

Draft ESIA report for Public Disclosure and Comments

Validation of Environmental and Social Assessment Studies

Sewerage Treatment Plant at Kankarbagh, Bihar

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Submitted to:



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Project

DEVELOPMENT AND OPERATIONS OF SEWAGE TREATMENT PLANTS AND SEWERAGE NETWORK AT PATNA, BIHAR

Implementing Agency

NATIONAL MISSION FOR CLEAN GANGA

Client



BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED

Project Engineer

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Concessionaire

DK SEWAGE PROJECT PRIVATE LIMITED

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Abbreviations

BIADA	Bihar Industrial Area Development Authority
BMTPC	Building Materials and Technology Promotion Council
BSEB	Bihar State Electricity Board
BSPCB	Bihar State Pollution Control Board
BUIDCo	Bihar Urban Infrastructure Development Company
C - GRM	Community - Grievance Redressal Mechanism
CGWB	Central Ground Water Board
CPCB	Central Pollution Control Board
DPR	Detailed Project Report
EC	Environmental Clearance
EHS	Environmental, Health & Safety
EIA	Environmental Impact Assessment
EPF	Employees' Provident Funds
ESDD	Environmental & Social Due Diligence
E&S	Environmental and Social
ESI	Employees' State Insurance
ESIA	Environmental & social Impact Assessment
ESMP	Environmental and Social Management Plan
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
IFC PS	International Finance Corporations Performance Standards
LARR	Land Acquisition, Rehabilitation and Resettlement
LULC	Land use land cover
MoEF&CC	Ministry of Environment, Forests and Climate Change
NAAQS	National Ambient Air Quality Standards
NCEP	National Centre for Environmental Predictions
NH	National Highway
NRSC	National Remote Sensing Centre
PFD	Project Flow Diagram
SBR	Sequencing Batch Reactor
SH	State Highway
STP	Sewage Treatment Plant
WB	World Bank
WHO	World Health Organization

Executive Summary

1. Background

VA TECH WABAG Limited (“WABAG”) has been awarded the contract by the Bihar Urban Infrastructure Development Company (BUIDCo), Government of Bihar for developing the Sewage Treatment Plant (STP) and its Network for the Kankarbagh zone of Patna, Bihar. The project is being developed under a Ganga River conservation mission named “Namami Gange” being managed by National Ganga River Basin Authority (NGRBA) with financial assistance from the World Bank.

In accordance with the provisions of Environmental Impact Assessment (EIA) Notification 2006, Schedule I, the project is not required to obtain an Environmental Clearance (EC) from the State or Central Authority. Hence conduct of EIA is not mandatory.

However, WABAG is aware that the project has the potential to cause adverse environmental and social impacts during planning, construction, and operation phases of the project. Further, the project is also funded by the World Bank which requires conduct of Environmental & Social Impact Assessment (ESIA) for projects with the potential to cause adverse environmental and social impacts. Hence, ESIA study of the Project was conducted during the preparation of the Detailed Project Report (DPR) as a proactive measure to minimize and mitigate these impacts.

However, considering the time gap since conduct of the ESIA studies and start of project development activities, WABAG was required to validate the ESIA studies and update them, where required. The ESDD Report dated April 2018 also required WABAG to prepare a detailed project specific Environmental & Social Management Plan (ESMP).

R1The ESIA study was conducted using the World Bank Environmental & Social Framework (2017) and World Bank Group’s Environmental, Health & Safety (EHS) General Guidelines (2007), and Guidelines for Water and Sanitation (2007) and was used as the basis for identification of impacts and recommending mitigation measures. World bank comments are incorporated in this documents along with the mitigation measures

2. Project Description

The proposed STP will be set up in the Pahari village in Kankarbagh, Patna District, Bihar within the land allocated for the existing Pahari Nalla STP. The STP will be constructed over a total land area of six (6) hectares and in addition to the STP, it will include staff quarters, laboratory, and other administrative buildings. The STP has been designed for an Average Design Capacity of 50 MLD and a Peak Design Capacity of 112.5 MLD of influent (sewage) flow.

The sewage treatment is based on a biological treatment process. The sludge generated from the treatment plant shall be anaerobically digested to produce biogas which in turn will be used for generation of power through gas engines. The STP will include the following treatment stages and components:

#	Treatment Stage	Components
1.	Preliminary Treatment	<ul style="list-style-type: none"> • Stilling Chamber • Mechanical Fine Screen • Manual Fine Screen • Grit Distribution Chamber

