborty	Chairman Brh XI	[signature] 28/03/15
3	Amit Kumar Roy	SO (S&D)	[signature]
4.	S. Ganguly	DG (P)	[signature]
5	P. K. Dhar	AE (C)	[signature]
6	Amita Kar Majumdar	Councillor-113	A Kar Majumdar
7.	K. Sarkar.	Dy CE(C)/S	[signature] 28.3.15
8	J. K. Sen	Dy CE(C)	[signature]
9	Goutam Banerjee	A.E(C) Br-XI	[signature]
10	Dipak Kr. Ghosh	SAE(C) Br-XI	[signature]
11.	Sudip Chakraborty	SAE(C) Br-XI	[signature]
12.	Pradip Kumar Dasgupta	A.E(C) Dr/S	[signature]
13.	Rajib Mondal.	SAE(C), Br-XI	[signature]
14	Prasenjit Ray	AE(C) Br XI	[signature]
15.	Saikat Banerjee.	SAE(C) Br-XI.	[signature]
16	Swapan Kr. Roy.	AE (C) Br-XI	[signature]
17.	Krishna Pada Kar	SAE(C) Br-XI	[signature]
18.	Aloke Ghosh	SAE(C)/Br-XI	[signature]
19.	S. Dasgupta	Dy.CE/KEIIP	[signature]
20	S. Das	Dy CE(P)-II/KEIIP	[signature]

Pg-1 of 2

Meeting on Concept Plan for S&D Improvement Works to be taken up under KEIIP in Borough XI

ATTENDANCE SHEET

Place : Borough XI – Office , Kolkata
Date : 28.03.2015

Sl. No.	Name	Designation	Signature
21	Manas Bandyopadhyay	Drainage Specialist DSC	[signature]
22	Soumitra Sen	Design Engineer DSC	[signature]
23.	Chandranath Bera	Jr. Design Engineer	[signature]
24	Ranajit Banerjee	Team Leader PMC	[signature]
25	Dipankar Kahar.	Dy TL DSC KEIIP	[signature]

MINUTES OF MEETING HELD AT BOROUGH XI OFFICE ON 13th May 2015 REGARDING CONCEPT PLAN FOR S & D NETWORK IN BOROUGH XI AND DISPOSAL LOCATION OF SWF

Person attended in the meeting

1. Shri. AroopBiswas, Hon'ble Minister, Govt. of WB
2. Shri.Tarakeswar Chakraborty , Chairman Borough XI
3. Shri.Gopal Roy, Councillor Ward-113
4. Shri.BiswajitMondal , Councillor Ward-114
5. Smt. Anita KarMajumdar, Councillor -112, KMC
6. Shri.Arup Chakraborty, Councillor -110, KMC
7. Shri. S. Ganguly, DG (P), KEIIP
8. Shri.P.K. Dhua, DG (C), KMC
9. Shri. S. Dasgupta, Dy Ch. Engr. (I) /KEIIP
10. Shri. Asish Dutta, EE , I &WD
11. Shri.Sunil Kr. Sahu, EE (C) /XI
12. Shri.B. K. Patra, EE (E)/ Ltg Z-IV
13. Shri.T. K. Malik, AE (E)/ Ltg Z-IV
14. Shri. Swapan Kr. Dey, AE (CE)
15. Smt. SupriyaProdhan , S.A.E (E)/Ltg Z-IV
16. Shri.Aloke Ghosh, SAE CE/ Borough XI
17. Shri.Sudip Chakraborty, SAE(CE) Borough XI
18. Shri. Saikat Banerjee, SAE (C) Borough XI
19. Shri. Milan Biswas,SAE (E)/ Ltg Z-IV
20. Shri. Prabir Kr. Ghosh, SE (E)
21. Shri. Dipak Kr. Ghosh , SAE (C)
22. Shri. S.N. Deshmuk, TL/ DSC. KEIIP
23. Dr.DiptarupKahali, Dy TL, DSC, KEIIP
24. Dr. M. Bandyopadhyay, S&D expert, DSC/ KEIIP
25. Shri. KalyanAsish Das, J.E./ DSC, KEIIP
26. Miss. Banhita Pal, J.E./ DSC, KEIIP

Hon'ble minister of West Bengal Government Mr. Aroop Biswas took the chair.

The meeting commenced with DG (P) welcoming the Hon'ble Minister with Borough Chairman, councillors, engineers of KMC, executive engineer of I & WD & representatives of all consultants. DG (P) explained the objective of the meeting that was conceptual plan of S&D system of uncovered parts of Borough XI and decision required on locations for disposal of SWF in the canals.Deputy Team Leader of DSC, KEIIP made a power point presentation on concept plan for S & D improvement works in Borough XI comprising part of wards 111, 112, 113 & 114.

DSC proposed combinedsystem for development of S&D network in Borough XI. Two pumping stations, one within premise of old Keorapukur canal PS and the other at near chianage 720 m of Rania Canal, have been proposed for effective disposal of SWF and DWF from the S&D system. Outfall structures have been also proposed to dispose off SWF to the Keorapukur canal / Western channel /Rania canal. DSC also proposed conversion of initial portion of Rania canal (0-720 chainage) into RCC box drain. Trunk S&D network including pumping stations have been proposed to be developed under two packages – TR – 02/01 (covering part of Ward 114) and TR-02/02 (covering parts of ward 111 to 114).

From package –TR-02/01, DWF will be pumped to SSE STP. Part of the SWF generated from the package – TR-02/02, will be disposed off to Keorapukur canal / Western channel through overflow outfalls and remaining part of SWF will be collected to proposed Keorapukur PS and it will be pumped out to Keorapukur canal.

