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JHARKHAND MUNICIPAL DEVELOPMENT PROJECT (JMDP)

-DRAFT-

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

STORM WATER DRAINAGE, DHANBAD

VOLUME I- MAIN REPORT

Jharkhand Urban Infrastructure Development Company Limited (JUIDCO)

November 2017

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ACRONYMS & ABBREVIATION

AAQ	Ambient Air Quality
BIS	Bureau of Indian Standard
BMTPC	Building Materials & Technology Promotion Council
CGWA	Central Ground Water Authority
CoI	Corridor of Impact
CSR	Corporate Social Responsibility
CTE	Consent to Establish
DEM	Digital Elevation Model
DG	Diesel Generator
DMC	Dhanbad Municipal Corporation
DNB	Diplomate of National Board
EHS	Environmental Health Safety
EMP	Environmental Management Plan
ESMF	Environmental and Social Management Framework
ESIA	Environment and Social Impact Assessments
EPC	Engineering Procurement Construction
FGD	Focus Group Discussion
GRC	Grievance Redressal Cells
HSSE	Health Safety Social Environment
IFC	International Finance Corporation
IMD	Indian Meteorological Department
JMDP	Jharkhand Municipal Development Project
JSEB	Jharkhand State Electricity Board
JSPCB	Jharkhand State Pollution Control Board
JUIDCO	Jharkhand Urban Infrastructure Development Company Limited
KII	Key Informants Interview
NH	National Highway
NHAI	National Highway Authority of India
NOC	No Objection Certificate
NSR	Noise Sensitive Receptors
OF	Outfall
OP	Operating Procedure
PAP	Projects Affected Persons
PIA	Project Impact Area
PIU	Project Implementing Unit
PM	Particulate Matter
PMU	Project Management Unit
RCC	Reinforced Cement Concrete
RoW	Right of Way
SES	Socio Economic Survey
SWD	Storm Water Drainage
UDHD	UrbanDevelopment and Housing Department
ULB	Urban Local Bodies

EXECUTIVE SUMMARY

Introduction

The UrbanDevelopment and Housing Department (UDHD), Government of Jharkhand hasdesigned Jharkhand Municipal Development Project (JMDP) with an objective to improve urban servicedelivery and urban management capacities in selected Urban Local Bodies (ULBs). JMDP entails planning and implementation of multiple sub-projects across different districts in Jharkhand. Government of Jharkhand has identified Jharkhand Urban Infrastructure Development Company Ltd. (JUIDCO Ltd.) as the primary implementing agency for executing the JMDP.

The Government of Jharkhand is seeking financial support from the World Bank towards the cost of the JMDP and intends to apply part of the funding received for consulting services for preparing Environmental and Social Management Framework (ESMF) and conducting the Environment and Social Impact Assessments (ESIAs) for the selected priority sub projects. Dhanbad Storm Water Drainage has been selected as one of the sub-projects for implementation under JMDP.

The project is aimed to improve the storm water flow in urban drainage networks based on citywide drainage master plans and designs. Roadside drains are proposed to be improved to alleviate major inundation from rainfall and reduce water-logging problems within the core urban areas.

The proposed works under this project of storm water drainage system of Dhanbad town include construction of 153.95 km (Dhanbad area: -112.26 km and Sindri area: 41.70 km) new drains with silt traps at catch basins and94 outfall structures. The work includes rehabilitation of existing drains and culverts to match the levels and sections with the proposed drains. It is proposed to construct all drains up to 0.6 m (depth) in brick masonry and drains exceeding 0.6 m depth in RCC to have proper stability and strength. It is also proposed to cover RCC drains of type A and B with pre-cast RCC covers and RCC type C with cast in situ covers.

The project activities will trigger World Bank Safeguard Policies OP 4.01 (Environmental Assessment), OP 4.11 Physical and Cultural Properties, OP 4.12 (Involuntary resettlement) detailed in table 8.

As per the guidelines laid in the ESMF, the project is categorised as E-2(Moderate environmental impacts largely reversible and site-specific, temporary) and S-1 (Significant

with adverse irreversible social impacts). Accordingly, ESIA report has been prepared by an independent agency and the ESIA report consists of description of project, analysis of alternatives, environmental baseline, socio-economic profile of project impact area, details of public consultation, environment and social impact assessment, resettlement action plan and environmental management plan, following the requirements of Bank OP 4.01 Category B project. WBG EHS Guidelines, and Industry Sector Guidelines, IFC EBRD Worker Accommodation guidelines have been used to recommend suitable environmental management measures.

Applicable Environmental and Social Policies

The key environment and social laws and legislation applicable for are The Water (Prevention And Control of Pollution) Act, 2012; Air (Prevention and Control of Pollution) Act 1981; Construction and Demolition Waste Management Rules, 2016, The Noise Pollution (Regulation and Control) Rules, 2000; PUC for vehicles for construction under Central Motor and Vehicle Act 1988,Building and Other Construction Workers Welfare Cess Act, 1996; The Child Labor (Prohibition & Regulation) Amendment Act, 2016; Indian Forest Act, 1927(Tree felling permission); MOEFCC Fly Ash Notification , 2009; Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; Solid Waste (Handling and Management) Rules, 2016; Construction and Demolition Waste Management Rules, 2016; Country Labour laws[1] and Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014. In addition, a clause and procedures for cultural properties chance finds will be included in the scope work of the contractor.

Public and Stakeholder Consultation

Stakeholder consultation was held twice-a) During E & S assessment (January – March 2017) and (b) after preparation of Draft ESIA (6th October 2017). During the consultation process, information pertaining to the sub –project like work schedule, procedures involved, project component, likelyimpacts, entitled grievance redressal mechanisms was disseminated. Feedback on mitigation measures, and grievance redressal mechanism were also collected during initial consultation period. A second consultation was held on 6th

[1] Contract labour (Regulation and Abolition) Act 1970; Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act, 2013; Employees P.F and Miscellaneous Provision Act, 1952; Child labour (Prohibition and Regulation) Act 1986; Inter-State Migrant Workmen's (Regulation of employment and Conditions of service) Act, 1979; The Building and Other Construction Works (Regulation of Employment and Conditions of Service) Act 1996; Minimum Wages Act 1948; Equal Remuneration Act 1976; Weekly Holidays Act 1942; Employer's Liability Act 1938; Bonded Labour System (Abolition) Act 1976 etc.

October 2017 , with local community, stake holders, PAP ,ULB members and government officials, where the draft ESIA was discussed in details .Stakeholder's queries regarding environmental and social impacts, mitigation measures to be implemented , entitlement matrix were addressed in the stakeholder meeting. Feedback on ESIA and probable suggestion was also discussed.

Assessment of Impacts

The present report discusses the findings of ESIA conducted for the Proposed Dhanbad Storm Water Drainage in terms of the potential environment and social impacts that may occur as a result of the implementation of project. The expected environment impacts during construction phase include increase in air (temporary and insignificant) and noise pollution (temporary and minor), soil erosion (temporary and insignificant), deterioration of water quality (temporary and insignificant) near the construction area. The major impacts of the project are expected to be during the construction phase leading air and noise quality deterioration, Health and Safety impacts to the works and local communities, traffic diversion and utility shifting, access to private properties, generation of construction debris (through demolition works and excavation activities) and disposal of excavated silt from the drains.

The proposed storm water drainage will have a considerable positive impact and result in reduction in water stagnation, flooding and associated property losses, reduction in water borne diseases which in turn would strengthen public health, enhancement of city aesthetics and reduction in ground water pollution. About 6568 number of Non Titleholders will be affected during the construction phase of the project. About 91 percent of the affected structures are either temporary or semi-permanent structure. Of the total affected structures 57 percent are under commercial use.In this project, 913 households will be physically displaced and 1073 will be economically displaced and 479 mobile vendors will be affected.

The report also suggests mitigation measures for avoiding, minimising and controlling the adverse impacts on the environment and social impacts induced by the project proposed. The policy, legal and institutional framework under the ambit of which the ESIA was undertaken, is also detailed out in this report.

The study also involved development of Environment and Social Management Plan (ESMP) and Resettlement Action Plan (RAP), which elaborates on the mitigation measures, means of implementation for the proposed measures, monitoring strategy and the costs pertaining to implementation of the proposed mitigation measures. The ESMP developed as part of the study proposes budgetary requirement of Rs 58.7 lakhs for implementing the proposed

mitigation measures. The RAP proposes a budget of Rs. 26.20 croreto compensate kiosk/vendor/static hawker for loss of livelihood and structures.

Institutional and Implementation arrangement for ESMP Supervision

The State PMU in Ranchi at JUIDCO will be overall responsible for addressing environmental and social safeguard measures. An environmental and social specialist is already in place in the PMU. The PMU will be supported by a Project Implementation Unit (PIU) at Dhanbad, responsible for day-to-day supervision of the implementation of the ESMP and RAP. The PMU specialists will also train and strengthen the capacities of specialists in the PIUs and other implementing entities. The project shall hire qualified consultancy firm/civil society organisations/NGOs for the implementation of RAP and other social mobilisation/IEC activities under the Project. The contractor's team will include a qualified EHS Engineer to implement the ESMP and associated environmental quality monitoring.

Construction Supervision and Quality Control Consultants are also in the process of being hired, and will contain a dedicated Environment, Social, Health and Safety Officer to verify compliance with ESMP, labour management, occupational health and safety requirements, and waste management procedures. The CSQC consultant team will also contain a dedicated Construction safety officer to supervise worksite safety. The scope of work for the CSQC is outlined in Annex VIII

The Project Management Consultants (PMC) hired by JUIDCo PMU shall provide additional support of social and environment specialists to the PMU and PIU to coordinate, review, support and monitor all respective safeguards aspects of the Dhanbad drainage project.

The compliance of the ESMP, labour management and OHS management by the contractor shall be monitored and assessed during construction by the PIU and CSQC consultant, and formal inspections by the PMU staff. There will also be a safeguard audit of the works which shall be carried out by an independent consultant. The JUIDCo PIU will submit monthly ESMP monitoring checklists as per Annex VII. JUIDCo PMU will submit Quarterly Environmental and Social safeguards reporting which includes progress and compliance on ESMP and RAP to the World Bank.

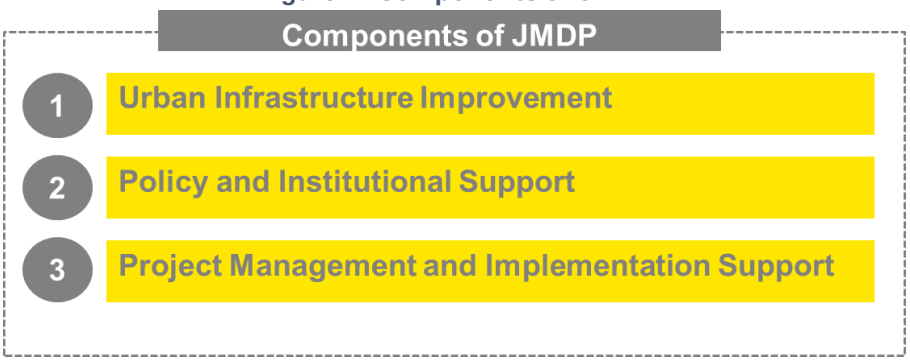
1 INTRODUCTION

1. The UrbanDevelopment and Housing Department (UDHD), Government of Jharkhand (GoJ), has created the Jharkhand Municipal Development Project (JMDP) with an objective to improve urban service delivery and urban management capacities in selected Urban Local Bodies (ULBs). Jharkhand Urban Infrastructure Development Company Ltd. (JUIDCO Ltd.) has been identified as the primary implementing agency for the JMDP.

"JUIDCO" is a company created under the administrative control of Urban Development Department, Government of Jharkhand for formulation, implementation and monitoring of various central/state sponsored urban infrastructure development schemes in the state of Jharkhand. JUIDCO has been undertaking implementation of storm water drainage projectsin the urban areas across the Stateof Jharkhand, besides projects in the other sectors.

2. The JMDP encompasses up gradation of municipal infrastructure (expansion of coverage, and construction and rehabilitation of basic infrastructure systems, such as, water supply, roads, municipal buildings, *etc.*) and associated operation and maintenance support. The JMDP primarily has three components, as shown in Figure-1 below.

Figure 1: Components of JMDP



3. These components entail planning and design of multiple sub-projects, across different districts in Jharkhand. The approach to develop them involves preparation of an initial guiding document called the "Environmental and Social Management Framework (ESMF)". Based on the ESMF, the Environment and Social Impact Assessments (ESIAs) were conducted.

As per WB policy 4.01, an ESMF is an instrument that examines the issues and associated impacts when a project consists of a program and/or series of sub-projects, and the impacts cannot be determined until the program or sub-project details have been identified. The ESMF sets out the principles, rules, guidelines and procedures to assess the environmental and social impacts. It contains measures and plans to reduce, mitigate and/or offset adverse impacts and enhance positive impacts, besides provisions for estimating and budgeting the costs of such measures, and information on the agency or agencies responsible for addressing project impacts.

4. These aforesaid objectives can potentially be achieved with appropriate financing support for infrastructure improvements and by introducing a broad range of improvements in urban policies, planning, and revenue generation.
5. In view of the above, the Government of Jharkhand (GoJ) is seeking financial support from the World Bank (WB) towards the cost of the JMDP and intends to apply part of the proceeds in hiring consulting firms to prepare ESMF and ESIA for priority sub projects. The priority sub-projects have been identified by the Government of Jharkhand based on technical, environmental, social and financial sustainability of the investments.

1.1 Brief Description of Project

6. Dhanbad is one of the twenty-four districts of the state of Jharkhand. Bokaro, Giridih and Jamtara are the other towns in its vicinity. The city of Dhanbad is connected to Kolkata (272 Km) by NH-2 and Ranchi (148 Km) by NH-23, while Patna lies at a distance of 291 Km on the south-eastern railway line. The present population of Dhanbad is about 11.62 lacs (2011 census).
7. Project area under Municipal Corporation has been divided into 55 wards. As per topographical survey, total DMC area is 202.58 sq. km. Out of this, fire zone (coal bearing area) is approx. 126.21 sq. km, which limits the scope of work to an area of 76.37 sq. km.
8. The project is aimed to improve the storm water flow in urban drainage networks based on citywide drainage master plans and designs. Roadside drains are proposed to be improved to alleviate major inundation from rainfall and reduce water-logging problems within the core urban areas.
9. The proposed works under this project of storm water drainage system of Dhanbad town include construction of 153.95km new drains with silt traps at catch basins and94 outfall structures. The work also includes rehabilitation of existing drains and culverts, if

the levels and sections are not as per the proposed engineering specification. It is proposed to construct all drains up to 0.6 m (depth) in brick masonry and drains exceeding 0.6 m depth in RCC to have proper stability and strength. It is also proposed to cover RCC drains of type A and B with pre-cast RCC covers and RCC type C with cast in situ covers.

1.2 PROJECT CATEGORIZATION

10. As outlined in the ESMF, JMDP, Dhanbad SWD has been categorized as E-2 and S-1.The project involves loss of structures and livelihood of non titleholders and no land acquisition is involved. Environment & Social screening checklist undertaken by JUIDCO PMU & PIU has been presented in Annexure –I.

1.3 SCOPE OF THE ESIA STUDY

11. The objective of ESIA is:
    - Identification of the project activities
    - Description of existing environment and social conditions of the area
    - Assessment of potential impacts associated with the project activities
    - Mitigation and monitoring measures proposed for impacts identified and
    - Incorporation of stakeholder suggestions and feedback
    - Preparation of an environment and social management plan which includes implementation arrangements for supervision.

12. As per the Terms of Reference (ToR), the scope of work for ESIA study broadly entails the following:
    i. Desk review of relevant technical sub-project documentation, such as the Detailed Project Report, City Master Plan for Dhanbad, design drawings, maps and location plans, designs, associated studies, etc.
    ii. Collection and desk review of relevant technical project documentation, feasibility studies, maps and location plans, designs, studies, drawings, maps, etc.
    iii. Site visits and surveys of such project sites and relevant areas of influence to verify social and environmental site conditions, anticipate potential risks and impacts, including an initial estimate of their scope, magnitude, geographic scope and likely duration;
    iv. Determine which specific Country, State and World Bank safeguard policies would be applicable, along with the necessary permits and clearances

v. Analyse environmental and social conditions, identify anticipated risks and impacts, develop management and mitigation measures/plan, monitoring plan, institutional responsibilities and arrangements for permits and licensing.

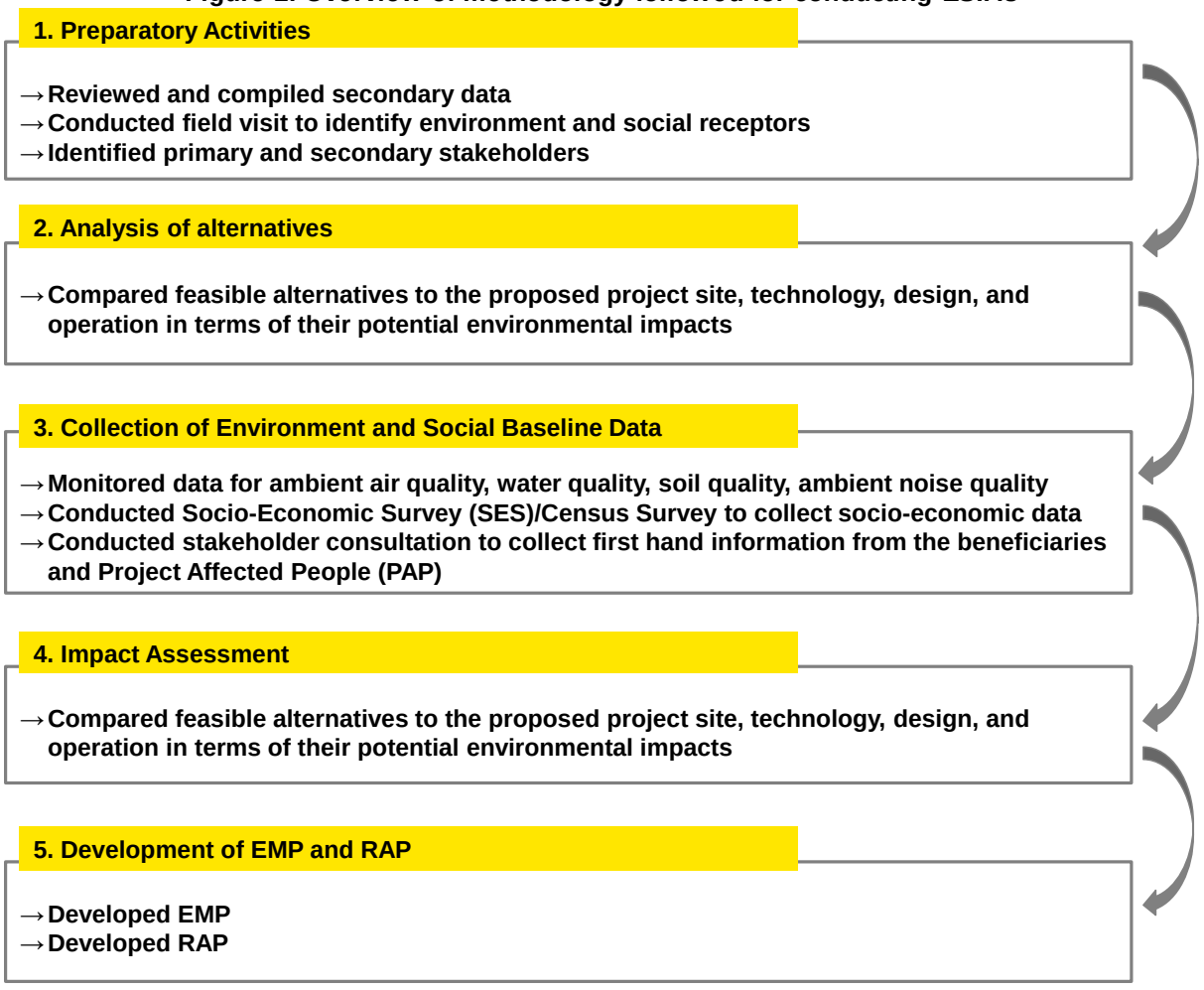
vi. Support the disclosure and consultation process in line with the local regulations and the Bank requirements and include in the final version of the ESIA how the issues raised during the consultation process were addressed.

vii. Develop detailed Management Plans that is ESMP and RAP as required for the bidding documents.

1.4 Approach and Methodology

13. This section of the report details the step by step approach followed for conducting the ESIA of Dhanbad SWD with respect to the proposed project as illustrated in the **Figure 2**below.

Figure 2: Overview of methodology followed for conducting ESIAs



(a). Preparatory Activities

14. Preparatory activities included team mobilisation and compilation of existing secondary information pertaining to the project area. Field visits were planned and conducted with the following objectives:

- Assessing existing environmental conditions
- Identifying potential environmental and social impacts
- Identifying potential mitigation measures
- Identifying interested and affected individuals or parties

(b). Analysis of Alternatives

15. The feasible alternatives to the proposed project site, technology, design, and operation were analysed in terms of their potential environmental and social impacts.

(c). Collection of Environmental and Social Baseline Data

16. This section details the methodology adopted for establishing the environmental and social baseline.

Environmental Quality Parameters

17. In case of environmental baseline, sampling of air quality, water quality (surface and ground), soil quality, and noise levels was undertaken in the first week of March. The sampling locations for monitoring of air, water, soil, and noise quality were identified based on the following:

- Existing topography
- Location of water bodies
- Wind direction and location of village/towns/sensitive areas
- Accessibility, power availability and security of monitoring equipment

18. The details of the parameters monitored have been presented below:

- **Ambient Air Quality**: Ambient air quality was monitored at seven locations for parameters including Particulate Matter (PM<10 micron, PM<2.5 micron), SOx and NOx.
- **Water Quality**: Information on water quality was generated by collecting and analysing samples from seven surface water bodies.
- **Soil Quality**: Soil quality was assessed by collecting six soil samples from four locations. Further, the collected soil samples were analysed for the physical and chemical parameters.
- **Ambient Noise Quality**: Ambient noise quality was monitored for 24 hours at seven locations within the study area.
- **Other relevant information related to** topography, geology, seismicity, ecology and land use pattern was collected through secondary research and information available on public domain

A. Social Baseline

19. As the first step, data from the secondary documents such as Census, ULB records etc. was reviewed for collecting basic socio-economic information. Further, the Socio-Economic Survey (SES) was conducted with an objective to assess the socio-economic profile of the project area. The SES was carried out through 'multistage proportional random sampling' (with replacement) procedure with 95% confidence level in the Project Impact Area (PIA). The SES captured the socioeconomic baseline of the PIA and helped in assessing the benefits and impacts of the project with respect to the actual prevailing situation.
20. As the next step, a census survey was conducted with an objective of gathering first-hand information on the following:

- Inventory of affected assets
- Categorization and measurements of potential loss
- Physical measurements of the affected assets/structures
- Identification of trees and crops
- Household characteristics, including social, economic and demographic profile
- Identification of non-titleholders
- Assessment of potential economic impact, including temporary loss

21. The census survey covered 100% structures affected within the proposed Right of Way (ROW) as per the Corridor of Impact (CoI) of the DPR and drawings provided. Structures considered are permanent (pukka), semi-permanent (semi-pukka) and temporary (kutcha).
22. In addition to SES and census survey, after finalization of the methodology, protocol and communication strategy by the JUIDCO, the World Bank and other relevant stakeholders, series of public consultations were conducted during January, March and June 2017. The public consultations were conducted through focus group discussions, individual interviews and formal as well as informal consultations. The vulnerable sections of Project Affected Persons (PAPs) were also included in the consultation process. The public consultation helped in ensuring people participation in the planning and implementation phase and further facilitated in disclosure of the project details to the would be PAPs and beneficiaries. In conformance to the World Bank principles of consultation and disclosure, the project activity was disclosed across the selected locations with the following key objectives:

- Understand the community concerns and issues
- Disclose environmental issues that may arise due to the project and discuss suggestions for mitigation measures

- Assess the present-day project site's characteristics and definitive social, livelihood, and environmental impacts
- Consult with affected communities and/or entities on the proposed project alternatives in order to minimize adverse impacts and enhance beneficial ones
- Obtain a consensus on the proposed activity, potential impacts and suggested mitigation measures

(d). Impact Assessment and Management Plan

23. Primary and secondary data collected for establishing the baseline, were analysed for identification of potential environmental and social impacts that may occur during different phases of the project. For each of the identified impacts, measures to avoid and/or mitigate these have been recommended in the Environment Management Plan (EMP) and Resettlement Action Plan (RAP). A relevant monitoring plan has been proposed to ensure effectiveness of the management measures.

1.5 Layout of the Report

24. The ESIA report has been organized into the following sections:

- **Section 1: Introduction** - This section provides a brief introduction to the project, scope of the ESIA and methodology followed for developing the ESIA.
- **Section 2: Project Description**- The project details in terms of location and components have been presented in this section.
- **Section 3: Administrative and Regulatory Framework**-This section details out the acts, policies and regulations rolled out by the Government of India at central and state level, which are applicable to the proposed project. Further, this section also reviews the applicability of World Bank's safeguard policies to the project activities.
- **Section 4: Analysis of Alternatives**- This section presents two scenarios, 'with project 'scenario and 'no project' scenario.
- **Section 5: Environmental Baseline Profile**- The findings of baseline studies conducted and secondary information collated have been presented in this section.
- **Section 6: Social Profile of PIA -** The socio-economic profile of the state, district and the PIA have been presented in this section.
- **Section 7: Public Consultations and Disclosure -** This section presents the summary of the public consultations including key informant interviews and in- depth interviews with primary and secondary stakeholders.

- .**Section 8: Environmental Impact Assessment -** This section presents the environmental impact assessment and environmental impacts identified during various phases of the project. The mitigation measures for the impacts have also been presented.
- **Section 9: Social Impact Assessment (SIA) and Resettlement Action Plan (RAP)** - This section presents the social impacts that may occur due to the project activity and Resettlement Action Plan and the indicative budget**.**
- **Section 10: Environmental and Social Management Plan**- The measures to avoid and mitigate environmental and social impacts across different phases of the project cycle with allocation of responsibilities and monitoring plan for reviewing effectiveness of the measures have been presented in this section. The cost of implementation of EMP has also been presented here.

2 PROJECT DESCRIPTION

2.1 *GENERAL*

25. With a view to developing the existing urban infrastructure setup in Dhanbad, JUIDCO intends to develop a new storm water drain scheme in Dhanbad.The project is aimed to improve the storm water flow in urban drainage networks based on citywide drainage master plans and designs. Roadside drains are proposed to be improved to alleviate major inundation from rainfall and reduce water-logging problems within the core urban areas.

2.2 *PROPOSED PROJECT*

2.2.1 Site Setting

26. Dhanbad town, the headquarters of Dhanbad district, is situated on the bank of River Damodar. It is located at 23.8° N latitude and 86.45°E longitude. Dhanbad is well connected with the National Highway-2 (NH2) and National Highway-32 (NH32) with a two-lane highway**.**Dhanbad is situated in the catchment basin of River Damodar, which is the major river flowing in the vicinity. River Damodar, flowing from west to east, forms the southern boundary of the municipal limits. The town has a large network of natural drains, intersecting major parts of the municipal area before finally draining into River Damodar. Presently, there are six major natural drains in the town, out of which four drain flow southwards and one flow eastwards and one natural drain slopes towards north east direction and finally drains into Khudia River. In addition to six major drains in Dhanbad area, two natural drains in Sindri area which is currently being used. In addition to these, two natural drains in Sindri area which outfalls DMC storm water to the River Damodar

2.2.2 Current Scenario

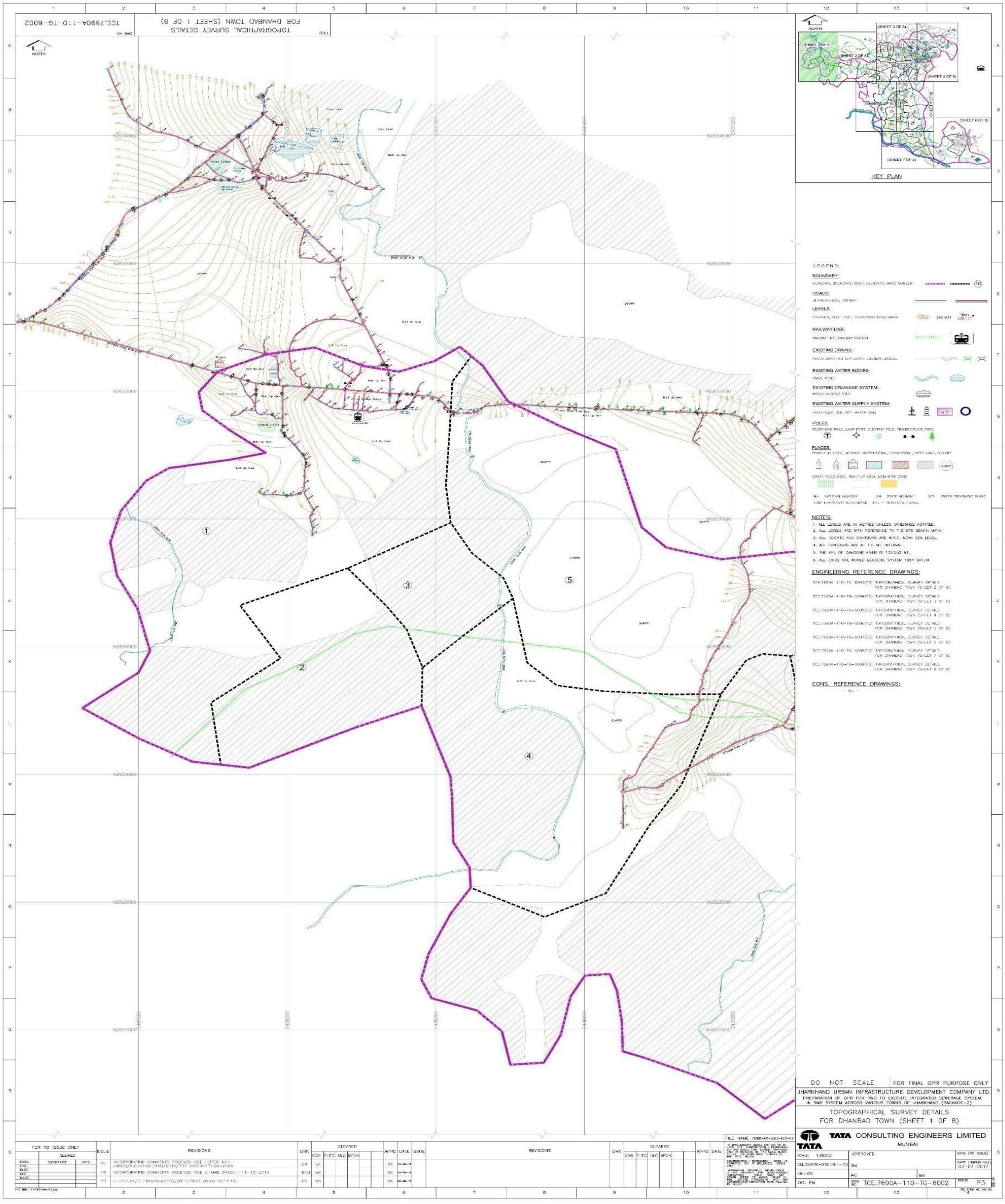
Existing storm water drain system

27. The existing road side drains are generally open and are mostly on one side of the road. Most of the drains are heavily silted and choked. The project area available for design (i.e., excluding coal bearing area and fire zone) has a road length of 243 km but, currently, has only 40 km of road side drains. The road side drains will require good engineering solutions and detailed investigations which have currently been considered in the proposed project. Currently, natural drains of around 10 km are present. The

coverage of storm water drains is about 16.5% (as compared to road length) which implies that the road-side drains are absent in most parts of the town.