#	Treatment Stage	Components
		<ul style="list-style-type: none"> Grit Chamber Bypass
2.	Primary Treatment	<ul style="list-style-type: none"> Primary Clarifier Distribution Chamber Primary Clarifier
3.	Secondary Treatment	<ul style="list-style-type: none"> Aeration Tank Process Air Blower Area Secondary Clarifier Distribution Chamber Return Activated Sludge Sump
4.	Disinfection and Disposal	<ul style="list-style-type: none"> Chlorine Contact Tank Gas Chlorination System Chlorine Leak Absorption System Absorbent Tank Caustic Solution Recirculation Pump Chlorine Leak Blower R1 Treated Water -disposed to PHARI STP-OUTLET channel
5.	Sludge Handling	<ul style="list-style-type: none"> Digester Feed Sump Anaerobic Sludge Digester Digested Sludge Sump Centrifuge Polymer Dosing System Supernatant Sump and Pumps
6.	Biogas Handling and Power Generation	<ul style="list-style-type: none"> Gas Holder Biogas Scrubber Biogas Flare R1 Biogas Engine- 635KVA capacity
7.	Heat Recovery System	<ul style="list-style-type: none"> Hot Water Tank and Hot Water Recirculation Pumps Jacket Water Waste Heat Recovery Unit Exhaust Gas Waste Heat Recovery Unit
8.	Auxiliary Units Section	<ul style="list-style-type: none"> Plant Water System Bore Wells Potable Water / Utility Water

Details of each process in the treatment system are provided in **Section 2.4** of the ESIA Report.

The project is at present in its pre-construction stage and the ongoing activities include levelling of site area and emptying of water from the existing tank in the site area. The project is estimated to be completed by December 2022.

3. Legal and Other Requirements

In accordance with the provisions of Environmental Impact Assessment (EIA) Notification 2006, Schedule I, the project is not required to obtain an Environmental Clearance under the Notification from the State or Central Authority. The land for the project has been allotted by Patna Municipal Corporation. Hence provisions of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 are not applicable.

R4 The key environmental, health and safety, employee welfare (social) regulations applicable to the project during construction and O&M phase are listed below:

Environmental Regulations

1. The Environment (Protection) Act, 1986
2. The Water (Prevention and Control of Pollution) Act, 1974
3. The Air (Prevention and Control of Pollution) Act, 1981
4. The Environmental Protection Second Amendment Rules 2002 (DG Set) & 2004
5. The Noise Pollution (Regulation and Control) Rules, 2000
6. The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2016
7. Construction and Demolition Waste Management Rules, 2016
8. Solid Waste Management Rules, 2016
9. E-Waste (Management) Rules, 2016
10. The Batteries (Management & Handling) Rules, 2001
11. Manufacture, Storage, and Import of Hazardous Chemicals (MSIHC) Rules 1989
12. Public Liability Insurance Act 1991
13. The Bihar Ground Water (Regulation and Control of Development and Management) Act, 2006
14. Central Ground Water Authority Guidelines to regulate and control Ground Water Extraction in India dated 1 June, 2019

Occupational, Health & Safety Regulations

1. Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996
2. The Factories Act, 1948 and Bihar Factories Rules, 1950
3. Central Motor Vehicles Act 1988
4. Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010
5. The Static and Mobile Pressure Vessels (Unfired) Rules 1981
6. The Boilers Act, 1923 amended upto 2007

Employee and Labour Welfare Regulations

1. Child and Adolescent Labor (Prohibition and Regulation) Act, 1986 and Amendment Act 2016
2. Minimum Wages Act, 1948
3. The Equal Remuneration Act, 1976
4. Employees' State Insurance Act (ESI), 1948
5. The Employees' Provident Funds (EPF) and Miscellaneous Provisions Act, 1952 amended up to 1996
6. The Employee Compensation Act 1923 and Amendment Act 2009
7. The Payment of Gratuity Act, 1972
8. The Maternity Benefits Act, 1961
9. The Payment of Bonus Act, 1965

10. The Contract Labour (Regulation and Abolition) Act, 1970
11. The Industrial Disputes Act, 1947
12. The Private Security Agencies (Regulation) Act, 2005
13. The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013

The key provisions of the regulation that the project will need to fulfil during the construction phase and operation & maintenance phase is provided in **Section 3.1**.

4. Project Categorization

The World Bank E&S Framework classifies projects as High Risk, Substantial Risk, Moderate Risk or Low Risk based on the type, location, sensitivity and scale of the Project, the nature and magnitude of the potential E&S risks and impacts, the capacity and commitment of the Borrower to manage such risks and impacts and other relevant areas.

A detailed assessment on environmental and social impacts of the project is presented in **Chapter 6** of the ESIA Report. Based on the assessment, it is identified that:

- The project impacts during construction and O&M phase are expected to be few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
- The project does not trigger involuntary resettlement.
- There are no Indigenous People in project influence area.
- There are no Protected Areas (Wildlife Sanctuaries and National Parks) in project influence area.
- Based on the project activities and its location, the project is not expected to result in any irreversible or unprecedented impacts.

Hence, the project has been classified as **Moderate Risk**.