DWF generated from the area considered under package TR-02/02, will be pumped to proposed Jiadagor STP at Jiadagor which would be constructed in the subsequent packages.

DSC showed three alternatives to dispose offpart of storm water from VivekanandaRoad PS proposed under package Tr-02/02instead of discharging nearby canal (Rania canal) to avoid over topping of the canal

A) At two locations –

i) Near confluence of Rania canal and Western Extension channel,
ii) Western Channel near Dinesh Nagar Bridge (Chainage -1200 m),

B) Near confluence of Western Extension channel & Western Channel,

C) Near confluence of Keorapukur canal & Western Channel.

After the presentation, a detailed discussion session was held and the following points have been emerged for further necessary actions as output of the session.

1) **Disposal of SWFfrom Vivekanda Road PS:**Hon'ble ministerdiscouraged the option C due to high cost involvement.He opined that either option A or B should be considered for the disposal of SWF. DG (P) stated that resection of the canals and regular maintenance of canal system would beneededfor option A or B.Hon'ble minister suggested that the canal rehabilitation work including lining and beautification of canal bank would preferably be taken up under KEIIP. DG(P) explained that encroachment of canal bank, if any,could be amajor constraint to take up the canal rehabilitation work under KEIIP because resettlement safeguard measures would strictly be adhered to in ADB projects.Hon'ble minister expressed that there is no encroachment problem. Irrigation department may follow up the matter. DG (P) statedthat it would be entire responsibility of I & WD to rehabilitate the canals, if any encroachment is present on the bank of the canals.
   Finally, hon'ble minister in consultation with local councillor decided Option –A i.e.
   i) Near confluence of Rania canal and Western Extension channel,
   ii) Western Channel near Dinesh Nagar Bridge (Chainage -1200 m),
2) **Conversion of Rania Canal into Box drain:** KEIIP has proposed to convert the initial reach of Rania canal into box drain for conveying of combined flow to the Vivekanada Road PS. It was agreed by all the participants.
3) **RajpurSonarpur Area:**KEIIP informed that for collection of combined waste water from Borough XI, some roads of the Rajpur-Sonarpurmunicipality would need to be used. So, KEIIP has been proposedto include some adjacent area of Sonarpur –Rajpur Municipality (Part of Ward 34 and 35)being the catchment area of Rania Canal.It was agreed by all the participants.
4) **Lateral Sewer:**Hon'ble minister expressed that development of only trunk S&D network would not serve the desired benefit to people.He advised that laying of lateral sewer should be taken up under KEIIP.DG (P) informed that development of trunk S&D network is only under the scope of KEIIP and remaining sewer is planned to be laid from the fund of KMC.
5) **Land acquisition for Vivekananda Road Pumping Station:**KEIIPhas proposed a combined pumping station at junction of Vivekananda Road and Rania Canal and STP at Jiadagarfor which lands would be required. Hon'ble minister enquired the status of acquisition of land.DG (P) informed that acquisition of the lands was under process.
6) **Joint Visit with I & WD and KEIIP:** Hon'ble Minister suggested for a joint site visit with I&WD, KMC and KEIIP officials to explore the existing condition of the canals and canal bank encroachment. DG(C) suggested that consultants should interact with I&WD officials for disposal of storm water flow from pump and outfall arrangement to the canals. A joint visit for the canals was scheduled on 15th May. EE (I&WD) requested KEIIP to send the proposals related to I & WD to Chief Engineer for necessary technical checking & consent.

Appendix 13: Minutes of the Meeting

Meeting held on Dec 01, 2015 at Paribesh Bhawan, Salt Lake between officials of WBPCB, KMC and KEIIP

The following persons attended the meeting

On behalf of KEIIP & KMC			
Sl. No.	Name	Contact no	E-mail
1.	Md. G.A. Ansari	9800862246	pdkeiip@gmail.com
2.	Soumya Ganguly	9831080056	soumya.ganguly@rediffmail.com
3.	Subhajit Das Gupta	9830060382	Subhajit.Dasgupta@gmail.com
4.	Ranajit Banerjee	9831074177	rbanerjee1946@gmail.com
5.	Dr. Chinmoy Chakrabarti	9830284360	chin_moy@yahoo.com
6.	Diptarup Kahali	9051022223	Diptarup.kahali@gkw.consult.com
7.	Dr. Ardhendu Mitra	9830415953	ardhendumitra@gmail.com

On behalf of WBPCB			
Sl. No.	Name	Contact no.	E-mail
1.	Dr. Kalyan Rudra	9433507176	chairman@wbpcb.gov.in
2.	Dr. Subrat Mukherjee, IFS	9874948678	ms@wbpcb.gov.in
1.	Dr. Ujjal Mukhopadhyay	9830063508	ujjal@wbpcb.gov.in
1.	S.K. Adhikari	9830596338	shyamala@wbpcb.gov.in
2.	Sarmistha Kundu	9831165615	Sormistha @wbpcb.gov.in
3.	Ranadip Mondal	9331934875	rmondal@wbpcb.gov.in
4.	Ruby Sinha	9330869729	ruby@wbpcb.gov.in
1.	D. Sarkar	9434031887	debasarkar@wbpcb.gov.in
2.	Barna Mujumdar	9038090305	barna@wbpcb.gov.in

At the outset the officials of KEIIP and KMC explained that the purpose of their visit to WBPCB and this meeting was to apprise the Board officials about the various activities being undertaken under the Kolkata Environmental Improvement Project (KEIP) and also under the Kolkata Environmental Improvement Investment Program (KEIIP).

They mentioned that the purpose of KEIP was primarily to focus on the development and environment of the KMC Wards 1-6 and 101 to 141 which had several infrastructural deficiencies leading to frequent flooding and lack of basic urban services. The duration of the KEIP was from the year 2002 to the year 2013.