28. Some of deficiencies and key environmental issues of existing system are as follows:
    i. Poor maintenance of the existing storm water drainage (SWD) system.
    ii. Encroachment of the drainage area by illegal constructions.
    iii. Lack of de-silting of SWDs over the years has resulted in reduction in carrying capacity.
    iv. Majority of the drains are open and some are unlined.
    v. Dumping of the solid waste into the nearby open SWD leading to choking of drains, and facilitating the breeding of disease vectors such as flies, mosquitoes, cockroaches, rats, and other pests, affecting the efficiency and efficacy of the system.
29. The flood prone areas in Dhanbad town are few low-lying areas located in Ward No. 25, 26, 28 and 29; however, during monsoon other areas also get water logged due to improper drainage system. This is due to the poor existing storm water drain system and it is causing considerable inconvenience and economic losses. This is a recurring problem for which a suitable surface storm water drain system needs to be developed.
30. The existing storm water drain network of Dhanbad has been presented in Figure below**.**

Figure 3: Current Topographical scenario of Dhanbad Municipal Corporation



Source: DPR

2.3 PROPOSED STORM WATER DRAIN SYSTEM

31. The catchment areas that are out of municipal limits, and are likely to contribute in the project area will also be considered and following aspects will be considered:
    - Topography - Ground slope
    - Drain Routing - Along the roads
    - Optimization of the drain depths
    - Availability of natural ponds
32. The storm water drains will be designed for gravity flow. Based on the natural topography and orientation of the receiving water body, Dhanbad will be divided into seven storm water drain zones (five in Dhanbad area and two in Sindri area) with outfalls in local ponds and natural drains ultimately draining to River Damodar. The different zones are described below and presented in Figure 4

Figure 4: Storm water drainage zones in Dhanbad

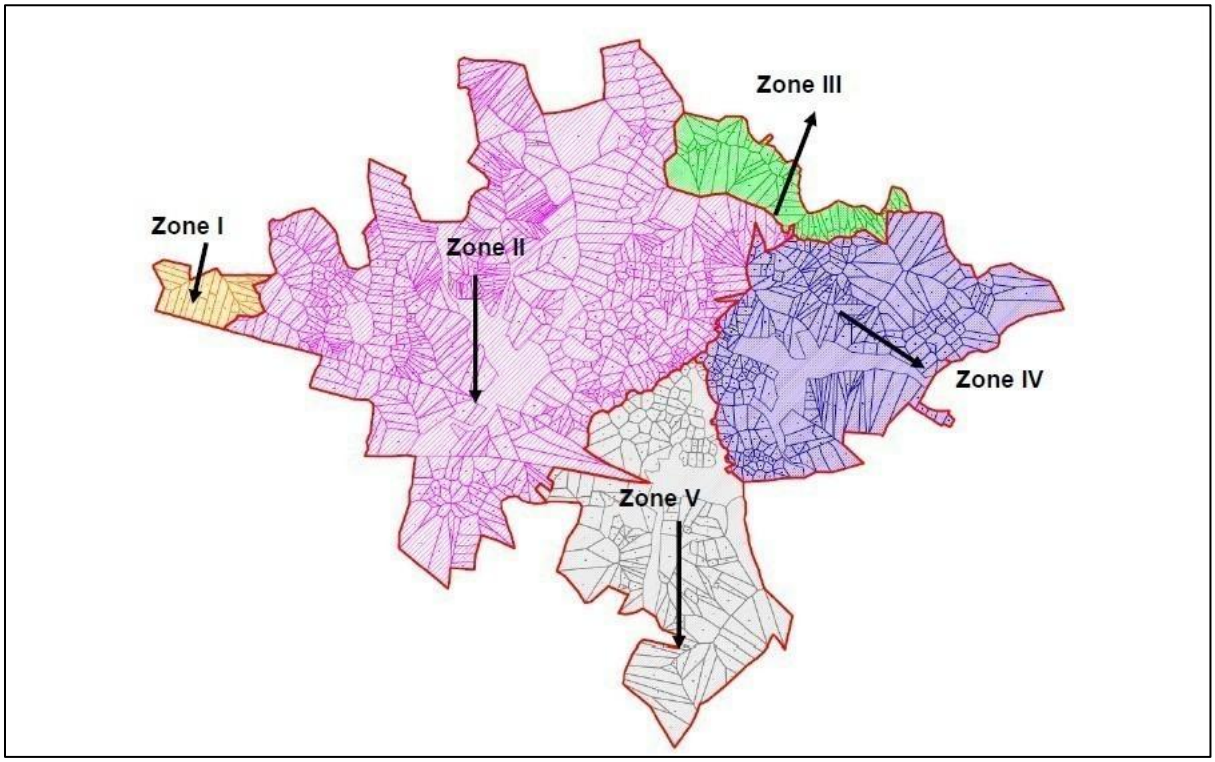
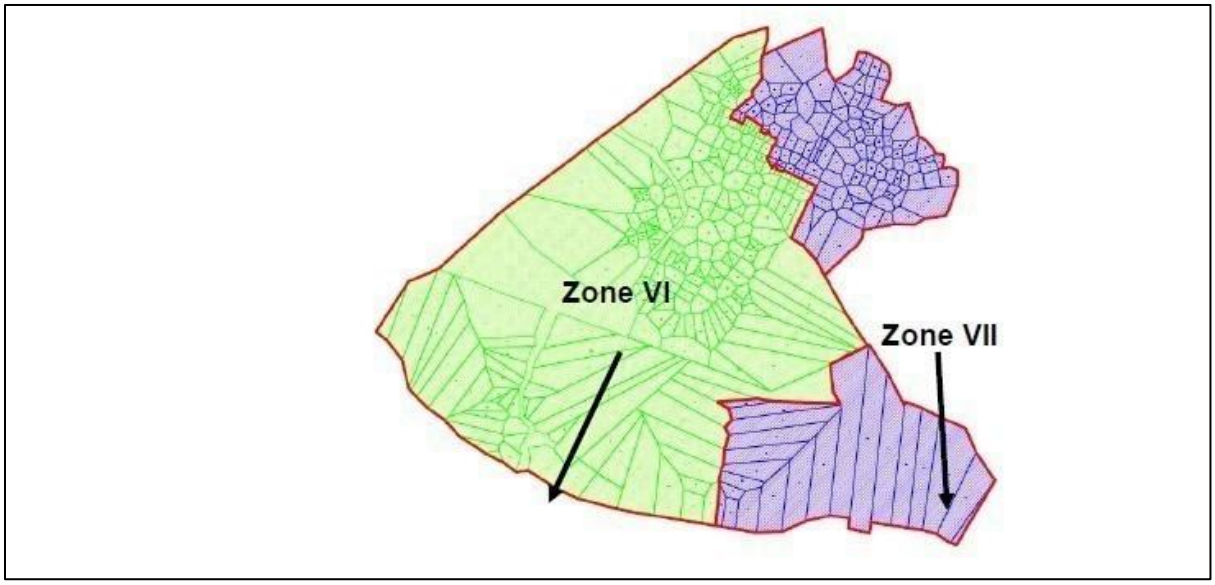


Figure 5: Catchment zones for Sindri area



Dhanbad area:

- **Zone-I:** This zone lies in north-western part of the town, above the railway line and drains into unlined natural drain flowing in Bhuli area. The existing unlined natural drain passes below the railway line through an existing culvert. The proposed road side drains will be designed to drain towards the existing unlined natural drain and in the direction of the natural storm water drain.

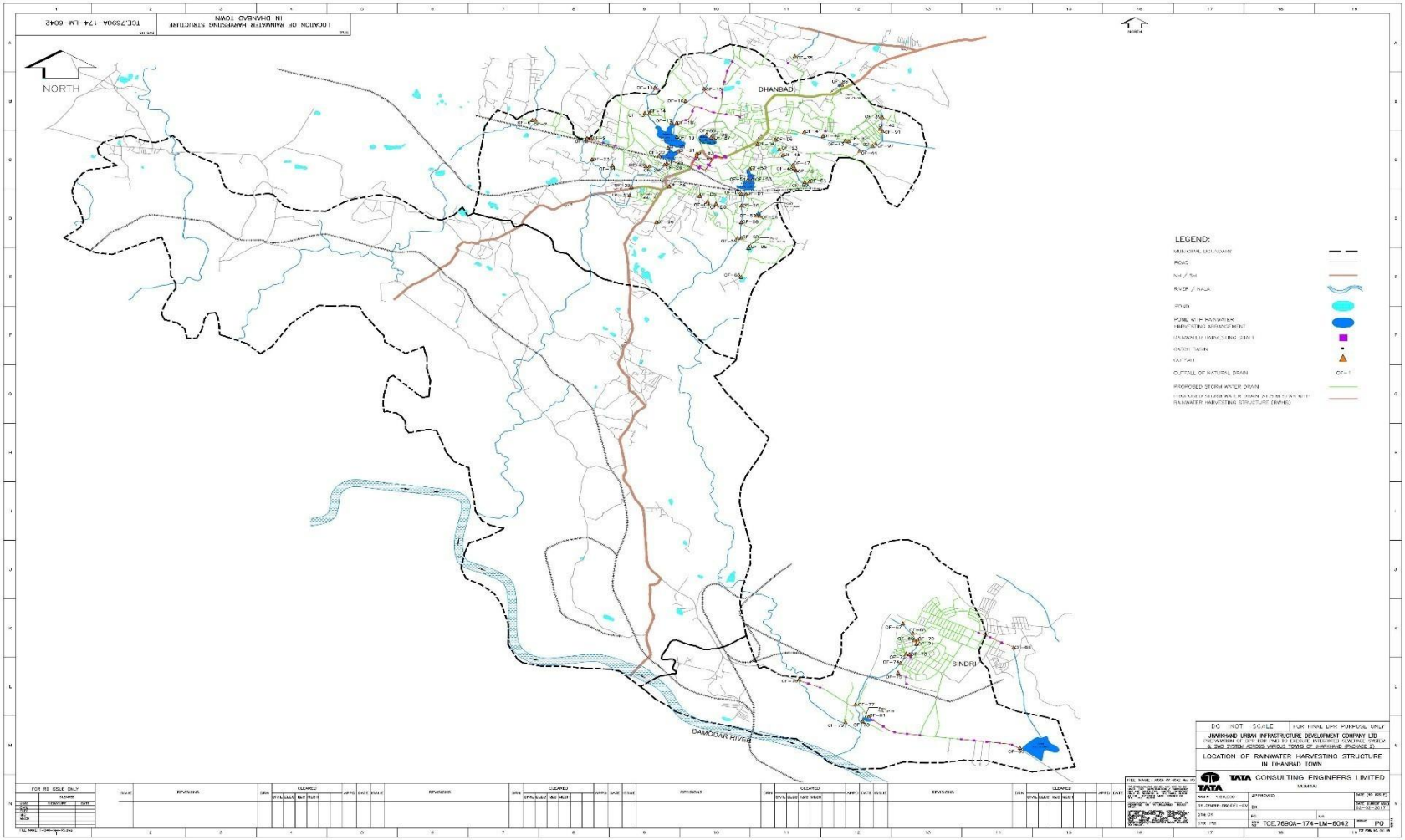
- **Zone-II:** This is the central part of the town. This catchment zone covers major area of the town and is divided into two parts by the railway line. The northern part of the area drains into two local ponds Rajendra Sarovar and Pampu pond. Two unlined natural drains drain off the overflow from the existing ponds towards south direction passing below railway line through 2 existing culverts. The natural drain continues to flow through the southern part of the zone. The proposed road side drains will be designed to drain towards the existing natural drain and in the direction of the natural storm water drain.
- **Zone-III:** This zone lies in the north-eastern part of the town, sloping towards north and discharges into unlined natural drain ultimately draining to Khudia River.
- **Zone-IV:** This zone lies in eastern part of the Town and discharges into unlined natural drain draining towards River Damodar.
- **Zone-V:** This Zone lies in South-eastern part of the town and is divided into two parts by the railway line. Upper half drains into Loco Talab and lower half drains into unlined natural drain flowing out of Loco Talab. The natural drain passes below the railway line through an existing culvert.

Sindri area:

- **Zone-VI:** Western part of Sindri is divided into two parts by the railway line and drains into unlined natural drain leading to Damodar River.
- **Zone-VII:** Eastern part of Sindri drains in local pond located at south-east corner of the town.

33. The proposed storm water drain project in Dhanbad has been presented inthe Figure below**.**

Figure 6: Proposed SWD of Dhanbad



Source: DPR

2.3.1 Design Considerations:

34. Keeping above features into consideration, proposal has been framed for gravity storm drains ultimately discharging into natural water bodies such as River and Nallah. Outfalls have been provided to the nearest available discharge point (in water bodies) to minimize the sizes and depths. Large ponds, wherever possible, have been integrated in proposal to reduce the depth of the drains and an escape drain has been proposed in the downstream of the pond which eventually discharges into natural drains or river. Physical barriers such as railway tracks and national highways have been kept into consideration while forming the drainage zones and crossing of NH and Railway have been avoided to the extent possible by making use of available culverts.
35. Only a few selected existing drains having good physical condition and adequate size have been integrated with the proposed drains. Rest of the existing drains are proposed to be dismantled.
36. With above methodology and intention to improve the environment conditions and social life, storm water drainage system of Dhanbad town including construction of 153.95 km (Dhanbad area: 112.26km and Sindri area: 41.70 km) new drains with silt traps at catch basins,94 outfall structures (19 outfalls discharging in Ponds, 40 outfalls discharging on culvert , 26 outfalls discharging in river/ drain, and 9 outfalls connecting to roads made by the road consultant) have been proposed

2.3.2 Integration of Ponds

37. Integration of local ponds (major and along the roads) with storm water drain system has been proposed. This will be achieved by providing outfalls of storm water drains into ponds. From these ponds, storm runoff overflow will either ultimately discharge into River Khudia and Damodar through natural water ways/Nallas or be routed into adjacent proposed drains on downstream side which will convey storm runoff to outfalls leading into River Khudia and Damodar
38. Integration of ponds has dual advantages. Firstly, integration will lead to economical design by reducing the depth of drains. Secondly, this arrangement will reduce the direct discharge of runoff to the river system and the flood risk downstream, and will allow localized reuse of storm water for landscaping and irrigation.
39. Runoff discharge into ponds will be through the silt traps (to avoid deposition of silt) followed by outfall structure. The overflow from pond will be diverted into the proposed downstream drains or natural waterways through outlet weir.
40. Altogether, 10 Nos. of major ponds has been integrated with storm drainage system and details are furnished in Table below:

Outfall	Name of Pond / Drain location	Ultimate discharge point
OF-19	Rajendra Sarovar	Overflow discharging towards natural drain connected to pond downstream
OF-20	Pampu Pond	
OF-31, OF-32, OF-85 to OF-87	Bekar Bandh pond	Overflow in Rajendra Sarovar which is ultimately discharging into natural drain.
OF-52	Pond above Loco Talab	Overflow discharging towards natural drain connected to pond in downstream.
OF-80	Pond in eastern part of Sindri area	Overflow discharging to culvert which is ultimately joining Damodar River
OF-81	Pond in western part of Sindri area	Overflow discharging to culvert which is ultimately joining Damodar River.
OF-88	Pond near CCWO Park (Sarai Delha pond)	Overflow discharging towards natural drain connected to pond in downstream
OF-95	Pond near Pathrakulli (Jora Talab)	Overflow discharging towards natural drain connected to pond in downstream
OF-34, OF-36	(At culvert) Near Bartand Bandh pond	Overflow discharging to culvert which is ultimately joining River.
OF-57, OF-94	(At culvert) Chat Talab	Overflow considered in CB-3855 which is ultimately discharging into natural drain

Source: DPR

2.3.3 Outfalls

41. The proposed works under this project of storm water drainage system of Dhanbad town include construction of 153.94 km (Dhanbad area: 112.26 km and Sindri area: 41.70 km) new drains with silt traps at catch basins, 94outfall structures. The details of storm water drain outfall points has been provided in **Table 1.**

Table 1: Proposed Outfall structure

Outfall	Name of Pond / Drain location
OF-1 to OF-6	Natural drain along the proposed widening of road (roadNo11, Road 12, Road 13, Road No 14, Road No 15 , Road No 16
OF-6 to OF-7	Natural drain/nalla in Bhuli area
OF-8, OF-9,	(At culvert) Natural drain/nalla near Silver Dovi school draining to Damodar river
OF-10, OF-12	(At culvert) Near Bhuli flyover

Outfall	Name of Pond / Drain location
OF-11, OF-13 to OF-16, OF-37	Natural drain/nalla draining to Rajendra Sarovar
OF-17, OF-18	(At culvert) Rajendra Sarovar
OF-19	Rajendra Sarovar
OF-20	Pampu Pond
OF-21	(At culvert) Near Pampu Pond
OF-22	Natural drain/ nalla draining to Pampu Pond
OF-23, OF-24	Natural drain/ nalla near zonal training school draining to Damodar river
OF-25 to OF-30	Natural drain/ nalla from Pampu pond draining to Damodar river
OF-31, OF-32, OF-85 to OF-87	Bekar Bandh pond
OF-33	(At culvert) Near Kanchan Market
OF-34, OF-36	(At culvert) Near Bartand Bandh pond
OF-35	Natural drain/ nalla ultimately draining to Khudia river
OF-39, OF-41, OF-42, OF-44	Natural drain/nalla in eastern part of Dhanbad draining towards Damodar
OF-40, OF-43, OF-90 to OF-92, OF-97	(At culvert) Natural drain/nalla in eastern part of Dhanbad draining towards Damodar
OF-46 to OF-51	Natural drain near professor colony draining towards Damodar
OF-52	Pond above Loco Talab
OF-53, OF-54	(At culvert) Loco Talab
OF-56	Natural drain from Loco Talab Draining towards Damodar
OF-57, OF-94	(At culvert) Chat Talab
OF-58 to OF-60	(At culvert) Natural drain from Loco Talab Draining towards Damodar
OF-63	(At culvert) Near Patraulhi
OF-66	Natural drain in eastern part of Sindri area
OF-67 to OF-75, OF-78	Natural drain in western part of the Sindri area
OF-76, OF-77, OF-79	(At culvert) Natural drain in western part of the Sindri area
OF-80	Pond in eastern part of Sindri area
OF-81	Pond in western part of Sindri area
OF-82, OF-83	(At culvert) near Loco Talab
OF-84	(At culvert) near Bisra Munda Chowk
OF-88	Pond near CCWO Park
OF-95	Pond near Pathrakulli
OF-96	(At culvert) Dahnsar area

Source: DPR

42. All drains up to 0.6 m (depth or width) will be constructed in brick masonry and drains exceeding 0.6 m (depth and width) in RCC to have proper stability and strength. RCC drains of type A and B are proposed to be covered with pre-cast RCC covers and RCC type C with cast in situ covers. The design of the typical outfalls structure has been presented in **Figure 7.**

2.3.4 Material Selection

43. RCC drains will be used for storm water drains of more than 0.6 m depth. Brick masonry drains have been proposed for drains shallower than 0.6m. The raw materials such

asstone aggregates, sand, cement, steel, bricks etc.will be obtained from already existing government approved quarries and manufacturing plans. The minimum size of the storm water drain will be 300 mm x 300 mm Minimum freeboard will depend on size of the drain and will be as per IRC SP: 50. It is also proposed to cover RCC drains of type A and B with pre-cast RCC covers and RCC type C with cast in situ covers

44. Carriage distance for various materials has been decided in discussion with various stakeholders such as ULB, JUIDCo and same has been used for cost estimation purpose. Table below presents the carriage distances for various materials.

Sl.No.	Material	Distances from Dhanbad
1	Stone Aggregates	23 km
2	Sand	35 km
3	Cement	3 km
4	Timbers	5 km
5	Steel	3 km
6	Bricks	10 km

45. The summary of the proposed drain has been provided in **Table 2.** The cross-sections of proposed new drains have been presented in **Figure 7.**

Table 2: Summary of Proposed Storm Water Drains

Length(m)	Material
14,247.11	Masonry
139,706.21	RCC
1,53,953.32	**Total**

Source: DPR

2.3.5 Waste Generation

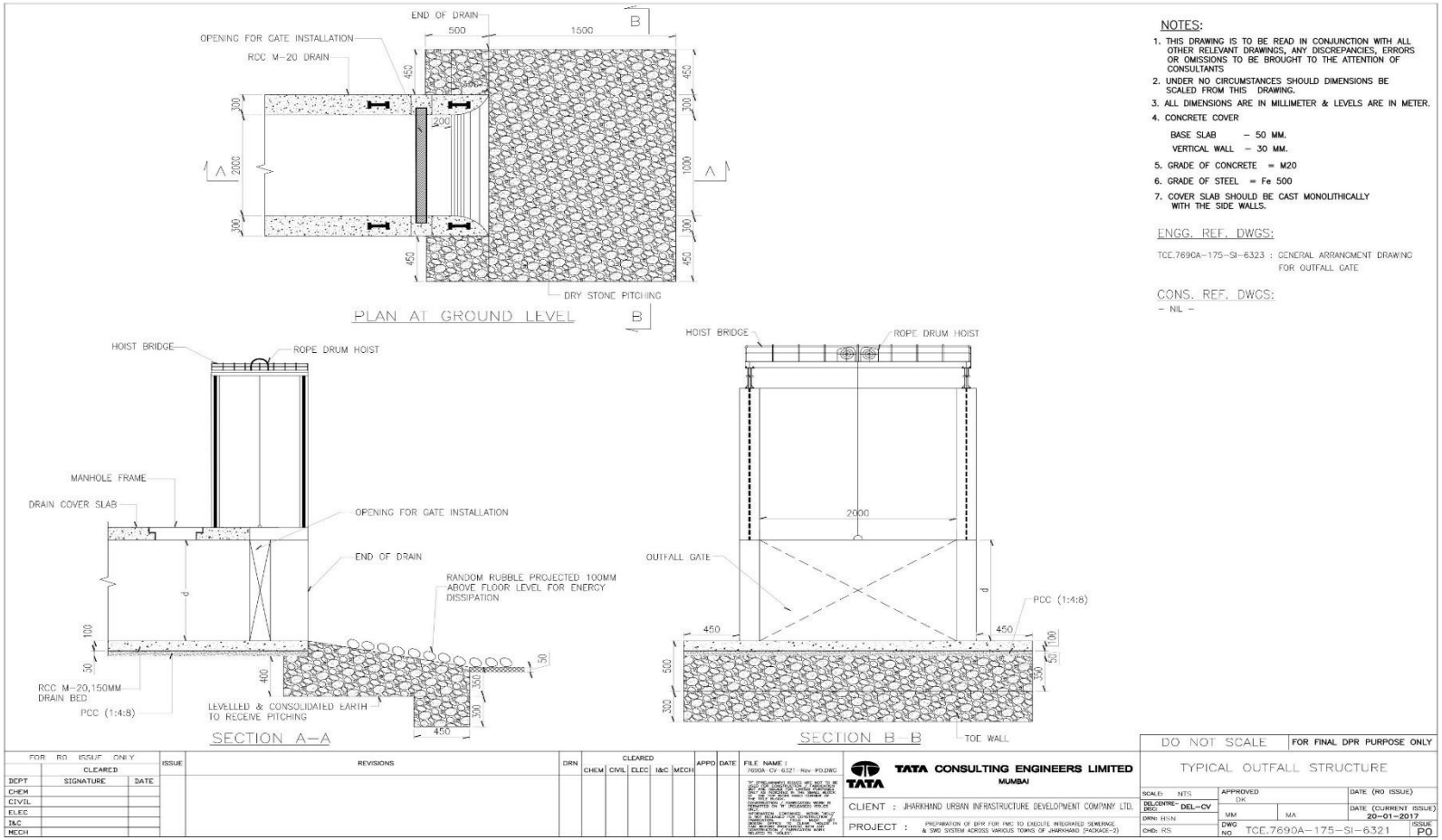
46. The principal waste products expected during the construction phase include excess excavated material and excavated material which is not suitable for backfill, and debris generated from demolition of existing pavements and drains.

During the operation phase, there will be collection and disposal of trash, mainly from but not limited to the trash screens and traps. This waste will be the same composition as general municipal solid waste and can be safely disposed to landfill with other general waste.

2.4 PROPOSED WORKS

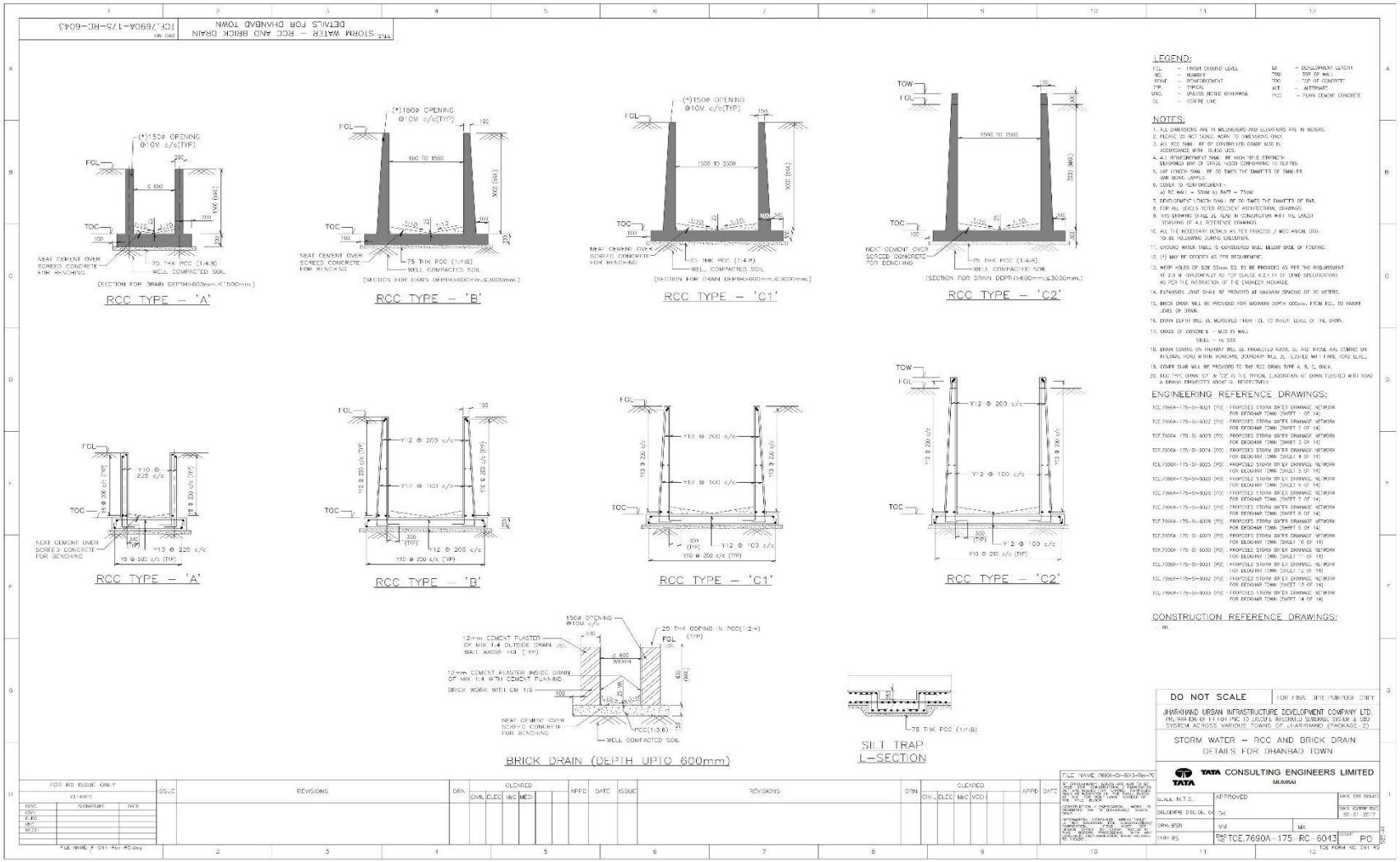
47. The town has been divided into four phases based on the road width.
    - Phase-1 consists of storm water drainage network on roads with width (Right of Way) up to 9 m.
    - Phase-2 comprises of storm water drainage network on roads with width 9.1 to 10.0 m.
    - Phase-3 comprises of storm water drainage network on roads with width 10.1 to 12 m.
    - Phase-4 comprises of storm water drainage network on roads with width 12 or above discharging into a nearby outfall.
48. Cost of civil works of includes cost of utility shifting, excavation of trenches, barricading, and construction of drains with either Masonry or RCC, refilling in trenches, rehabilitation of culverts in drains, road restoration, (flexible and rigid roads), dismantling of pavement, and demolishing of existing drains.

Figure 7: Typical Outfall Structure



Source: DPR

Figure 8:Cross-sections of proposed new drains



Source: DPR

2.4.1 Types of Drain Covers

49. Drain covers will be based on the proposed drain types (i.e. brick or RCC) and road types (i.e. internal roads or highways). Details are provided in Table 3. Drain walls will be flushed with road or projected above ground level based on type of drain and roads on which they are provided. The RCC type A and B will be covered with pre-cast RCC covers and RCC type C with cast in situ covers.

Table 3: Drain Cover

Description of items	On Internal Road			On Highways		
	RCC Type A	RCC Type B	RCC Type C	RCC Type A	RCC Type B	RCC Type C
Drain Wall	Flushed with FRL	Flushed with FRL	Flushed with FRL	Projected above GL	Projected above GL	Projected above GL
Width of drain	≤ 600 mm	> 600 mm ≤ 1500 mm	> 1500 mm ≤ 2500 mm	≤ 600 mm	> 600 mm ≤ 1500 Mm	> 1500 mm ≤ 2500 Mm
Depth of drain	> 600 mm ≤ 1500 mm	> 600 mm ≤ 3000 mm	> 600 mm ≤ 3000 mm	> 600 mm ≤ 1500 mm	> 600 mm ≤ 3000 Mm	> 600 mm ≤ 3000 Mm
Drain cover	Covered	Covered	Covered	Covered	Covered	Covered
Grade of concrete in slab cover	M-25	M-25	M-25	M-25	M-25	M-25
Type of precast solid drain cover	Precast R.C.C. cover slab of (500 mm length x span width in mm x 150 mm thick)	Precast R.C.C. cover slab of (500 mm length x span width in mm x 150 mm thick)	Cast-in situ R.C.C. Cover slab of (500 mm length x span width in mm x 225 mm thick)	Precast R.C.C. cover slab of (500 mm length x span width in mm x 100 mm thick)	Precast R.C.C. cover slab of (500 mm length x span width in mm x 100 mm thick)	Cast-in-situ R.C.C. Cover slab of (500 mm length x span width in mm x 100 mm thick)
Type of precast perforated drain cover	Precast R.C.C. Perforated cover slab @ 10 mtr C/C (500 mm	Precast R.C.C. Perforated cover slab @ 10 mtr C/C	-- NA --	Precast R.C.C. Perforated cover slab @ 10 mtr C/C (500 mm length x	Precast R.C.C. Perforated cover slab @ 10 mtr C/C (500 mm length x	-- NA --

Description of items	On Internal Road			On Highways		
	RCC Type A	RCC Type B	RCC Type C	RCC Type A	RCC Type B	RCC Type C
	length x span width in mm x 150 mm thick)	(500 mm length x span width in mm x 150 mm thick)		span width in mm x 100 mm thick)	span width in mm x 100 mm thick)	
Type of Manhole Cover	-- NA --	-- NA --	SFRC Manhole cover of 450 mm x 450 mm in size (HD 20T) @ 5 mtr C/C	-- NA --	-- NA --	SFRC Manhole cover of 450 mm x 450 mm in size (MD 10T) @ 30 mtr C/C
U-PVC sleeve pipe	-- NA --	-- NA --	-- NA --	110 mm dia U-PVC sleeve pipe @ 10 mtr C/C	110 mm dia U-PVC sleeve pipe @ 10 mtr C/C	110 mm dia U-PVC sleeve pipe @ 10 mtr C/C
Plastic encapsulated Footrest	-- NA --	-- NA --	-- NA --	-- NA --	-- NA --	Applicable

Source: DPR

2.4.2 Land Acquisition

50. Construction of drains along the roads and outfall structures will not require any land acquisition.. The construction of drains will primarily be located within the ROW of the roads, government lands or government office premises as confirmed from the DPR and discussions with authorities at site.

2.4.3 Labour Requirement

51. During the peak construction time the total no of skilled and unskilled labours is estimated to be 350 nos. However most of the labour shall be locally hired by contractor from nearby villages/area. Approximately 85-90% of labours will be locally hired. It is

expected that only 10-15% (55 nos.) of skilled labours and unskilled labours may come from outside the Dhanbad city. The Labour camp shall be setup indicatively for 55 nos. of labour and will be approximately 1 acre of government land. Employer may provide land for constructing labour camp. However, in case of non availability of land contractor shall be reimbursed the actual rate incurred on accommodating their labour as per prevailing corporation rates. Guidelines for setting up of labour camp have been provided in Annexure IV.

2.4.4 Operation and Maintenance

52. Drains will be so designed their shape and slope are retained in the designed manner during their life time. It will be designed to ensure that the drains retain their full cross section, particularly for the monsoon. The system of maintenance can be classified into following three categories:
    - Continuous regular maintenance.
    - Periodical maintenance.
    - Special maintenance/Repairs for improvement.

53. The extent of these repairs depends upon location of the drain, nature of nearby habitation and cross storm water drain structures. Garbage, solid waste and road cleanings enter the drain resulting in silting and solid crustation of extraneous material making the maintenance difficult. Periodical inspection and maintenance of drains is very much necessary as failure of drains may occur more due to deficiency in maintenance rather than defect in design. The principal activities may be:
    - De-silting.
    - Cleaning of obstruction, debris and blockage.
    - Repairing of lining immediately at the commencement of damage or deterioration.

54. Regular attention and continuous action are important aspects of maintenance programmes. It is very essential that maintenance units have all the 'as built' drawings of existing drains showing all technical details on ground. The drain should be identified by suitable numbering with proper chainage. It should be ensured that works are maintained as per details shown in the inventory prepared just after completion of the storm water drain scheme.

55. The cleaning routine should clearly indicate the work to be done, the frequency for that work, the equipment and labour to be used and most important, the safety measure and equipment required. The cleaning is required for all the elements namely, the kerb channel, bell mouth, the pipe, grit chamber/inspection chamber and the drain. Though it is not practicable to assign identical frequencies for each element

as a routine for each area, it should be such to ensure that the various elements are cleaned before the drain gets blocked. For different localities, it may be based on local experience.

56. It is a common practice that all the drains shall be de-silted thoroughly before onset of monsoon. All kutcha drains require dressing and deepening before monsoon. It is also essential that all the drains are in a state of repair and re-grading, reshaping or profile correction, wherever required is completed well before the onset of monsoon. In case of pipe drains, if it is not possible to de-silt it manually, suitable mechanical devices shall be employed. Outfall structures and the cross-storm water drain structures also require similar treatment.

57. During the rains the exit and entry point of water will be observed for the presence of undesirable collection of rubbish, polythene/paper bags blocking the passage of water, and in every way ensuring free, unobstructed flow of rain water. The condition of road camber also will be observed. During rains, especially after heavy showers, all cross-storm water drain structure shall be inspected to observe any blockage due to debris, log of wood and other such materials. Necessary corrective measures shall be taken immediately after rains. Missing manhole covers and broken covers are also required to be replaced/repaired on priority basis to avoid accidents.

3 LEGAL & REGULATORY FRAMEWORKAND PROJECT CATEGORIZATION

58. This chapter details out the policy, legal and institutional framework under the ambit of which the ESIA was undertaken. Further, this chapter also reviews the national laws relevant to the ESIA. Infrastructure development activities such as water supply project may pose critical impacts on the environment, largely from two perspectives. Firstly, the direct effects of construction/improvement which results in disturbance on environmental and social systems. Secondly, the economic activities which are created in the post-construction phase which have both negative and positive impacts on the environment and social setting of the nearby areas. Considering the severe implications, there is a need to manage the environmental and social effects under a legal framework both at national and state level.