5. Baseline Analysis

A three (3) km radius from the centre of the project was defined as the project influence area ("study area") for the conducting the baseline studies and impact assessment. The baseline analysis was conducted through a combination of secondary data processing and primary baseline environmental & social monitoring.

Rationale for defining a 3 km buffer area:

The extent of impacts arising from the project during construction and O&M phases will be local impacts and limited to immediate vicinity of the project area.

The rationale for delineating 3 km radius as the project influence area is listed below:

- a) A study of receptors present around the project area was conducted. A limited number of receptors were found present in the delineated project influence area that could potentially be impacted due to the project activities.
- b) Land for setting up the STP belongs to Patna Municipal Corporation. There were no encroachers or squatters identified on the allotted land.
- c) The source of water during construction will be a combination of ground water and tanker water. During operation and maintenance phase, the water used shall be a combination of ground water and recycled sewage (treated) water.
- d) Sewage treated in the STP shall be discharged as per statutory limits.

e) The wastewater discharges and fugitive emissions are not expected to traverse beyond 3 km.

Thus, a 3 km buffer would be sufficient to study the impacts on the community and other sensitive receptors as indicated above.

Meteorology

The monsoon season spans from July to October and the highest levels of precipitation are experienced in the month of October (197 mm). Maximum temperatures are experienced from April to July (>35 °C) and minimum temperatures are experienced from November to February (15-18 °C). The predominant wind direction is observed to be from south-west to north-east direction with higher wind speeds (5 – 10 m/s) are experienced from the west-north-west and west direction of the study area.

Physical Resources

The 24-hour average concentration of NO_x on two consecutive days of monitoring in the study area were observed to be well within NAAQS standard and WHO guideline values. The SO₂, PM_{2.5} and PM₁₀ levels were well within NAAQS standard values but exceeded the limits provided by the WHO guidelines at all locations monitored. The average ambient noise levels obtained for all the locations were observed to be exceeding the permissible limits of the CPCB standards and EHS guidelines for both day and night noise levels.

The study area falls under the high dense built fabric. The topography is flat plains as the study area is part of Indo-Gangetic flood plains with gangetic alluvium type soil. The predominant slope observed is from south-west to north-east.

The River Ganga is the nearest surface waterbody (aerial distance of approx. 1.02 km) and is located towards north of the study area. As per the Central Ground Water Board (CGWB), Patna Sadar falls under “critical” zone while Patna City falls under “safe” zone for ground water development. Although the project site falls under Patna City, it is in close proximity (approx. 1.08 km) to the boundary of Patna Sadar (critical zone). The ground water monitoring analysis showed parameters of TDS, Total alkalinity as CaCO₃ and Total Hardness as CaCO₃ (mg/L) are beyond acceptable limits at all locations while the parameters of Magnesium as Mg (mg/L) and Chloride as Cl⁻ (mg/L) were exceeding acceptable limits but were within permissible limits as per the BIS 10500 standards.

Natural Hazards

As per the Building Materials and Technology Promotion Council (BMTPC) Hazard maps, the study area is located in the Zone IV i.e. High Damage Risk Zone (MSK VIII) for Earthquake and the High Damage Risk Zone for cyclones. The study area is also located in an area vulnerable to floods.

Ecological Hazards

The study area does not comprise of Reserved/ Protected Forests. There are no Important Bird Areas (IBA) in the study area.

Economic Development

The major land cover in the study area is settlements (61%) followed by agriculture fallow land (38%). The study area is accessible from the State Highway (SH)-1 (Sadikpur-Pavera-Masaurhi) connecting to the National Highway (NH)-30 (Patna-Bhaktiyarpur Road). In addition, two national highways (NH 19 & 98) also pass through the Study area.

Agricultural Development

The study area lies within the 'Middle Gangetic Plain' agro-climatic zone of the country as classified by the Planning Commission of India. The major crops grown in the study area are paddy, wheat, gram, and seasonal vegetables.

Social and Cultural Resources

The average literacy rate in Patna District is 59.26%. The District has a high proportion (67.77%) of non-working population. There are no places of cultural heritage or archaeological importance and Scheduled Areas in the study area.

6. Stakeholder Consultation

Stakeholder Consultations were conducted in the nearby villages within 3 km from the site area. The consultations were conducted in the form of Focus Group Discussions with potential affected persons and discussions and interviews with key informants. The primary objective of stakeholder consultation was to understand the acceptance of the project and obtain impressions of the stakeholders about the project and discuss issues envisaged by the local community that may be encountered due to the project. The other objectives of the consultations included understanding of the existing local socio-economic status, social fabric, and local sensitive receptors. A summary of the consultations has been provided in **sub-section 4.8.2** of the ESIA Report.

7. Analysis of Alternatives

The proposed Kankarbagh STP is located on land allotted and owned by the Patna Municipal Corporation. Thus, aspects of land acquisition and resettlement are not triggered which also results in reduction of project costs.