Subsequently, the second phase i.e. KEIIP started in the year 2014 and is expected to run upto 2022. The KEIIP aims at rrehabilitation of inefficient and out-dated water supply assets to minimize cost of operation, restoration and enhancement of production capacities, and reduction of water loss in distribution and construction of sewer network to newly developed areas.

They explained and indicated the different locations where the new STPs were planned for installation. During the discussion, the KMC and KEIIP officials were intimated about the new CPCB standards of Sewage Treatment Systems for implementation. A copy of the same was handed over to them for reference.

The KMC and KEIIP officials submitted that in the course of their activities under the KEIP and KEIIP, they would conform to all statutory formalities (CFE and CFO) as and when applicable. Statutory environmental obligation of KEIIP with respect to currently planned work programs including those requiring authorisation from WBPCB was presented by KEIIP which is reproduced below:

1. No Environmental Clearance (EC) under EIA Notification 2006 is required for any work packages under KEIIP
2. Under Tranche 1: Rehabilitation of WTP (20 MGD) at Palta – CTE received on 10.09.2015. CTO to be obtained before commission
3. Under Tranche 1: Rehabilitation of SSE STP - *work for ponds embankment, work on floating aerator, removal of silt & sludge from aerobic, ponds, aerated lagoons and maturation pond* – CTE and CTO exist. No change in design and capacity; therefore no fresh CTE required
4. No CTE and CTO required for other projects under Tranche 1 & 2

5. Tentative KEIIP Works Requiring WBPCB's clearance

Sr. No.	Name	Capacity	Technical summary	Status	Outfall to
1	Jiadgore STP	40 MLD	Sequential Batch Reactor (SBR)	To be applied for CTE & CTO	Keorapukur canal
2	SSE STP*	60 MLD	Facultative Aerated Lagoon (FAL)	To be applied for CTE & CTO	Churial Extension canal
3	Kalagachia & Suti STP	70 MLD	Sequential Batch Reactor (SBR)	To be applied for CTE & CTO	Churial canal
4	Bantala STP	Yet to be worked out	Sequential Batch Reactor (SBR)	To be applied for CTE & CTO	SWF Channel
5	Joka STP	Yet to be worked out	Sequential Batch Reactor (SBR)	To be applied for CTE & CTO	Keorapukur canal
6	Baghajatin STP	Yet to be worked out	Sequential Batch Reactor (SBR)	To be applied for CTE & CTO	TP system

SBR: Probable option of sewage treatment considering the minimum land requirement
* Rehabilitation & renovation (with increase in capacity)

The meeting ended after discussing the following two issues which are not directly connected with the current work program of KEIIP.

1. Wastewater treatment for the dyeing-bleaching units in and around Maheshtala, Chatta area - KEIIP officials informed that they were aware of the fact that MSME Dept. is looking into the matter and that the MSME has already identified a land which may accommodate about 200 units along with the Common Effluent Treatment Plant. It was further informed that MSME Dept. has also appointed a consultant for this purpose.

2. Unauthorised activities of leather shaving units in and around the CLC, Bantala - It was decided that the concerned stakeholders viz. KEIIP, Directorate of Industries, WBPCB, KMC and the local administration would meet on a mutually convenient date to resolve the issue.

Appendix 14: Consultation and participation plan of Sewerage and Drainage Subproject

C&P Activity	Target Stakeholders	Type of Participation	Objectives of the C&P Activity	Responsible Unit/Persons	Time Frame	Cost Estimate INR
1 **Project Orientation Workshop** for government officials (especially KMC & WBPCB officials, officers, and staff on the Investment program (half day)	50 government officials and staff per Project orientation workshop consisting of representatives from the officials and staff, especially the Municipal Corporations; and private contractors	Information sharing Consultation Shared responsibility Shared decision making	To introduce the Project To demonstrate the link between improved S & D and sewerage infrastructure and good health, women's empowerment, and environmental conservation (Note: Seminar topics and contents to be gender-sensitive, socially inclusive, and raise environmental & social awareness). To present Safeguards and Social Frameworks and Plans and disclosure requirements. To discuss roles and accountabilities of various government units. To discuss issues related to use of government lands /property for the Project, environmental risks. To mitigate potential problems e.g., citizens' use of government lands and property that will be lost to the Project such as hawking rights on streets, temporary occupation of public facilities, construction material storage on public facilities, environmental risks especially aquatic ecology of Hooghly river, Compilation and agreement on recommendations	PMU with assistance from Project Team	Year 1: One Project orientation workshop	Project Orientation Workshop for officials = 1,00,000/-
1 **Project Orientation Seminar** for household heads on the investment	100 community members, preferably, household heads, with at least 30	Information sharing Consultation Shared decision	To introduce the Project, highlighting its importance and benefits to the community To demonstrate the link between improved S & D and sewerage infrastructure and good health,	PMU with assistance from Project Team	Years 1:	Project Orientation Seminar households = 50,000

C&P Activity	Target Stakeholders	Type of Participation	Objectives of the C&P Activity	Responsible Unit/Persons	Time Frame	Cost Estimate INR
program (half day) 1 **Project Orientation Seminar** for women only on the investment program (half day)	women participating At least 50 women community members per Project Orientation Seminar	making .	women's empowerment and environmental conservation. (Note: Seminar topics and contents to be gender-sensitive, socially inclusive, and raise environmental/ social awareness). To present safeguards and social frameworks and plans. Compilation of concerns and views related to S & D and sewerage. Compilation and agreements on recommendations			Project Orientation Seminar for women = 50000/-
One Consultation workshop (half day) with temporarily affected persons	50 hawkers/ vendors, and small shopkeepers affected per subproject	Information sharing Consultation	To introduce the Project. To demonstrate the link between improved water supply and sewerage infrastructure and good health, women's empowerment and environmental conservation & social protection. To show possible livelihood/business opportunities/alternatives. (Note: Seminar topics and contents to be gender-sensitive, socially inclusive, and raise environmental awareness). To present social and resettlement framework and draft social and resettlement plans. To mitigate potential resistance to	PMU with assistance from Project Team	Year 1: One consultation workshop	Consultation Workshop = 75,000