3.1 APPLICABLE NATIONAL & STATE REGULATIONS

59. An overview of the applicable environmental regulations for this project is provided in the Table 4below:

Table 4: Applicable Environmental Regulations of GoI and GoJ

S.No	Act/Rules	Purpose	Applicable Yes/ No	Reason for Applicability/ Non-Applicability	Authority
	Environmental Regulations				
1.	Environment Protection Act-1986 The Environment (Protection) Rules, 1986	To protect and improve the overall environment.	Yes	As most environmental notifications, rules and schedules in India are issued under this Act, an Environmental Statement needs to be submitted annually by the entity to whom Consent to Establish and Consent to Operate is being granted by the State Pollution Control Board.	Ministry of Environment and Forests, Government of India (MoEF&CC), Govt. of India (GoI), Central Pollution Control Board (CPCB), Jharkhand State Pollution Control Board (JSPCB)
2.	Air (Prevention and Control of Pollution) Act, 1981 and Air (Prevention and Control of Pollution) Rules, 1982	To control air pollution by controlling emission of air pollutants, as per the prescribed Standards.	Yes	This act will be applicable during construction. Applicable for establishment of batching plant and utilization of diesel generator sets.	JSPCB
3.	Water Prevention and Control of Pollution) Act, 1974- Water (Prevention and Control of Pollution) Rules, 1975	To control water pollution by controlling discharge of pollutants as per the prescribed Standards.	Yes	This act will be applicable during construction for batching plant. Under this law, it is mandatory to obtain consent from JPCB for any discharge of effluents.	JSPCB

S.No	Act/Rules	Purpose	Applicable Yes/ No	Reason for Applicability/ Non-Applicability	Authority
4.	The Forest (Conservation) Act,1980	To check deforestation by restricting conversion of forested areas into non-forested areas.	No	There is no diversion of forest land for non-forest activities i.e. forest land required for any of the projects.	Forest Department, State Government and MoEF&CC
5.	Wild Life (Protection) Act, 1972	To protect wildlife through National Parks and Sanctuaries.	No	The proposed project is not located within, and in the buffer zone of protected areas.	Chief Conservator Wildlife, Wildlife Wing, State Forest Department and MoEF&CC, GoI
6.	Environmental Impact Assessment (EIA) Notification 2006 Amendment S.O. 3999(E) dated December 2016	Sets out the procedure of conducting EIA for projects and activities covered under the Notification to obtain Environmental Clearance.	No	Storm Water Drainage Project do not fall under this regulation and projects of this category do not require prior environmental clearance.	MoEF&CC
7.	Solid Waste (Handling and Management) Rules, 2016	Lays down the methods of handling Municipal Solid Waste (MSW) and its scientific disposal.	Yes	The provisions will be applicable to the labour camp that will be setup for the sub-projects. The labour camp will follow solid waste management practices.	JSPCB
8.	Construction and Demolition Waste Management Rules, 2016	Every waste generator shall prima-facie be responsible for collection, segregation of concrete, soil and others. Also storage of construction and demolition waste generated and deposition to	Yes	Applicable as construction waste will be generated during the construction phase.	JSPCB

S.No	Act/Rules	Purpose	Applicable Yes/ No	Reason for Applicability/ Non-Applicability	Authority
		collection centre or handover to authorised processing facilities.			
9.	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.	Stipulates the method of segregating, storing, managing, and disposing hazardous and other wastes regulated under the Rules.	Yes	Applicable to the hazardous waste (waste oil from diesel generator sets, oil soaked cotton, used oil filters) generated during construction and operational phases.	JSPCB
10.	Biological Diversity Act 2002 and Biological Diversity Rules 2004	The Biological Diversity Act, which came into force in February 2003, aims to promote conservation, sustainable use and equitable sharing of benefits of India's biodiversity resources. It provides for establishment of a National Biodiversity Authority at national level, State Biodiversity Boards at state level and Biodiversity Management Committees at the level of Panchayats and Municipalities	No	The project known is not located in proximity to any ecologically sensitive areas.	Forest Department, State Government and Ministry of Environment and Forests,
11.	The Noise Pollution (Regulation and Control) Rules, 2000	The standards for noise for day and night have been promulgated by the MoEF&CC for various land uses.	Yes	Applicable to all noise generating construction activities and construction equipment deployed at worksite.	JSPCB
12.	Ancient Monuments and	Conservation ofcultural and historicalremains found in India.	No	The project is not in proximity to any Ancient Monument, declared	Archaeological Dept. GoI, Indian Heritage Society

S.No	Act/Rules	Purpose	Applicable Yes/ No	Reason for Applicability/ Non-Applicability	Authority
	Archaeological Sites and Remains Act, 1958			protected under the act.	and Indian National Trust for Art and Culture Heritage (INTACH)
13.	Public Liability and Insurance Act, 1991	Protection from hazardous materials and accidents.	Yes	As hazardous material may be stored by the contractor during construction phase.	JSPCB
14.	Eco-sensitive Zone Notifications (ECZ)	The activities in areas around Wildlife Sanctuaries and National Parks are regulated from the perspective of conservation of wildlife.	No	The current project is not located in the ESZ.	Monitoring Committee for ESZ in the State
15.	The Manufacture, Storage and Import of Hazardous Chemical Rules, 1989	It provides measures, regulations and controls to reduce environmental, safety and health risks. While manufacturing, handling and storage of hazardous chemicals.	Yes	Applicable as during construction phase, projects may have to store hazardous chemicals at site.	JSPCB
16.	Jharkhand Minor Mineral and concession Rules	Regulates prospecting of minerals including minor minerals such as building stones, gravel, ordinary clay, and ordinary sand.	Yes	Building materials such as sand, soils, aggregate would may be obtained from licensed quarries and areas.	District Collector State Department of Mining
17.	Bio Medical Waste (Management & Handling) Rules 1998	The rules lays down the method of collection of hospitalwaste, its transportation and disposal based on scientific methods and applicable to Dhanbad Municipal corporation .	Yes	All medical waste from the labour camps, though primarily first aid related care would need to observe the BMW rules for disposal.	JPCB

S.No	Act/Rules	Purpose	Applicable Yes/ No	Reason for Applicability/ Non-Applicability	Authority
18.	Draft Faecal sludge and Septage management policy, 2017	The overall goal of this policy is to transform Urban areas into community-driven, totally sanitized, healthy and liveable cities and towns.	yes	The FSSM Policy sets the context, priorities, and direction for, and to facilitate, state-wide implementation of FSSM services in all ULBs such that safe and sustainable sanitation becomes a reality for all in each and every household, street, town and city	Urban Development & Housing Department
	Occupational Health & Safety				
19.	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	It regulates the employment and conditions of service for building and other construction workers and also provides for their safety, health and welfare.	Yes	This is applicable as the construction works will employ 10 or more workers.	District Labour Commissioner and Buildings Inspector
20.	Central Motor Vehicle Act, 1988	To check vehicular air and noise pollution.	Yes	This rule is applicable for vehicles deployed in construction activities.	Motor Vehicle Department
21.	Explosive Act, 1984	Safe transportation, Storage and use of explosive materials.	Yes	Applicable as the project require transporting and storing diesel, Oil and lubricants etc.	Chief Controller of Explosives
22.	Gas Cylinder Rules, 2016	Stipulates conditions on import, transport, storage, use, filling and possession of any compressed gas cylinders so as to reduce associated risks and hazards to the environment, health and safety.	Yes	Applicable as oxygen or oxyacetylene gas will be used for cutting during construction activities. LPG cylinders may also be used.	Chief Controller of Explosives

S.No	Act/Rules	Purpose	Applicable Yes/ No	Reason for Applicability/ Non-Applicability	Authority
	Labour Welfare				
23.	Workmen Compensation Act, 1923	It provides regulation for payment of compensation by employers to their employees for injury by accident i.e. personal injury or occupational disease.	Yes	Construction workers will be involved in the project.	District Labour Commissioner
24.	Inter-state Migrant Workers Act, 1979	It protects workers whose services are requisitioned outside their native states in India Contractor who employs or who employed five or more Inter-State migrant workmen is required to obtain registration under this act	Yes	Interstate migrant workers may be involved in the projects.	District Labour Commissioner
25.	The Child Labour (Prohibition & Regulation) Amendment Act, 2016	It prohibits employment of children in certain specified hazardous occupations, processes and regulates the working conditions in others.	Yes	Construction workers will be involved in the project.	District Labour Commissioner
26.	Minimum Wages Act, 1948	Payment of minimum rate of wages as fixed and periodically revised by the State Government.	Yes	Construction/daily wage workers will be involved in the projects.	District Labour Commissioner
27.	Building and Other Construction Workers Welfare Cess Act, 1996	An Act to provide for the levy and collection of Cess on the cost of construction incurred by employers.	Yes	Construction workers will be involved in the project.	District Labour Commissioner
28.	The Prohibition of	The broad objectives of the	Yes	Drains would need to be	Ministry of law

S.No	Act/Rules	Purpose	Applicable Yes/ No	Reason for Applicability/ Non-Applicability	Authority
	Employment as Manual Scavengers and their Rehabilitation Act 2013 or M.S. Act 2013 & Rules-2013 called as "The Prohibition of Employment as Manual Scavengers and their Rehabilitation Rules 2013" or "M.S. Rules 2013".	act are to prohibit the employment of manual scavengers and the hazardous manual cleaning of drains, sewer and septic tanks, and to maintain a survey of manual scavengers and their rehabilitation		desilted in construction and operational phase of the project. which would need to be conducted using mechanical means, no manual scavenging will be supported. The project is only stormwater drainage however, considering the spirit of the Act, to avoid manual cleaning of the chambers and to facilitatemaintenance by machineries, inspection doors are provided.	and Justice, monitored by ULB
	Resettlement and Rehabilitation				
29.	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act -2013 and Jharkhand Right to Fair Compensatio	Fair compensation for acquisition of: (i) Land and other immovable assets; (ii) Resettlement of displaced population due to LA and (iii) Economic rehabilitation of all those who are affected due to land acquisition. The Act also covers the Lease Holders, Share	No	No land acquisition will be undertaken for the project.	Revenue Department of respective under the District Collector.

S.No	Act/Rules	Purpose	Applicable Yes/ No	Reason for Applicability/ Non-Applicability	Authority
	n and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules-2015	Croppers and Tenant.			
30.	The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act	Grants legal recognition to the rights of traditional forest dwelling communities.	No	The project does not have forest dwellers and, no forest land will be used for the infrastructure components. There is also no change in the character of the land.	Ministry of Tribal Affaires, GoI and Department of Tribal Welfare of various State Government and Panchayati Raj
31.	Panchayats (Extension to Scheduled Areas) Act, 1996	Ensuring self-governance through traditional Gram Sabha for people living in the scheduled areas of India.	No	There is no scope of Land Acquisition. The impacts are confined within the Right of Way. There is also no change in the character of the land.	State Government through Gram Sabha.
32.	The Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014.Jharkhand street vendor (Protection of	The Act aims to protect the rights of urban street vendors and to regulate street vending activities. It provides for Survey of street vendors and protection from eviction or relocation; issuance of certificate for vending; provides for rights and obligations of street vendors; development of street	Yes	The projects are likely to impact many street vendors, Kiosk and hawkers.	ULBs and State Government.

S.No	Act/Rules	Purpose	Applicable Yes/ No	Reason for Applicability/ Non-Applicability	Authority
	livelihood and regulation of street vending), Rules 2014.	vending plans; organizing capacity building programmes to enable the street vendors to exercise the rights contemplated under this Act;			
33.	Chota Nagpur Tenancy Act, 1908.	The Act provides for rights of tribal communities/indigenous people in the State of Chota Nagpur plateau area. The basic objective of the Act was to restrict the transfer of tribal land to non-tribal. But in case of development project, Section 46 allows for transfer of land only with permission of District Commissioner	No	There is no scope of Land Acquisition. The impacts are confined to existing Right of Way.	Land Revenue Department, District Commissioner

3.2 WORLD BANK SAFEGUARD POLICIES

60. The objective of the World Bank's environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment during the development process. These policies provide guidelines for bank and borrower staff in identification, preparation, and implementation of programs and projects. Safeguard policies provides a platform for participation of stakeholders in project design, and are an important instrument for building ownership among local populations (World Bank, 2006). The applicable safeguard policies and their applicability are presented in the **Table 8**below.

Table 5: Applicability of WB Safeguard Policies for the Project

WB Safe Guard Policy	Key Features	Applicability
OP 4.01- Environmental Assessment	▶ Potential environmental consequences of projects are identified early in the project cycle. ▶ Environment Assessment (EAs) and mitigation plans required for projects with significant environmental impacts or involuntary resettlement. ▶ EAs to include analysis of alternative designs and sites, or consideration of "no option". ▶ Requires public participation and information disclosure before Board approval.	Applicable. The policy is applicable because there are environmental impacts associated with the construction of the drainage infrastructure. In this regard, a comprehensive Environmental and Social Impact Assessment has been undertaken by an independent consultant hired by JUIDCo address all anticipated impacts through drainage sub project such that they are avoided, minimised and mitigated. And, establish a detailed Environment and Social Management Plan that will provide guidelines for environmental management, monitoring, and capacity building of the implementing agencies.
OP 4.11 Physical and Cultural Properties	▶ Purpose is to assist in the preservation of cultural property, such as sites having archaeological, paleontological, historical, religious and unique cultural values. ▶ Generally, seeks to assist in their preservation and avoid their elimination. Discourages financing of projects that may damage cultural property.	Applicable No cultural heritage areas will be removed or destroyed due to project activities, and construction activities of the project will not impact any physical and cultural properties. A clause for chance finds procedures will be included in the contractor's documents in case any chance finds will be discovered during excavation activities, they will be notified to Department of Archaeology.

WB Safe Guard Policy	Key Features	Applicability
OP 4.12 -Involuntary Resettlement	▶ Implemented in projects which displaces people. ▶ Requires public participation in resettlement planning as part of Social Assessment (SA) for project. ▶ Identification of "those who have formal legal rights to land (including customary and traditional rights recognized under the laws of the country. ▶ Intended to restore or improve income earning capacity of displaced populations in addition to their resettlement. ▶ Intended to provide compensation for lost assets and other resettlement assistance to "those who have no recognizable legal right or claim to the land they are occupying". ▶ Some project interventions are likely to trigger issues such as those related to land acquisition, loss of assets and impact on livelihood sources. Identification of any potential impacts and mitigation measures to address likely impacts is proposed. ▶ Transfer of Government land under different tenure systems could trigger adverse impacts such as loss of access to natural resources – firewood, fodder, water etc. and loss of sources of income/ livelihood/ shelter/ homestead.	Applicable, as the project has a permanent and temporary impact on the vendors, all non-title holders, during the construction period.

3.3 IFC EHS GUIDELINE

61. **Table 6** presents the IFC EHS guideline applicable for the project.

Table 6: IFC EHS guideline applicable to project

Safeguard Policies	Objective	Applicability	Safeguard
IFC: General EHS Guidelines	The (EHS) guidelines contain performance level and measures on environmental, occupational health and safety for construction, community health and safety to be followed during the construction, operation and decommissioning phases.	The sub-project will adhere to the performance level and measures provided in the IFC general EHS guidelines, Mitigation measures proposed including OHS management plan (Annex VI) has been prepared using the EHS guidelines, and to provide the contractor with the guidance in implementing the required measures.	The sub-projects will adhere to the performance level and measures provided in the IFC general EHS guidelines, Environmental quality standards as per IFC general EHS guidelines which are applicable to JMDP sub-projects have been presented in Annexure II
IFC Workers' Accommodation: Processes and Standards: Guidance Note	This Guidance Note addresses the processes and standards that should be applied to the provision of workers' accommodation	Applicable, as the sub-projects will involve setting up of labour camp during construction phase.	The plan to be followed for setting up of the labour camp has been provided in Annexure IV. This plan is prepared in reference to the Workers accommodation: processes and standards (A guidance note by IFC and EBRD). The objective of this plan in Annex IV is to provide guidance to the contractor or other agency involved in setting up of the construction and labour camp for keeping the health & Safety of workers and impacts of setting up such camps on the local community in consideration while developing and establishing such camp.

3.4 PROJECT CATEGORIZATION

62. As outlined in the ESMF, JUIDCO will categorize the projects into different categories – E1, E2 and E3 on basis of environmental screening and S-1, S-2 & S-3 based on social screening of the project which is linked to severity of impacts and regulatory requirements.

Table 7: Environmental& Social Categorization of Projects

Category	Description	Type of Project	Actions
Environmental			
E-2	Moderate environmental impacts largely reversible and site-specific, temporary	▶ Project is categorized as E-2, if its potential adverse environmental impacts are less severe than those of E-1 projects ▶ E2 projects are expected to have only moderate level of environmental impacts which are mainly temporary, experienced in the construction stage.	Moderate environmental impacts largely reversible and site-specific, temporary
Social			
S-1	Significant with adverse irreversible social impacts	▶ If it involves acquisition of private land and affects more than 200 persons or 50 households ▶ If it involves physical displacement.	Significant with adverse irreversible social impacts
S-2	Moderate with minimized social impacts	▶ If impacts are limited to less than 200 persons or about 50 household of minor nature	Moderate with minimized social impacts
S-3	Minor with direct or indirect social impacts.	▶ No private land acquisition or no loss to PAPs.	Minor with direct or indirect social impacts.

63. As per the ESMF of JMDP, Dhanbad SWD has been categorized as E-2 and S-1. The following environmental impacts are anticipated for the storm water drainage project package, as outlined in the ESMF.

During construction phase

64. The major impacts of the project are expected to be during the construction phaseleading to increase in air quality deterioration, and increase in ambient noise levels, traffic diversion and utility shifting, access to private properties, and disposal of excavated silt from the drains.

i. Impact on public private properties and other sensitive receptors along the storm water drains

ii. Changes in local drainage patterns (temporary as the drain does not alter the natural drainage pattern)
iii. Disruption to local traffic (temporary and reversible)
iv. Impacts on land use and landscape due to site clearing and ground levelling (temporary and minor)
v. Impacts on soil environment due to excavation activities and movement of heavy machinery and excavator (temporary and reversible)
vi. Incremental increase in ambient air quality, noise levels and dust (temporary and minor reversible)
vii. In addition, Dhanbad city is crowded and has heavy traffic movements which will be disrupted during the construction phase.
viii. Without proper mitigation/ control measures possibility of the following impacts:
ix. Contamination of soil, surface and ground water from oil, diesel spills
x. Excavated silt from existing drains unless disposed appropriately will have public health impacts
xi. The project involves temporary loss of livelihood and no land acquisition is involved. Environment & Social screening checklist undertaken by JUIDCO PMU & PIU has been presented in Annexure –I.

During operation phase

65. The project will reduce water logging problem in the city. Build aesthetic and hygienic conditions in the city. Proper channelization of runoff to nearest water bodies.Dumping of solid waste in the drains may impact flow, affecting community residing in those areas.
66. In the absence of inadequate management /cleaning of drains by ULB, stagnation of water may take place, which may lead to mosquito breeding grounds and other water borne diseases which may affect community health and aesthetics of the area.

3.4.1 E& S permissions required

67. **Pre-construction stage**

i. All clearance required from other departments and Environmental aspects shall be ensured and made available before start of work.
ii. Necessary clearances would be required from National Highway authority of India for national highway crossings, from State Highway Authority of Jharkhand for state highway crossings and PWD for roads which is under their purview.
iii. For trees identified for cutting, permission will be obtained from the Deputy Commissioner/ DFO prior to the commencement of work.
iv. NOC for utility shifting from concerned departments

v. Approved Land Acquisition Plan and R&R Plan from District Collector, where land is being acquired, structures are affected etc.

68. **Construction Stage**

i. Labour license from Department of Labour

ii. Contractor who employs or who employed five or more Inter-State migrant workmen need to obtain registration of interstate workmen migrant license from labour commissioner

iii. Approval from regulatory authority for withdrawal of water for construction purpose

iv. PUC for construction vehicles from Motor Vehicle Department, Jharkhand

v. NOC from JSPCB for Storage, handling and transport of hazardous material

vi. NOC for transporting and storing diesel, oil and lubricants from Chief Controller of Explosives

vii. CTE & CTO from JSPCB for batching plant, hot mix plant, DG set(>15 kVa)

4 ANALYSIS OF ALTERNATIVES

69. Due to rapid thrust of population and urbanization of Dhanbad, the city witnessed unplanned and haphazard infrastructural development leading to obstruction and change in natural drainage pattern of the region. This has resulted in water logging and localized flooding in the low-lying areas of the city during rainy season.

    As per the DPR shared by JUIDCO, absence of appropriate storm water drainage system in Dhanbad town has been leading to floods and water logging causing considerable inconvenience, health hazards and economic losses. Improved storm water drainage system shall be beneficial as storm water of Dhanbad town will be drained to river and local ponds. Improved storm water drainage system may also bring solution to other related issues pertaining to sewerage, sanitation and solid waste, thus ensuring improved environmental and social conditions for local people of Dhanbad.

70. As part of this study, a detailed environmental and social analysis of the two project scenarios i.e. 'with project' and 'no project' is presented below in **Table 11:**

Table 8: Overview of positive and negative impacts in two scenarios: (i) with project and (ii) "No-project"

With Project Impacts		"No-Project" Impacts	
Positive	**Negative**	**Positive**	**Negative**
► Re-designed storm water drainage infrastructure will result into improved management of storm water, thereby preventing floods. ► The project will result into direct and indirect creation of employment during execution of project. ► The proposed drainage network is consisting of covers which avoids intervention of solid waste/garbage into the drain. ► Water logging will be reduced due to the proposed storm water drainage network.	► Minor changes in soil quality pattern. ► Temporary Loss of livelihood. ► Short term increase in dust due to earth work during construction at micro-level. ► Short term risk to community health and safety, which can be mitigated with safety features ► Limited access or disrupted normal operations in the area ► During construction phase, community can face inconvenience during festive season. ►	► No loss of access routes ► No Temporary loss of livelihood ►	► Absence of a proper drainage system causes water logging, thereby providing a breeding ground for disease causing vectors which in turn impacts public health. ► Currently, Dhanbad does not have a proper drainage system, so storm water mixes with untreated domestic waste water and flows into surface water bodies, thereby deteriorating the water quality. ► Un-aesthetic and unhygienic conditions will prevail in Dhanbad ► Rejuvenation of pond water will be restricted ► Ground water contamination due to water stagnation .

71. From the above table, it can be concluded that the proposed project will have temporary disruptions and impacts, however the larger environmental value of the project greatly outweighs the temporary negative social and environmental impacts that will be generated due to project activity. The temporary impacts can be managed through appropriate mitigation measures. The proposed project is expected to benefit the Dhanbad Town, as it will help in achieving better sanitary conditions in the town.

Analysis of Alternatives

72. The frequency of storm water for which the system is to be designed depends on the importance of the area to be drained. The suggested frequency of flooding in the different areas as per the CPHEEO Manual is as follows

- Peripheral areas twice a year
- Central and Comparatively high priced areas once a year
- Commercial and high priced areas once in 2 years

73. Different alternatives considering the design parameters

- Return period – 5 years
- Return period – 2 years
- Return Period – 1 year

74. Return period of 2& 5 years was resulting in increase in land beyond the available RoW, which was leading to land acquisition .To avoid land acquisition and as the project area is primarily urban area comprising of residential areas, a flood frequency of once in a year has been considered for the design .

5 ENVIRONMENTAL BASELINE

75. This section presents the existing environmental and socio economic baseline status of the study area. The study area for the project was delineated by identifying the project area of influence with a focus on adverse impacts. An area of 100m buffer from either side of the centre line of storm water drain (storm water line and associated infrastructure) alignment was identified as these project areas of influence (10m direct area of influence and 100m indirect area of influence). Baseline studies have been carried out for this Area of Influence (AoI).

5.1 PROJECT AREA OF INFLUENCE

76. The project area of influence has been determined based on nature of work and area in which the work is to be executed considering following parameters:

a. Air: ımpacts on air quality will be experienced as a result of gaseous emissions from construction equipment and dust (due to excavation and concreting) during construction phase of the project within a 50 m distance from construction sites. Residential and commercial structures present within 100 m of the proposed storm water drain network and motorists on the road will be directly affected.

b. Water: The permanent and temporary watercourses present within 50 m of the proposed project will be potentially affected by the project due to surface runoffs during construction phase.

c. Soil: Impacts on soil will be limited to the construction corridor of 30-50 m width which will be used for construction work.

d. Noise: As noise attenuates rapidly with distance, the impact of noise generated by use of construction equipment, mainly for drilling, will be restricted to the immediate vicinity of the construction corridor, estimated to be about 100m.

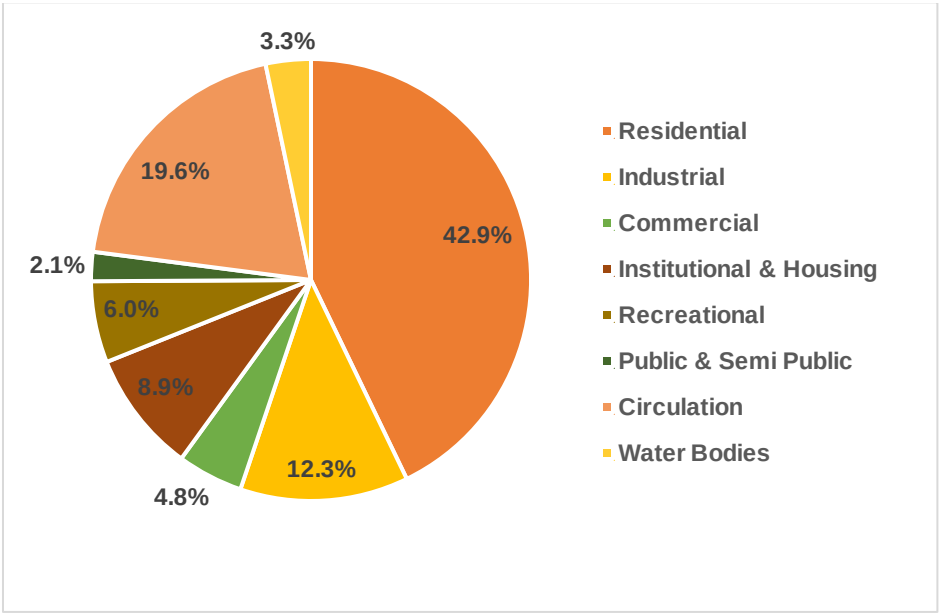
e. Vegetation / Flora/ Trees: Area of impact will be limited to the footprint of the construction area.

5.2 LAND ENVIRONMENT

5.2.1 Land Use

77. Dhanbad Municipal Corporation approximately covers a total area of 5,600 hectares. The residential areas in Dhanbad constitute about 44.9 percent followed by Circulation and Industrial areas. The coverage of storm water drains is about 16.5% (as compared to road length). **Figure 9**below presents the breakup of land use of Dhanbad Municipal Corporation.

Figure 9: Land Use break up of DMC

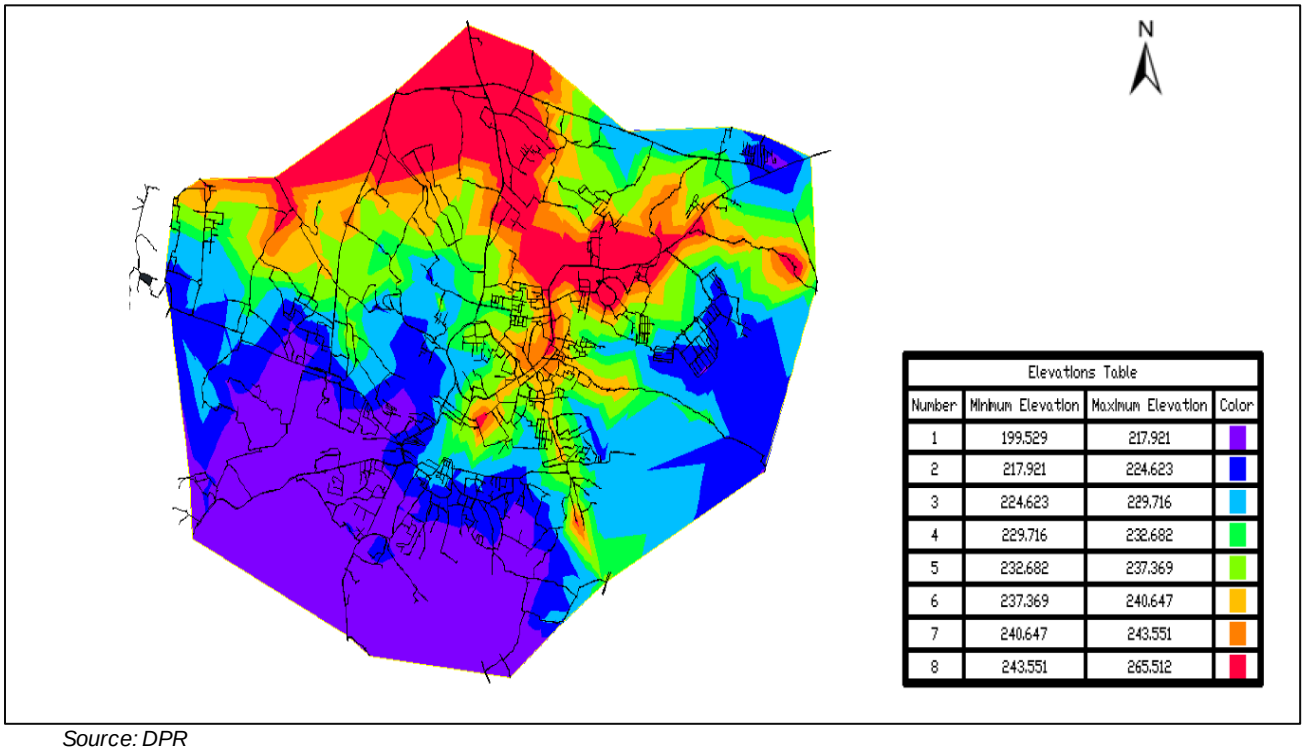


Source: Draft master plan, DMC (As on March 31, 2017)

5.2.2 Topography

78. Dhanbad is situated around National Highway-2 (NH-2) and National Highway-32 (NH-32). It is famous for its coal mining and has some of the largest mines in India. The town slopes from Northwest to Southeast, with levels varying from 265.5m to 125m. Figure 8 presents the DEM map of DMC.

Figure 10: DEM Map of Dhanbad



Source: DPR

5.2.3 Geology & Geomorphology

79. Major portion of Dhanbad Municipal Corporation area is covered by metamorphic rocks. The study area includes rock types of ChotaNagpur granite and gneisses of Achaean age. The main geomorphic features and landforms in DMC area are as follows:

- Alluvial Plains: These are found near the river tracts and consist of gravels, sands, silt, clay etc.
- Pediplain (PM): These are developed over granite gneiss and Meta sediments. High frequencies of lineaments are found. These are found in Gobindpur block and parts of Tundi block.

5.2.4 Hydrogeology

80. Groundwater occurs in the area under unconfined condition in the weathered zones at shallow depths in most of the litho units in the Achaeans and almost all the litho units in the Gondwanas. Groundwater occurs under confined to semi-confined condition where the fractures are deep seated and are unconnected with the top weathered zone. Aquifer geometry- The aquifer can be divided into two zones – shallow and deeper aquifer. The aquifer geometry for shallow and deeper aquifer has been established through hydro geological studies, exploration, and the surface and subsurface geophysical studies in the district covering all geological formations.

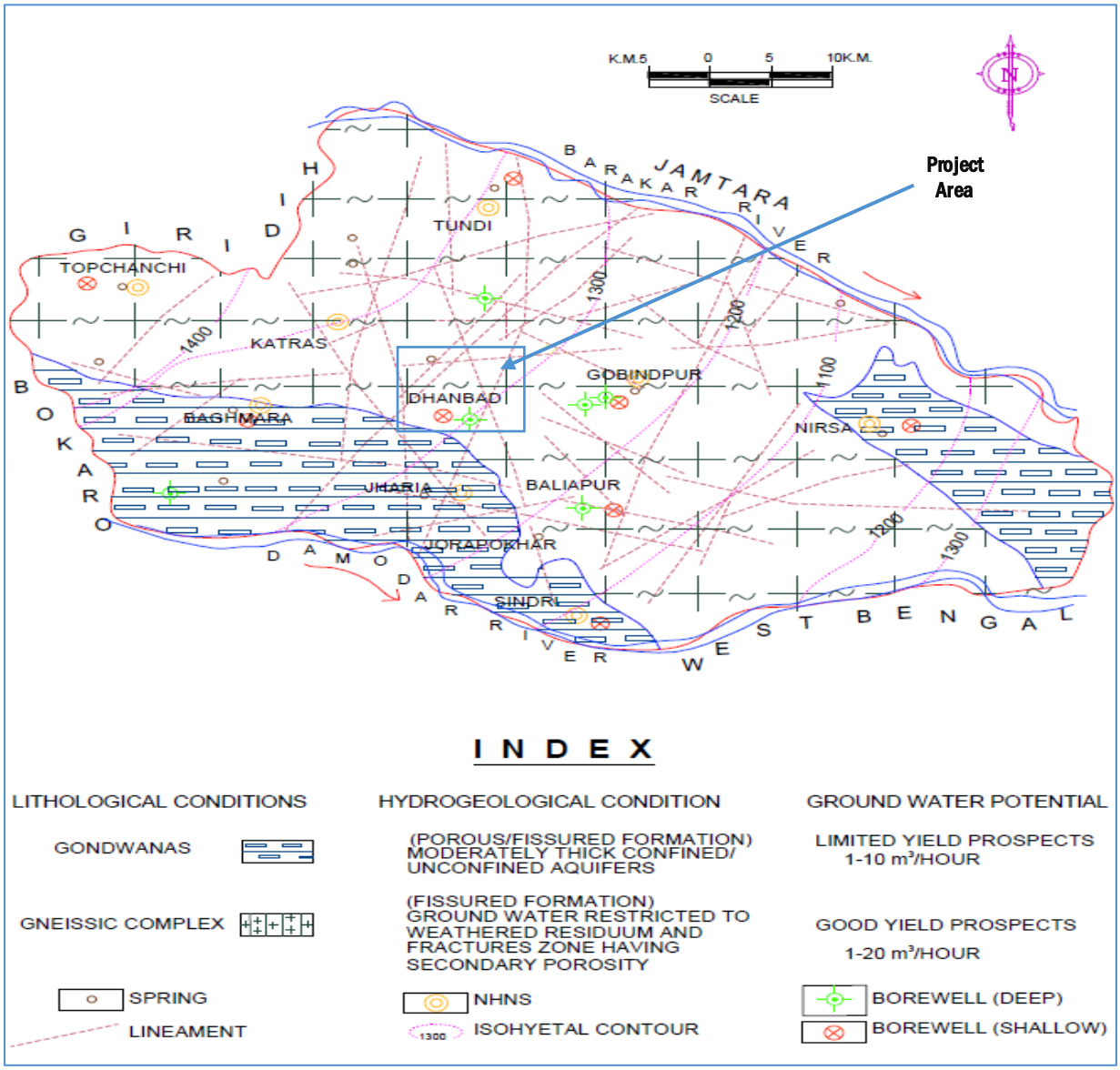
Shallow aquifer The shallow aquifers are being tapped through dug wells, dug cum bore wells or shallow bore wells drilled to the depth of 60 m. The weathered mantle and shallow fractures constitute the shallow aquifers. The thickness of weathered mantle varies from 5 to 25 MBGL. The well inventory data suggest that the maximum depth of dug well in granite gneiss and Gondwana is 17 m and 25 m respectively. Exploration in granite gneiss indicates that shallow fractures are less productive, as a result many dug wells and hand pumps dry up during summer.

Deeper aquifers Depths-to-water levels and groundwater conditions: Groundwater conditions in various litho units are usually described under two broad heads as follows:

a. **The porous Formations:** The main members of the porous formations are the Newer and Older alluvium of the recent and sub-recent age. Recent alluvium is found in very thin veneers in topographic depressions along the Damodar River. Insignificant occurrences may also be noticed along Barakar River and in some major tributaries of these two. However, they cannot be considered as potential aquifers.
b. **The Fissured Formations:**Achaeans meta-sedimentary, the granites, intrusive metabasics and the Lower Gondwana sedimentary constitute the productive aquifer. The first three types are consolidated formation and the last one is a semi consolidated formation.

81. Figure 11below presents the Hydrogeological map of Dhanbad district showing the project area.

Figure 11: Hydrogeological map of Dhanbad district



Source: CGWB

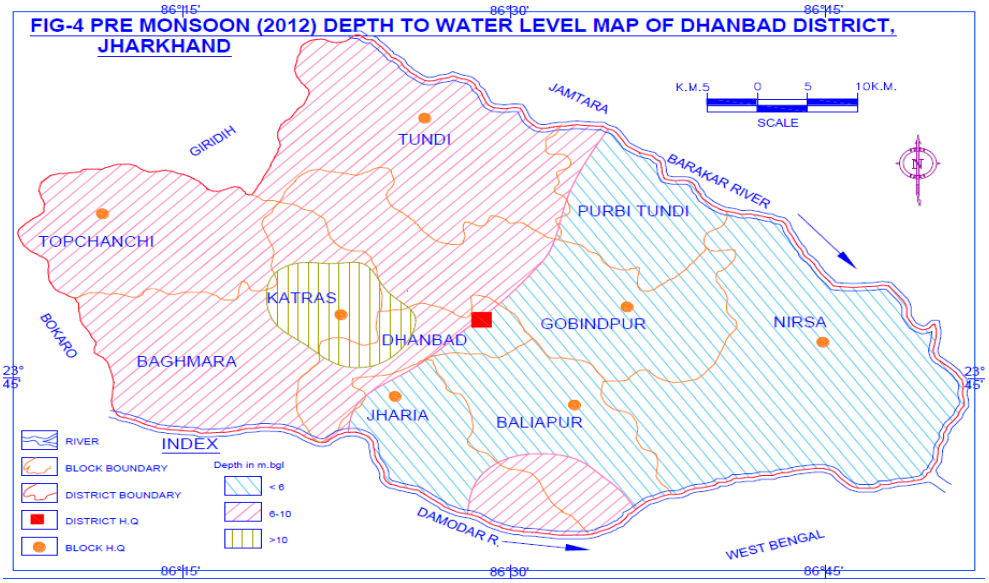
5.2.5 Ground Water Status

82. As per CGWB report of 2012-13, pre-monsoon depths to water level map of dug wells show water level between 1.29-14.60 mbgl Govindpur, area which is 3 km from project site show water level between 8-10 mbgl. The seasonal ground water fluctuation map for dug well data is prepared based on the inventory wells of pre-and post monsoon data. The map depicts that maximum (about 55 percent) area falls under 2-4m range while 20 percent area comes under 4-6m range and 20 percent area under 6-8 m. range while about 5 percent under 0-2 m range.