The Kankarbagh STP is a Sequencing Batch Reactor (SBR) based process and has been approved by the State Development Authority as part of the bidding process. SBR systems have been successfully used to treat both municipal and industrial wastewater. They are uniquely suited for wastewater treatment applications characterized by low or intermittent flow conditions.

Further, the sludge generated from treatment will also be used for Biogas generation through an anaerobic digestion process which will further be used in a co-generation plant to produce heat and electrical energy and will be reused in plant operations thus reducing energy requirements.

The treated effluent from the plant will be reused for plant water requirements and may also be provided to the nearby agricultural fields for irrigation purposes. This will result in reduction of freshwater usage.

8. Impact Assessment

Positive Impacts

The Kankarbagh STP project is being developed under a Ganga conservation mission named "Namami Gange". The proposed project will enable lowering of treatment loads and also increase the physical coverage of an underground sewer network. The Kankarbagh Zone is one of the highly populated and core areas of the city with no dedicated sewage treatment mechanism. The project will thus ensure adequate treatment and eventually lower pollution loads in the River Ganga. This will also ensure the channels are not flooded during monsoon thus preventing waterlogging and associated impacts.

The STP has also been designed in a way to promote and incorporate principles of resource efficiency and waste utilization. The sludge generated from the treatment process will be used to generate biogas which will be used for electricity and heating requirements in the STP operations. The treated sewage will also be reused for plant operations and may also be provided for irrigation of the surrounding agricultural fields.

The project would also generate employment opportunities for locals during construction and operation phases of the project.

Adverse Impacts

The adverse impacts identified during construction phase are of 'medium' and 'low' scale as most of them will be 'local' in extent and of 'short' duration limited to the period of construction. There will be no 'high' impacts due to the project on environment, occupational health & safety, and community health & safety during construction phase.

Project Development/ Planning Adverse Impacts		
Nature of Impact/ Activity	Impacted EHS Component	Impact Classification
1. Viewscape impacts due to proximity of settlements to the project area	Local community	Medium

Construction Phase Adverse Impacts		
Nature of Impact	Impacted EHS Component	Impact Classification
1. Increase in fugitive dust emissions causing air pollution from site clearance, excavation, raw material transportation, storage of excavation spoil, use of fuel wood in labour camps	Ambient air quality, community health, worker health	Medium
2. Increase in concentrations of PM ₁₀ , PM _{2.5} , SO ₂ from burning of fuel in construction equipment, transportation vehicles and cooking in labour camps.		
3. Increase in ambient noise levels due to operation of construction equipment.	Worker health	Medium
4. Soil contamination due to improper management of construction waste, spills and leaks, absence of sanitation provisions in labour camp.	Soil quality, Ground water, Local community	Medium
5. Ground water pollution due to leaching of materials and waste into the soil	Ground water Local community	Medium
6. Exposure to physical, chemical hazards, exposure to noise, working with construction equipment, fugitive dust, emergencies at site	Construction workers	Medium
7. Exposure to migrant workers, air and noise pollution, project security personnel, obstruction to community activities and accidents caused in the nearby community due to construction activities	Local community	Medium

Construction Phase Adverse Impacts		
Nature of Impact	Impacted EHS Component	Impact Classification
8. Alteration of natural drainage pattern due to site levelling	Landform, local community	Low
9. Resource consumption such as water, fuel, causing depletion	Local community	Low
10. Loss of flora due to site clearance impacting avian fauna habitat	Flora, avian fauna	Low
11. Soil erosion due to site clearance	community health	Low
12. Obstruction to flows in open <i>Nallahs</i> and deterioration of water quality due to soil erosion and dumping of construction waste	Surface water quality, local community	Low

The adverse impacts during the Operation and Maintenance phase comprise only of 'medium' and 'low' scale as most of them are local in extent with a mix of 'short' and 'long' term impacts.

Operation and Maintenance Phase Adverse Impacts		
Nature of Impact	Impacted EHS Component	Impact Classification
1. Natural resource consumption causing depletion	Local community	Medium
2. Soil contamination due to leakages, spillages, and unscientific management of various types of waste	Soil quality Groundwater quality Local community	Medium
3. Air pollution through air emissions and odour generation from the operation of the treatment plant equipment and various treatment processes	Ambient air quality Local community	Medium
4. Leakages and overflows resulting contamination of soil, freshwater bodies, and groundwater	Surface water quality Groundwater quality Soil contamination Local community	Medium
5. Exposure to various occupational health and safety impacts including <ul style="list-style-type: none"> • Physical hazards • Biological hazards • Chemical hazards • Noise & vibration • Odour • Exposure to operational/natural/ manmade emergencies at project site 	Local community STP workers and employees Visitors to the STP	Medium
6. Community Impacts resulting from use of untreated wastewater, exposure to odour, resource depletion, influx of immigrant population, misbehaviour of	Local community	Medium

Operation and Maintenance Phase Adverse Impacts		
Nature of Impact	Impacted EHS Component	Impact Classification
security, and accidents and emergencies occurring in the STP		

9. Environmental and Social Management Plan

Institutional Arrangement

The overall responsibility of supervision and ensuring implementation of the ESMP will lie with WABAG during all phases of the project. The ESMP will be applicable to all Contractors and Sub- Contractors including labour contractors and their workers working in the project during all phases.