C&P Activity	Target Stakeholders	Type of Participation	Objectives of the C&P Activity	Responsible Unit/Persons	Time Frame	Cost Estimate INR
			the Project Compilation of recommendations & agreements on remedial measures			
One Consultation workshop with the academe, NGOs, and other civil society organizations (1 whole day)	50 representatives of the academic field, NGOs, and other civil society organizations	Information sharing/knowledge generation. Consultation Shared responsibility	To introduce the Project. To demonstrate the link between improved S & D and sewerage infrastructure and good health, women's empowerment, and environmental conservation and social protection. To show possible livelihood/business opportunities/alternatives. (Note: Seminar topics and contents to be gender-sensitive, socially inclusive, and raise environmental awareness) Compilation of views on proposed conservation and mitigation measures. To mitigate potential resistance to the Project. To discuss possible roles as watchdogs of the Project's implementation. To gather other relevant recommendation	PMU with assistance from Project Team	Year 1: One consultation workshop	Consultation Workshop = 100,000/- Travel of participants = 40,000
Strategic and Action Planning Workshop	Councillors, KMC and KMC officials & engineers	Information sharing Shared responsibility.	To develop strategic and action plans in accordance with the Project road map. To review compliance with social	PMU with assistance from Project Team	Annually	Councillors meetings 50,000 X 5 years = 250,000

C&P Activity	Target Stakeholders	Type of Participation	Objectives of the C&P Activity	Responsible Unit/Persons	Time Frame	Cost Estimate INR
1 half day for Councillors and KMC officials & engineers 1 half day for ADB Project Team		Shared decision making control	safeguards, environment, and gender frame works and plans. To discuss progress in implementation, including problems encountered and means to mitigate/address them. To regularly report on the progress of implementation.			Project Team monitoring meetings: 15000 X 4 years = 60,000
Participatory Monitoring Meetings (half day) (for community watchdogs)	20 representatives (50% women) from the community and civil society (representatives of CBOs, NGOs, ward committees, poor/slum communities, private sector)	Information sharing. Shared responsibility	Discussion of issues and concerns during Project implementation. To discuss and recommend measures to mitigate/ address the problems. To monitor progress of Project implementation	PMU with assistance from Project Team	Participatory Monitoring Meetings: Semi-annually	15000 X 2 meetings X 4 years = 120,000
TOTAL COST OF CONSULTATION AND PARTICIPATION - INR ~ 8.45,000/-						

ADB = Asian Development Bank, KMC = Kolkata Municipal Corporation, NGOs = nongovernment organizations, PMU = program management unit.

Appendix 15: Grievance Redressal Mechanism of KEIIP – Approval notice

GRIEVANCE REDRESSAL MECHANISM OF KEIIP WORKS

- Display of address of Contractors' site office at all work locations.
- At Contractors' site office Complaint & Suggestion Books are to be made available for lodging any complaint. The concerned Executive Engineer of KEIIP to periodically monitor these Books and take necessary actions for redressal with intimation to the complainant.
- At every Borough under which works are under progress, a Public Relation & Grievance Redressal Unit, comprising of a few KEIIP staff to be established for availing detailed information of the works, registering of complaint and act as Liaison for its redressal under intimation to the complainant.
- In KEIIP office at 206, A.J.C. Bose Road, Kolkata – 700 017, the Administrative Officer, KEIIP will be In-charge of the grievance redressal matters under the Project Director.
- Complaints may also be lodged through KEIIP website and KMC website.
- Through KMC WhatsApp no. 8335988888, all complaints relating to KEIIP will be sent to the Project Director, KEIIP for redressal.
- A Grievance Redressal Committee (GRC) has been constituted consisting of :

1) Administrative Officer, KEIIP - Member
2) Dy. C.E.(I), KEIIP - Member
3) Social Safeguard Specialist, KEIIP -Member
4) Environmental Specialist, KEIIP -Member
5) Special Officer (Coord.), KEIIP - Member Secretary (Convener)
6) Team Leader, DSC, KEIIP - Member

under the Project Director, KEIIP for regular monitoring of the entire process.

TL/DSC may ensure 'X' above.

Dt: 12.08.2015

TL/DSC
AO
SO/C

As proposed. AO & SO/C will please also take necessary action as proposed above.

12/8/15

Appendix 16: Sample Grievance Registration Form

(To be available also in Bengali, Hindi and Urdu)

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

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

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

FOR OFFICIAL USE ONLY

Registered by: (Name of Official registering grievance)	
Mode of communication: Note/Letter E-mail Verbal/Telephonic	
Reviewed by: (Names/Positions of Official(s) reviewing grievance)	
Action Taken:	
Whether Action Taken Disclosed:	Yes No
Means of Disclosure:	

Appendix 17: Monthly Environmental Monitoring Report - Format

ENVIRONMENTAL MONITORING AND EVALUATION
MONTHLY ENVIRONMENTAL COMPLIANCE MONITORING FORMAT FOR SUB-PROJECT

SECTOR:
MONTH/YEAR:
PROJECT (PACKAGE):
WORKING LOCATION:
DATE OF OBSERVATION:
NAME OF THE MONITORING PERSON FROM DSC (Designation):