83. Figure 12andFigure 13presents the pre-monsoon and post monsoon ground water depth of Dhanbad District.From the ground water point of view, all the blocks of the

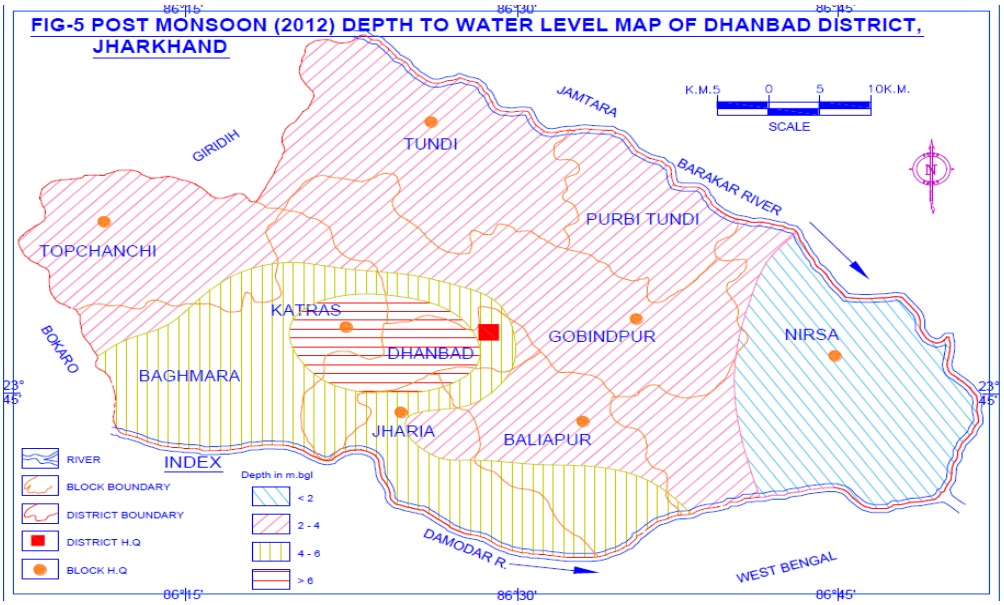
district are under safe category and so far, no blocks have been notified by Central Ground Water Authority (CGWA).

Figure 12:Pre-monsoon ground water depth of Dhanbad



Source: CGWB

Figure 13: Post-monsoon ground water depth of Dhanbad



Source: CGWB

5.2.6 Storm Water Drains

84. The storm water drain system of the district is the part of Damodar sub-basin. All the rivers that originate or flow through the district have an easterly or south easterly course. The Damodar is the most important river with an easterly course for about 125 km. Streams as Jamunia, Katri, and Pusai originate from northern hills of Parasnath and Tundi areas. These flow from N – S to NNW – SSE and meet river Damodar. The

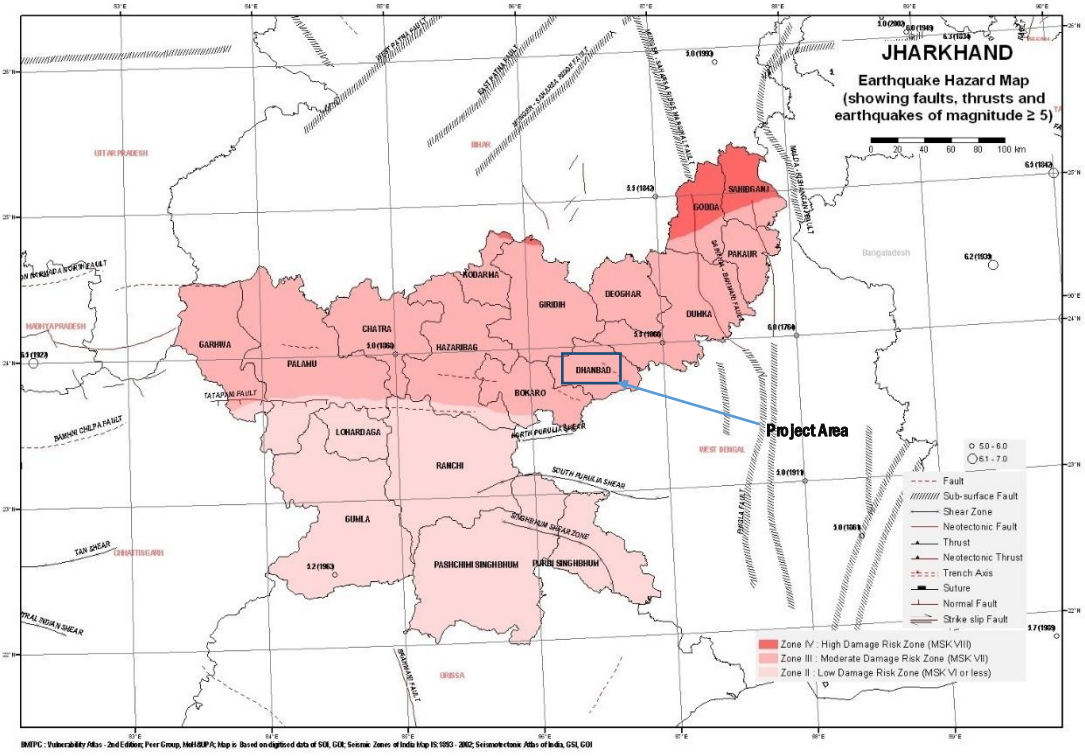
Barakar river is the most important tributary of the Damodar and their confluence marks the eastern border of the district. It receives from the west its only tributary, the Khudia, which takes its rise in the extreme west of the district between the Parasnath and Tundi ranges.

5.3 NATURAL HAZARDS

5.3.1 Seismicity

85. As per the earthquake hazards map of India provided in the Vulnerability Atlas prepared by Building Materials and Technology Promotion Council (BMTPC), Dhanbad District and the surrounding area lies in Zone III – Moderate risk Zone and vulnerable to earthquakes of intensity (MSK VII).

Figure 14: Earthquake Hazard Map



Source: BMTPC

5.3.2 Floods

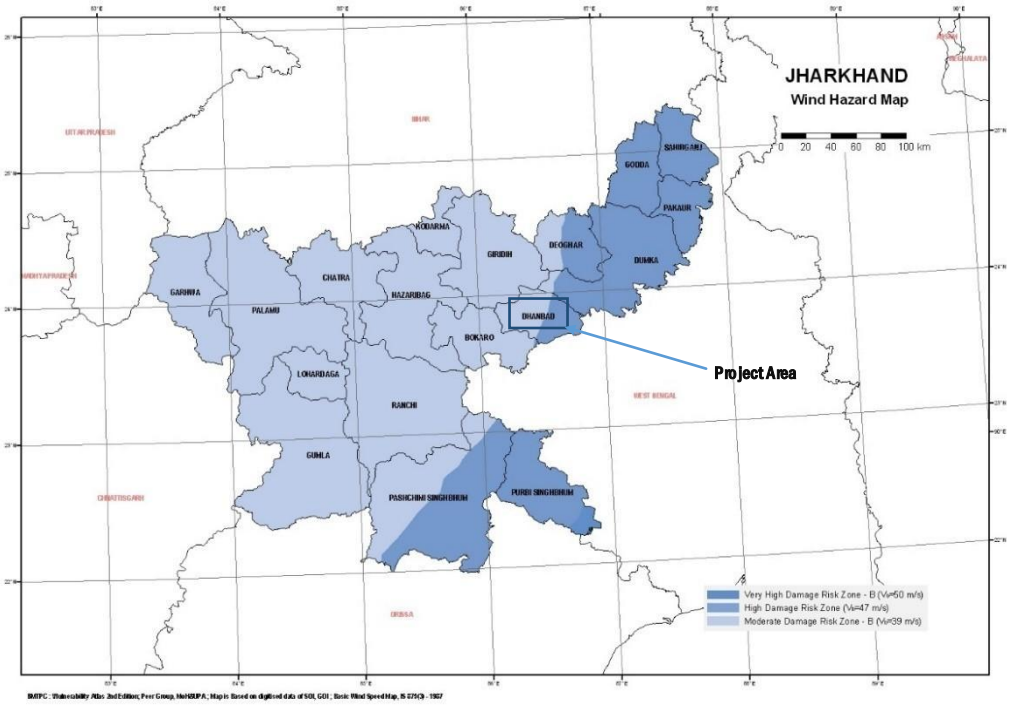
86. As per the Flood Hazard Map of India, BMTPC, Dhanbad district does not fall under area liable to floods. As reported by DMCthe flood prone areas in Dhanbad town are few low-lying area located in Ward No. 25, 26, 28 and 29.

5.3.3 Wind hazard

87. As per Wind Hazard Map of India provided in the Vulnerability Atlas prepared by BMTPC, eastern part of Dhanbad District lies in High Damage Risk Zone – B (Vb=47

m/s) and the western part of the District falls in in Moderate Damage Risk Zone – B (Vb=39 m/s).The seismicity, and wind hazard of the study area has been presented in Figure ***15***

Figure 15: Project area marked on Wind Hazard Map



Source: BMTPC

5.4 Soil Quality

88. Soil samples were collected from study area at six locations during March 2017. The details of the soil sampling locations are described in**Table 9**and presented in **Figure 16.**

Table 9: Soil Sampling Locations

Sl.N	Sampling Locations	Location Code	Geographical Coordinates		Land Use
			Latitude (N)	Longitude (E)	
1	Near Steel Gate	S 1	23.81436111	86.45842	Agricultural Land
2	Memco more	S 2	23.82519444	86.46028	Agricultural Land
3	City centre	S 3	23.80461111	86.42439	Agricultural Land
4	Matkuria temple	S 4	23.78783333	86.40792	Small open land next to Residential complex
5	Housing colony	S 5	23.8055	86.43794	Small open land next to Residential complex
6	Barmasia ground	S 6	23.78363889	86.43978	Small open land next to Residential complex

Note: The soil samples at each location were collected from different depths of 0 to 15 cm (D-1), 15 to 30 cm (D-2), 30 to 60-cm (D-3) and 60 to 100cm (D-4) at each location).Soil sampling locations were chosen based on site sensitivity and prevailing activities within 50m of study area. Samples were collected by hand driven sampling augers from surface at different depths.The samples were packed in dependable, waterproof containers and analysed as per ASTM, USEPA IS: 2720, M.L. Jackson (Soil Chemical Analysis). The sampling and testing carried out in March 2017.

Figure 16: Soil Sampling Locations

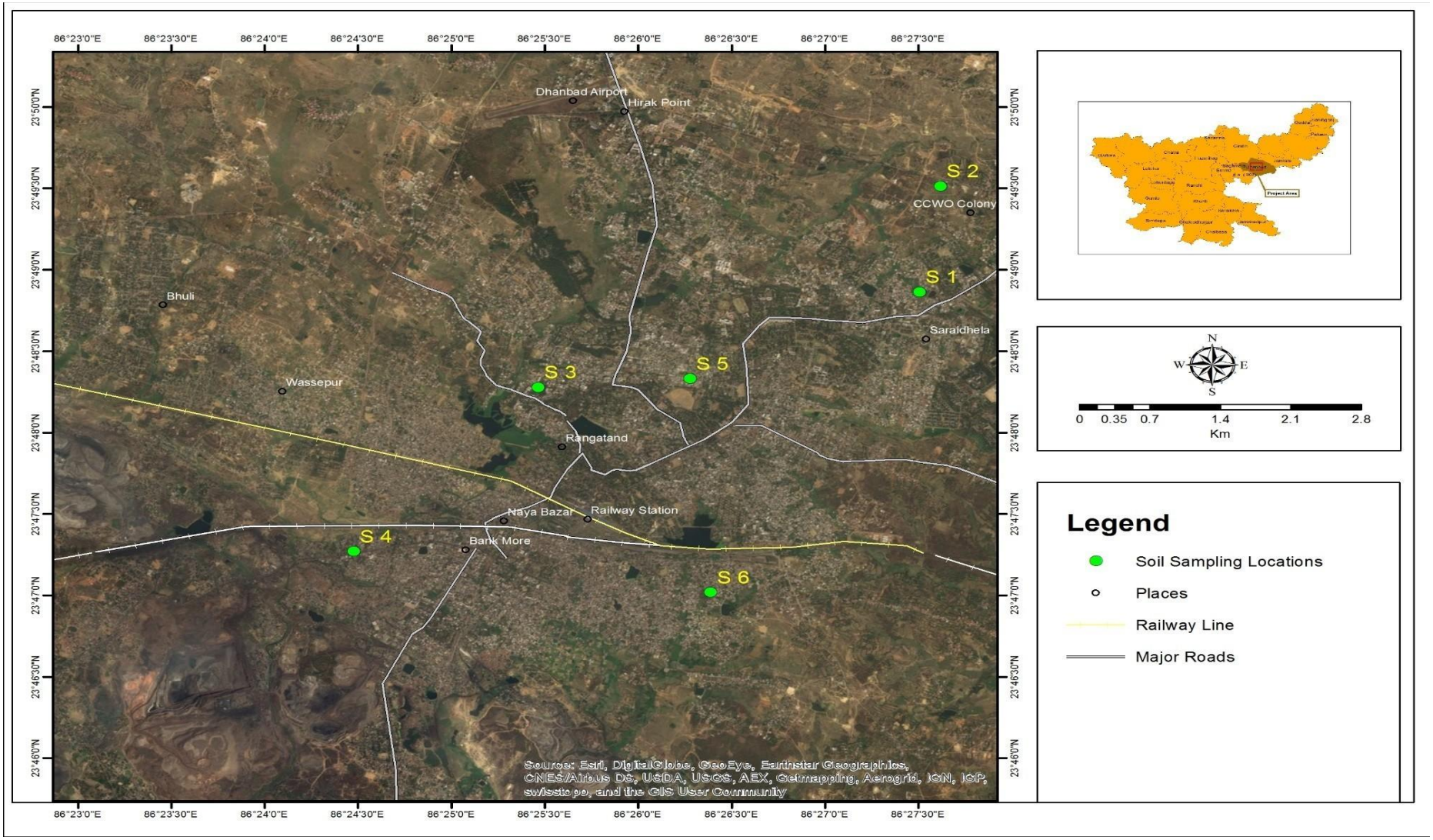


Table 10: Physio-Chemical Characteristics of Soil

Sl. No.	Parameter & Unit		Method	Unit	Sampling Locations					
					S 1	S 2	S 3	S 4	S 5	S 6
1.	Texture	Sand	International pipette method	%	84	69	70	86	82	68
		Silt		%	4.9	3.6	6.9	3.5	5.3	6.5
		Clay		%	11.1	27.4	23.1	10.5	12.7	25.5
2.	Porosity		Stochastics method	%	18.7	15.5	20.6	13.9	11.6	14.5
3.	Bulk Density		Weighing bottle method	g/cm^3	1.9	1.3	1.4	1.4	1.9	1.2
4.	Water holding capacity		Saturation moisture percentage	%	89	72	75	92	88	74
5.	pH		Electrometric method	--	6.8	7.7	6.9	7.9	6.4	6.7
6.	Conductivity		Electrometric method	mho/cm	108	126	143	164	190	135
7.	Magnesium		Titrimetric method	meq/100gm	4.8	5.1	5.2	5.1	7.3	6.3
8.	Calcium		Titrimetric method	meq/100gm	5.8	4.3	6.9	4.5	5.3	4.8
9.	Alkalinity		Titrimetric method	%	11	17	9	9	12	9
10.	Chloride		Mohr's titration method	mg/l	11.9	14.2	13.9	16.3	11.5	10.9
11.	Sodium		Direct air acetylene flame method	ppm	60.7	70.4	60.3	43.5	32.5	56.8
12.	Potassium		Direct air acetylene flame method	ppm	5.1	6.9	5.7	4.9	3.4	5.2
13.	Organic carbon		Walkely & black method	%	0.16	0.41	0.27	0.36	0.72	0.26
14.	SAR		Specific absorption rate	meq/l	26.36	32.47	24.52	19.85	12.95	24.11
15.	Nitrogen		Alkaline permanganate method	Kg/ha	412	298	187	216	312	542
16.	Salinity		Electrometric method	Kg/ha	16.7	29.5	42.5	21.4	32.9	41.7

89. The soil texture of S2, S3 & S6 are sandy clay loamy, S5 falls into sandy loamy and S1 & S4 falls into loamy sand. The clay percentage in samples varied from 10.5% to 27.4%. As per the standard soil classification given in Table 13, soil sample S1& S4 were observed to be slightly acidic, S3, S7 & S8 were observed to be neutral , whereas S2,S5 & S6 were observed to be slightly alkaline.

Table 11: Soil Classification

pH	Classification	Soil Samples
<4.5	Extremely acidic	
4.51-5	Very strong acidic	
5.01-5.5	Strongly acidic	
5.51-6	Moderately acidic	
6.1-6.5	Slightly acidic	S5
6.51-7.3	Neutral	S1, S3 & S6
7.31-7.8	Slightly alkaline	S2
7.81-8.5	Moderately alkaline	S4
8.51-9.00	Strongly alkaline	
>9	Very strongly alkaline	

Source: http://www.esf.edu/pubprog/brochure/soilph/soilph.htm

5.5 AIR ENVIRONMENT

5.5.1 Climate and Micro-meteorology of the Study Area

90. The climate of the study area is classified as tropical monsoon climate with following four main seasons:

- Winter season : January and February
- Pre-monsoon season: March to May
- Monsoon season: June to September
- Post monsoon Season : October to December

Meteorology

91. The secondary data on ambient temperature, atmospheric pressure, relative humidity and wind speed has been analysed based on Indian Meteorological Department (IMD) data for Dhanbad observatory. The same has been summarised in **Table 12and Table 13.**

Table 12: Climatology of Dhanbad: Ambient Air Temperature, Relative Humidity, Vapour Pressure, Wind Speed

Month	Temperature (Mean daily in °C)				Relative Humidity in %		Vapour Pressure (hPa)		Wind Speed
	Max Daily	Min Daily	Highest	Lowest	8:30 hrs	17:30 hrs	8:30 hrs	17:30 hrs	In km/hr
Jan	25.4	6.7	29.0	10.5	65	48	12.0	12.6	5.3
Feb	28.3	13.0	33.4	8.6	57	40	12.4	12.7	6.6
March	33.6	17.6	38.4	13.1	48	32	14.1	13.3	5.8
April	37.9	21.9	42.4	17.5	51	32	19.3	15.9	6.6
May	38.1	23.4	43.4	18.4	64	43	25.8	21.2	6.7
June	35.2	23.9	41.8	20.8	77	65	30.3	28.0	6.8
July	31.7	23.2	35.6	21.3	87	80	31.6	31.3	6.9
August	31.2	23.0	34.2	21.0	88	82	21.3	31.3	6.3
Sept	31.4	22.5	34.5	20.4	85	78	30.1	29.8	6.0
Oct	31.3	19.6	34.1	15.9	75	67	24.4	24.6	4.3
Nov	29.0	15.1	32.1	11.4	65	57	17.1	17.6	3.9
Dec	25.6	10.8	28.9	7.5	64	52	12.7	13.2	4.4
Avg	**31.6**	**18.7**	**44.5**	**6.3**	**69**	**56**	**21.8**	**21.0**	**5.8**

Source: IMD

Table 13: Climatology of Dhanbad: Rainfall, Cloud amount and Weather

Month	Rainfall (mm)			Cloud Amount (Oktas)		Weather Phenomena					
	Monthly Total	Avg. No of rainy days	Max -24 hourly	All Clouds		Average Number of days with					
				8:30 hrs	17:30 hrs	PPT(0.33 mm or more)	Hail	Thunder	Fog	Dust Storm	Squall
Jan	11.9	1.2	42.9	1.0	1.1	1.8	0.0	0.4	0.0	0.0	0.0
Feb	24.9	1.7	90.6	1.3	1.5	2.9	0.1	0.9	0.0	0.0	0.0
March	23.5	2.2	48.2	1.3	1.6	3.2	0.1	2.2	2.5	0.0	0.0
April	25.2	2.4	42.6	1.8	2.0	3.5	0.1	3.3	1	0.2	0.0
May	62.1	4.3	93.0	2.4	3.0	5.9	0.1	4.4	0.1	0.2	0.0
June	235.4	11.8	173	5.0	5.6	14.2	0.1	6.0	0.1	0.1	0.0
July	367.9	18	198.1	6.4	6.6	21.9	0.0	5.5	0.3	0.0	0.0
August	325.7	16.9	272.0	6.1	6.2	20.6	0.0	4.5	0.2	0.0	0.0
Sept	282.4	11.6	234.0	4.6	5.2	15.7	0.0	4.5	0.4	0.0	0.0
Oct	109.1	4.6	183.1	2.2	2.4	6.0	0.0	1.5	0.4	0.0	0.0
Nov	9.0	0.9	89.4	1.0	1.2	1.3	0.0	0.1	2.4	0.0	0.0
Dec	7.5	0.6	39.4	0.8	0.8	0.8	0.0	0.0	4.6	0.0	0.0
Average				**2.8**	**3.1**						

Total	**1484.6**	**76.2**				**97.8**	**0.5**	**33.2**	**21.1**	**0.5**	**0.0**

Source:IMD

Temperature

92. As per the data recorded at meteorological station, Dhanbad, the temperature begins to increase from March till June. April and May are the hottest months with highest temperature of 38.1°C recorded in May month. The lowest temperature of 7.5 °C was recorded in month of December. The daily mean minimum temperature varies from 6.7 °C in January to 23.9 °C in June, whereas the daily mean maximum temperature varies from 25.4°C in January to 38.1°C in May.

Relative Humidity

93. The mean relative humidity in different months is shown in **Figure 17.** The relative humidity is generally high during the period of monsoon from June to October. It is about 69 % during morning hours and 56 % during evening hours. The minimum humidity of 48% is recorded in March and maximum relative humidity of 88% is experienced in August. Maximum 24 hourly rainfall during the period 1961- 1990 is shown in Figure 17. The annual average rainfall in the region is about 1484.6 mm spreading over 76.2 days. Maximum rainfall occurs during month of July (367.9 mm) and minimum during the month of December (7.5 mm).

Figure 17: Relative Humidity

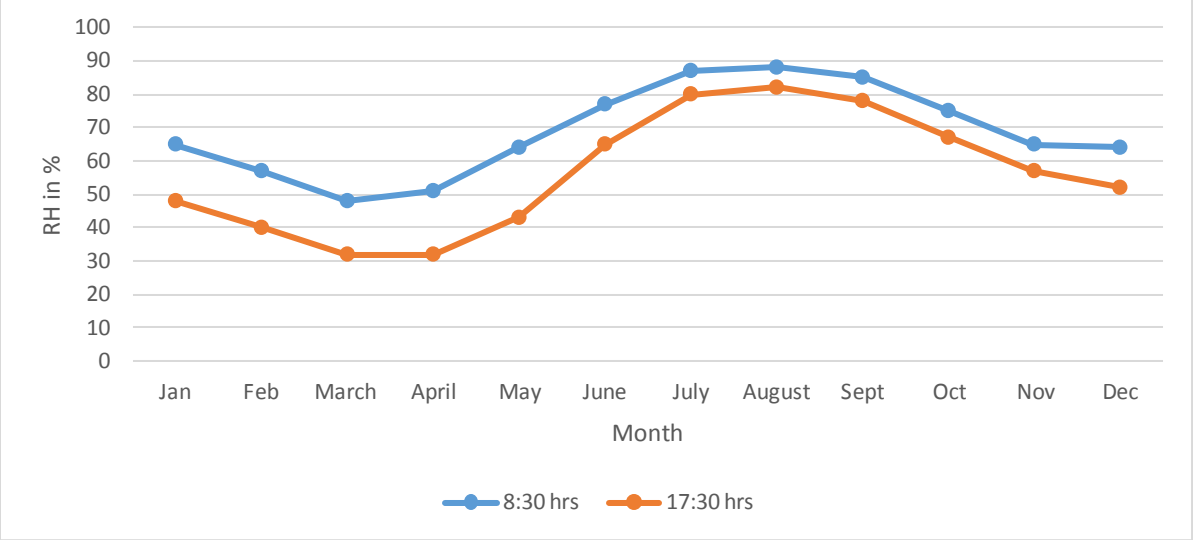
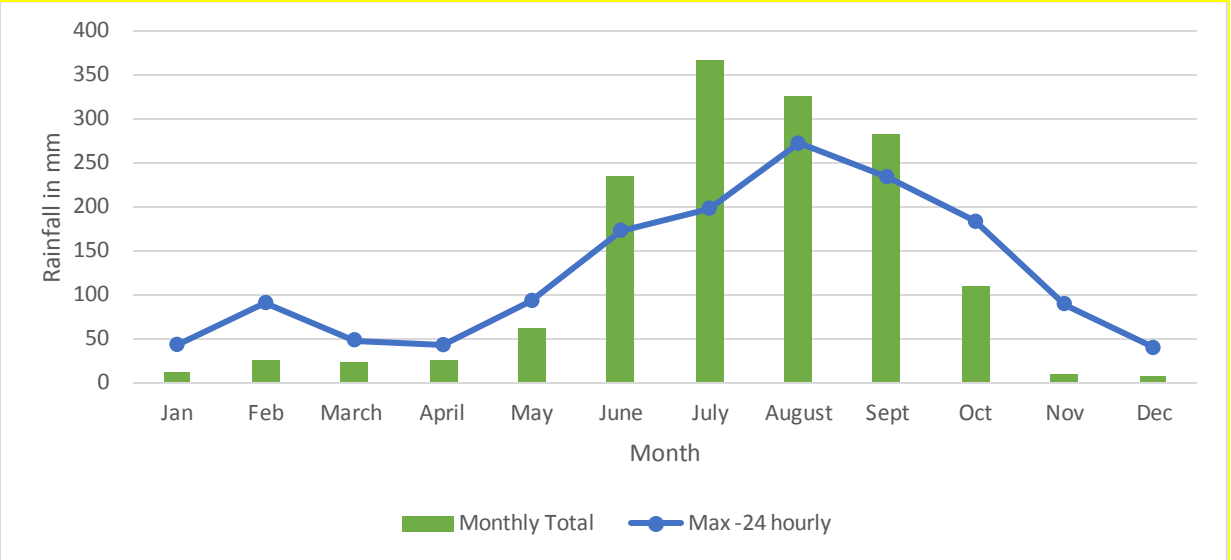


Figure 18: Rainfall Details



Cloud Cover

94. The highest cloud cover of 6.4 oktas is recorded during the month of July.

Wind Speed/Direction

95. The mean wind speed is recorded to be highest in the month of June at 10.8 kmph and lowest in the month of December at 7.1 kmph. The predominant wind direction is recorded to be from East and West during the summer season (March-May), West and the monsoon season (June- September), East and Calm during post monsoon season (October-November) and winter season (December – February). Wind direction details as per IMD at Dhanbad meteorological station has been presented in **Table 14.**

Table 14: Wind Direction of Dhanbad

Month	Morning Time Predominant Wind			Evening Time Predominant Wind		
	I	II	III	I	II	III
January	Calm	NW	W	Calm	NW	NE
February	Calm	NW	W	Calm	NW	SE
March	Calm	NW	W	Calm	NW	SE
April	Calm	SE	W	Calm	NW	SE
May	SE	Calm	SW	SE	Calm	NW
June	SE	Calm	SW	SE	Calm	NE
July	Calm	SE	SW	Calm	SE	SW
August	Calm	SE	NE	SE	Calm	NE
September	Calm	SE	NE	SE	Calm	NW
October	Calm	SE	NE	Calm	SE	NW
November	Calm	NW	NE	Calm	NW	NE
December	Calm	NW	W	Calm	NW	NE

5.5.2 Ambient Air Quality

96. A total of seven (7) monitoring locations representing residential, industrial, high traffic zone and commercial setup were selected to determine air quality levels within the study area. The locations of the monitoring stations were based on preliminary analysis of the meteorological conditions, particularly predominant/frequent wind directions. Logistical considerations such as accessibility, security, and availability of reliable power supply etc. were also considered while finalizing the locations of Ambient Air Quality Monitoring (AAQM) stations. Details of the AAQM stations are summarized in **Table 18**and presented in **Figure 19.**

Table 15: Description of Ambient Air Quality Monitoring Stations

Sl	Station Code	Coordinates		Location Description	Remarks
		Latitude	Longitude		
1	AAQ1	23.78711	86.38492	Shastri Bhawan	Residential area near project site in Ward No 10 in downwind direction
2	AAQ2	23.79633	86.43089	Near DRM office	Residential area near project site in Ward No 27 in downwind direction
3	AAQ3	23.80042	86.44094	DGMS office	Residential area near project site & proposed outfall structure in Ward No 29 in downwind direction
4	AAQ4	23.81414	86.46156	Steel Gate	Residential area near project site & proposed outfall direction in Ward No 28 in upwind direction
5	AAQ5	23.78814	86.40789	Matkuria	Residential area near project site & proposed outfalls in Ward No 19 in downwind direction
6	AAQ6	23.80564	86.43919	Housing Colony	Residential area near project site & proposed outfalls in Ward No 25 in downwind direction
7	AAQ7	23.80192	86.42678	Bekar bandh Chowk	Residential area near project site & 10 proposed outfalls in Ward No 25 in downwind direction

97. The ambient air quality monitoring was conducted in first week of March for each of the locations on a 24-hours schedule. The equipment was kept in open space away from vegetation and the height of samplers monitoring was kept in range of 3 – 5 m. Monitoring was done as per the Guidelines for Ambient Air Quality Monitoring, National Ambient Air Quality Series NAAQMS/25/2003-04 for the following parameters:

- Respirable Suspended Particulate Matter (RSPM/ PM_{10})

- Fine particulate Matter (FPM/ $PM_{2.5}$)
- Sulphur Dioxide (SO_2)
- Nitrogen Dioxide (NO_2)

98. For the collection of samples for PM_{10}, SO_2 and NO_2, Respirable Dust Samplers (RDS – APM 460 BL) (make: Envirotech) along with gaseous sampling impingers were used. For the collection of $PM_{2.5}$, Fine Particulate Sampler (Model APM 151), make Envirotech was used. Sulphur Dioxide (SO_2) was collected by drawing air through absorbing solution of sodium tetrachloromercurate (EPA modified West & Gaeke Method) and NO_2 was collected by drawing air through the mixture of absorbing solutions of sodium hydroxide and sodium arsenite (Na-Arsenite modified Jacobs & Hochheiser Method). The measurement for both SO_2 and NO_2 was done colorimetrically. All the analyses were carried out as per IS-5182 monitoring protocol, giving details regarding schedule, frequency, averaging period.
99. Results of AAQM are presented in **Table 16**.

Table 16: Ambient Air Quality Monitoring Result

Sl. No	Monitoring Locations	PM_{10}	$PM_{2.5}$	SO_x	NO_x
1	AAQ1	139.19	50.31	28.71	45.53
2	AAQ2	120.56	47.43	29.43	40.25
3	AAQ3	107.42	39.26	30.14	40.21
4	AAQ4	114.25	59.14	31.23	52.17
5	AAQ5	114.32	59.36	26.18	53.31
6	AAQ6	79.43	34.87	18.54	34.21
7	AAQ7	89.34	38.51	30.21	42.32
NAAQS Guideline		**100**	**60**	**80**	**80**
IFC Guideline		**50**	**25**	**20**	**200(1 hour)**

Figure 19: Air & Noise Monitoring Locations

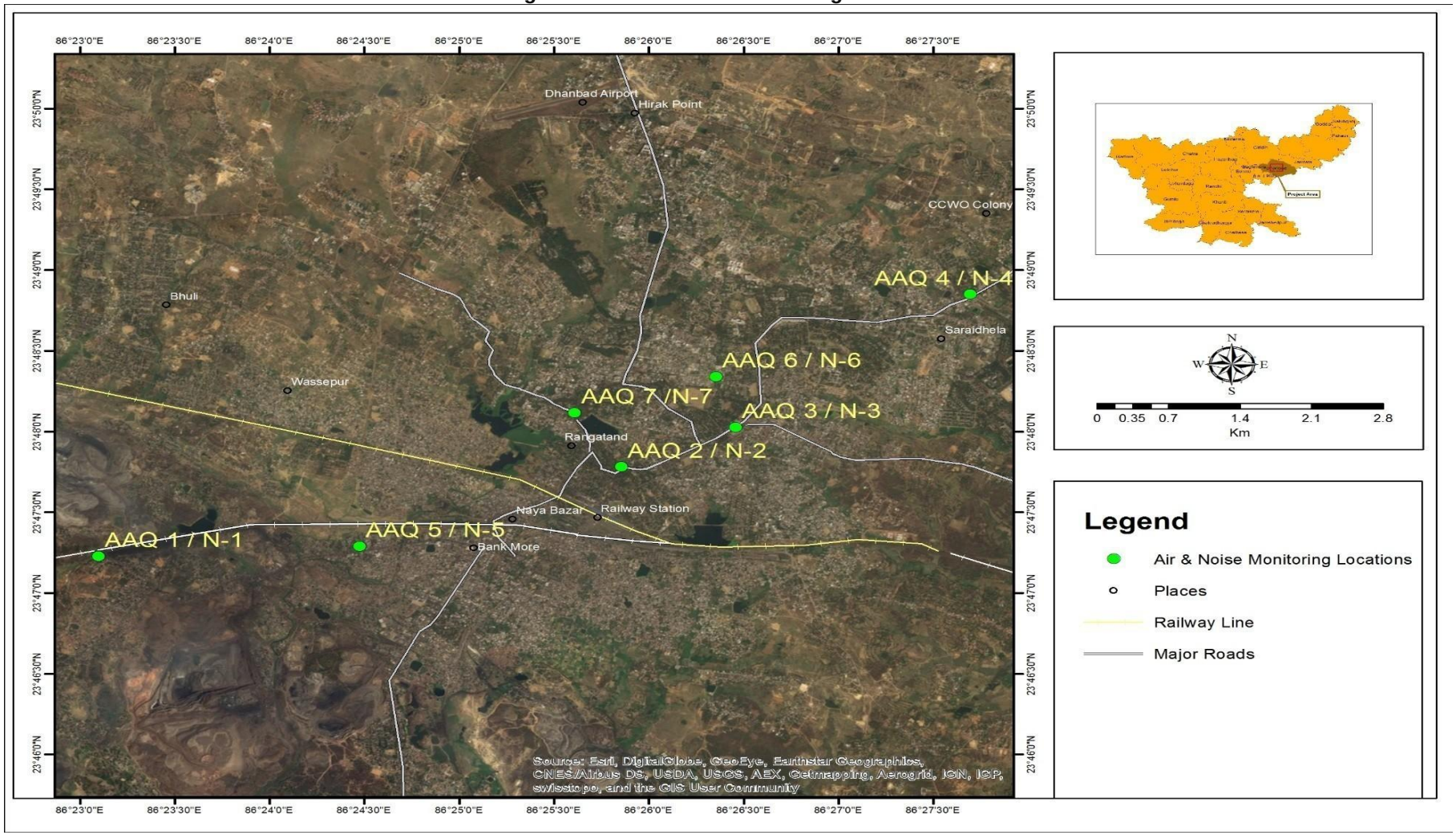
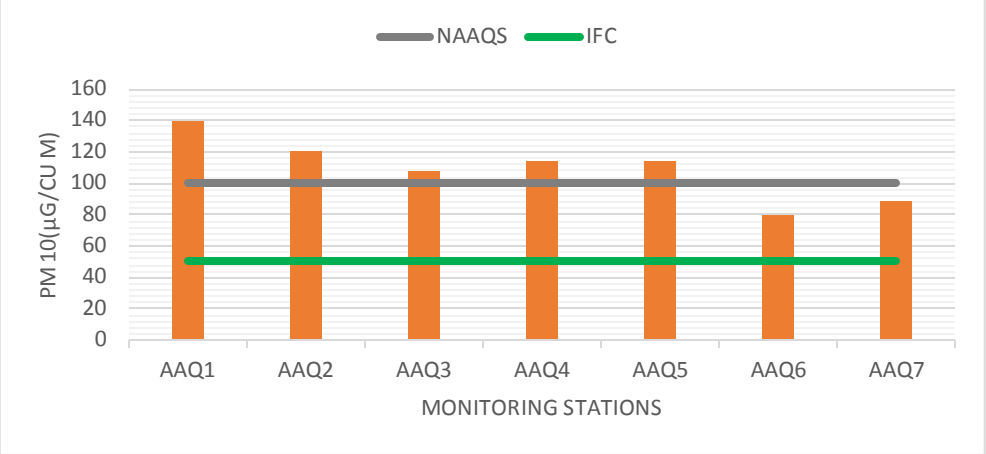
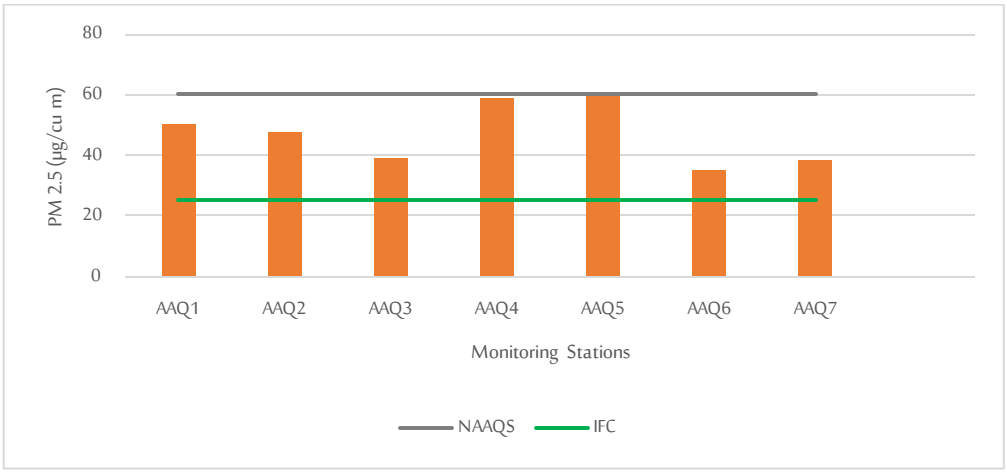


Figure 20: PM 10 Analysis



100. As observed from Figure 19, PM $_{10}$ was observed to be in range from 79.43 (AAQ-6) to 139.19µg/cu.m (AAQ-1).PM $_{10}$ value was observed higher than IFC standards at all stations. The higher value observed may be due to clearing, operation of diesel engines, demolition, burning, and working with toxic materials observed near this areas.