An Environmental, Health & Safety (EHS) Department will be constituted for the project. The environmental and occupational health and safety aspects of project construction and O&M will be managed by this department. The employee welfare and grievance mechanism will be managed by the Human Resources Department of the project. These departments will report to the Project/ Plant Manager of the STP. The EHS Department should comprise of an EHS Manager and EHS Engineer(s).

Management Actions

Based on the project and associated activities, and E&S impacts identified for the project (which includes environmental, occupational health and safety, community health and safety and social), management measures have been recommended covering all phases of the project. An E&S monitoring plan for construction phase and operation & maintenance phase of the project has also been developed. Refer **Section 7.3** of the ESIA Report for detailed set of actions recommended for management of all identified adverse impacts.

WABAG has a certified Integrated Management System (IMS) as per ISO 9001:2015, ISO 14001: 2015, and ISO 45001:2018 international standards. The management system developed at the corporate level is extended to the project. WABAG has accordingly prepared Construction Environment and Social Management Plan for the construction phase actions and work instructions. The Environment, Social, Health and Safety Management Plan for Kankarbagh STP has been developed by WABAG for the operation and maintenance phase operation control procedures.

Stakeholder Engagement & Grievance Redress

A Stakeholder Engagement Plan is developed for the project that identifies the primary and secondary stakeholders under each stakeholder group (neighbouring communities, community representatives, industrial establishments, regulators, institutional stakeholders, and other groups), analyses the influence of each stakeholder and accordingly presents a Plan for engagement with the various stakeholders. Refer **Section 7.5** of the ESIA Report for the Stakeholder Engagement Plan.

The ESMP provides the structure and process to be followed by the project for redressing community grievances through a project level Community Grievance Redress Mechanism (GRM). The GRM is a platform to provide the affected communities a credible and effective channel of communication and allow them to communicate their grievances/concerns which they believe to be caused by the project activities. A Grievance Redress Committee (GRC) is to be established at the project level comprising of Project Head, E&S Officer from BUIDCo and a third-party representative. A Community Liaison Officer

will be appointed for attending to community grievances and engaging with them on a regular basis. The GRM provides a procedure for receipt and recording of grievances, review and investigation of grievances by the GRC, grievance resolution, grievance closure, and redressal of anonymous grievances. The GRM will be publicized among the community stakeholders identified in the Stakeholder Engagement Plan. Contact details of the Community Liaison Officer and GRC will be made available through displays at the project site gate. All grievances will be reviewed and resolved by the GRC. Refer **Section 7.6** for details on the GRM.

1 Introduction

1.1 Background of the Project

VA TECH WABAG Limited (“WABAG”) has been awarded the contract by the Bihar Urban Infrastructure Development Company (BUIDCo), Government of Bihar for developing the Sewage Treatment Plant (STP) and its Network for the Kankarbagh zone of Patna, Bihar. The project is being developed under a Ganga River conservation mission named “Namami Gange” being managed by National Ganga River Basin Authority (NGRBA) with financial assistance from the World Bank.

The ‘Namami Gange Programme’, is a as ‘Flagship Programme’ by the Union Government of India launched in June 2014 with a budget outlay of INR 20,000 Crore. The objective of the Programme is to accomplish the twin objectives of effective abatement of pollution, and conservation and rejuvenation of the River Ganga. Sewerage treatment infrastructure is one of the eight main pillars of the mission and approx. 63 sewerage management projects are under implementation and twelve (12) new projects are under planning and construction stages in the five (5) States of Bihar, Jharkhand, Uttarakhand, Uttar Pradesh, and West Bengal.

The city of Patna (Bihar State) is divided into six sewerage zones – Digha (Zone I), Beur (Zone II), Saidpur (Zone III & IV-North), Kankarbagh (Zone IV), Pahari (Zone IV-South & V) and Karmalichak (Zone VI). Of these, Digha and Kankarbagh at present, do not have operational STP’s. Further, it was understood that city has only 20% of physical coverage of the underground sewer network, with minimal records on the details and number of households connected to the sewers. The rest of the city, (~80% area) is dependent on an open drain network, which collects both sewage and drainage which is discharged through natural drains into the river Ganga or river Pun Pun, thereby resulting in excessive pollution. At present, to prevent water discharge of untreated wastewater, interception, and diversion (I&D) of the water is being carried out and the water is sent to the existing four (4) STP’s of the City.