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/ Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
1.	**Mitigation/protection of Land Environment**						
1a	Proper storage of construction materials and petroleum products –avoidance of land pollution						
1b	Conservation of top soil						
1c	Proper disposal of unusable soils and spoils to pre-approved disposal sites						
1d	Storm water control and wind screening to prevent soil loss from the site.						
2.	**Mitigation/protection of Air Environment**						
2a	Water sprinkling at construction site for arresting dust (if any during dry period)						
2b	Cover or damp down sand stockpiled at site						
2c	Utilize screen by using wooden supports and shade cloth where dust is unavoidable in residential/ commercial /sensitive receptors areas						
2d	Keep vehicles and machinery in good working order and meet manufacturers specifications for safety, fuel consumption etc						
2e	Covering of materials carrying vehicles-reducing dust hazard						
2f	Vehicles and Equipments having Pollution Under Control Certificate						
2g	No fires are allowed on site						
2h	Carrying out air quality monitoring						
3.	**Mitigation of Noise**						
3a.	Regular maintenance of noise producing equipment						
3b.	At sensitive locations enclosures provided around generator set and other noise producing machinery						
3c.	Use of ear plug by the workers at noise generating location						
3d	Locate concrete batching, asphalt, crushing plants, lay down areas and construction camps away from sensitive						

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/ Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
	receptors						
3e	Plan construction activities to reasonable working hours where near sensitive receptors.						
3f	Fit and maintain silencers to all machinery on site						
3g	Monitor noise levels in potential problem areas						
4.	**Mitigation/protection of Water Environment**						
4a.	Protection of water bodies nearby the project site by application of suitable mitigation measures- not to discharge waste water in nearby water body						
4b	Chemicals or hazardous substances do not contaminate the water body, or groundwater on site.						
5.	**Mitigation/protection of Biological Environment**						
5a	Vegetation clearing and tree-felling have prior permission as the work front progresses.						
5b.	Plant and maintain five trees for every one removed- in case of tree felling (if any)						
5c	Clearing of indigenous vegetation is kept in a nursery for use at a later stage (such as site rehabilitation process)						
6.	**Mitigation of Socio-economic Environment**						
6a.	Level of mitigation measures for local people- placement of caution tape and barricade at excavated area						
6b.	Avoidance of pick traffic hour for carrying of materials like pipe						
6c.	Arrangement of employment at least 50% of workforce from communities near sites						
7.	**Mitigation of overall environment, safety and health**						
7a.	Use of Personal Protective Equipment like helmet, gumboot, gloves, nose mask, safety belt and earplugs at working place						
7b.	Provision of warning signs of hazardous working areas						
7c.	Visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas						
7d.	Maintaining safety during movement of equipment						
7e	Arrangement of First Aid box						

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/ Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
	and fire extinguisher at Labour camp and site office and First Aid box at all working sites						
7f	Use of modern vehicles and machinery and maintain as specified						
7g.	Demarcation of excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches.						
7h.	Enclosure at construction site						
7i	Placement of public information board with mention of safety requirement at working places						
7j	Boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage						
8	**Material Management**						
8a	Storage of stockpiles. Stockpiles do not obstruct natural water pathways						
8b	Exposure of stockpile to windy conditions or heavy rain with vegetation, cloth, or tarps.						
8c	Proper transportation of hazardous materials						
9	**Camp site Management**						
9a	Camp and working areas are kept clean and tidy						
9b	Proper drainage of the camp site						
9c	Discharge into neighbours' properties.						
9d	Maintenance of toilets in a clean state						
9e	Maintenance of eating area						
9f	Arrangement of solid waste collection bin, dispose wastes at the pre-approved sites						
9g	Collection of litter from the work and camp areas						
8.	**Mitigation of Sensitive environment**						
8a.	Level of protection at religious, cultural and historic sites if any nearby						
8b.	Maintaining working schedule by avoiding sensitive time						

Note: Put √ mark in EMP application column
Remarks column need to be filled up considering present state along with suggestion and site photos
For each sub-project monitoring should be done at all the working sites
Suggestion should be provided against EMP application level
In case of non applicable – please write NA/NR in Remarks column

(Name & Signature of monitoring person of DSC)

(Name & Signature of Safety Officer of Contractor)

(Name and Signature of TL/Dy TL DSC/ Environment Specialist of DSC)

(Name & Signature of Environment Specialist of PMU)

Appendix 18: Environmental Monitoring Format - Semi Annual

I. INTRODUCTION

A. Background

- Overall project description, objectives and outputs

B. Report purpose

- Environmental category of the sub-projects

II. IMPLEMENTATION PROGRESS

A. Status of Subprojects

- Description and Status of sub project- under implementation or to be awarded

Summary of Subprojects

Sr. No.	Package No.	Components	Status

Status of Awarded Sub-project Under the Program

Package No.	Component	Start Date	Number of Days/Months to Complete Work	Target date of completion	% Physical Progress on report date	Works Completed on report date

B Compliance of Safeguard Loan Covenants

- Table provides a summary of compliance to the loan covenants related to environmental safeguards.

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

C Implementation Arrangement

- Implementation arrangement of environment monitoring
- Responsibility of contractor, project management authority and design and monitoring consultant
- Detail safeguard team of the project

III. ENVIRONMENTAL PROCEDURE REVIEW

Environmental Legal Requirement

- Provides a list of national and state laws, rules, policies and regulations applicable to program

Environmental Legal Requirements Applicable to Specific Project

Component	Applicable Legislation	Compliance	Action Required

Compliance with Environmental Legal Requirements

- Describe present status of Environment, forest and other clearances are mentioned below.