Figure 21: PM 2.5 Analysis



PM $_{2.5}$ was observed to be in range of 34.87 (AAQ-6) to 59.14 µg/cu.m (AAQ-4). The higher value observed may be due to high traffic movement in congested roads in this location.

5.6 *NOISE ENVIRONMENT*

101. To assess the background noise levels in the study area, ambient noise monitoring was conducted. Total seven (7) locations within the study corridor were selected as indicated in **Table 17** and presented earlier in **Figure 19 (N-1 to N-7)**.

Table 17: Description of Ambient Noise Quality Monitoring Stations

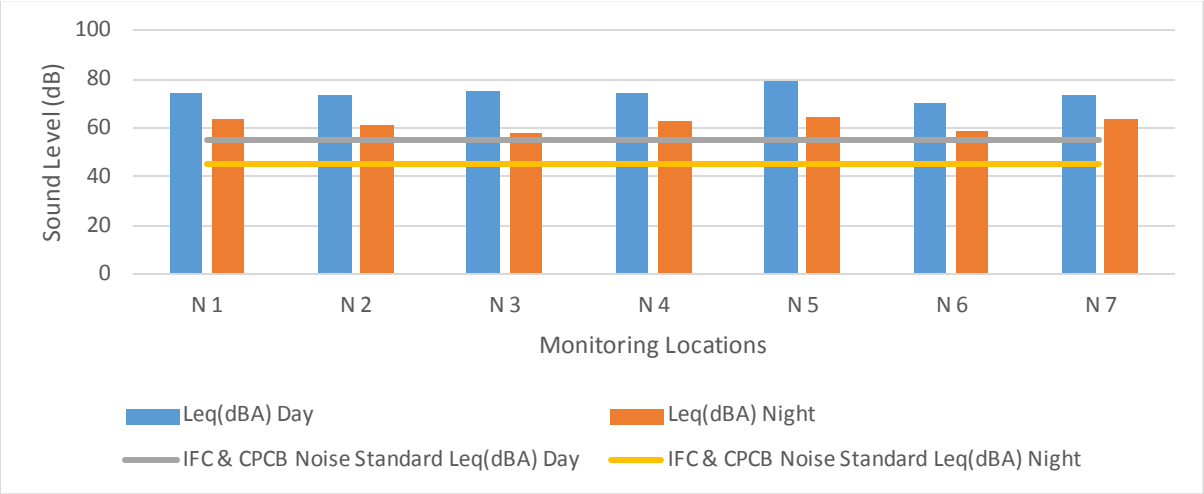
Sl.No.	Station Code	Coordinates		Location Description	Remarks
		Latitude	Longitude		
1	N-1	23.78711	86.38492	Shastri Bhawan	Residential area near project site in Ward No 10
2	N-2	23.79633	86.43089	Near DRM office	Residential area near project site in Ward No 27
3	N-3	23.80042	86.44094	DGMS office	Residential area near project site & proposed outfall structure in Ward No 29
4	N-4	23.81414	86.46156	Steel Gate	Residential area near project site & proposed outfall direction in Ward No 28
5	N-5	23.78814	86.40789	Matkuria	Residential area near project site & proposed outfalls in Ward No 19
6	N-6	23.80564	86.43919	Housing Colony	Residential area near project site & proposed outfalls in Ward No 25
7	N-7	23.80192	86.42678	Bekar bandh Chowk	Residential area near project site & 10 proposed outfalls in Ward No 25

The summarized noise level data, recorded, is provided in **Table 20** and presented in **Figure 22.**

Table 18: Summarized noise level data

Location Code	Area Category	Leq (dBA		Day Time(dBA)		Night Time(dBA)		Noise Standard – Day(IFC & CPCB)db(A)	Noise Standard –Night (IFC & CPCB)db(A)
		Day	Night	Max.	Min.	Max.	Min.		
N 1	Shastri Bhawan, Bank more	74.7	63.9	85.5	68.4	68.8	54.5	**55**	**45**
N 2	DRM office Dhanbad	73.5	61.0	78.9	62.5	65.3	58.4	**55**	**45**
N 3	Near DGMS office	75.1	57.8	80.3	59.3	60.6	47.8	**55**	**45**
N 4	Steel Gate, Saridhela	74.3	62.8	78.9	68.1	65.3	57.6	**55**	**45**
N 5	Matkuria	78.9	64.8	80.8	76.4	67.8	58.6	**55**	**45**
N 6	Housing colony	70.5	58.6	74.7	65.8	63.6	48.9	**55**	**45**
N 7	Bekar Bandh chowk	73.3	63.6	75.7	61.6	67.3	56.8	**55**	**45**

Figure 22: Noise Level Observation



102. The day time equivalent noise level reckoned from 0600 to 2200 hours (Leq day) varied from 70.5 to 78.9 dB(A) while night time equivalent noise level reckoned from 2200 to 0600 hours varied from 57.8 to 64.89 dB (A).The noise level observed exceeds the national and IFC standardswhich is due to heavy traffic movements near the sampling locations (proposed construction sites).
103. However, the results of the noise level in every sampling station is in higher side, this is due to the sampling locations were nearby heavy traffic.

5.7 *WATER ENVIRONMENT*

104. Total 6 surface water bodies and 2 ground waters were selected for monitoring based on proximity to project area, dependency of community and proposed outfall structures to be prepared. The water sampling locations have been detailed inTable 19 and presented in Figure 23

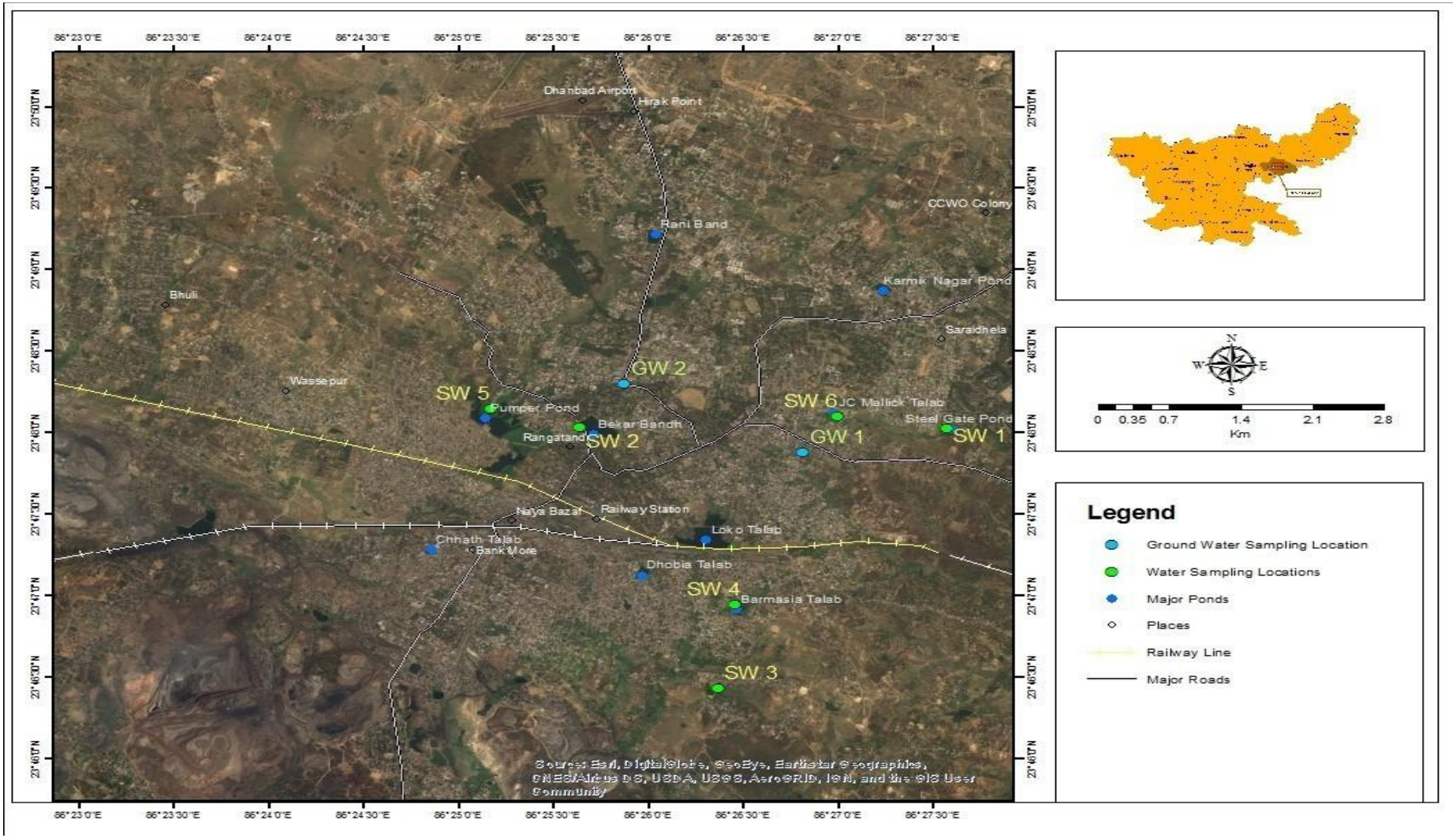
Table 19: Water Sampling Locations

Sl.No	Sampling Locations	Location Code	Geographical Coordinates		Remarks
			Latitude (N)	Longitude (E)	
1	Steel gate pond	SW 1	23.80044	86.45953	Used by local community of ward no 28. Approx. no of Outfall will be 4
2	Bekar Bandh	SW 2	23.80056	86.42736	used by local community of Ward No 25& 3 proposed outfalls in .Ponds was used for recreational purpose also
3	Jora talab (patra kulhi)	SW 3	23.77386	86.43942	used by local community of Ward No 32& 1 proposed outfalls in

Sl.No	Sampling	Location	Geographical Coordinates		Remarks
4	Barmasia chat talab	SW 4	23.78247	86.44094	used by local community of Ward No 30& 2 proposed outfalls in
5	Pampu pond, polytechnic road	SW-5	23.80247	86.41958	used by local community of Ward No 25& 5 proposed outfalls
6	JC Mallick Road Teli Talab	SW-6	23.80203	86.44961	community of Ward No 29& 2 proposed outfalls
7	Near Devipada, Hirapur	GW 1	23.79797	86.44686	Bore well used by residence of Hirapur
8	City centre	GW 2	23.80497	86.43119	Bore well used by local community near combined building

105. Grab water samples were collected from locations in 5 litre sampling bottles and 250 ml sterilized clean glass/pet bottle for complete physio-chemical and bacteriological analysis respectively. The samples were analysed as per standard procedure/method given in IS: 3025, IS: 1622 and Standard Method for Examination of Water and Wastewater Ed.20, published jointly by American Public Health Association (APHA) and American Water Works Association (AWWA).

Figure 23:Water Monitoring Locations



5.7.1 Surface Water

106. Total 6 surface water parameters for analysis of surface water quality were selected based on the utility of the particular source of water as per MoEF&CC guidelines. The surface water monitoring locations have been provided in Table 20. The quality of surface water was compared with IS: 10500-2012 for drinking purposes and also against water quality criteria as per CPCB guidelines for aquatic resources.

Table 20: Primary Water Quality Criteria for Designated-Best-Use-Classes

Designated-Best-Use	Class	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	▶ Total Coliforms Organism MPN/100ml shall be 50 or less ▶ pH between 6.5 and 8.5 ▶ Dissolved Oxygen 6mg/l or more ▶ Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organized)	B	▶ Total Coliforms Organism MPN/100ml shall be 500 or less ▶ pH between 6.5 and 8.5 ▶ Dissolved Oxygen 5mg/l or more ▶ Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	▶ Total Coliforms Organism MPN/100ml shall be 5000 or less ▶ pH between 6 to 9 ▶ Dissolved Oxygen 4mg/l or more ▶ Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Propagation of Wild life and Fisheries	D	▶ pH between 6.5 to 8.5 ▶ Dissolved Oxygen 4mg/l or more ▶ Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	▶ pH between 6.0 to 8.5 ▶ Electrical Conductivity at 25°C micro mhos/cm Max.2250 ▶ Sodium absorption Ratio Max. 26 ▶ Boron Max. 2mg/l
	Below-E	▶ Not Meeting A, B, C, D & E Criteria

Source: Central Pollution Control Board

107. The surface water quality analysis of the samples in the study area is provided in **Table 21**.

Table 21: Surface Water Quality Monitoring Result

Sl.	Parameters	Unit	Method	Monitoring Location						IS: 10500, 2012, Acceptable Limit	IS: 10500, 2012, Permissible Limit
				SW 1	SW 2	SW 3	SW 4	SW-5	SW-6		
1	pH value	-	APHA 4500 H+ B	7.16	7.52	7.4	7.36	7.22	7.72	**6.5-8.5**	**No relaxation**
2	Temperature	^{0}C	APHA 2550 B	24.8	24.8	24.7	24.8	24.7	24.8		
3	Conductivity	µs/cm	APHA 2510 B	632	755	780	1225	1242	3106		
4	Total Suspended solid	mg/l	IS 3025 (P-17)	59	73	68	79	92	83		
5	Hardness	mg/l	IS 3025 (21)	166	266	334	660	376	538	**200**	**600**
6	DO	mg/l	IS 3025 (38)	8.4	7.6	7.2	8.4	6.8	6.4		
7	BOD	mg/l	IS 3025 (44)	5.8	5.2	1.9	2.5	6.5	4.8		
8	COD	mg/l	IS 3025 (58)	60.8	53.2	22.8	34.2	79.8	57		
9	Nitrate	mg/l	APHA 4500 NO^{3}-B	1.7	1.3	1.9	2.3	1.8	1.5	**45**	**No relaxation**
10	Phosphate	mg/l	IS 3025 (P-31)	0.28	0.41	0.23	0.17	0.11	0.14		
11	Chloride	mg/l	IS 3025 (P-32)	10.2	85	75.3	176	121.3	462.8	**250**	**1000**
12	Sulphate	mg/l	IS 3025 (P-24)	4.2	4.1	5.7	3.1	3.2	6.9	**200**	**400**
13	Calcium	mg/l	IS 3025 (P-40)	49.6	22.3	17.4	37.4	12.6	28.6	**75**	**200**
14	Magnesium	mg/l	APHA 3500 Mg B	110.2	69.6	52	84	129.6	168	**30**	**100**
15	Oil & Grease	mg/l	IS 3025 (P-39)	5.3	4.6	4.6	4.2	4.8	4.7		
16	Phenolic compound	mg/l	IS 3025 (P-43)	ND	ND	ND	ND	ND	ND	**0.01**	**0.02**

Sl.	Parameters	Unit	Method	Monitoring Location						IS:	IS: 10500,
17	Lead[2]	mg/l	APHA 3111 B	ND	ND	ND	ND	ND	ND	0.01	No relaxation
18	Boron	mg/l	APHA 3111 B	ND	ND	ND	ND	ND	ND	0.5	1.0
19	Arsenic	mg/l	APHA 3112 B	ND	ND	ND	ND	ND	ND	0.01	0.05
20	Mercury	mg/l	APHA 3114 B	ND	ND	ND	ND	ND	ND	0.001	No relaxation
21	Cadmium	mg/l	APHA 3111 B	ND	ND	ND	ND	ND	ND	0.003	No relaxation
22	Copper	mg/l	APHA 3111 B	ND	ND	ND	ND	ND	ND	0.05	1.5
23	Zinc	mg/l	APHA 3111 B	0.18	0.27	0.17	0.42	0.12	0.52	5	15
24	Iron	mg/l	APHA 3111 B	0.01	0.01	0.05	0.04	0.03	0.07	0.3	No relaxation
25	Total coliform	MPN/100ml	APHA 9221 B	540	350	430	920	1600	350	Shall not be detectable in any 100 ml sample	

[2]Detection Limits- Cu- 0.1 mg/l, Mn- 0.1 mg/l, Phenolic compound-0.001 mg/l, Mercury-0.002 mg/l, Cd-0.01 mg/l,As-0.003 mg/l, Pb-0.01 mg/l

108. From the above table, it has been observed pH for all the surface water samples was found within the drinking water limits (6.5 to 8.5) as promulgated by Bureau of Indian Standards (IS: 10500).
109. BOD was observed to be less than 3mg/l in SW4. DO level was observed more than 6mg/l at all locations. Faecal coliform and total coliform was present in all the water samples, which indicates the risk of other more harmful pathogens and the presence of human or animal faecal contamination in the surface water.
110. Surface water sample collected from ponds at SW-4 can be classified as below 'Class A' (Drinking Water Source without conventional treatment but after disinfection) and SW-1, 2, 5 & 6 can be classified as Class D (Propagation of Wild life and Fisheries).

5.7.2 Ground Water

111. The ground water quality analysis of the samples in the study area is provided in Table 22.
112. From the table below, it is seen that the pH for the groundwater sample was found within the drinking water limits (6.5 to 8.5).TDS value of ground water at GW-1was observed to be higher than the acceptable limit but was within the permissible limit. Level of Calcium has been observed to be more than permissible limit in GW-1.All other parameters were within the acceptable parameters of IS: 10500.

Table 22: Ground Water Quality

S. No.	Parameters	Unit	Method	Monitoring Location		IS: 10500, 2012 Acceptable Limit	IS: 10500, 2012, Permissible Limit
				GW 1	GW 2		
1	pH value	--	APHA 4500 H+ B	6.9	7.2	6.5-8.5	No relaxation
2	Temperature	0C	APHA 2550 B	24.8	24.6		
3	Conductivity	µs/cm	APHA 2510 B	1413	453		
4	Total Dissolved solid	mg/l	APHA 2540 C	774	260	500	2000
5	Total suspended solid	mg/l	IS 3025 (P-17)	54.3	31.4		
6	Alkalinity	mg/l	IS 3025 (P-23)	254	56	200	600
7	Hardness	mg/l	IS 3025 (21)	662	178	200	600
8	DO	mg/l	IS 3025 (38)	1.3	1.1		
9	COD	mg/l	IS 3025 (58)	11.4	15.2		
10	Calcium	mg/l	IS 3025 (P-40)	246.4	60	75	200
11	Magnesium	mg/l	APHA 3500 Mg B	11.2	6.8	30	100
12	Chloride	mg/l	IS 3025 (P-32)	161.4	49.8	250	1000
13	Sulphate	mg/l	IS 3025 (P-24)	18.3	11.4	200	400

14	Nitrate	mg/l	APHA 4500 NO3-B	30.2	40.8	45	No relaxation
15	Fluoride	mg/l	APHA 4500 F (C)	0.4	0.2	1	1.5
16	Copper	mg/l	APHA 3111 B	ND	ND	0.05	1.5
17	Iron	mg/l	APHA 3111 B	0.02	0.05	0.3	No relaxation
18	Manganese[3]	mg/l	APHA 3111 B	ND	ND	0.1	0.3
19	Phenols	mg/l	IS 3025 (P-43)	ND	ND	0.001	0.002
20	Mercury	mg/l	APHA 3114 B	ND	ND	0.001	No relaxation
21	Cadmium	mg/l	APHA 3111 B	ND	ND	0.003	No relaxation
22	Selenium	mg/l	APHA 3111 B	ND	ND	0.01	No relaxation
23	Arsenic	mg/l	APHA 3112 B	ND	ND	0.01	0.05
24	Lead	mg/l	APHA 3111 B	ND	ND	0.01	No relaxation
25	Zinc	mg/l	APHA 3111 B	0.15	0.09	5	15

[3]Detection Limits- Cu- 0.1 mg/l, Mn- 0.1 mg/l, Phenolic compound-0.001 mg/l, Mercury-0.002 mg/l, Cd-0.01 mg/l,As-0.003 mg/l, Pb-0.01 mg/l

26	Total coliform	MPN/100ml	APHA 9221 B	< 1.8	< 1.8	Shall not be detectable in any 100 ml sample

5.8 TERRESTRIAL ECOLOGY

113. Prominent flora species that have been observed in DMC area near to proposed construction site are Mangifera indica(Mango), Emblica officinalis(Amla), , Ficus hispida(Hairy Fig), Albizzia lebbek(Shirish Tree), Ficus glomerata(Indian Fig Tree), Syzygium cumini(Jamun), Azardirachta indica(Neem), Ficus infectoria IWhite Fig), Ficus religiosa(Sacred Fig), Aegle marmelos(Bhel), Madhuca indica (Mahua), Daibergia latifolia(Indian Rosewood), Albizzia procera(Siris), Ziziphus jujube(baer), Cassia fistula(Amaltus), Bauhinia variegate(Orchid Tree), Bauhinia purpuraca(Purple Orchid Tree).. Prominent major suburbs reported are Ricinus communis(Castor Oil), Carissa opacal(Karanda), Anona squamosal(Sugar Apple), Nyctanthes arbortristis(Jasmine), Zizyphus oenoblia(Jujube), Jatropha curacas(Nettlespurge), Zizyphus nummularia(Jharber), Tararix dioica(Indian Tamarisk) and Ocimum sanctum(Tulsi).
114. Macaca mulatta(monkey), Canis lupus familiaris(dog), Felis catus (cat),Sus scrofa domesticus(domestic pig), Corvus brachyrhynchos(crow) , Cuculidae spp (Cuckoo), Passer domesticus (sparrow) are the major faunas report in DMC area. No endangered or critical species have been reported in Dhanbad Municipal area.

5.9 URBAN SANITATION

115. As per the 2011 census, 16,692 household, about 7.5% of urban population has access to piped sewer system; 111,276 households (49.98%) discharge waste into septic tank system. 3,683 (1.65%). About 36% of the urban population has no access to latrine within premises, the remaining have access to public and service latrines. In 2017, Dhanbad has been declared open defecation free by the ULB.
116. The government of Jharkhand is also planning a city-wide sewerage and Septage project under the AMRUT scheme. Dhanbad does not have city wide sewage collection, conveyance and treatment. The sewage generated from these areas is disposed into soak pits and/or septic tanks. The current (2017) sewage generation in non-fire zone is estimated at 54.70 MLD and this is expected to increase to 65.36 MLD in 2032 and 77.65 MLD by 2047. Improper practice of sewage disposal leads to unhygienic and unhealthy environmental conditions in the town. There is great need for construction of new sewerage system in the town.

6 SOCIAL PROFILE OF THE PIA

6.1 SIA METHODOLOGY

117. The socio-economic profile of PIA (Project Impact Area) is based on data from the secondary documents such as Census 2011, ULB records, and the Socio-Economic Survey (SES) conducted with an objective to assess the socio-economic profile of the project area.

118. In addition, census survey was conducted with an objective of gathering first-hand information on the following:

- Inventory of affected assets
- Categorization and measurements of potential loss
- Physical measurements of the affected assets/structures
- Identification of trees and crops
- Household characteristics, including social, economic and demographic profile
- Identification of non-titleholders
- Assessment of potential economic impact, including temporary loss.

119. The census survey covered 100% structures affected within the proposed Right of Way (ROW) as per the Corridor of Impact (CoI) of the DPR and drawings provided.

120. In addition to SES and census survey, after finalization of the methodology, protocol and communication strategy by the JUIDCO, the World Bank and other relevant stakeholders, series of public consultations were also conducted during January -March and June 2017. The public consultations were conducted through focus group discussions, individual interviews and formal as well as informal consultations. The vulnerable sections of Project Affected Persons (PAPs) were also included in the consultation process. The public consultation helped in ensuring people participation in the planning and implementation phase and further facilitated in disclosure of the project details to would be PAPs and the beneficiaries. In conformance to the World Bank principles of consultation and disclosure, the project activity was disclosed across the selected locations with the following key objectives:

- Understand the community concerns and issues
- Disclose environmental issues that may arise due to the project and discuss suggestions for mitigation measures
- Assess the present-day project site's characteristics and definitive social, livelihood, and environmental impacts

- Consult with affected communities and/or entities on the proposed project alternatives in order to minimize adverse impacts and enhance beneficial ones
- Obtain a consensus on the proposed activity, potential impacts and suggested mitigation measures

6.2 *SOCIO ECONOMIC PROFILE*

121. The PIA is a predominantly urban and semi urban area within the Dhanbad Municipal Corporation (DMC). As per survey in the month of Jan- Jun 2017, the affected population has a sex ratio slightly skewed in favour of males at 949 females per 1000 males which is higher than the DMC average of 908 as per 2011 Census. Hinduism is the dominant religion followed by Islam and Christianity. The OBC and Hindu population are 47% and 24% respectively in the PIA.

Households

122. Majority of the sample households (68%) are of "nuclear" type with parents and unmarried children "Joint" families account for 28% which are composed of parents with their married sons/daughters. Besides, 4% of all families are "extended" type with parents all brothers and their families live together. The average family size is 5.1 persons in the PIA.

Population by Schedule Tribe and Schedule Caste

123. As per 2011 Census, Schedule Caste (SC) constitutes 7% while Schedule Tribe (ST) is 6% of total population.

Literacy

124. Total literacy rate of the sample population is quite high at 92%. It much higher than the Jharkhand state's average literacy rate of about 68% and also higher than the literacy rate of the DMC (79%). The highest proportion literates have achieved upto class X (37%) followed by those who have attained Class V level (27%).

Economy

125. Majority of the population (44%), earn an income ranging between Rs 30,001 to Rs.100,000 annually. The income group ranging from Rs 100,001 to Rs 300,000 consists of another 21%. There were 18% of the population having higher income than Rs. 3, 00,000 per annum in the PIA. Poor families with income below Rs 30,000 are large in number (17%). Average annual household income of the sample families was worked out to be Rs.76,231/- which brings per capita annual income to Rs.14,947/- or a monthly per capita income of Rs.1246/-. So far as expenditure pattern of average household is concerned major share (43%) is spent on most necessary daily

consumables, like food items. An average family's annual expenditure in payment for 'Loan & Borrowing' is 9.4%.

Occupational profile

126. The working population of the project impact area amounts to 57% (active age group of 18-59 year). A high percentage of non-working population consists of women (81%) who are mostly housewives solely engaged in household chores. The majority of the working population (53%), is engaged in trade and business as shop keeper, petty contractors, transport operators or brokers. 14% involve in Government, Quasi Government or private services (14%). There is a huge disparity between the male and the female workers in all the occupations. Skilled labour and unskilled labour forces is 12% and 7% respectively of the sample working population.

Vulnerable population

127. Of the total sample families there are 12% families belonging to BPL category, 1% Physically Challenged Family (PCH), 7% are scheduled caste, 6% Schedule Tribe and 4% families are headed by women.

Assets and Durables Possessed

128. Majority households own residential structures as individual household asset. Most of the structures (32%) are constructed with temporary materials like, mud and bamboo walls and tin roofs. Nearly 31% families own semi-pucca structures which are partly built with permanent materials such as cement, brick etc. Pucca RCC structures are owned by 27%.

Health care service

129. There are 8 Primary Health Centres PHC, a few sub-centres spread over the larger settlements within PIA. In Dhanbad town two PHCs and one district hospital provide tertiary health service to the people within PIA.
130. Although several public and private health facilities are available in the state, overall infrastructure for dispensing health related services require improvements. An exception is the famous Tata Motors Hospital which is an example of an ISO 14001 and 18001 certified hospital with Diploma of National Board (DNB) teaching facilities.

Sanitation and other civic amenities

131. Throughout the PIA sanitation facility is poor to say the least. People however, have made own arrangement of individual toilet which is crude type and not hygienic. Solid waste management is also not in place. People of the clusters defecate in the open. In urban/ semi urban centres sanitation system is old and many households still use kutcha or unsanitary latrines.

132. As the project site at Dhanbad, the pucca drain exists at few wards but presently in a very bad condition. Other than these few wards, there is either kutcha or temporary drain or no drainage or sewerage system as far the PIA is concerned.

7 PUBLIC CONSULTATIONS AND DISCLOSURE

133. Stakeholder consultations were held to understand the stakeholder expectations and location specific challenges. The proposed works under this project of storm water drainage system of Dhanbad town include construction of 153.95 km new drains with silt traps at catch basins and 94 outfall structures.

7.1 *IDENTIFICATION OF STAKEHOLDERS AND METHODS FOR CONSULTATION*

134. The primary stakeholders that were identified for consultations for the Dhanbadstorm water drainage project are the PAPs and the direct beneficiaries. The secondary stakeholders include other individuals and groups, *viz.*, the ULBs, other Governmental/Quasi-governmental departments, *etc.* The stakeholders identified, the social survey methods followed for collecting primary data and disclosure of the project are presented in the table below.

Table 23: Stakeholders identified and methods used

Category of respondent	Type of respondents	Survey method
Primary		
Citizens	Citizens' consultation in Ward level	Focus Group Discussion (FGDs) - gender disaggregated as far as possible
Government and other stakeholders	▶ Jharkhand Urban Infrastructure Development Company Ltd (JUIDCO) ▶ Principal Secretary, Urban Development & Housing Department, Government of Jharkhand ▶ Jharkhand State Pollution control Board ▶ Director, State Urban Development Agency (SUDA) ▶ The World Bank ▶ Land Revenue Department ▶ Public Health Engineering Department (PHED), Dhanbad ▶ Public Works Department (PWD) ▶ Water supply, Dhanbad Nagar Panchayat ▶ Drinking water and sanitation department, Dhanbad Nagar Panchayat	Meetings / FGDs/ Interviews
Private and	▶ Members of Vendor	Meetings / FGDs/ Depth Interviews

Category of respondent	Type of respondents	Survey method
community stakeholders	Committee Dhanbad ▶ Local clubs, Other offices ▶ Eateries and small artisans ▶ Social Organization	
Secondary		
Ward members within the PIA	Residents and Commercial Entities of the Project Impact Area (PIA) who are not impacted selected randomly.	Socio-economic quantitative (semi structured) questionnaire

7.2 *DETAILS OF CONSULTATIONS*

135. The details of consultations are as follows:

Table 24: Details of Consultations[4]

Sl.No.	Place	FGD	
		Number	No. of participants
1.	Gobindpur	1	8
2.	Ward Number 24	1	5
3.	Ward Number 31	1	10
4.	Ward Number 43	1	12
Total		4	35

7.3 *PROCESS OF CONSULTATIONS*

136. **Consultation during the E&S Assessments**: As a part of environmental and social impact assessment, public/stakeholder consultations were organized in Dhanbad project for SWD. Furthermore, information pertaining to the sub-project like work schedule, procedures involved, project component, likelyimpacts, entitled grievance redressal mechanisms was disseminated. Feedback on mitigation measures, and grievance redressal mechanism were also collected during initial consultation periodother stakeholders such as the Land Revenue Department, Road Construction Department were also involved in the consultations to the extent possible. The outcomes of the initial consultations held during the January- March 2017 were incorporated, as appropriate, in the designs and mitigation plans.

137. **Consultation on Draft ESIA:** The draft ESIA was presented and explained to local community, stake holders, PAP and ULB members on 6th October 2017.The impacts arising due to the project, the mitigation measures and ESMP were discussed in details.

[4]Given the socio-economic background of PAPs, most of them are engaged in their livelihood activities during the day. Therefore, despite repeated efforts to involve them in consultation process, only few attended.

138. **Levels of Public Consultation**

A. State Level

- Secretaries of different Ministries and Departments of Government of Jharkhand
- Labour Commissioner
- Chief Engineer and Engineering Department

B. City /ULB Level

- Mayor/Chairman
- Municipal Commissioner
- Councillors and Representatives of different departments

C. Location/Site Level

- Heads of the households likely to be impacted
- Members of the likely impacted households
- Clusters of PAPs
- Villagers

7.4 TYPES/CATEGORIES OF CONSULTATIONS

139. **The** consultations were held with both primary and secondary stakeholders. The primary stakeholders that were identified are the Projects Affected Persons (PAP) and the direct beneficiaries. The secondary stakeholders included other individuals and groups, with an interest in the project, viz., the ULBs, other Govt. departments, etc. Consultation among the Secondary stakeholders included consultations at State and City level. The State Level includes all Secretaries and other dignitaries of different Ministries and Departments of the Government of Jharkhand (GOJ), Offices of Central Government etc. The City Level included the Urban Local Body (ULB), Mayor/Chairman, Councillors and Representatives of different departments.