Thus, in a bid to lowering treatment loads and ensure adequate treatment, the construction of two STP’s in the Digha (100 MLD capacity) and Kankarbagh (50 MLD capacity) Zones have been envisaged along with a well-connected underground sewer network.¹ The Kankarbagh zone has been created by taking parts from Beur and Pahari zone and covers a total of 886.50 hectares of the total Patna Municipal Corporation (PMC) Area with a total population of 2,13,389 persons as per the 2011 census.

The proposed STP (50 MLD) at Kankarbagh is being developed in a Hybrid Annuity Model.

1.2 Purpose of the Project

In accordance with the provisions of Environmental Impact Assessment (EIA) Notification 2006, Schedule I, the project is not required to obtain an Environmental Clearance (EC) from the State or Central Authority. Hence conduct of EIA is not mandatory.

WABAG is aware that the project has the potential to cause adverse environmental and social impacts during planning, construction, and operation phases of the project. Further, the project is also funded by the World Bank which requires conduct of Environmental & Social Impact Assessment (ESIA) for projects with the potential to cause adverse environmental and social impacts.

¹ Environment and Social Due Diligence Report for Proposed Sewage Treatment Plant (50 MLD) and Sewerage Network (150 km) at Kankarbagh Zone Patna, dated April 2018.

Hence, ESIA study of the Project was conducted during the preparation of the Detailed Project Report (DPR) as a proactive measure to minimize and mitigate these impacts. This has been provided as part of the Appendices in the Environmental & Social Due Diligence (ESDD) Report of the project dated April 2018.

However, considering the time gap since conduct of the ESIA studies and start of project development activities, WABAG is required to validate the ESIA studies and update them, where required. The ESDD Report also requires WABAG to prepare detailed project specific Environmental & Social Management Plan (ESMP). This document presents the validated ESIA study and ESMP for the proposed STP at Kankarbagh.

1.2.1 Reference Framework

The reference framework for conduct of validation of ESIA was:

- Applicable local, State, National environmental and social legal regulations
- World Bank Environmental & Social Framework (2017)
- World Bank Group's Environmental, Health & Safety Guidelines (WB-EHS) – General (2007), and Water and Sanitation (2007)

1.3 Approach and Methodology for ESIA

The approach and methodology for conduct of Environmental and Social Impact Assessment (ESIA) Study is presented in Figure 1 and described in the subsequent subsections.

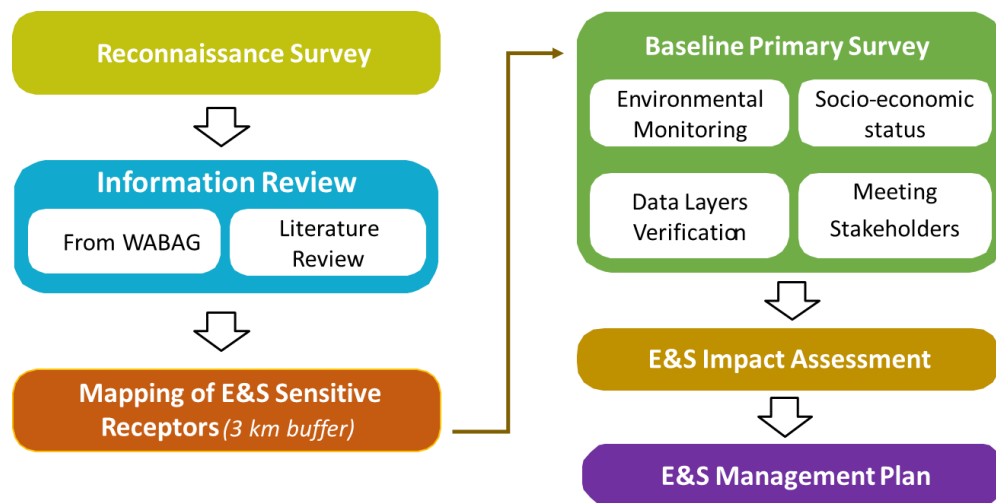


Figure 1: Approach and Methodology for ESIA

1.3.1 Reconnaissance of Project Area

A reconnaissance visits to the proposed STP project location and all associated components of the project was conducted from 16-21 March 2020 along with WABAG personnel from the Project office in Patna.

The purpose of the reconnaissance was to:

- Understand the fabric of the project area.
- Observe current activities that are carried out in the project area.
- Identify the presence of encroachers or squatters on the lands designated for the project.

Discussions were also conducted with the Project Head and the EHS Head to understand the project components, status of the project activities and availability of project specific studies/ documents.