Status of Compliance with National and State Legal Requirements upto report period

Package	Main package work	National and State Legal Requirement	Status	Conditions of the Clearance/NOCs

IV. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

- There should be reporting on the following items which can be incorporated in the checklist of routine Environmental Site Inspection Report followed with a summary in the semi-annual report send to ADB. Visual assessment and review of relevant site documentation during routine site inspection needs to note and record the following:

(i) What are the dust suppression techniques followed for site and if any dust was noted to escape the site boundaries?
(ii) If muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;
(iii) Adequacy of type of erosion and sediment control measures installed on site, condition of erosion and sediment control measures including if these were intact following heavy rain;
(iv) Are there designated areas for concrete works, and re-fuelling?
(v) Are there spill kits on site and if there are site procedures for handling emergencies;
(vi) Is there any chemical stored on site and what is the storage condition?
(vii) Is there any dewatering activities if yes, where is the water being discharged;
(viii) How are the stockpiles being managed?
(ix) How is solid and liquid waste being handled on site?
(x) Review of the complaint management system;
(xi) Checking if there are any activities being under taken out of working hours and how that is being managed.

Package wise compliance status as per site specific EMP. Blank sample monitoring table as follows,

Blank Summary Monitoring Table –S & D sub project

A. Pre-construction Stage

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Utilities/Tree cutting	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. (iii) Collection of tree cutting permission with assistance PMU/DSC						
Traffic Management	(i) Prepare a short traffic management schedule during preconstruction phase.						
Social and Cultural Resources	(i) Consult Archaeological Survey of India (ASI) or concerned department in Kolkata to obtain an expert assessment of the archaeological potential of the site; (ii) Consider alternatives if the site is found to be of medium or high risk; (iii) Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	recognized and measures are taken to ensure they are protected and conserved.						
Construction work camps, hot mix plants, stock pile areas, storage areas, and disposal areas.	(i) Prioritize areas within or nearest possible vacant space in the subproject location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community; and (v) Avoid setting up of labour camp near river						
Sources of Materials	(i) Prioritize sites already permitted by the Mining Department; (ii) If other sites are necessary, inform construction contractor that it is their responsibility to verify the suitability of all material sources and to obtain the approval of SIPMIU and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	approval from PMU						