Table 25: State Level Consultation

Sl. No.	Name	Designation	Date
1	Sanjay Kumar Suman, IFS	Member Secretary, Jharkhand State Pollution Control Board	13.01.2017
2	Ajay Rastogi, IAS	Special Secretary, Department of Environment and Forests	14.01.2017
3	Praveen Kumar Toppo	Labour Commissioner	
4	Prabhat Kumar	Joint Labour Commissioner	
5	Amarinder Pratap Singh, IAS	Principal Secretary, Ministry of Drinking Water and Sanitation	23.01.2017
6	Ashok Kumar /	Chief Engineer / Member, Monitoring	25.01.2017

	Yogender Sharma	Cell - Water Resources Department	
7.	Smt. Himani Pandey, IAS	Secretary, Welfare Department	12.01.2017

Table 26: **City Level Stakeholders**

Items	Reference
Location	RRDA building, Dhanbad
Date:	30.01.2017
Attendees from the City	Various department of Dhanbad municipality Councillors, Ward Councillors
Attendees from Consultant :	Soumi Dasgupta Swati Sur Payel Mondal

7.5 *FINDINGS OF PUBLIC CONSULTATIONS*

Table 27: Findings of Public Consultations

Location	Summary	Consensus
Gobindpur	A detailed public consultation was organized with the potential project affected persons, people's representatives, shopkeepers, businessmen, and others regarding the project benefits and vis-à-vis estimated loss. During discussion it has been observed that the benefits of the proposed project area were acknowledged by the local people but they stressed that the Executing Agency, need to incorporate proper traffic safety measures to reduce accidents, once the road is operational. The local people had agreed in the view of the proposed project which will solve the water logging in the area but apprehend to the pollution and .traffic issues that may arise during the construction of the drainage	The Government officials had agreed to take special care for traffic safety. Traffic management plan will be made in consultation with local authority and will be implemented by contractor to reduce the traffic impacts and local inconvenience
Ward No 24	Most of the people impacted were squatters (residential/commercial/ residential cum commercial).People were concern of any land acquisition to be undertaken due to the project and also discussed about the loss of livelihood that may arise The squatters and hawkers informed that DMC has already carried out the survey and are in a process of developing a plan on to relocate them. As per DMC, 14 places have been identified, where the vendors can be relocated. To perform the relocation of the vendors the Nagar Nigam, consents were taken from the relevant vendor	The resettlement action plan to be developed for the projectwill have mitigation measures to cover temporary loss of livelihood

Location	Summary	Consensus
	associations.	
Ward No. 31& 43	The benefits of the project was discussed with the PAP. People were informed about the cut-off date (20th June, 2017). Some stakeholder raised concerns about the inconvenience and the increase in pollution levels that will occur due to construction activity	EMP to be made part of bid document, so that contractor will be made aware of all the mitigation measures that is to be implemented before bidding. Regular monitoring will be undertaken to oversee that all mitigation measures are implemented by contractor. Grievance cell will be created at project as well as JUIDCO level to quickly solve any issues that may arise due to construction activity
Purana Bazaar	The benefits of the project was discussed with the PAP. .Census survey to be conducted was discussed with all the stakeholders. People were informed about the cut-off date (20th June , 2017) Concern were raised on impact on livelihood Some stakeholder raised concerns about the inconvenience and the increase in pollution levels that will occur due to construction activity	The resettlement action plan to be developed for the project will have mitigation measures to cover temporary loss of livelihood
Dhaiya Main road	People had concern on loss of livelihood and land acquisition that may undertaken. Few affected parties informed that they used the pond during Chatt puja and any construction activity may possess safety risk during the puja	The resettlement action plan to be developed for the project will have mitigation measures to cover temporary loss of livelihood No construction activity would be undertaken during chatt puja. All under construction site will be properly barricaded during the puja festival

Table 28: Findings of Consultation with Government Officials

Date / Place	Summary of Discussion	Consensus	Mitigation Measures - Input to technical Design
State Level			
Special Secretary, Department of Environment and Forests	► Discussion was held on the JMDP and proposed sub-projects in water supply, storm water drainage and road sectors and suggestions were sought on environmental issues to be addressed in Environmental and Social Management Framework. ► For road projects, Special Secretary suggested alignment of projects in such a way that tree cutting will be minimized. ► Team was informed about the Order No: 3503/2014 passed by Jharkhand High Court that contains guidelines on tree cutting. He informed that application needs to be submitted to High Power Committee headed by Chief Conservator of Forests, Ranchi for tree cutting purpose for linear projects ► He told that environmental parameters monitored in municipal areas can be collected from JSPCB ► He also stressed on the necessary mitigation measures that needs to be adopted to minimize air emissions from construction sites/ due to transport of construction material	► ESMF and ESIA would be shared. ► All statutory Guidelines and order to be followed ► Environmental parameters in municipal areas were collected. ► EMP would be shared with the Department	► Minimizing Environmental Impacts by consultation with the DPR Consultant. ► EMP would be a part of the Bid Documents
Sanjay Kumar Suman, IFS, Member Secretary, Jharkhand State Pollution Control Board	Team appraised Member Secretary on JMDP and proposed sub-projects in water supply, storm water drainage and road sectors and sought suggestions on environmental issues to be addressed in Environmental and Social Management Framework.	CTE & CTO is not required for road beautification, but is required for batching plant, hot mix plant and DG set.	EMP to be added in the BOQ.

Date / Place	Summary of Discussion	Consensus	Mitigation Measures - Input to technical Design
Smt. Himani Pandey, IAS, Secretary, Welfare Department	Meeting team appraised Secretary on Jharkhand Municipal Development Project (JMDP) and proposed sub-projects in water supply, storm water drainage and road sectors and sought her suggestions on environmental and social issues to be addressed in Environmental and Social Management Framework. For road projects , she suggested to validate the ROW and stressed that the vendor compensation should be carried out as per the national /state laws	ESMF and ESIA would be shared. The RAP and EMP would be displayed in the Welfare Office Notice Board. The GRC committee Contact Details would be displayed.	DPR Consultant was asked to review the RoW details. Initiation for formation of GRC.
Praveen Kumar Toppo, Labor Commissioner & Prabhat Kumar, Labor Commissioner, Dhanbad,	The meeting team appraised Labor Commissioner and Joint Labour Commissioner on Jharkhand Municipal Development Project (JMDP) and proposed sub-projects in water supply, storm water drainage and road sectors. The team sought the suggestions on environmental issues. The team was informed about the licenses that are required and the facilities to be provided to the workers.	ESMF and ESIA would be shared. The EMP would be available in public domain.	EMP to be added in the BOQ. All the Labour Rules would also be part of the bid document Guidelines for labour camps to be incorporated in ESIA and the contractor have to provide facilities as provided in the guideline
Amarinder Pratap Singh, IAS, Principal Secretary, Ministry of Drinking Water and Sanitation	The meeting team appraised Principal Secretary on Jharkhand Municipal Development Project (JMDP) and proposed sub-projects in water supply, storm water drainage and road sectors and sought their suggestions on environmental issues to be addressed in Environmental and Social Management Framework.	ESMF and ESIA would be shared. The EMP would be available in public domain.	Necessary permits for water withdrawal to be obtained for construction purpose.

Date / Place	Summary of Discussion	Consensus	Mitigation Measures - Input to technical Design
	Related to road project he discussed issues related to water pollution due to construction activity. He also recommended the facilities to be provided to the labours in labour camps and also stressed that proper drinking water facility and toilet facilities should be made available in the labour camps. Also he stressed that proper mitigation measures should be incorporated to avoid water pollution during the construction phase.		
Ashok Kumar / Yogender Sharma , Chief Engineer / Member, Monitoring Cell - Water Resources Department	The meeting team appraised Chief Engineer and his team on Jharkhand Municipal Development Project (JMDP) and proposed sub-projects in water supply, storm water drainage and road sectors and sought their suggestions on environmental issues to be addressed in Environmental and Social Management Framework. Regarding the road project, chief engineer stressed that as Dhanbad is a water stress location, proper measures should be implemented to mitigate any high impacts on water availability due to the project	ESMF and ESIA would be shared. The EMP would be available in public domain.	Mitigation measures to reduce impacts on water availability will be provided in EMP and the contractor has to implement the same.
CITY Level			
RRDA Building, Dhanbad, **Various department of Dhanbad municipality** **Councillors, Ward Councillors** **Date: 31.01.2017** **Place: Dhanbad**	Provisions of toilets/ urinals should be kept at labour camps during the construction activity Trees should be planted as per national and international rule & guidelines. Survey for trees to be felled should be undertaken Parking facilities should be provided where roads were being widened. For dust reduction sprinkler system should be installed DPR should consider 6 lanes road instead of 4 lanes	As per provision of EMP Trees should be planted. All CPRs, Waiting Sheds, Public Toilets would be provided. No scope of Land Acquisition and the construction will be	EMP was to review to accommodate all aspects of Environment and Safety. The DPR Consultants were asked to include COI in

Date / Place	Summary of Discussion	Consensus	Mitigation Measures - Input to technical Design
	Foot-over bridges or junctions should be constructed at specific positions for pedestrian to cross. Proper identification of people directly affected by the project should be undertaken and stressed on proper compensation for the PAP.	within the available RoW. Safety measures would be a part of EMP and BOQ. Temporary Impacts will be a part of RAP which would be disclosed in websites and other media.	their drawings.

Table 29: Findings of Consultation of Draft ESIA & RAP

Date / Place / No. of Participants	Summary of Discussion	Consensus
6th October 2017 , Mayor, Municipal Commissioner, ULB members, RCD , PAP ,Professors of Engineering Colleges, Trade Union , Women Self Help Group, Hawkers Association	► The draft ESIA was presented to the Participants ► The environmental impacts and its mitigation measures were explained in detail ► Social impacts arising due to the project and its mitigations were discussed with the participants ► The participants stressed that majority of the labours to be employed during the construction and operation phase should be locals ► Entitlement matrix and compensation to be provided to non-titleholders were discussed in details. ► Mitigation measures to be implemented for air pollution was discussed in details ► Steps to be taken to control deterioration of surface water present near the road ► Loss of livelihood and allowances to be provided for loss of livelihood was discussed. ► Discussion on institutional arrangement and component to be overseen by ULB was discussed ► Reports to be prepared by CSQC and PIU were also discussed. ► Approved ESIA report to be provided to ULB	► Approved report will be provided to ULB ► EMP and RAP will be made part of bid document

Table 30: Summary of Key Concerns raised by stakeholders and its redressal

S.No	Key Concern	Redressal
Environmental Concern		
1	Communities raised concern on increase in traffic problems that may occur during the construction phase	Traffic management plan will be made in consultation with local authority and will be implemented by contractor to reduce the traffic impacts and local inconvenience
2	Communities raised concern that they used the pond during Chatt puja and any construction activity may possess safety risk during the puja	No construction activity would be undertaken during chatt puja. All under construction site will be properly barricaded throughout the construction phase.
3	Some stakeholder raised concerns about the increase in pollution levels that will occur due to construction activity	Adequate safe measures to mitigate environmental impact have been assessed and made part of EMP. EMP will be made art of bid documents, so that the contractor is aware beforehand the mitigation measures to be implemented at site .Additional regular monitoring will be undertaken to oversee that all mitigation measures are properly implemented by contractor. Grievance cell will be created at project as well as JUIDCO level, so that public can raise issues on any environmental concern that may arise due to construction activity
4	Some stakeholder raised issues on deterioration of water quality of ponds, if	Disposal of any construction materials will not be allowed in any surface water. Safety measures to minimize deterioration of water quality have been proposed in the EMP. Further regular monitoring will be undertaken to oversee that all mitigation measures are

S.No	Key Concern	Redressal
	construction debris are dumped on the ponds/water bodies near the construction site	properly implemented by contractor.
Social Concern		
5	People were concern of any land acquisition to be undertaken due to the project	People were informed that no land acquisition to be undertaken for this project
6	People raised concern that temporary business of shopkeepers and vendors in the project stretch will be impacted	Entitlement Matrix prepared for JMDP project covers compensation to be provided for temporary loss of livelihood

8 ENVIRONMENTAL IMPACT ASSESSMENT

- This chapter assesses key potential environmental impacts that are expected to occur during the project duration. The significance of the impacts have been assessed based on the methodology defined in Chapter 6. The expected impacts have been categorized in following two phases:
- **Construction phase**
- **Operation phase**

8.1 *IMPACTSDUE TO PROJECT ACTIVITY*

8.1.1 Positive Impacts

140. The positive impacts of the project are

- The population in the project area will be benefited by the implementation of this project with reduction in inundation related issues.
- Economic Benefits: Direct economic benefits such as the costs for the restoration of damaged roads, engaging earth work excavators, cost of pumping and associated fuel costs, the cost of materials such as sand bags, restoring cross drainages, small bridges etc. will be reduced. Further, the cost of cash and kind reliefs to flood affected population, loss of livestock, and other structures will be reduced after implementation of SWD Project.
- Indirect benefits such as improved health and living conditions due to reduced risk of exposure to water borne diseases, and vectors which cause malaria and dengue

8.1.2 Negative Impacts

141. The negative impacts that may potential arising due to the project activity during construction & operation phase has been presented in **Table 31**.

Table 31: Environmental Impact due to construction and operation phase

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
Pre- Construction Phase			
Utility shifting	Minor	Trenching works and excavation activities may impact existing utilities and cause disruption in services. As per the DPR, no major utilities are being impacted, however a provisional sum has been included in the project cost In case it is required.	i. Before construction, a joint field verification will be conducted by the Contactor, CSQC, JUIDCO PIU to map out the alignments, to check if any utility is being impacted due to construction works such as street lighting, water lines, telecommunication lines etc. ii. Get maps of the underground infrastructure from the relevant institutions. iii. Sensitise workers carrying out excavations so that they exercise caution to minimize chances of underground infrastructure damage ii. Prior permission will be taken from regional offices of Electricity, Telecommunications, Water works etc. iii. Any common property resource such as handpump, if removed shall be relocated at the earliest with consent of the using community to suitable location. iv. All utilities and common property resources impacted (permanently) due to the project will be relocated with prior approval of JUIDCo before construction starts. v. Any Utility/ CPR shall be relocated at the earliest, in case of damage, the services are restored within the shortest time. vi. JUIDCo PIU will supervise the utility shifting

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			activity and ensure that there are no delays or inconveniences caused to the dependent communities. JUIDCo will ensure the ESMP provisions apply to all executing agencies conducting the utility shifting activities.
Impact on Vegetation/ tree cutting	Minor	Within the urban area, construction activities may involve clearing of shrubs, grasses. No major tree cutting is anticipated, but cannot be ruled out.	i. Only clear vegetation that is necessary for the construction activities ii. Determine access roads which are to be used by machinery used in the construction and site clearance phase of the development to avoid the unnecessary trampling of vegetation that will be maintained within the urban area. iii. Adjust drain alignments to minimise damage to trees iv. No tree cutting will be carried out during nesting season. v. In case felling becomes necessary, felling activity to be undertaken only with permission from forest department and all conditions stated in the permit will to be adhered. Replacement tree planting with same species or indigenous species. vi. All Site restoration should utilize native vegetation species and replanting undertaken during rain seasons to ensure high re-vegetation success. vii. Provide adequate protection to the trees to be retained with tree guards (e.g. Masonry tree

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			viii. guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars) as required. ix. Take adequate care to determine to root protection zone and minimise root loss.
Raw material Sourcing and transport	Minor	i. Drain and Road construction will require considerable volume of materials including gravel, sand aggregate ii. (stone) and marking paint. Other materials include lime, bitumen, water, cement and steel. This is short-term and reversible impact iii. Transport of raw material to the project sites, can have temporary impacts of road dust generation through movement of trucks.	i. Quarrying will be carried out at government approved and licensed quarries only at Gobindpur, Palani, Baliapur Quarry & Crusher. ii. Prior written permission from authorities for use of water/ tanker water for construction activity will be submitted to the PIU iii. The contractor shall control road dust by watering wherever necessary and covering of trucks with tarpaulin sheets during transportation of soil and material. iv. No excavation of materials will take place from the bund of the water bodies v. Contractor shall provide temporary road signage during construction and ensure drivers observe speed limits and for safety of other road users. vi. Contractor shall prohibit haulage activities at night to avoid accidents in high population settled areas and business centres. vii. Contractor shall erect temporary signs along routes used by haulage trucks. viii. To avoid excessive haulage traffic noise at sensitive facilities, the contractor should not install temporary speed reduction features

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			(humps) adjacent to schools or hospitals. This would avoid noise associated with high speed deceleration and acceleration at humps. ix. EHS compliance and practice of the quarries where raw material will procure will be reviewed.
Material storage	Minor	There will be need to stockpile and store assorted materials at or near construction site to ensure uninterrupted access to supplies. This could lead to pollution of land and watercourses by spilling and wash away of materials if appropriate mitigation measures are not put in place. This impact can occur anywhere along the road and receptors are soil and water resources near storage sites and local communities dependent on affected environmental resources.	i. Protect material stockpiles from storm water erosion (e.g. by excavating a cut-offditch around stockpiles to keep away storm water). ii. Bunded storage for fuel with non- permeable flooring. iii. Contractor shall cover material stockpiles with fabric/ tarpaulin or other materials. iv. Avoid stockpiling material near waterways/wetlands or on slopes. v. Proper cover and stacking of loose construction material will be ensured during construction of outfall structures at construction site to prevent surface runoff and contamination of receiving water body. (The most likely source of watercourse contamination is loose soil being washed into rivers and streams during construction of drainage structures) vi. Installation of secondary containment measures in areas where fuels, oils or lubricants are stored loaded or unloaded,

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			including filling points. vii. Contractor should have a portable spill control pack (comprising absorbent pads/pillows, rolls, blankets, etc.) on site to contain and clean up fuel spills.
Setting up of Hot mix/asphalt plant	Moderate	i. Surfacing and road restoration will require bitumen. Location of the plant, bitumen preparation, storage andapplication could have environmental impacts on air quality, and surrounding communities. ii. Littering due to poor housekeeping at the asphaltplant or improper disposal of unused bitumen and aggregates or bitumen spills would have the localizedimpact of soil and water contamination. However, this impact is temporary and reversible but likelihood of it occurring is low since ingredients of asphalt (bitumen and aggregate) represent a financial cost to the contractor and waste is unlikely.	i. Asphalt mixing plants will be sited over 1000 m (refer CPCB/SPCB,) from any community, water bodies ii. All maintenance facilities, hot mix plant and concrete mixing plant shall be established with prior consent to establish to be obtained from SPCB. iii. All such equipment/plant shall be fitted with air pollution control system and shall comply with condition of consent to establish. iv. Periodic monitoring shall be carried as per consent conditions. v. Ensure good housekeeping to avoid onsite and offsite environmental contamination bybitumen. vi. The contractor shall collect leftover bitumen and aggregates properly keeping it for use on othersections of the road. vii. Contractor shall not discharge bitumen into road side drains, and shall collect and store empty bitumen drums at equipment yards and notabandon them along the road.
Environmental	Minor	i. Temporary influx of approximately 55 nos.	i. Contractor will set up and maintain labour

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
and social risk due to setting up of Labour Accommodation		of labours in the area. This will require approximately 1 acre of land to set up accommodation and ancillary facilities. ii. Arriving migrant workers will require housing, food supply, merchandize, transport, health care, entertainment, social interaction, etc. If not managed appropriately this influx of workers (and followers) can lead to adverse social and environmental impacts on local communities. iii. Sewage and waste generated in labour camp may lead to land contamination	accommodation facilities accordingly to Annex IV. ii. Contractor to hire workers through recruitment offices and avoid hiring "at the gate" to discourage spontaneous influx of job seekers. iii. Vaccinating workers against common and locally prevalent diseases; iv. Establishment of health centres at camp and construction site v. Mandatory and regular training for workers on required lawful conduct in host community and legal consequences for failure to comply with law vi. The contractor will follow the guidelines for siting and management of labour camp to ensure labour are provided with all facilities, conveniences and safety. vii. JUIDCO will issue the directives to Contractor and Contractor will accordingly prepare code of conduct. viii. Details of project will be displayed at prominent places such as ULB's office and Deputy Commissioner's office. ix. Necessary directives will be given to Contractor for hiring the local work force. However, in case of unavailability of required labour force and associated goods and services locally for the construction of civil

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			works, because of a number of reasons such as worker unavailability and lack of technical skills and capacity, the labour force (total or partial) may be brought in from outside the project area from nearby municipal towns and villages and sometimes from outside the state. x. Labour camp will have rooms for accommodating labours xi. Potable drinking water will be provided at the labour camp site xii. Septic tank will be provided as per BIS 2470 1(1985) xiii. Separate W/C and bathroom will be provided at the labour camp site. Open defecation will be strictly prohibited xiv. Provision of bins for collection of kitchen and food waste generated from labour camp site, which will be cleaned every day and disposed as per direction provided by DMC
Impacts of setting up equipment yard workers camp	Moderate	i. Although the workers camp and equipment yard would cover a relatively small area (1 acre)it can cause impacts if not managed and monitored appropriately. ii. Camp and equipment yard will require land to develop, temporarily altering land use. Their operation will	The contractor will follow all the provisions in the labour camp site management plan Annex IV and Waste management plan annex V

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
		generate domestic and hazardous waste (waste oil) which if improperly managed can contaminate soil, water resources and pose public health risks. iii. Unrestored camp and yard sites would cause aesthetic impacts from contamination from fuel, oil or unused bitumen. iv. Workers camps are also associated with fuel storage and dispensing, vehicle maintenance areas and workshops, offices and generator houses, vehicle wash bays and waste management/disposal. v. Land clearing will lead to loss of vegetation. The major causes are pollution (due to all forms of waste/ litter), fuel wood collection, soil erosion, spillage of oils and fuel, fire etc. vi. Lack of emergency medical capability at the camp can pose situations even from relatively simple incidents such as snakebites. vii. All these have potential for environmental contamination if not mitigated appropriately	
Construction Phase			

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
Traffic and Pedestrian management		i. Construction of the proposed drain may need the re-routing of some vehicular and pedestrian traffic ii. Increased risk to safety of pedestrian and stray animals during construction activities. iii. Difficulty in accessing property adjacent the drain	i. Where ever the entry and exit to houses/ establishments are affected due to construction ii. activities, alternate temporary arrangement for crossing over shall be provided iii. Detailed traffic control plans will be prepared and submitted to the engineers for approval, one week priorto commencement of works. iv. The traffic control plans shall contain details of temporary diversion, details of arrangements v. for construction (road stretches, timing and phases) a. Provide the construction itinerary in advance so that the potentially affected population can b. use alternative routes and start early to get to their destinations on time. c. Erect warning signs of ongoing works. d. Access of residents should be facilitated by installing appropriate temporary bridges e. over the trenches. f. Suitable warning signs should be placed at near locations and should be visible at night. g. Alternatives access ways should be communicated to the community h. Install signage, barricading, fencing as required and include safety measures for transport of hazardous materials/ trucks, which shall be limited to certain times, and

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			arrangements for flagmen.
Impacts on cultural properties and common property resources	Minor	i. Archaeologically chance finds in the project corridor cannot be ruled out ii. There is no impact on Cultural properties	Any articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of theGovernment and shall be dealt with as per provisions of the relevant legislation. If any chance find is discovered during excavations, the chance finds procedures in Annex X will be followed.
Soil Erosion	Minor	i. Due to excavation and allied construction activities, the upper stabilized portion will become loose and hence susceptible to erosion. ii. Exposed soil during construction is vulnerable to erosion if excavated surfaces are bare and unprotected from heavy rainfall. iii. The impact is likely to occur under most conditions and will be limited to project footprint area	i. The disturbed areas and soil stock piles will be kept moist to avoid wind erosion of soil ii. Topography will be restored to the extent possible and re-vegetated for slope stabilization to prevent soil erosion to the extent possible, immediately after the completion of construction of each of the foot print; iii. Small bunds will be created in case of any activities near the water body or drainage areas within the site to prevent washing of the soil into these waterways iv. Provision of silt/sediment trap in areas susceptible to high erosion will be made
Land Contamination	Minor	i. A small proportion of waste generated during construction phase will be hazardous and may include used oil, waste fuel, grease and waste oil soaked rags.	i. All waste arising from the project is to be disposed of as per the waste management plan in Annex VI. ii. Littering and burning of waste will be strictly prohibited and labours will be trained towards

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
		ii. Leaks and spills of oil, lubricants, or fuel from heavy equipment, improper handling of chemical/fuel storage and wastewater may cause contamination iii. Domestic wastes consisting of food waste, plastic, glass, and paper waste will also be generated by the construction workforce at any canteen facility/ rest area and also at labour camp site.	the same; iii. Municipal domestic waste will be generated at site to be segregated onsite and recyclables sold to vendors/ scrap dealers; iv. It will be ensured that the hazardous waste is properly labelled, stored onsite at a location provided with impervious surface, shed and secondary containment system in accordance to Hazardous Wastes Rules, 2016; v. It will be ensured that the routine disposal of hazardous waste through approved vendors and records should be properly documented along with required manifests vi. Construction contractor will ensure that no unauthorized dumping of used oil and other hazardous wastes is undertaken at the site and it is disposed through JSPCB approved recyclers only. vii. Use of spill control kits to contain and clean small spills and leaks will be ensured viii. Transport vehicles and equipment will undergo regular maintenance at designated areas (equipped with proper drainage) to avoid any oil leakages ix. Unloading and loading protocols will be prepared for diesel, oil and used oil respectively and workers will be trained to prevent/contain spills and leaks.

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			x. The contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refuelling sites will belocated at least 500 m from sensitive receptor sand refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground.
Disposal of Excavated silt	Minor	i. Soil and water contamination due to improper disposal of excavated material, construction and demolition wastes ii. Clogging of drains due to improper disposal of excavated material construction and demolition wastes iii. Excavated silt would have to be disposed safely from the existing drains.	i. The excess excavated earth will be conveyed to the existing ULB dumping yards at Sijua. ii. The existing drain will be excavated mechanically. iii. Domestic waste water will be diverted through flexible or hose pipes into a collection tank iv. No dumping of excavated material in natural drainage courses v. All vehicles delivering material to the site shall be covered to avoid material spillage.
Deterioration of Water Quality	Moderate	i. Water contamination will occur due to improper disposal of excavated material, construction and demolition wastes ii. The surface runoff carrying the excavated loose top soil will lead to increased sedimentation in the receiving water bodies. The impact will be temporary and will be for the entire construction period. iii. Chances of contamination of surface and	i. Septic tank and soak pits will be provided (as per specifications given in IS 2470 1995 Part I and Part II) onsite and at labour camp for treatment and disposal of sewage, thereby minimizing the adverse impacts of wastewater discharge; ii. Proper cover and stacking of loose construction material will be ensured during construction of outfall structures at construction site to prevent

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
		groundwater resources may likely to occur due to improper management of sewage at project site, labour camp or other accidental spills/leaks at the storage areas iv. There is only a minor impact on the quantities of water to be used for construction	surface runoff and contamination of receiving water body; iii. Use of licensed contractors for management and disposal of waste and sludge will be encouraged; iv. Construction labours will be restricted from polluting the source or misusing the source. v. Labour camps will not be located near water bodies. No discharge from labour camps will follow their path into nearby water bodies. Dumping of debris in or nearby water bodies will be strictly avoided vi. No disposal of any construction materials will be made in any surface water
Increase in air pollution	Moderate	i. Air quality in and around the project site would be impacted to some extent due to construction and construction related activities. The main impact will be during site levelling, excavation, construction material handling etc., ii. The likely emissions from construction activities will include the following iii. Fugitive dust emissions from excavation work, digging, stacking of soils, filling, handling of construction material, transportation of material, emission due to movement of tyres and plying of heavy construction machinery etc.	i. The emissions from diesel generators (meant for emergency power requirement) will be controlled to minimise impacts of air emissions by optimised operations, orientation at the site and providing stack height of 6 m (calculated as per stack height criteria of Central Pollution Control Board) from ground level for wider dispersion of gaseous emissions; ii. Proper maintenance of engines and use of vehicles with “Pollution Under Control Certificate” will be ensured iii. Fugitive dust emissions will be suppressed by spraying water, wetting of the stockpile; iv. Proper location of material stockpiles will be

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
		iv. Gaseous emissions from operation of diesel generators for power requirement during construction phase v. The proposed works under this project of storm water drainage system include construction of 153.95 km new drains across Dhanbad Municipal Corporation area. Human settlements, commercial spaces are present near the RoW of the whole alignment. vi. The impact will be temporary and will be lasting approximately 1 to 2 months at each stretch.	ensured, especially sand and soil. All such construction lose material will be provided with temporary bunds and screens (or providing wind breaks) to prevent erosion and generation of fugitive dust. When not in use, all stockpiles of the loose construction material will be covered with tarpaulin sheets; v. Trucks transporting soil and material will be covered with tarpaulin sheets vi. Wind breaking wall at predominant wind direction will be constructed
Impact on Noise Environment	Moderate	i. The major sources of noise due to construction activities will be due to: • Use of heavy machineries and vehicles during construction and demolition. • Use of transportation during building operation period. • Operation of D.G. sets. ii. All activities during construction period will increase noise levels which will directly impact the residents residing near the SWD construction areas- Activities such as materials delivery, trench excavation and construction traffic willgenerate noise and vibration	i. Hammering and vibration compaction will be minimised when near structures, buildings or property boundary where applicable, residential class mufflers and engine shrouds (acoustic lining) will be used on all equipment. These measures should be tailored per the proximity of buildings to the project sites and earthwork program. ii. Regardless of the size or type of vehicle, operators should implement the manufacturer recommended engine maintenance programs; and Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components will be conducted

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
		iii. The activities involved will have temporary impacts on the residents in the neighbourhood of the project area and in the congested roads and small lanes where the project is implemented. iv. Impact from vibration from construction equipment, in particular vibrating rollers used for earthworks and pavement compaction.	iii. Machinery and equipment that may be in intermittent use will be shut down or throttled down during non-work periods iv. Low noise equipment will be used as far as practical v. The number of equipment operating simultaneously will be reduced as far as practicable vi. Equipment known to emit noise strongly in one direction will be orientated so that the noise is directed away from nearby NSRs as far as practicable; vii. DG sets, if used, will be provided with acoustic enclosures; viii. Minimal use of vehicle horns in the project area will be encouraged; and ix. Equipment noise will be 85 dB(A) at 1 m from the source in line with WB EHS guidelines x. Drivers should be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits; xi. Recruit staff from the surrounding communities to decrease the travelling distance. xii. Maximise use of oscillating rollers in substitution of vibratory rollers or plate compactors in order to reduce the magnitude

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			of vibration and thereby the risk of damage to existing buildings xiii. PPE for construction workers
Public Health and Safety	Moderate	i. Activity is that construction sites easily accessible by the public particularly where the drain passes through highly congested areas. ii. Significant risk to public and especially children arising from active construction work sites iii. Demolition will be required to clear the work site. Although much of this willoccur under the RAP, and will not require heavy machinery. Most materials from demolition are easily recyclable and cleared in time not the create risk to public access, movement and safety. iv. There will be impact from increase fugitive dust emissions on public health and welfare.	i. Prevention of accidents needs to be ensured with proper barricading, signage boards and lighting etc. ii. The length of the open excavated trench should be minimised in order to reduce possible accidents iii. The construction area should be barricaded at all time in a day with adequate marking, flags, iv. reflectors etc. for safety of general traffic movement and pedestrians v. Using of modern machineries such as JCBs, backhoes etc., shall be used to minimize the construction period, it will reduce the construction period impacts to the nearby residents vi. Construction material shall be covered or stored in such a manner so as to avoid being affected by wind direction. vii. Unpaved haul roads near / passing through residential and commercial areas to be watered thrice a day. viii. Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage. ix. Sprinkling of water to be done at regular

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			intervals at places of work to protect the nearby inhabitants and road user x. In case accidents occur; the procedures must be in place for such accidents that do occur to deal with this: works contractors first aider and kit, prearranged access to emergency facilities, accident reporting and investigation procedures.
Impacts on sensitive receptors	Minor	Provisions would need to be ensured so that no substantial adverse impacts on schools, hospitals and healthcare centres through increased noise and air pollution impacts	i. Noisy construction operations in residential and sensitive areas should be done only between 7.30 am and 6.00 pm. ii. Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise. iii. Provision of enclosing generators and concrete mixers at site. iv. Sound barriers shall be installed during the construction phase to protect the inhabited areas from the noise from construction activities. v. Adequate barricading and safety measures to protect dust pollution and noise impacts on sensitive receptors like schools and hospital etc. due to vehicle movement to be ensured prior to the start of work and their effectiveness to be checked during construction

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			vi. Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured specially near residential / commercial / sensitive areas. vii. Stationary construction equipment will be kept at least 500m away from sensitive receptors. viii. All possible and practical measures to control noise emissions during drilling shall be employed.
Occupational Health and Safety of Workers	Major	i. The workers and site personnel will be exposed to various physical, chemical hazards during construction activities and handling of equipment such as working in excavation pits, hot work, electrical work, operation of JCB, hydra crane etc. ii. All activities during construction period will increase air pollution and noise levels which will directly impact the construction workers and site personnel. iii. There are high risk operations involved such as electrical work, tree cutting, excavation, and operating heavy machinery iv. Working at night time presents a heightened risk to worker health and	i. The contractor will follow the OHS plan in Annex VI, including provisions for emergency response and night time work ii. All workers will be provided with requisite personal protective equipment iii. Provision of all workers with requisite personal protective equipment will be made; iv. Provision of onsite toilet and washing water for workers will be made; v. Provision of 'No smoking' signs in office, community places, construction camps as well as high-risk areas prone to fire hazards e.g. near fuel tanks will be made; vi. Adequate fire safety, fire exists and fire assembly points at camp will be ensured; vii. Provision of mobile water tanks and toilets at every active construction worksite.