1.3.2 Information Review

The following items were reviewed for preparation of the updated ESIA Reports:

- Project Environmental and Social Due Diligence report
- Environmental and Social Impact Assessment report
- Project design and description of project flow
- Finalized map of project components (STP, IPS, I&D, sewer network etc.)
- Construction approach and methodology
- Topographic survey drawings
- Project-specific HSE Plan for construction and O&M stages

In addition to the above mentioned items, secondary literature review was carried out in order to better understand the project area. These included archaeological sites, hospitals, religious places (temples/ mosques/ churches etc), schools/ colleges, water bodies, gardens etc.

1.3.3 Mapping of Sensitive Receptors

Based on the location and context of the project, a project influence area of 3 km radius from the centre point of the project location was defined as the project study area. The environmental and social (E&S) receptors sensitive to project development were identified and spatially represented by creating data layers using ArcGIS. Secondary data for mapping activities was sourced from recognized, publicly available databases. The outputs of the mapping exercise were used as input for planning the baseline primary survey.

1.3.4 Baseline Primary Surveys

The baseline primary surveys involved:

- Verification of data layers mapped using secondary data
- Baseline environmental quality monitoring
- Focus group discussion with project stakeholders
- Visit to relevant government department offices to confirm or collect data

1.3.5 Legal Requirements and IFC-PS

The national regulations on environment, health, and safety and social that are applicable to the project during pre-construction, construction, operation & maintenance phases, as well as key regulations that do not apply to the project were identified. The compliance requirements of each regulation by the Company (such as obtaining approvals, submitting monitoring reports, and storage of materials in a particular manner etc.) were further identified. The process followed during land allocation for the project and its compliance to legal requirements were also recorded.

1.3.6 Environmental & Social Impact Assessment

Based on the E&S sensitive receptors present in the study area and activities during different phases of the project (pre-construction, construction, operation, decommissioning), E&S impacts have been identified. The results of baseline primary surveys were used as input to identify impacts. The

vulnerability of the project area to earthquake and flood was also identified with reference to the Vulnerability Atlas of India.

For assessment of E&S impacts of the project, the World Bank Environmental & Social Framework (2017) and WB-EHS – General and Water and Sanitation were referred.

1.3.7 Environmental and Social Management Plan

Based on the project and associated activities, and E&S impacts identified for the project (which includes environmental, occupational health and safety, community health and safety and social), management measures have been recommended covering all phases of the project (pre-construction, construction, operation and maintenance, and decommissioning).

For identification of management measures, the World Bank Group's EHS Guidelines General (2007), and Water and Sanitation (2007) have been referred. The general hierarchy for planning management measures i.e. elimination, substitution, engineering control, administrative control and personal protective equipment was adopted. The responsibility for implementation of the management measures and indicators for monitoring implementation and effectiveness of the measures are also presented along with a project-level Stakeholder Engagement Plan and Grievance Redress Mechanism.

1.4 Organization of the Report

The ESIA Report is organized into the following Chapters:

- **Executive Summary** provides a brief background of the project, applicable E&S national legal requirements, key impacts, and mitigation measures of the Project.
- **Chapter 1** provides a brief background about the project, specifying the need to undertake the ESIA study, reference framework for the assignment and approach adopted for undertaking the ESIA.
- **Chapter 2** gives details about the project location, various components and process flows of the project.
- **Chapter 3** outlines the application of Indian legal requirements on environment, health and safety and social aspects of the project. It also establishes applicability of the World Bank E&S Framework requirements and defines the risk category of the project.
- **Chapter 4** presents findings of the baseline studies conducted in the project influence area and secondary information collected to understand the existing environmental and social conditions. A summary of the stakeholder consultations and the approach adopted are also provided.
- **Chapter 5** presents the alternatives assessed and environmental and social good practices to be implemented by the project.
- **Chapter 6** presents E&S impacts identified across the project lifecycle.
- **Chapter 7** presents the Environmental and Social Management Plan (ESMP) to address the identified impacts.

The report is supported by **10 Annexures** that are referenced in the respective chapters.

2 Project Description

2.1 Project Location

The STP for the Kankarbagh zone is proposed to be set up in the Pahari village located in Patna District in the State of Bihar. Please refer **Annex 1** for the zonal map of Kankarbagh and **Figure 2** for the project location.