DSC = Design Supervision Consultant, PMU = Project Management Unit

B. Construction Stage

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Climate	Consider seasonal climatic variations during scheduling of construction activities in the area. Do excavations and other clearing activities only during agreed working times and permitted weather conditions. Implement storm water control as per method approved by PMU. No open fires permitted on site						
Air Quality	Guidelines that deal with the control of air pollution and dusts on site have been outlined in the Environmental Management Plan (EMP) Ensure compliance with the Air Act. Ensure compliance with emission standards Undertake monitoring of air pollution levels in						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	potential problem areas. Manage (including storage, transport, handling and disposal) hazardous substances used. Avoid dust generating construction activities during strong winds. Cover soil loads in transit. Cover stockpiles of soil or apply suitable dust palliative such as water or commercial dust suppressants. Regularly service vehicles off-site in order to limit gaseous emissions. No open fires permitted on site Place portable toilets on-site and maintain on a daily basis.						
Geology and soil	The design of the site drainage system is adequate to control runoff from the micro-tunnels and open areas in line with topographical features of the site. Rehabilitate all sites during construction including construction camps, stockpile area, temporary access and hauling routes, as soon as possible after the						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	disturbance has ceased. Contractor to exercise strict care in the disposal of construction waste, with proof of disposal at an approved site provided after offloading each waste load and this logged/registered. Contain contaminated water and dispose off site at an approved disposal site in consultation with WBPCB. Dispose of waste from the oil interceptors only through suitable waste-handling contractor and request for safe disposal certificates. Mix cement, concrete and chemicals on a concrete plinth and contain spillages or overflows into the soil. Do not allow vehicle maintenance on site. If oil spills occur, dispose contaminated soil at a disposal site in consultation with WBPCB. Stockpile subsoil and overburden in all construction and lay down areas. Protect topsoil and subsoil from contamination. Return for						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	backfilling in the correct soil horizon order.						
Drainage and hydrology	The site surface has been engineered and shaped in such a way that rapid and efficient evacuation of runoff is achieved. Provide containment areas for potential pollutants at construction camps, refueling, depots, asphalt plants and concrete batching plants. Implement waste management practices. Control and manage transport, storage, handling and disposal of hazardous substances.						
Biodiversity Fauna and Flora	Permission will be obtained (if required) from the PMU for the cutting/felling of trees prior to start of civil works. Ensure any landscaping to be undertaken will be done with locally indigenous species and low maintenance requirements.						
Land uses	PMU has consulted with various organizations, departments, etc within the area and will be continued during the construction phase. Put a sign of “Keep Clear”						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	near critical roads (e.g. in front of fire and police stations and hospitals). Consult with local departments, organizations, etc regarding location of construction camps, access and hauling routes, and other likely disturbances during construction. Provide clear and realistic information regarding detours and alternative accesses for local communities and businesses in order to prevent unrealistic expectations. Provide clear and realistic information regarding employment opportunities and other benefits for local communities in order to prevent unrealistic expectations. Make use of local labor, materials, goods and services as far as possible Provide walkways and metal sheets where required to maintain access across for people and vehicles. Increase workforce in front of critical areas such as						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	institutions, place of worship, business establishment, hospitals, and schools. Consult businesses and institutions regarding operating hours and factoring this in work schedules. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.						
Infrastructure and Services	Undertake utility shifting prior to commencing pipe laying/micro-tunneling. Keep construction-related disturbances to a minimum. Consult with affected service providers regarding impacts on access to infrastructure and services and alternatives. Consult with affected communities or businesses prior to foreseeable disruptions, for example notifying residents of a temporary severance of water supply. Provide backup or alternative services during construction-related						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	disruptions, for example by providing generators for power supply. Provide access points to infrastructure and services. Monitor complaints by the public.						
Traffic	Reroute traffic and close roads according the Traffic Management Plan (TMP). The objective of the TMP is to ensure safety of all the road-users along the work zone and to address: (i) protection of work crews from hazards associated with moving traffic; (ii) mitigation of the adverse impact to the road capacity and delays to the road-users; (iii) maintenance of access to adjoining properties; and (iv) issues that may delay the subproject works. Negotiate with privately-owned public transport operators regarding the affected public transport facilities and routing. Negotiate with business owners and social service operations regarding the loss of parking and loading bays. Clear roads signs will be						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	erected for the full length of the construction period. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints. Ensure the City Traffic Police will be available on site. Communicate road closure together with the proposed detour via advertising, pamphlets, radio broadcasts, road signage, etc. The implementation of the road detour is also dependent on advance road signage indicating the road detour and alternative routes. Define clearly construction routes. Strictly control access of all construction and material delivery vehicles. Enforce speed limits. Do not allow deliveries during peak traffic hours						
Health and Safety	Implement good housekeeping practices at the construction camp. Strictly implement health and safety measures and audit on a regular basis. Secure enclosed						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	construction site. Use reputable contractors. Provide warning signs of hazardous working areas. Clearly demarcate excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches. Thoroughly train workers assigned to dangerous equipment. Workers have the right to refuse work in unsafe conditions. Undertake waste management practices (Planned disposal of sludge from pumping stations within surrounding areas of PS) particularly for Pumping Station Control speed and movement of construction vehicles Exclude public from the site Ensure all workers are provided with and use Personal Protective Equipment. Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	equipment operating areas Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site; Provide medical insurance coverage for workers. Provide clean eating areas where workers are not exposed to hazardous or noxious substances; Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; Ensure moving equipment is outfitted with audible back-up alarms; Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	easily understood by workers, visitors, and the general public as appropriate.						
Noise and Vibrations	Locate concrete batching, asphalt, crushing plants, lay down areas and construction camps away from sensitive receptors. Restrict construction activities to reasonable working hours where near sensitive receptors. Keep adjacent landowners informed of unusually noisy activities planned. Regulate roadworthiness of vehicles. Ensure that machinery in a good state of maintenance. Fit and maintain silencers to all machinery on site. Monitor noise levels in potential problem areas.						
Aesthetics, Landscape Character, and Sense of Place	Properly fence off storage areas. Collect all domestic solid waste central point of disposal and feed into the city waste collection system. Contractor to exercise strict care in disposing construction waste. Identify suitable waste disposal site with enough						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	capacity to hold additional waste to be generated by the construction activities. Retain mature trees on and around the site where possible. Remove unwanted material and litter on a frequent basis.						
Workers Conduct	Ensure strict control of laborers Minimize working hours to normal working times Control littering Ensure no overnight accommodation is provided.						
Employment Generation	Employ local (unskilled) labor if possible Training of labor to benefit individuals beyond completion of the subproject. Ensure recruitment of labors will take place offsite. Ensure at least 50% of all labor is from surrounding communities in the contractual documentation.						
Archaeological and Cultural Characteristics	Ensure that construction staff members are aware of the likelihood of heritage resources being unearthed and of the scientific importance of						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	such discoveries. Contact ASI or the State Department of Archaeology if any graves be discovered and all activities will be ceased until further notice. Contact ASI or the State Department of Archaeology if any heritage resources or objects, defined in the Act, be discovered and all activities will be ceased until further notice. Cease all activities immediately and do not move any heritage object found without prior consultation with ASI or the State Department of Archaeology No structures older than 100 years will be allowed to be demolished, altered or destructed without a permit from ASI or the State Department of Archaeology.						

DSC = Design Supervision Consultant, H&S = health and safety, RPM = respirable particulate matter,, SPM = suspended particulate matter, PMU = Project Management Unit; PIU = Project Implementation Unit

C. Defects Liability Stage

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Air Quality	Ensure compliance with the Air Act. Ensure compliance with emission standards Regularly service vehicles off-site in order to limit gaseous emissions.						
Biodiversity Fauna and Flora	Ensure no accidental damage to local flora and fauna.						
Land Uses	Put a sign of “Keep Clear” near critical roads (e.g. in front of fire and police stations and hospitals). Consult with local departments, organizations, etc regarding location of construction camps, access and hauling routes, and other likely disturbances. Provide clear and realistic information regarding detours and alternative accesses for local communities and businesses in order to prevent unrealistic expectations. Provide walkways and metal sheets where required to maintain access across for people and vehicles. Increase workforce in front						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. Consult businesses and institutions regarding operating hours and factoring this in work schedules. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.						
Health and Safety	Implement good housekeeping practices at pumping stations. Strictly implement health and safety measures and audit on a regular basis. Provide warning signs of hazardous working areas. Clearly demarcate excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches. Thoroughly train workers assigned to dangerous equipment. Workers have the right to refuse work in unsafe conditions. Undertake waste						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	management practices-specifically periodic removal of sludge from pumping stations. Ensure all workers are provided with Personal Protective Equipment. Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site; Provide medical insurance coverage for workers. Provide clean eating areas where workers are not exposed to hazardous or noxious substances; Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; Ensure moving equipment is outfitted with audible back-up alarms;						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate.						
Noise and Vibrations	Restrict maintenance activities to reasonable working hours where near sensitive receptors. Keep adjacent landowners informed of unusually noisy activities planned. Fit and maintain silencers to all machinery on site. Monitor noise levels in potential problem areas.						
Workers Conduct	Ensure strict control of laborers Minimize working hours to normal working times Control littering						
Solid Waste	Regular removal through municipal system and approved disposal (preferably within pumping station area)						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Wastewater	Ensure adequate pumping						

V. ENVIRONMENTAL MONITORING AND EVALUATION

- Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports.