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
		safety aspects.	viii. Provision of signage reminding use of PPE at appropriate locations in the project areas including ancillary work sites will be made; ix. Project supervising engineers will inspect contractors' compliance with safety precautions during construction/project activities. x. All machines to be used in the construction will conform to the relevant Indian Standards (IS)codes, will be free from patent defect, will be kept in good working order, will be regularlyinspected and properly maintained as per IS provision xi. The contractor shall arrange for: • A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone • Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital.
Operation Phase			
Maintenance	Moderate	i. Drainage maintenance work if not carried out with proper EHS considerations can also have impacts to water quality. ii. Silt deposited along the drain if not cleaned routinely could lead to reduction in volume of drain and impact on receiving water bodies.	i. It will be ensured by PIU/ULB that drains are not clogged. Correct operation and maintenance of drains and trash screen ii. The drains will require regular inspection and maintenance with clearance of any accumulated silt or trash, and the trash screen will need regular removal of trash, the

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			clearance interval will be shorter in therainy season than in the dry season. iii. For control of sediments it is proposed to construct sediment trap at the confluence point of drain with the water body so that the sediments are deposited in the silt trap and settle over there which can be removed periodically. It is also possible to provide additional silt traps at the point where the cross-drainage confluence and the silt from these silt traps shall be periodically removed. following practices should be adopted in maintaining storm water drains: a. Drains will be regularly inspected and cleaned especially prior to monsoons. b. All damaged or missing drain covers will be replaced immediately c. Rubbish and silt that are removed from the drainage system will not be left alongside the drain and will be immediately disposed in the designated municipal solid waste site. d. Sediment silt within the drain will be removed and disposed at designated landfill area.
Public Health	Moderate	i. The runoff during monsoon will lead to silting of the drains. ii. The de-silted material if dumped on adjacent area could be a nuisance to the public due to odour, breeding of	i. The storm water drains would need to be periodically de-silted in-order to maintain its carrying capacity. ii. Periodical monitoring will be carried out and sources of waste will be identified by the ULB,

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
		mosquitoes, obstruction in movement of pedestrians. iii. People have tendency to throw solid wasteinto the drains in the absence of bins and adequate solid waste management. iv. Clogging of drains due to deposition of eroded soil, leading to formation of misquotes breeding grounds and foul odours.	and additional bins in critical locations will be provided and frequent collection and disposal of wastewill be ensured. iii. ULB will initiate action to ensure proper linking of such connections to other waste disposal systems and it will l be ensured that the drains carry only the rainwater. iv. Conduct water quality monitoring quarterly for all receiving ponds to in case water quality standards decrease, public advisory will be issued so that no domestic washing or recreational activity takes place if water quality dips beyond CPCB Class E. v. Drains are designed as box type drain in RCC with cover on top which will curtail dumping of solid waste in drains. vi. Public awareness programs have been proposed through IEC activities to proper waste disposal to ensure public co-operation and not to throw garbage and other waste into the drains.
Contamination of storm water in the drain	Major	i. Potential positive impact if solid waste is more effectivelyremoved from the drains than it is at present ii. Though 48% of the city is connected to septic tanks, and 7% to piped sewer network, there is a chance that Domestic household waste water may flow into the	i. Drain needs to be undertaken to remove leaves, litter, sediment, oily materials that can cause blockage of inlets and outlets. ii. Drain cleaners must deposit material from blocked drains in municipal waste storage bins. And all broken drain cover slabs need to be replaced

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
		storm water drain. iii. Domestic household solid waste thrown into the drain	iii. The ULB with support from JUIDCo would need to carry out education and Awareness campaigns to communities regarding their 'responsible' activities in relation to drainage management. iv. JUIDCo is supporting the ULB Dhanbad for a sewerage scheme for the city to be implemented under the central government AMRUT scheme which will be implemented in the next 3-5 years. v. The proposed storm water drainage system is covered which avoids curtails dumping of solid waste in drains.
Health and Safety of drain cleanliness workers	Moderate	i. Worker health and safety during routine maintenance and general cleaning and unblocking of the drains needs to be ensured, else there could be health and safety related impacts and accidents. ii. The ULB may also carry out seasonal maintenance such as structure repairs, emergency maintenance t and the regular upkeep will be undertaken as necessary.	i. Inspection doors shall be provided at regular interval to facilitate maintenance activities. This will be carried out only by machineries, and workers will be given adequate PPE ii. No manual scavenging/cleaning will be carried out iii. All drain cleaning will be carried out by mechanical means/ machinery, however in case of any need for manual maintenance in closed drains the following shall beensured. a. Allow only certified workers to work in any confined space. b. Provide adequate ventilation. c. A person should be stationed outside the

Impacts	Impact Significance	Explanation of impact	Mitigation Measures
			confined space to monitor the weather condition and keep communication with the workers inside. If required, ensure the use of approved breathing apparatus d. Appropriate emergency procedures shall be formulated to deal with serious or e. imminent danger. f. Instructions, training and advice shall be provided to all workers to be workingwithin a confined space.

9 SOCIAL IMPACT ASSESSMENT (SIA) AND RESSETTLEMENT ACTION PLAN (RAP)

1. The Social Impact Assessment at this stage aims to document the impact of the project on the community and settlement, in order to prepare the resettlement and rehabilitation framework and provide detailed information about the social impact. Though the proposed project will bring substantial social and economic development in the region but it will also adversely affect the assets falling within the corridor of impact. The census socio-economic survey was started on10thJune 2017 to enumerate the level of impact. The analysis of census data collected of the PAHs is detailed in below sections.

3.1 IMPACT ON STRUCTURE AND THEIR TYPE

2. Construction of drains along the roads and outfall structures will not require any land acquisition. The construction of drains will primarily be located within the ROW of the roads, government lands or government office premises as confirmed from the DPR and discussions with authorities at site. But the ROW is encroached and there would be impact on assets due to the sub-project.

3.1.1 Type of affected structures

3. The details of properties likely to be affected by the proposed storm water drainage project was recorded, using structured questionnaires. In general the social assessment of the impact has been done within the existing ROW/ government land. The census findings reveal that there are about 6568 affected households having assets and/or pursuing livelihood within the existing ROW. The following sections deals with the details of the affected structures along the drainage. The number of affected properties is given in below table.

Table 32: Type of structures affected (Encroacher and Squatter)

Type of structure	No.	%age
Residential	1,217	18.53
Commercial	3,757	57.21
Resi-cum-Commercial	79	1.19
Static Hawkers	1,036	15.78
Mobile Hawkers	479	7.29
Total	**6,568**	**100.00**

Source: Census Survey, JUIDCO, June 2017

3.2.2 Type of commercial structure

4. Out of the total affected structures, 57% are commercial in nature and most of them are shops (2824 in number) as shown in table 3.

Table 33: Type of commercial structure

Type of structures	No.	%age
Shops	2,824	75.17
Hotel	92	2.45
Small Eatery	65	1.73
Kiosk	10	0.27
Farm House	14	0.37
Petrol Pump	-	0.00
Clinic	1	0.03
STD Booth	-	0.00
Workshop	-	0.00
Vendors	195	5.19
Commercial Complex	32	0.85
Industrial structure	2	0.05
Restaurant	1	0.03
Any Other	521	13.87
Total	**3,757**	**100.00**

Source: Census Survey, JUIDCO, June 2017

3.2.3 Type of construction of affected structures

5. Most of the structures likely to be affected along the drainage site, are temporary and semi-permanent in nature (about 71% and 20% respectively). The detail of type of constructions of the structures is summarized in the table 4.

Table 34: Type of construction

Type of Construction [Col]	Nos.	%age
Temporary	4,665	71.03
Semi-permanent	1,283	19.53
Permanent	620	9.44
Total	**6,568**	**100.00**

Source: Census Survey, JUIDCO, June 2017

3.2.4 Ownership of properties

6. The census survey also establishes that all the affected structures are either encroachers or squatters. Few of the affected structures are occupied by tenants. The property falling within the corridor of impact as per its type of ownership has been

documented in Table 4. Out of the total 6568 affected households, 4103 are encroachers who will be economically displaced and their economic activities will be affected during the construction stage. The remaining 2465 PAH comes are squatters categories, out of which 479 are mobile vendors and 1036 is static vendors and 913 falls under categories of residential and residential cum commercial squatters. The static vendors and residential and residential cum commercial PAH will also be physically displaced. Vendors will be shifted to vending zone which is proposed under the municipal corporation and for this purpose 12 locations have been identified and proposal has been sent to state government for approval and land of allocation for establishing the vending zone. The number of affected households is given in table 5.

Table 35: Ownership of properties

Sl. No.	Road name/Ward	Encroacher	Squatter	Grand Total
1.	Ara More	1	1	2
2.	Bank More Road	207	151	358
3.	Barmasiya road	39	66	105
4.	Bartand Road	72	18	90
5.	Barwada road	6	63	69
6.	Bekar Bandh	114	38	152
7.	Bhuli road	3	0	3
8.	Bus stand road	92	47	139
9.	central hospital road	5	0	5
10.	Chhat Talab, Barmasia	0	2	2
11.	Chiragora road	13	11	24
12.	city center road	5	0	5
13.	CMPF Colony road	6	5	11
14.	CMPF ROAD	14	4	18
15.	Dhaiya main road	10	66	76
16.	Dhanbad - Jamtara road	608	205	813
17.	Dhanbad Sindri Road	219	104	323
18.	Duhatand Road	1	8	9
19.	golf ground	3	0	3
20.	Govindpur Road	51	17	68
21.	HE School Road	21	11	32
22.	Hirapur	675	749	1424
23.	Jharia Road	11	13	24
24.	Kalali road	2	0	2
25.	Kandra Bazar	4	1	5
26.	Kandra Sindri Road	4	0	4
27.	Katras road	67	10	77

28.	Kendra Bazar	1	0	1
29.	Koylanagar Road	389	85	474
30.	Kumhar Patti Road	3	15	18
31.	kuwar singh baliapur road	8	0	8
32.	Law College Road	9	9	18
33.	Luby circular road	49	6	55
34.	Manitand	4	2	6
35.	Matkuria Road	54	2	56
36.	Mithu Road	46	7	53
37.	Nutan D Road	91	6	97
38.	Patrakuli Road	26	72	98
39.	PMCH ROAD	85	2	87
40.	Purana Bazaar	358	175	533
41.	Rani Road Bhuda	16	2	18
42.	Saharpura sindri road	7	1	8
43.	Saraidhela road	140	104	244
44.	Shaharpura road	2	1	3
45.	Sindri Baliapur road	16	10	26
46.	sindri domgor road	2	0	2
47.	Station road	197	113	310
48.	Telephone Exchange Road	2	0	2
49.	Telipada road	27	13	40
50.	Tundi Dhaiya Road	221	178	399
51.	Tundi Govindpur road	7	0	7
52.	Vaistpada road	11	1	12
53.	Zila parishad road	8	3	11
54.	SSLNT Road	26	33	59
55.	Bus stand to housing colony road	13	6	19
56.	Mazdoor chowk to Birsa Chowk	4	2	6
57.	Dhirendrapuram Colony Road	6	2	8
58.	Mazdoor chowk to station road	12	24	36
59.	Rohrabandh - Baliapur road	4	1	5
60.	Baliapur Road	6	0	6
Grand Total		**4103**	**2465**	**6568**

Source: Census Survey, JUIDCO, June 2017

3.2.5 Occupancy status of the structures

7. Out of the total affected structures, 62% are used by their owners and about 38% of them has been rented out and are currently occupied by tenants as shown in table 6.

Table 36: Occupancy status of affected properties

Owner of the property	No.	%age
Owner	4,103	62.47
Tenant	2,465	37.53
Total	**6,568**	**100.00**

Source: Census Survey, JUIDCO, June 2017

3.3 SOCIO-ECONOMIC PROFILE OF PROJECT AFFECTED HOUSEHOLDS

8. The purpose of census survey was to create a broad database of the affected properties as well as the project-affected persons (PAPs) in order to understand the social profile of the project-affected area. It helps in appraise the positive as well as negative change in the life style of the communities in the project influence area due to implementation of the project as an external intervention. Based on the primary data collected during census survey, an assessment of the socio-economic profile of the affected population has been outlined in the following paragraphs.

3.1.2 Social composition of PAHs

9. The data indicate that most of the affected households belong to OBC category. Out of total PAHs, 47 % belong to OBC category followed by 24% of households falling under General category. About 6% of the affected households are Schedule Tribes. However, the Scheduled Tribe population is now in main stream population and is having no indigenous characteristics. There are no indigenous tribe affected due to proposed project, So TDP is not required.The detail has been given in **Table 7**.

Table 37: Social stratification of PAHs

Social class	No.	%age
ST	399	6.07
SC	454	6.91
OBC	3113	47.40
General	1579	24.04
Did not respond	1023	15.58
Total	**6568**	**100.00**

Source: Census Survey, JUIDCO, June 2017

3.3.2 Vulnerable groups

10. An assessment was made to bring out the vulnerable PAHs (Below Poverty Line families, Women-headed Households (WHH), Lonely old aged and Physically challenged) headed households. Their distribution on the stretch in terms of absolute numbers and percentage are given below. The data reveals that out of 6568 affected households, 5698 belongs (about 86.75) to vulnerable group. About 81% PAHs are BPL and 4.42% of them are WHH.

Table 38: Vulnerable Groups

Household type	No.	%age
Below Poverty Line	5345	81.38
Women Headed Household	290	4.42
Physically Challenged/Handicap	37	0.56
Lonely Old age	26	0.40
Total	**5698**	**86.75**

Source: Census Survey, JUIDCO, June 2017

3.4 PROVISION TO UPDATE INFORMATION

11. The information, related to the affected households, collected during the preparation of this report will further be verified during the project implementation. A joint verification would be conducted by the JUIDCO official, NGO appointed for implementation of RAP and representative of the local community, in the presence of affected households. Any required modification (addition/ deletion of the eligible/non-eligible households) noted during the joint verification will be referred to the Grievance Redressal Committee (GRC) for decision making. Once the requested modification is approved from GRC, the revised list of the eligible households will be included in the micro-plan to be prepared by the NGO during RAP implementation.

10 ENVIRONMENTAL MANAGEMENT PLAN

142. This section describes the environmental and social measures to be implemented in and mitigate the impacts that are anticipated as a result of the project activities proposed at project site. These measures will be implemented to mitigate the adverse impacts of the project and enhance its positive impacts, by avoiding impacts where possible, and by reducing, remedying or compensating for impacts where they cannot be avoided. The Environment and Social Management Plan (ESMP) for the project represents a consolidated list of mitigation measures and aims to:

    i. Set out the arrangements that will be put in place by the project to manage the environmental and social performance of the project during construction phase
    ii. Describe the monitoring programmes required to assess accuracy of predicted impacts and adequacy of mitigation strategies; and
    iii. Provide a comprehensive listing of the various mitigation and monitoring measures that are to be implemented to avoid or reduce negative impacts and enhance positive impacts.
    iv. Ensure compliance with the applicable National, and State Environment and Social laws and regulations as well as the World Bank's safeguard policies.
    v. Institutional arrangements that are and will be put in place by JMDP for the environmental and social compliance.
    vi. Detail the plan for periodic monitoring of the effectiveness of the mitigation measures and residual impacts.
    vii. Outline the capacity building plan for enhancing the capacities of the key stakeholders on environmental and social management.
    viii. Detail the budget requirements for implementation of the ESMP
    ix. Provides a framework for compliance auditing and inspection of the project that will give the regulators and external stakeholders the assurance that the project's commitments to environmental and social mitigation and its aims with respect to environmental and social performance are being met.

The primary objectives will be to comply with:

    i. All applicable Indian legislation as identified in Chapter 3
    ii. World Bank Safeguard Policies, where these vary the most stringent standard will apply, as identified in Chapter 3
    iii. And local state level policies, as identified in Chapter 3

iv. Ensure all E&S permits and clearances applicable to the project have been provided.

143. A comprehensive storm water drainage scheme has been proposed in accordance to the natural drainage course including integration with existing water bodies and ponds to the maximum extent possible. Thestorm water drainage system of Dhanbad town includes construction of 153.95 km (Dhanbad area: 112.26km and Sindri area: 41.70 km) new drains with silt traps at catch basins,94 outfall structures (19 outfalls discharging in Ponds, 40 outfalls discharging on culvert, 26 outfalls discharging in river/ drain, and 9 outfalls connecting to roads. It is proposed to construct all drains up to 0.6 m depth in brick masonry and drains exceeding 0.6 m depth in RCC to have proper stability and strength. It is also proposed to cover RCC drains of type A and B with pre-cast RCC covers and RCC type C with cast in situ covers. Most of the existing drains constructed in the project alignments will be dismantled due to their poor condition, some selected existing drains having good physical condition and adequate size have been integrated with the proposed drainage system.

144. Construction activities will inevitably result in increased noise and potential air and water

pollution during the limited period required to execute the works at any one location.

Further waste materials from the works will need to be disposed which may have adverse

impacts on the environment. Works on drains will cause obstruction of access, disruption totraffic, disruption or loss of livelihood amongst others.

10.1 Institutional Arrangement for ESMP Implementation

145. The key institutions involved in the implementation of the EMP, their roles and responsibilities are outlined in this section.

Table 39: Key institutions for EMP implementation

Level	Implementing institutions	External institutions servicing the sub-project	
State	JUIDCO – Project Management Unit (PMU)(already in place) ► Environmental Specialist ► Social Specialist	JUIDCO's Project Management Consultant (PMC) ► Environmental Specialist ► Social Specialist	
Dhanbad ULB level	JUIDCO – Project Implementation Unit (PIU) ► Environmental	JUIDCO's Construction Supervision and Quality Control Consultant (CSQC Consultant)	Contractor ► Environmental Health and Safety Specialist

	▪ Specialist ▪ Social Specialist	▪ Environmental Health and Safety Specialist ▪ Construction Safety officer	▪ Social Specialist

146. **JUIDCO-PMU**: JUIDCO is the primary implementing agency for the JMDP under which the Dhanbad-Road sub-project is being implemented. JUIDCO has established a Project Management Unit (PMU) for JMDP, which has a dedicated environment and social specialist. The JUIDCO-PMU will have ultimate responsibility and obligation to ensure for implementing the provisions of the ESMP. This role will include on-going identification and management of environmental impacts, monitoring social and environmental performance, ensuring availability of committed human resources and budget for ESMP implementation, periodic monitoring and reporting on ESMP performance. JUIDCO PMU will also carry out regular training on EHS aspects especially for construction stage, orientation and experience sharing programs to enhance the knowledge and capacity of the project staff. JUIDCO-PMU will coordinate with Project Implementing Unit (PIU) and Project Management Consultant (PMC) for effective monitoring of the ESMP. The JUIDCO PMU will draw support from safeguards specialists from the project management consultant's team if needed.

147. The PMU will also put in place training programmesas per the ESMF for contractors' staff on environment and social impacts in construction stage which include OHS management, maintenance of labour camp code of conduct and hygiene, use of PPE, HIV prevention, gender, and maintaining hazard free work spaces JUIDCO-PMU will coordinate with Project Implementing Unit (PIU) and Project Management Consultant (PMC) for effective monitoring of the ESMP. The JUIDCO PMU will draw support from safeguards specialists from the project management consultant's team if needed.

148. **JUIDCO-PIU:** The PIU located at the ULB level, this will be established and have a dedicated environment and social specialist to supervise and monitor the contractor's performance in implementing the ESMP. The PIU will assume direct responsibility for day-to-day project management, coordination and implementation of the sub project. The PIU will also supervise implementation of ESMP, and submit monthly progress reports to the PMU; and, will monitor the financial and physical progress of ESMP, adequacy of public consultation and compliant handling, and grievance redressal. It will also facilitate smooth coordination between the contractor, CSQC and the relevant government departments (utilities, traffic management etc.) for ESMP implementation. The PIU will also form the formal link between he ULB and JUIDCo, obtaining various

clearances and approvals required and essential for project implementation, and reporting ESMP non-compliance to the PMU.

149. **Construction Supervision and Quality Control:** The CSQC Consultant will have a full-time Environment, Social, Health and Safety specialists to undertake day to day supervision of the implementation of the ESMP, labour management, OHS and waste management provisions, including all mitigation, management and monitoring measures by the Contractor, will provide required on-site guidance for safeguards compliance, and non-compliance, will report on safeguards compliance to the PIU. The CSQC consultant firm will also have a full-time construction safety officer on board, specifically dedicated towards monitoring site, safety, accident prevention and hazardous work sites. The scope of work for the CSQC ESHS specialist is attached in Annex VIII

150. **Contractor:** The contractor will be responsible for implementation and adherence to all the mitigation measures, monitoring and inspection arrangements outlined in this ESMP associated with their respective activities. The contractor will be required to comply with the mitigation provisions, specifications, drawings of the ESMP and with any related code of conduct required by JUIDCO.The contractor selection process will include consideration of the capacities of the entities to ensure compliance to legal environmental and social requirements as well as adherence to the ESMP. The contract conditions will emphasize the obligations of the contractor on both these aspects. The contractor will put in place experienced specialist in the roles of Environmental Health and Safety; and Social as a part of the implementation team.

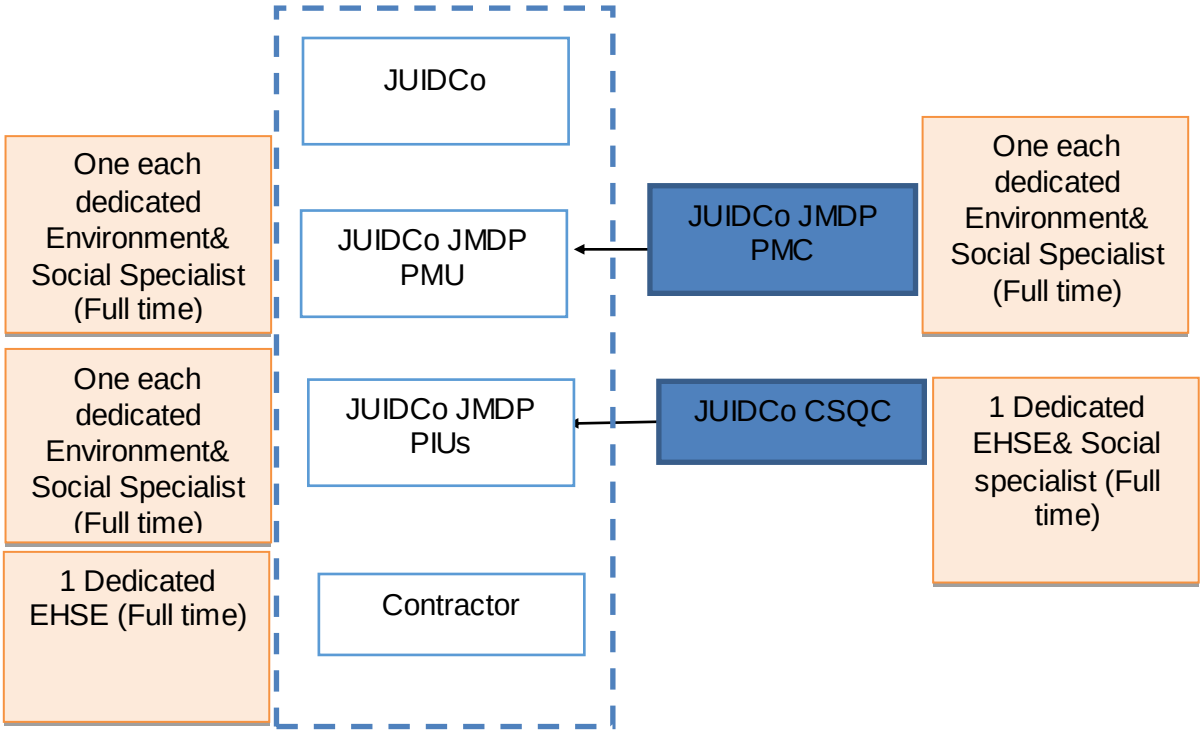
151. **Dhanbad Municipal Corporation:** The ULB officers, engineers will form an integral part of the PIU. However, the ULB will also support the sub project implementation in conducting information education and communication activities for citizens on maintaining drain cleanliness, promote understanding ofthe importance of drainage systems as well as on issues of indiscriminate solid waste disposal.

152. The ULB will also work with the PIU, addressing complaints from citizens, assistance in obtaining necessary government approvals for waste management, and raw material requirements. The ULB will also be the key agency which will support institutional coordination for utility shifting, road restoration activities.

153. The ULB will be responsible for Maintenance works for the drainage project, and will need to carry out regular monitoring of water quality in the receiving ponds, and visual inspection visits to ensure sustainability of the assets created. Drainage channels will need to be repaired when necessary and solid waste will need to be prevented from blocking drains. This is required to obtain the full benefits of the project but also provide visible evidence to the communities of the worth of the project. The ULB will need to

ensure integration between any proposed water supply and sewerage works so that holistic approach to solving water supply, sanitation, drainage and solid waste problems for Dhanbad is taken up and ensures success of the projects.

154. The organogram of the project is presented below:



155. The human resources in each of these institutions for ESMP implementation will be as follows:

Level	Institution	Human Resources
State	JUIDCO PMU	Full time dedicated 1 each Environment& Social Specialist
State	JUIDCO PMC	Full time dedicated 1 each Environment& Social Specialist
ULB	JUIDCO PIU	1 dedicated Environment Engineer& Social Specialist
	CSQC Consultant	Full time Environment Health and Safety Engineer & Social Specialist
	Contractor	Full time Environment Health and Safety Engineer

10.2 STRUCTURE OF THE ESMP

156. The ESMP discusses the aspect/potential impacts and specific action to be taken for its management. It refers to the responsible person ensuring commitment for implementation and means of verifying whether the same has been implemented. The timing and frequency of monitoring along with the supervision responsibility and reporting requirements are also provided.

157. As a part of the EMP, JUIDCO will commit to recognizing the environmental issues, social and livelihood impacts on the local communities at the individual sub-project sites. Overall, JUIDCO/PMC/the Contractor will not restrict or curtail the rights of local communities during the development of the sub-project other than for interventions that are necessary from the perspective of community health & safety.

158. In case of any future changes in the sub-project design, the EMP will need to be updated to reflect the new scope of the activities. Such revisions will be finalized in consultation with the World Bank.

159. The CSQCwill be responsible for the performance of all contractors with the overall accountability resting with the JUIDCO-PMU. This will include regular training, monitoring and ensuring that all EMP commitments and policy requirements are translated into 'contractors' requirements and that these requirements are implemented to their full intent and extent.

160. Contractors will be responsible for implementation of and adherence to all the mitigation measures outlined in this ESMP associated with their respective activities. All contractors will be required to comply with the provisions of the ESMP

10.2.1 Safeguards Audit.

161. There will also be an annual safeguard audit carried out for the JMDP projects, by an independent consultant. ESMP and all its provisions will be audited, and where required the consultant firm will make recommendations for improvement. The contractor would need to take corrective action, supervised and verified by the JMDP PIU.

10.3 Environment and Social Management Plan

162. The ESMP presents a listing of the mitigation measures to be taken for each potential impact along with details on the responsible person, means of verification, timing and frequency of monitoring, supervision responsibility and reporting requirements. Before the start of construction work, the Project Engineer, contractor's team will carry out joint field verification of the EMP. The efficacy of the mitigation measures suggested in the ESMP will be checked and if required, the Engineer will modify the EMP and BoQ associated with the mitigation measures. Additionally, JUIDCO shall organize orientation sessions for all contractor staff of and field level implementation staff of Contractor and all consultants on environment and social management

163. Before the start of construction work, theProject Engineer, contractor's team will carry out joint field verification of the EMP. The efficacy of the mitigation measures suggested in the ESMP will be checked and if required, the Engineer will modify the EMP and BoQ

associated with the mitigation measures. Additionally, JUIDCO shall organize orientation sessions for all contractor staff of and field level implementation staff of Contractor and all consultants on environment and social management for management of construction phase impacts

164. The ESMP of the project is presented in Table 40 to mitigate the environmental impacts that may arise due to the project.

Table 40: Environmental Management Plan for Dhanbad SWD

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
Pre- Construction Phase				
1.1	Regulatory Approvals	i. Tree cutting permission, if any trees are to be felled, from State Forest Department. ii. Approval from regulatory authority for withdrawal of water for construction purpose. iii. Labour license from Department of Labour. iv. Prior permission will be taken from regional offices of Electricity, Telecommunications, Water works etc. If utility shifting is required to be undertaken by the contractor	Necessary permits are in place - Before start of construction activity	Contractor, (Primary responsibility) CSQC (secondary responsibility)
1.2	Utility Relocation & Accessibility	i. Before construction, a joint field verification will be conducted by the Contactor, CSQC, JUIDCO PIU to map out the alignments, to check if any utility is being impacted due to construction works such as street lighting, water lines, telecommunication lines ii. Sensitise workers carrying out excavations so that they exercise caution to minimize chances of underground infrastructure damage iii. Any common property resource such as handpump, if removed shall be relocated at the earliest with consent of the using community to suitable location. iv. Any Utility/ CPR shall be relocated at the earliest, in case of damage, the services are restored within the shortest time.	JUIDCo PIU will supervise the utility shifting activity and ensure that there are no delays or inconveniences caused to the dependent communities. JUIDCo will ensure the ESMP provisions apply to all executing agencies conducting the utility shifting activities.	Contractor, (Primary responsibility) CSQC (secondary responsibility)
1.3	Planning of Traffic Arrangements	Traffic management plan to be prepared in consultation with Traffic Police Department.	Approved Traffic Management Plan	Contractor, (Primary responsibility) CSQC

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
				(secondary responsibility)
1.4	Joint Field verification of ESMP	i. The Project Engineer, Contractors Team will carry out joint field verification with CSQC team of the ESMP, surveying for the proposed design and confirmation of levels to ensure the required gradients. ii. Checking for accommodating utilities crossing the drains: raising, lowering or re-location if require iii. Check The efficacy of the mitigation measures suggested in the ESMP If required, the Engineer will modify the BoQ associated with the mitigation measures.	A field verification survey report will be prepared by the contractor and verified by CSQC	Implementation: Contractor, CSQC and PIU
1.5	Information Dissemination and Communication Activities	i. Prior to construction activity, information dissemination will be undertaken by JUIDCO and the ULB at the project site and at the city level. The wider dissemination of information to public will be undertaken by JUIDCo through the disclosure of ESIA / ESMP reports in the website of the ULB and JUIDCo. ii. At the project sites, i.e. the direct impact zone, information boards will be displayed to disseminate the project details Such information boards will display project name, concerned official's name in the engineer's office with his designation and contact no., name and contact details of an authorized official in local JUIDCo PIU office. These information boards will be approximately of size 5' x 5' and will be designed and put up in such a way that public can easily read it from a distance. iii. Boards will also be setup at the sites of construction	JUIDCo PIU and CSQC will ensure all information signage at all key locations has been displayed.	Implementation: Contractor Supervision: CSQC and PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		camps and labour camps and debris disposal site. These information boards will also mention the availability of a complaint register with ESHS officer of the CSQC consultant.		
1.6	Storage of construction materials	i. JUIDCO PIU, Contractor consultation with ULB shall identify the site for temporary use of land for construction sites /storage of construction materials including pipes etc. These sites shall not cause an inconvenience to local population / traffic movement. These locations shall be approved by the engineer in charge. ii. Protect material stockpiles from storm water erosion (e.g. by excavating a cut-off ditch around stockpiles to keep away storm water). iii. Bunded storage for fuel with non- permeable flooring. iv. Contractor shall cover material stockpiles with fabric/ tarpaulin or other materials. v. Avoid stockpiling material near waterways/wetlands or on slopes. vi. Proper cover and stacking of loose construction material will be ensured during construction of outfall structures at construction site to prevent surface runoff and contamination of receiving water body. (The most likely source of watercourse contamination is loose soil being washed into rivers and streams during construction of drainage structures) vii. Installation of secondary containment measures in areas where fuels, oils or lubricants are stored loaded or unloaded, including filling points.	Approved areas will be demarcated, the necessary barricading and security arrangements will be provided by the contractor	Implementation : Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		viii. Contractor should have a portable spill control pack (comprising absorbent pads/pillows, rolls, blankets, etc.) on site to contain and clean up fuel spills.		
1.7	Setting up of Labour Camp	i. Labour camp site will be identified and set up over area of 1 acres as per the provisions in Annex IV. Approximately 50-60 labour will be housed in the camp site. ii. Labour camp sites should be located close to the project area. iii. Contractor to hire workers through recruitment offices and avoid hiring "at the gate" to discourage spontaneous influx of job seekers. iv. Vaccinating workers against common and locally prevalent diseases; v. Establishment of health centres at camp and construction site vi. Mandatory and regular training for workers on required lawful conduct in host community and legal consequences for failure to comply with law vii. The contractor will follow the guidelines for siting and management of labour camp to ensure labour are provided with all facilities, conveniences and safety. viii. JUIDCO will issue the directives to Contractor and Contractor will accordingly prepare code of conduct. ix. Details of project will be displayed at prominent places such as ULB's office and Deputy Commissioner's office. x. Necessary directives will be given to Contractor for hiring the local work force. However, in case of	JUIDCo PIU and CSQC will assess that the labour camp has been set up in accordance with the provisions/specifications in Annex IV. A Labour camp inspection checklist will be furnished in monthly ESMP report.	Implementation : Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		unavailability of required labour force and associated goods and services locally for the construction of civil works, because of a number of reasons such as worker unavailability and lack of technical skills and capacity, the labour force (total or partial) may be brought in from outside the project area from nearby municipal towns and villages and sometimes from outside the state. xi. Potable drinking water will be provided at the labour camp site xii. Septic tank will be provided as per BIS 2470 1(1985)Separate W/C and bathroom will be provided at the labour camp site. Open defecation will be strictly prohibited xiii. Provision of bins for collection of kitchen and food waste generated from labour camp site, which will be cleaned every day and disposed as per direction provided by DMC		
1.8	Raw Material Sourcing	i. Quarrying will be carried out at government approved and licensed quarries only at Gobindpur, Palani, Baliapur Quarry & Crusher. ii. Prior written permission from authorities for use of water/ tanker water for construction activity will be submitted to the PIU iii. The contractor shall control road dust by watering wherever necessary and covering of trucks with tarpaulin sheets during transportation of soil and material. iv. No excavation of materials will take place from the	► JUIDCO PIU and CSQC to verify licences and permits for raw materials.	Implementation : Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		bund of the water bodies v. Contractor shall provide temporary road signage during construction and ensure drivers observe speed limits and for safety of other road users. vi. Contractor shall prohibit haulage activities at night to avoid accidents in high population settled areas and business centres. vii. Contractor shall erect temporary signs along routes used by haulage trucks viii. To avoid excessive haulage traffic noise at sensitive facilities, the contractor should not install temporary speed reduction features (humps) adjacent to schools or hospitals. This would avoid noise associated with high speed deceleration and acceleration at humps		
1.9	Tree Cutting/ vegetation Clearance	i. Determine access roads which are to be used by machinery used in the construction and site clearance phase of the development to avoid the unnecessary trampling of vegetation that will be maintained within the urban area. ii. Adjust drain alignments to minimise damage to trees iii. No tree cutting will be carried out during nesting season. iv. In case felling becomes necessary, felling activity to be undertaken only with permission from forest department and all conditions stated in the permit will to be adhered. Replacement tree planting with same species or indigenous species. v. All Site restoration should utilize native vegetation species and replanting undertaken during rain	JUIDCo PIU will verify all permits for tree cutting and transport of cut trees is in place i. Record of trees felled and planted. ii. Compensatory plantation Tree/plants survival rate	Implementation : Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		seasons to ensure high revegetation success. vi. Provide adequate protection to the trees to be retained with tree guards (e.g. Masonry tree vii. guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars) as required. viii. Take adequate care to determine to root protection zone and minimise root loss.		
2.0	Setting up of Hot mix/asphalt plant	i. Asphalt mixing plants will be sited over 1000 m (refer CPCB/SPCB,) from any community, water bodies ii. All maintenance facilities, hot mix plant and concrete mixing plant shall be established with prior consent to establish to be obtained from SPCB. iii. All such equipment/plant shall be fitted with air pollution control system and shall comply with condition of consent to establish. iv. Periodic monitoring shall be carried as per consent conditions. v. Ensure good housekeeping to avoid onsite and offsite environmental contamination by bitumen. vi. The contractor shall collect leftover bitumen and aggregates properly keeping it for use on other sections of the road. vii. Contractor shall not discharge bitumen into road side drains, and shall collect and store empty bitumen drums at equipment yards and not abandon them along the road.	i. JUIDCo PIU and CSQC will verify sites and ULB consent. ii. CSQC will verify locations	Implementation : Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
iii.	Construction Stage			
2.0	Traffic and Pedestrian Movement Management	i. Where ever the entry and exit to houses/ establishments are affected due to construction ii. activities, alternate temporary arrangement for crossing over shall be provided iii. Detailed traffic control plans will be prepared and submitted to the engineers for approval, one week prior to commencement of works. iv. The traffic control plans shall contain details of temporary diversion, details of arrangements v. for construction (road stretches, timing and phases) vi. Provide the construction itinerary in advance so that the potentially affected population can use alternative routes and start early to get to their destinations on time. vii. Erect warning signs of ongoing works. viii. Access of residents should be facilitated by installing appropriate temporary bridgesover the trenches. ix. Suitable warning signs should be placed at near locations and should be visible at night. x. Alternatives access ways should be communicated to the community xi. Install signage, barricading, fencing as required and include safety measures for transport of hazardous materials/ trucks, which shall be limited to certain times, and arrangements for flagmen.	i. Accident records ii. Visual Inspection of all signage, barriers and lighting. iii. Any record of spill of hazardous waste	Implementation: Contractor Supervision: CSQC and JUIDCo PIU
2.1	Land Contamination	i. All waste arising from the project is to be disposed of as per the waste management plan in Annex VI ii. Littering and burning of waste will be strictly	i. All monitoring action will be carried out in accordance with the	Implementation: Contractor

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		prohibited and labours will be trained towards the same; iii. Municipal domestic waste will be generated at site to be segregated onsite and recyclables sold to vendors/ scrap dealers; iv. It will be ensured that the hazardous waste is properly labelled, stored onsite at a location provided with impervious surface, shed and secondary containment system in accordance to Hazardous Wastes Rules, 2016; v. It will be ensured that the routine disposal of hazardous waste through approved vendors and records should be properly documented along with required manifests vi. Construction contractor will ensure that no unauthorized dumping of used oil and other hazardous wastes is undertaken at the site and it is disposed through JSPCB approved recyclers only. vii. Use of spill control kits to contain and clean small spills and leaks will be ensured viii. Transport vehicles and equipment will undergo regular maintenance at designated areas (equipped with proper drainage) to avoid any oil leakages ix. Unloading and loading protocols will be prepared for diesel, oil and used oil respectively and workers will be trained to prevent/contain spills and leaks. x. The contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and	actions presented in Annex VI ii. Memorandum of Understanding with approved recycler of JSPCB for disposal of Hazardous waste, if generated.	Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		refuelling sites will be located at least 500 m from sensitive receptors and refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground.		
2.2	Impact due to debris, soil, silt and mixing of domestic waste water	i. The existing drain will be excavated mechanically. ii. Domestic waste water will be diverted through flexible or hose pipes into a collection tank. iii. Disposal of waste in designated solid waste dumping site at Sijua	i. Collection of debris, soil and silt ii. Transportation and disposal to designated site at Sijua	Implementation : Contractor Supervision: CSQC and JUIDCo PIU
2.3	Soil Erosion	i. The disturbed areas and soil stock piles will be kept moist to avoid wind erosion of soil. ii. Topography will be restored to the extent possible and re-vegetated for slope stabilization, to prevent soil erosion to the extent possible, immediately after the completion of construction of each of the foot print; iii. Small bunds will be created in case of any activities near the water body or drainage areas within the site to prevent washing of the soil into these waterways iv. Provision of silt/sediment trap in areas susceptible to high erosion will be made.	Review of implementation of mitigation measures.	Implementation : Contractor Supervision: CSQC and JUIDCo PIU
2.4	Impacts on water quality	i. Septic tank and soak pits will be provided (as per specifications given in IS 2470 1995 Part I and Part II) onsite and at labour camp for treatment and disposal of sewage, thereby minimizing the adverse impacts of wastewater discharge; ii. Proper cover and stacking of loose construction material will be ensured during construction of outfall structures at construction site to prevent surface runoff	Review of implementation of mitigation measures	Implementation : Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		and contamination of receiving water body; iii. Use of licensed contractors for management and disposal of waste and sludge will be encouraged; iv. Construction labours will be restricted from polluting the source or misusing the source. v. Labour camps will not be located near water bodies. No discharge from labour camps will follow their path into nearby water bodies. Dumping of debris in or nearby water bodies will be strictly avoided vi. No disposal of any construction materials will be made in any surface water		
2.5	Air Pollution	i. The emissions from diesel generators (meant for emergency power requirement) will be controlled to minimise impacts of air emissions by optimised operations, orientation at the site and providing stack height as per stack height criteria of Central Pollution Control Board) from ground level for wider dispersion of gaseous emissions; ii. Proper maintenance of engines and use of vehicles with "Pollution Under Control Certificate" will be ensured. iii. Fugitive dust emissions will be suppressed by spraying water, wetting of the stockpile; iv. Proper location of material stockpiles will be ensured, especially sand and soil. All such loose construction material will be provided with temporary bunds and screens (or wind breaks) to prevent erosion and generation of fugitive dust. When not in use, all stockpiles of the loose construction material will be	Review of status of implementation of suggested mitigation measures. Air Quality Monitoring by NABEL/MoEFCC accredited Laboratory.	Implementation : Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		covered with tarpaulin sheets; v. Trucks transporting soil and material will be covered with tarpaulin sheets vi. Wind breaking wall at predominant wind direction will be constructed.		
2.6	Noise Pollution	i. Hammering and vibration compaction will be minimised when in close proximity to structures, buildings or property boundary where applicable, residential class mufflers and engine shrouds (acoustic lining) will be used on all equipment. ii. Normal working hours of the contractor will be between 06:00 and 18:00 hours; iii. Only well-maintained equipment will be operated on-site; iv. Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components will be conducted; v. Machinery and equipment that may be in intermittent use will be shut down or throttled down during non-work periods; vi. Low noise equipment will be used as far as practicable; vii. The number of equipment operating simultaneously will be reduced as far as practicable; viii. Equipment known to emit loud noise in one direction will be orientated so that the noise is directed away from nearby Noise Sensitive Receptors (NSRs) as far as practicable; ix. DG sets, if used, will be provided with acoustic	Review of status of implementation of suggested mitigation measures. Noise monitoring to be done on monthly basis.	Implementation: Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		enclosures; x. Minimal use of vehicle horns in the project area will be encouraged; and xi. Equipment noise will be 85 dB (A) at 1 m from the source in line with WB EHS guidelines. xii. Drivers should be instructed on the benefits of driving practices that reduce both therisk of accidents and fuel consumption, including measured acceleration and drivingwithin safe speed limits; xiii. Recruit staff from the surrounding communities to decrease the travelling distance. xiv. Maximise use of oscillating rollers in substitution of vibratory rollers or plate compactors in order to reduce the magnitude of vibration and thereby the risk of damage to existing buildings xv. PPE for construction workers		
2.8	Impacts on Sensitive receptors	i. Noisy construction operations in residential and sensitive areas should be done only between 7.30 am and 6.00 pm. ii. Preventive maintenance of construction equipment and vehicles to meet emission standardsand to keep them with low noise. iii. Provision of enclosing generators and concrete mixers at site. iv. Sound barriers shall be installed during the construction phase to protect the inhabited areasfrom the noise from construction activities. v. Adequate barricading and safety measures to protect dust pollution and noise impacts onsensitive receptors like schools and hospital etc. due to vehicle movement to be ensuredprior to the start of work and their effectiveness to be checked during construction vi. Idling of temporary trucks or other equipment should	Review of status of implementation of suggested mitigation measures.	Implementation: Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured specially near residential / commercial / sensitive areas. vii. Stationary construction equipment will be kept at least 500m away from sensitive receptors. viii. All possible and practical measures to control noise emissions during drilling shall be employed.		
2.9	Public Health and Safety	i. Prevention of accidents needs to be ensured with proper barricading, signage boards and lighting etc. ii. The length of the open excavated trench should be minimised in order to reduce possible accidents iii. The construction area should be barricaded at all time in a day with adequate marking, flags, iv. reflectors etc. for safety of general traffic movement and pedestrians v. Using of modern machineries such as JCBs, backhoes etc., shall be used to minimize th construction period, it will reduce the construction period impacts to the nearby residents vi. Construction material shall be covered or stored in such a manner so as to avoid being affected by wind direction. vii. Unpaved haul roads near / passing through residential and commercial areas to be watered thrice a day. viii. Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage. ix. Sprinkling of water to be done at regular intervals at places of work to protect the nearby residents and road	i. Regular monitoring ii. Provision of PPE to workers and iii. Training to all onsite workers on Safety iv. Implementation of Health and Safety plan	Implementation: Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		users x. Incase accidents occur; the procedures must be in place for such accidents that do occur to deal with this: works contractors first aider and kit, prearranged access to emergency facilities, accident reporting and investigation procedure		
2.10	Disposal of Excavated silt	i. The excess excavated earth and silt from drains will be conveyed to the existing ULB dumping yards at Sijua. ii. All vehicles delivering material to the site shall be covered to avoid material spillage. iii. The existing drain will be excavated mechanically. iv. Any liquid stream entering nearby drains will be diverted through flexible or hose pipes into a collection tank.	Review of status of implementation of suggested mitigation measures.	Implementation: Contractor Supervision: CSQC and JUIDCo PIU
2.11	Occupational Health and Safety of Workers	i. The contractor will follow the OHS plan in Annex VI, including provisions for emergency response and night time work ii. All workers will be provided with requisite personal protective equipment iii. Provision of all workers with requisite personal protective equipment will be made; iv. Provision of onsite toilet and washing water for workers will be made; v. Provision of 'No smoking' signs in office, community places, construction camps as well as high-risk areas prone to fire hazards e.g. near fuel tanks will be made; vi. Adequate fire safety, fire exists and fire assembly points at camp will be ensured; vii. Provision of mobile water tanks and toilets at every active construction worksite.		Implementation: Contractor Supervision: CSQC and JUIDCo PIU

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		viii. Provision of signage reminding use of PPE at appropriate locations in the project areas including ancillary work sites will be made; ix. Project supervising engineers will inspect contractors' compliance with safety precautions during construction/project activities. x. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision xi. The contractor shall arrange for: • A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone • Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital		
2.12	Physical and Cultural properties chance find	i. Contractor will follow 'Chance finds' steps and procedures if any artefact/relic is uncovered during construction (annex X) ii. A clause for 'Chance finds' would be added to the ESMP and subsequently the bidding documents for the works contract which explains the steps to follow whenever new archaeological remains, antiquity or any other object of cultural or archaeological importance are encountered during construction phase	Visual Inspection	Implementation: Contractor Supervision: CSQC and JUIDCo PIU
2.13	Demobilisation of construction material, temporary	i. To prepare site restoration plan prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish burnt, excreta or other	Review of status of implementation of suggested mitigation	Implementation: Contractor

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
	sheds etc. having impact on Aesthetics & EHS.	disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy. ii. Remove all construction equipment from construction site with due care of health, safety and environment; iii. Remove all demobilisation waste from the construction site and dispose of non-hazardous civil waste in low lying area within the site, while any hazardous waste is to be disposed as the requirement of JSPCB; iv. Re-vegetate bare area as per the landscape development plan.	measures Visual inspection	Supervision: CSQC and JUIDCo PIU
Operational Phase				
3.1	Routine Maintenance	i. It will be ensured by PIU/ULB that drains are not clogged. Correct operation and maintenance of drains and trash screen ii. The drains will require regular inspection and maintenance with clearance of any accumulated silt or trash, and the trash screen will need regular removal of trash, the clearance interval will be shorter in therainy season than in the dry season. iii. For control of sediments it is proposed to construct sediment trap at the confluence pointof drain with the water body so that the sediments are deposited in the silt trap and settleover there which can be removed periodically. It is also possible to provide additional silttraps at the point where the cross-drainage confluence and the silt from these silt trapsshall be periodically removed. iv. Drains will be regularly inspected and cleaned	Regular visual check	ULB

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		especially prior to monsoons. v. All damaged or missing drain covers will be replaced immediately vi. Rubbish and silt that are removed from the drainage system will not be left alongside the drain and will be immediately disposed in the designated waste bins and subsequently ensure that it will disposed at municipal solid waste site at Sijua.		
3.2	Public health	i. The storm water drains would need to be periodically de-silted in-order to maintain its carrying capacity. ii. Periodical monitoring will be carried out and sources of waste will be identified by the ULB, and additional bins in critical locations will be provided and frequent collection and disposal of wastewill be ensured. iii. ULB will initiate action to ensure proper linking of such connections to other waste disposal systems and it will l be ensured that the drains carry only the rainwater. iv. Conduct water quality monitoring quarterly for all receiving ponds to in case water quality standards decrease, public advisory will be issued so that no domestic washing or recreational activity takes place if water quality dips beyond CPCB Class E. v. Drains are designed as box type drain in RCC with cover on top which will curtail dumping of solid waste in drains. vi. Public awareness programs have been proposed through IEC activities to proper waste disposal to ensure public co-operation and not to throw garbage	Regular visual check	ULB

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		and other waste into the drains.		
3.3	Contamination of storm water drain	i. Drain needs to be undertaken to remove leaves, litter, sediment, oily materials that can cause blockage of inlets and outlets. ii. Drain cleaners must deposit material from blocked drains in municipal waste storage bins. And all broken drain cover slabs need to be replaced	Regular visual check	ULB
3.4	Public Awareness and social intermediation	The ULB with support from JUIDCo would need to carry out education and Awareness campaigns to communities regarding their 'responsible' activities in relation to drainage management, and discourage solid waste dumping, disposing of wastewater streams in the drainage lines.	Conduct awareness workshops with communities	ULB
3.5	Health and Safety of drain cleanliness workers	i. No manual scavenging/cleaning will be carried out ii. All drain cleaning will be carried out by mechanical means/ machinery, however in case of any need for manual maintenance in closed drains the following shall beensured. • A person should be stationed outside the confined space to monitor the weathercondition and keep communication with the workers inside. If required, ensure the use of approved breathing apparatus • Appropriate emergency procedures shall be formulated to deal with serious orimminent danger.	During all drain cleaning and rehabilitation activities	ULB

Sl. No	Impacts/ Actions	Mitigation Measures	Monitoring/ Action	Responsibility
		• training and advice shall be provided to all workers to be working within a confined space.		

10.4 Environmental Monitoring and Evaluation Program

10.4.1 Monitoring Programme

252. The monitoring programme of drainage project will be required to ensure effectiveness of implementation of suggested mitigation measures. The environmental monitoring will help in assessing the changes in environmental conditions by monitoring the effective implementation of mitigation measures proposed for drainage project, and measuring deteriorations in environmental quality for further preventive actions.

253. Since project is likely to have impact on various components of environment, the monitoring requirement covering soil erosion, tree plantation, air quality, water quality noise, has been defined and included. It will be essential for contractor to comply with applicable National regulations and World Bank safeguard requirements. Contractor will also have to comply with applicable standards with respect to Water, air, Noise, Dredge Material and as applicable to this project.

254. The Contractors team will carry out monitoring, the details of which are providedwith implementation and supervision responsibility. This will be verified by the CSQC and JUIDCo PIU. The aspects to be covered include the following:

10.4.2 Monitoring Schedule and Parameters

255. To evaluate the effectiveness of ESMP, regular monitoring of the important environmental parameters will be taken up. The schedule, duration and parameters to be monitored for project are shown in Table 43.

10.4.3 ESMP integration into bid documents

256. JUIDCo issue the bid documents, which would include ESMP to shortlist contractors, based on theirexpression of interest and capability. The contractor selection process will include consideration of the capacities of the entities to ensure compliance to legal environmental, labour and social requirements as well as adherence to the ESMP.

257. The cross-reference to these tables should be included as part of the General Conditions of Contract. As a standard practice, there is an overall reference to the environment, social and labour laws that should be followed in this section / item. In addition, the adherence to the mitigation / enhancement measures and monitoring requirements tables should be included. The two tables will have to be added (without cost), and the full ESMP should be cross-referred in the description of this item.

258. Cost table: All the items in the ESMP cost table relevant to the contractor should be referred in the Bill of Quantities (BoQ) table. The BoQ table in the bid documents includes the various tasks to be done by the contractor under different categories.

Against each task, the contractor must indicate a unit rate while completing the bid document.

Table 41: Environmental Monitoring schedule

Type of Monitoring	Parameters for Monitoring	Frequency	Responsibility	Monitoring Locations
Pre- Construction Phase				
Permits/ approvals and licenses	All clearance required from other departments and Environmental aspects shall be ensured and made available before start of work.	Before construction	Implementation: Contractor/ Forest Department Verification: CSQC	-N. A-
Tree Cutting	If tree cutting is required, then it can be undertaken after necessary approval from regulatory authority All Trees earmarked for cutting shall be removed from the construction sites before commencement of construction	Before construction	Implementation: Contractor/ Forest Department Verification: CSQC	At respective Project Site
Safeguarding of Trees and Vegetation	Provide adequate protection to the trees to be retained with tree guards	Before construction	Implementation: Contractor Verification: CSQC	At respective Project Site
Construction Phase				
Public Information and Signage	Public informed of Project activities in advance of works contractors occupying each section of work site or use of roads for movement of materials. information regarding the project, and contact of the ESHS officer in case of complaints.	Before Construction starts	Implementation: Contractor Verification: CSQC	Posted information on project schedule and notices on road closures, etc.) Each Ward Office. At and around work sites
Ambient air quality	PM_{10}, $PM_{2.5}$, SO_x, NOx, CO, HC, Total Suspended Particulate (TSP).	Every month except monsoon during construction period	Implementation: Contractor	Baseline locations /Near sensitive

Type of Monitoring	Parameters for Monitoring	Frequency	Responsibility	Monitoring Locations
Standards: NAAQS, 2009 Ambient Air Quality Standards, CPCB, 1994, Air (Prevention and Control of Pollution) Act,1981	(Monitoring and sampling through approved monitoring agencies)	Wherever air pollution parameters increase above specified standards, additional measures as decided by the engineer shall be adopted	Verification: CSQC	receptors (Sampler to be located 50 m from the plant in the downwind direction. Use method specified by CPCB for analysis).
Dust generation	Adequacy of dust suppression techniques- Sprinkling of water on the exposed site and dust suppression barriers to minimize the generation of dust and respirable suspended particulate matters Visual Inspection	Daily	Implementation: Contractor Verification: CSQC	All along project road alignments Vehicle loading/unloading
Waste Management Plan provisions	Visual inspection, and verification of Records of waste generation, handling and disposal methods	Weekly	Implementation: Contractor Verification: CSQC	Labour camp All active construction sites
Hazardous materials or wastes.	Use or disposal of hazardous materials. Monitored to prevent accidents and reduce remedial costs for clean-up.	Monthly	Implementation: Contractor Verification: CSQC	Accident reports. Materials disposed from dismantled drains

Type of Monitoring	Parameters for Monitoring	Frequency	Responsibility	Monitoring Locations
Water Quality Monitoring Indian standards for Inland Surface Water (IS; 2296, 1982)	Parameters for Surface water quality standards (IS; 2296) Water pH, TDS, Total hardness, Sulphate, Fluorides, Chloride, Fe, Pb	Once every season during construction period - At locations of increased pollution, remedial measures to be adopted /all inflow channels shall be checked for pollution loads		All baseline locations Locations representing water quality in the drains and Receiving ponds
Ambient Noise National Ambient Air Quality Standards in respect of Noise, Noise Pollution (Regulation and Control) Rules, 2000	Ambient noise levels in dB(A) of day time and night time (Monitoring and sampling through approved monitoring agencies) Noise monitoring will be carried out in each contract section in daytime and at night on a weekly basis at construction sites.	Weekly Once a week for 2 days. 2 times per day (including late evenings). In case of noise levels causing disturbance to the sensitive receptors, management measures as suggested in the ESMP shall be carried out	Implementation: Contractor Verification: CSQC	At all residential and sensitive areas, such as schools, hospitals, etc. Major construction materials hauling roads/ equipment yards Baseline locations- Equivalent noise levels using an integrated noise level meter kept at a distance of 15m from edge of pavement Ad hoc monitoring will also be undertaken depending on complaints/ concerns by citizens

Type of Monitoring	Parameters for Monitoring	Frequency	Responsibility	Monitoring Locations
Noise -OHS Standards as per Noise Rules, 2000	Occupational exposure (Monitoring and sampling through approved monitoring agencies)	At least once a month.	Implementation: Contractor Verification: CSQC	For personnel working in high noise areas i.e. areas generating noise levels more than 85 dB (A).
Soil Erosion	Visual inspections, photographs of a dequacy of erosion control measures- Measures to prevent runoff from site including bunding around loose construction material instances of gully erosion	Weekly at active worksites and thereafter as necessary during the period of use but not less than quarterly.	Contractor	At sample locations in the receiving water bodies, at the places of dumping silt, excavated earth.
Worker Welfare and Accommodation	Compliance with Labour camp site management plan	Weekly	Contractor	At the labour camp and contractor's temporary operational sites during construction activities
General Hygiene in construction camp as per labour camp site management plan checklist	i. General cleanliness ii. Periodical removal of garbage iii. Inspection to check hygienic conditions and general cleanliness of toilets and common areas iv. Identification of water logged	Daily	Contractor	Labour Camp

Type of Monitoring	Parameters for Monitoring	Frequency	Responsibility	Monitoring Locations
	areas having disease vector carrier like mosquitoes (avoid water logging)			
Occupational Health and Safety and worker welfare	i. Usage of protective clothing and PPEs ii. General health check-up of workers iii. HIV/AIDS Awareness for Contractor staff iv. Regular medical check-ups for labour v. Check-ups for communicable diseases. vi. Worker Signage's- health and safety vii. Ensure all heavy machinery is served and in good working condition	Monthly Weekly	Contractor	Labour Accommodation facility All active construction sites
Safety of Construction Sites	i. General security - preventing un-authorized access to the labour camp by fencingand deployment of night security guards ii. All active construction sites, excavated areas, where material is stored (fuel, lubricants, etc.) barricaded at all time in a day with adequate	Every Shift - Site Inspections	Contractor	At all active construction sites

Type of Monitoring	Parameters for Monitoring	Frequency	Responsibility	Monitoring Locations
	marking, flags, iii. reflectors etc. for safety of general traffic movement and pedestrians. iv. Check ID cards for all authorised personnel v. Register of access to labour camp.			
Tree Compensatory Plantation	Survival rate of trees planted	weekly. For duration of contract period-	Contractor	Along road sides and area where plantation has been undertaken
Operation Phase				
Community Awareness campaigns	Post-project state of the drains and solid waste management. Acting on awareness through practicing non-dumping of solid waste into drains	Single at time of awareness Observation- post-project	ULB	No specific location- ULB can prioritise.
Water Quality	(pH, Temperature, Turbidity, Dissolved Oxygen, Total Suspended Solids, Total Dissolved Solids, Biological Oxygen Demand, Total Coliforms, mineral oils and petroleum products)	Three times a year (once before Chatt Puja)	ULB	At all 10 integrated ponds i. Chat Talab ii. Bartand Bandh pond iii. Jora Talab iv. Sarai Delha pond v. Pond in western part of Sindri area near Deuli-

Type of Monitoring	Parameters for Monitoring	Frequency	Responsibility	Monitoring Locations
				Khairpal Road vi. Pond in eastern part of Sindri area near Deuli-Khairpal Road vii. Bekar Bandh pond viii. Pond above Loco Talab ix. Pampu Pond x. Rajendra Sarovar
Drainage Effectiveness	i. Visual Inspection of solid waste dumping, clearing of leaf litter waterlogging, odour, mosquito breeding. ii. Disposal of waste from maintenance of drainage facilities shall be conducted in accordance with national regulations for Municipal Solid Wastes (Management and Handling) Rules, 2000 & The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act 2013 or M.S. Act 2013 iii. Inspect drain covers, and replace if damaged	Thrice a year, (compulsory-before, the monsoon)	ULB	Throughout the drainage network

NOx – Oxides of Nitrogen, SO_x – Sulphur Dioxide, PM – Particulate Matter

10.4.4 Documentation and Record Keeping

165. Documentation and record keeping of requirements specified in ESMP will include the following databases and registers:

i. Project level Management Information System (MIS) will be updated by JUIDCO's Environmental and Social Specialists pertaining to ESMP implementation
ii. Quarterly ESMP compliance, monitoring and verification report by PMU specialists and submitted to the World Bank.
iii. End of Project report submitted by PMU to the World Bank which contains all aspects of ESMP compliance, and findings and addressal of all safeguard audit issues.
iv. Monthly ESMP progress report submitted by CSQC consultant team to PMU and PIU
v. Monthly monitoring ESMP checklist/ verification report maintained by JUIDCo PIU and submitted to PMU (per format in Annex VII)

166. In addition, the PIU will maintain a file comprising of the following documents:

i. Legal register to track details of all NOCs, licenses and permits pertaining to the sub project
ii. Database of all project impacted entities to be compensated as per the proposed entitlement framework as well as grievance records.
iii. Labour camp monitoring checklist and accident/injury register
iv. OHS equipment and site management register
v. Record of all labour licences, registration of workers and labour camp establishment permit.
vi. Training register for contractor's team, and project staff
vii. Environmental Quality (Air, Water, Soil, Ambient Noise) monitoring register
viii. Waste management monitoring register
ix. Environment and social audit findings and compliance reports
x. JUIDCO-PMU is the primary agency responsible for ESMP implementation and reporting to the World Bank. Hence the PMU shall coordinate all inputs from PIU, CSQC and submit the following environmental reporting documentation to World Bank pertaining to Dhanbad Drainage.

167. JUIDCO-PMU shall submit the following environmental reporting documentation to World Bank:

10.4.5 Environmental Monitoring Reports:

During Project Implementation, quarterly environmental monitoring reports will be submitted by JUIDCo PMU to the Bank for environmental and social progress of JMDP. Specifically, the sub project ESMP progress report will include the following information:

i. Background/context of the monitoring report (adequate information on the project, including physical progress of project activities, scope of monitoring report, reporting period, and the monitoring requirements including frequency of submission as agreed upon);
ii. Changes in project scope and adjusted safeguard measures, if applicable;
iii. Qualitative and quantitative environment and social monitoring.
iv. Monitoring parameters/indicators and methods based on the monitoring plan/program in the ESMP;
v. Monitoring EHS compliance with WBG EHS Guidelines, and WBG, EBRD Worker accommodation standards.
vi. Results of ambient environmental sampling (e.g., air quality and noise) and subsequent ambient sampling to be undertaken by contractors as specified in the ESMP (results to be compared to applicable standards).
vii. Monitoring of all mitigation measures listed in table 55
viii. If noncompliance or any major gaps identified, include a corrective action plan;
ix. Records on disclosure of monitoring information to affected communities;
x. Identification of key issues, or complaints from affected people, or recommendations for improvement;
xi. Monitoring adjustment measures recommended based on monitoring experience/trends and stakeholder's suggestions.
xii. Information about actual institutional arrangement for implementing the monitoring program/plan provided or adjusted, as may be required;
xiii. Information on occupational health and safety, injury, and accidents reported on site.
xiv. Monitoring of all waste and debris management
xv. Proposed items of focus for the next report and due date.

10.4.6 Monthly Progress Reports

The CSQC consultantshall, by no later than 10th of the following month, submit a brief progress report summarizing the physical and financial progress of the construction contract and the activities undertaken by the supervision team for the preceding month including progress made on ESMP as per the scope in Annex VIII. The reports shall include the

minutes of the monthly site coordination/stakeholder meetings and complaints handled and all verification of environment quality monitoring of water, air, noise and soil.

10.4.7 Sub-Project Completion Report:

The PMU will submit a Sub-Project Completion Report to World Bank after completion of construction phase i.e. after completion of 24 months. This will also include performance evaluation on the Contractor's implementation of the ESMP and compliance with audit findings and any non-compliance issues raised.

10.4.8Capacity Building and Training

168. The implementation of the ESMP will require a robust environmental, health and safety training plan which will ensure that the job specific training and EHS induction training needs are identified. This will be based on the specific requirements of EMP and capacity of site and project personnel (including the Contractors and Subcontractors) of project to undertake the required actions and monitoring activities. General environmental awareness will be increased among the project's team to encourage the implementation of environmentally sound practices and meet compliance requirements of the project activities. This will help in minimising adverse environmental impacts, complying with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment will be imparted to the contractors and sub-contractors prior to the commencement of the project.

Table 42: Capacity Building and Training Plan

Training program	Key stakeholders participating	Frequency of training	Methodology of training
Training program on ESMP, compliance for PIU and ULB officers	PIU and ULB representatives, Environment and Social specialist PIU, Supervising Engineer ULB	Annual	Workshop, face to face training. provided by JUIDCO PMU safeguards staff
Training on ESMP, Labour management, OHS, use of PPE, and emergency response measures for Contractor staff/labour	Contractor staff	During contractor mobilization phase, prior to commencement of work.	Orientation Session & During the construction phase progress as required. On-site awareness program at construction site and at labour camp

			Provided by JUIDCO PMU safeguards staff, supported by CSQC and CSQC,

10.4.8 Stakeholder Engagement

169. To facilitate stakeholder engagement during the execution of project, a Community Disclosure and Grievance Redressal (CDGR) system will be established. It is suggested that the system be implemented by JUIDCO-PMU & PIU with support from appointed PMC. The grievance mechanism must address community grievances as well as worker's grievances. The CDGR must have various stakeholders and must meet regularly with PAPs to resolve the grievances.

170. The system will comprise of the following:

a) An accessible and simple grievance redressal procedure: The grievance redressal procedure will outline the process and steps to be taken, the key people responsible, and the upper limit to the time taken to resolve a conflict to the satisfaction of the complainant. In case there are grievances that have reached a stalemate, a third-party mediation may be considered. The entire GR process will be disclosed to the community at individual project sites, and it should be JUIDCO's and its PMC's endeavour to get all complaints recorded in the grievances log, and address the same in a consistent manner

b) A public consultation plan: This plan will outline the range of awareness and communication initiatives that will be implemented by JUIDCO in order to transparently and proactively address stakeholder concerns during the implementation of project activity.

171. The Environmental and Social Officers of JUIDCO-PMU will also need to coordinate with the various implementation agencies to meet the EMP's commitments to stakeholder engagement as follows:

a) Interface between JUIDCO, contractors, sub-contractors and the local community

b) Disclosure of project specific information about all components to villages/municipal wards within the footprint area of individual sites

c) Establish a mechanism to obtain, report and monitor all grievances from the local community

d) Regular engagement with gram panchayats and other local stakeholder groups identified in this report

The Environmental and Social Specialists of JUIDCO-PMU will also need to coordinate with the various government agencies and ULBs to meet the ESMP's commitments to stakeholder engagement as follows:

i. Interface between JUIDCO, contractors, sub-contractors, relevant government departments (forest, utilities, traffic police) and the local community
ii. Disclosure of project specific information including the ESIA and ESMP on ULB website and District Library
iii. Establish a mechanism to obtain, report and monitor all grievances from the local community
iv. Regular engagement with citizens and local stakeholder groups identified in this report
v. For better implementation of environmental management plan, grievance redressal mechanism has been proposed.

10.5 Budget Allocation for ESMP

172. The indicative split up of capital and recurring cost for the environmental management for the project is presented in**Table 43.**
173. Mitigation measures proposed in the ESMP will be implemented by the Contractor and supervised by the CSQC consultant. The works to be undertaken by the contractor have been quantified and the quantities included in the respective BOQ items. The specifics of environmentalhealth and safety measures to be followed by the contractor have been included in the Annex IV Labour Camp Site management, Annex V Waste Management, Annex VI OHS Management in this document.

Table 43: Indicative Budgetary allocation for EMP implementation

Sl. No.	Particular	Capital Cost (INR in Lakhs)	Locations/Samples
A)	**Construction Phase**		
1.	Provision of adequate drainage and bunds/ diversion dykes,Provision for temporary arrangements to cross drains during execution to prevent soil/ raw material escape	Covered Part of Project cost	
2	Mobile Water points and toilets for workers and sewage disposal facility	Covered Part of Project cost	
3	**Trainings** to be provided to contractors staff/workers with information pertaining to minimizing solid waste, camp site hygiene, usage	Covered under ESMF Cost	

Sl. No.	Particular	Capital Cost (INR in Lakhs)	Locations/Samples
	of designated toilets; HIV prevention, gender, and occupational health and safety including usage of PPE, and maintaining Workplace EHS signage.		
4	**Utility Shifting** The cost of existing utility shifting is taken separately in engineering costing, the mitigation and monitoring measures have been incorporated under the engineering costs	Covered under Project Cost	
5	Air Quality monitoring[5]	2.95	Locations: 7 zones and 1 Labour camp Samples: 60 Cost/samples:4920
6	Water Quality Monitoring [6]	2.98	Locations: Outfalls and labour camp Samples: 360 Cost/samples: 8280
7	Noise Monitoring(Occupational & Ambient)[7]	0.75	Location: construction site and labour camp Samples:38 Cost/samples: 1980
8	Miscellaneous expenses for construction phase EMP implementation	17.0	
9	Maintaining hygiene and labour welfare and campsite toilets, waste management and cleanliness	Covered under project cost	
10	Health and Safety (PPE cost)		
	EMP Mitigation Measures a. Signage's, warning signs, flags, barricading b. All facilities to be provided to labour including health checkup and medical care c. Tarpaulin sheets to cover sand and other loose material when transported by trucks d. Drinking water and wastewater management, toilets in labour camp and on construction sites. e. Solid Waste dust bins at camp & construction sites	Covered under Project cost	

[5] Air Monitoring : 2 monitoring samples at each zone (7 zones 1 near labour camp -

[6] Water Quality Monitoring (at 2 Monitoring stations per zone per month): Total 7 zones – 14 , one at labour camp every month for 2 years

[7] Noise Monitoring :, 3 location for 18 months

Sl. No.	Particular	Capital Cost (INR in Lakhs)	Locations/Samples
	Total	50.5	
B)	**Operation Phase**		
1	Water quality monitoring as per Parameters for Surface water quality standards (IS; 2296)3 times a year, once before Chatt Puja Festival	Covered under O&M cost	10 ponds • Chat Talab • Bartand Bandh pond • Jora Talab • Sarai Delha pond • Pond in western part of Sindri area near Deuli-Khairpal Road • Pond in eastern part of Sindri area near Deuli-Khairpal Road • Bekar Bandh pond • Pond above Loco Talab • Pampu Pond • Rajendra Sarovar
2	Soil Quality Monitoring Soil quality parameters (Pb, SAR and oil & grease, monitoring silt for presence of toxic metals) - Quarterly	Covered under O&M cost	At sample locations in the receiving waterbodies, at the places of dumping silt, excavated earth.
3	Public education and awareness campaigns for drain cleanliness	Covered under O&M cost	
4	Drain cleaning and maintenance, disposal of excavated silt/waste	Covered under O&M cost	
5	Training programmes for Labour to carry out maintenance work	Covered under O&M cost	
	Total O&M cost= 66.51 Lakhs (one year)		

Note: The above cost does not include cost of manpower needed for the ESMP implementation

12. R&R budget has been worked out for the sub-project based on impacts identified during the census survey. Since the subproject donot involve land acquisition, the R&R cost includes cost of structures and R&R assistance as per the entitlement matrix. Some of the features of this R&R cost estimate are outlined below:
    - Compensation for structures at their replacement cost;
    - Resettlement Assistance.

The total R&R budget for the proposed subproject works out to Rs. 26.20 crore. A contingency cost (of 10%) has also been included in the total budget which would cover non-identified and other costs during R&R implementation.