Ambient Air Quality Monitoring Data at working sites

Package	Monitoring location	Monitoring stage	Date of monitoring	Parameters				
				SO_2 $\mu g/m^3$	NO_2 $\mu g/m^3$	$PM_{2.5}$ $\mu g/m^3$	PM_{10} $\mu g/m^3$	HC $\mu g/m^3$

Noise Level Monitoring Data at Working Sites

Package	Sampling Locations	Implementation Stage	Date of Monitoring	Day Time Leq dB(A)	Night Time Leq dB(A)

Water quality monitoring data as per standard parameters

- Comparison of during construction data with base line data
- Mitigation measures against impact
- Performance monitoring

Table for Performance Fact Sheet for Required Environmental Consents/Clearances of the project

	Package	Name of Contractor	EMP Part of contract Document(Yes / No)	Environmental Consents / Clearances Required					
				Tree Cutting	Crusher	Batching Plant	Hot Mix Plant	Diesel Generator Set	Pollution Under Control (PUC) Certificates for Contractor's Vehicles

Table for Performance Fact Sheet for EMP Implementation of the project

	Package Number	Name of Contractor	EMP Part of contract Document (Yes / No)	Contract or Social/ Environment Person	Overall Status of EMP Implementation	Field to be Monitored as per EMP												
						Source of Materials	Camp Sites	Landscape and Aesthetics	Air Quality	Noise Level	Traffic	Ecological Resources – Terrestrial	Accessibility	Water Quality	Occupational Health & safety	Community Health & safety	Socio cultural resources	Employment generation
					In compliance (2) / Partial Compliance (1) / Not in compliance (0) / Not applicable (n/a)													

VI. CONSULTATIONS AND DISCLOSURES CONDUCTED

- Detail of consultation done during project implementation and proposed schedule of consultation
- Detail of training conducted

VII. GRIEVANCE REDRESSAL

- Detail of grievances recorded and cases resolve

VIII. FINDINGS AND RECOMMENDATIONS

- Based on site observation and document check corrective action plan to be drawn

Table Corrective Action Plan

	Non-compliance	Action Required	Responsible	Target Date	Indicator of Compliance

Appendix of the Report-

LOCATION MAP OF THE PROJECT AREA
IMPLEMENTATION SCHEDULE
PHOTO ILLUSTRATION OF PROJECT LOCATIONS COVERING EMP COMPLIANCE
SITE SPECIFIC EMP
Spoil Management Plan
AIR, NOISE, WATER QUALITY DATA – MONITORING TEST REPORT CERTIFICATE
Site specific Health & Safety plan
Records of trainings conducted during training period
Workers insurance certificate
Availability of labour work package wise
Tree felling permission or other relevant NOC
Traffic Management plan
Environment, health and safety budget
Public consultation during project implementation
Sample Grievance Registration Form

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number
Name: _____ Date: _____
Title: _____ DMA: _____
Location: _____ Group: _____
Weather Condition: _____
Initial Site Condition: _____

Concluding Site Condition:
Satisfactory _____ Unsatisfactory _____ Incident _____Resolved _____ Unresolved _____

Incident:
Nature of Incident:
_____

Intervention Steps:
_____

Incident Issues

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

Emissions	Waste Minimization
Air Quality	Reuse and Recycling
Noise pollution	Dust and Litter Control
Hazardous Substances	Trees and Vegetation

Site Restored to Original Condition Yes ☐ ☐

Signature _____
Name Name

SAMPLE CHECKLIST FOR CONSTRUCTION SAFETY

Sl. No.	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
1	Appointment of qualified construction safety officers						
2	Approval for construction safety management plan by the SC						
3	Approval for traffic management/control plan in accordance with IRC: SP: 55-2001						
4	Maintenance of the existing road stretches handed over to the contractor.						
5	Provision of temporary traffic barriers/barricades/caution tapes in construction zones						
6	Provision of traffic signboards						
7	Provision for flags and warning lights						
9	Providing plastic crash barrier						
10	Provision of adequate staging, form work, and access (ladders with handrail) for works at a height of more than 3 m						
11	Provision of adequate shoring / bracing/barricading/lighting for all deep excavations of more than 3 m depth.						
12	Demarcations (fencing, guarding, and watching) at construction sites						
13	Provision for sufficient lighting, especially for						

Sl. No.	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
	night time work						
14	Arrangements for controlled access and entry to construction zones						
15	Safety arrangements for road users/pedestrians						
16	Arrangements for detouring traffic to alternate facilities						
17	Regular inspection of work zone traffic control devices by authorized contractor personnel						
18	Construction workers' safety - Provision of personnel protective equipment						
19	A. Helmets						
	B. Safety shoes						
	C. Dust masks						
	D. Hand gloves						
	E. Safety belts						
	F. Reflective jackets						
	G. Earplugs for labour						
20	Workers employed on bituminous works, stone crushers, concrete batching plants, etc. provided with protective goggles, gloves, gumboots, etc.						
21	Workers engaged in welding work shall be provided with welder protective shields						
22	All vehicles are provided with reverse horns.						
23	All scaffolds, ladders, and other safety devices shall be maintained in safe and sound						

Sl. No.	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
	condition.						
24	Regular health check up for labor/ contractor's personnel						
25	Ensuring sanitary conditions and all waste disposal procedures and methods in the camps.						
26	The contractor shall provide adequate circuit for traffic flow around construction areas, control speed of construction vehicles through road safety and training of drivers, provide adequate signage, barriers, and flag persons for traffic control						
27	Provision of insurance coverage for the contractor's personnel						

Contractor

Consultant