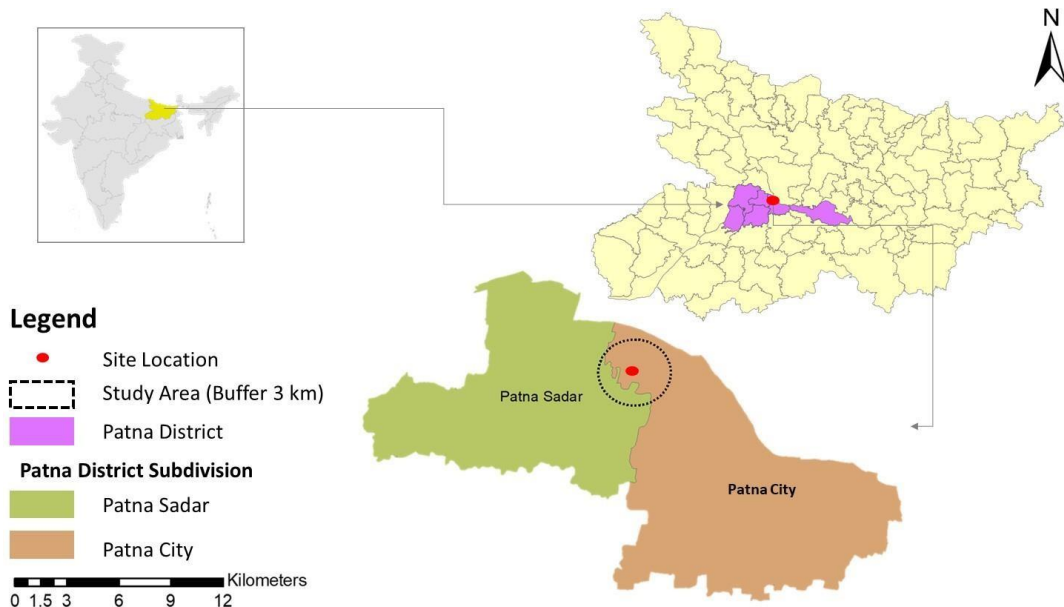


Figure 2: Administrative Boundaries and Project Location

The project area is accessible from the State Highway (SH)-1 (Sadikpur-Pavera-Masaurhi) connecting to the National Highway (NH)-30 (Patna-Bhaktiyarpur Road). The nearest airport to the project site is Patna Airport which is located at a distance of approx. 15.2 km to the west of the site. The nearest railway station is the Gulzarbagh Railway Station (approx. 3.8 km north of the site) while the major railway station is the Patna Saheb Railway Station (approx. 5.5 km north-east of the site).

2.2 Criteria for Site Selection

The site for the proposed Kankarbagh zone STP in the Pahari Village is located within the land area allocated for the existing Pahari Nalla STP developed under the 'Ganga Action Plan-II.' The designated land belongs to the Patna Municipal Corporation.

The criteria for site selection are based on availability of suitable land and extent of diversion of existing sewage flows. The existing set up of sewerage network in Kankarbagh is connected to Pahari Nalla which is proximate to the proposed STP. The proposed STP will ensure diversion of the flow from the Pahari Nalla Outfall and SPS A (covering ward 29, 31, 35 & 44) to SPS B (partly covering ward 30) to the STP. The sewage collected at SPS B will then be pumped to the proposed Kankarbagh STP. Refer **Figure 3**.

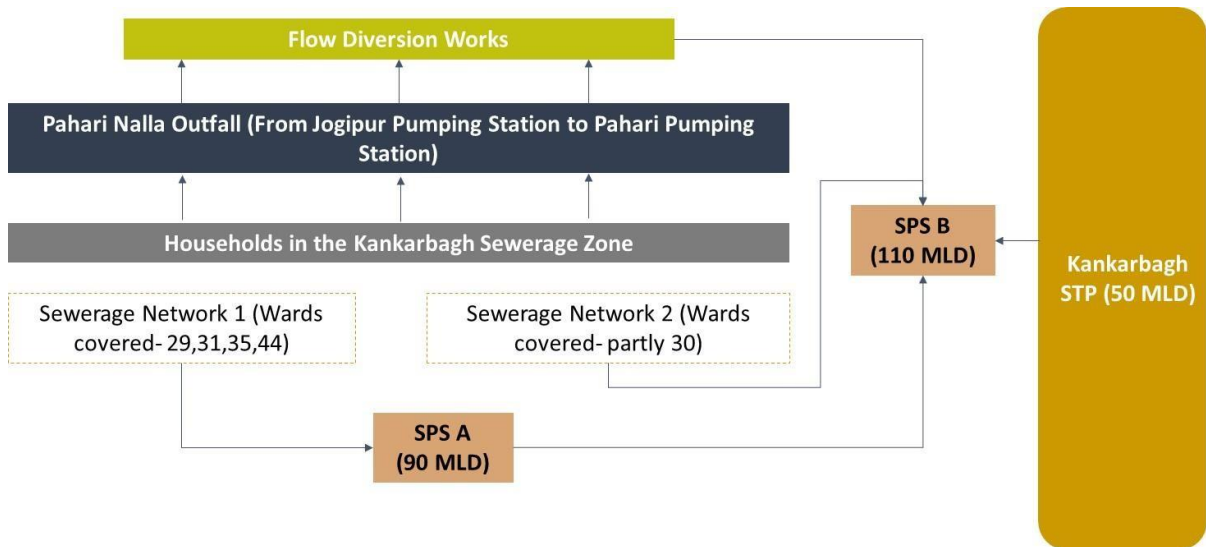


Figure 3: Sewerage System in Kankarbagh Zone



Premise allotted to WABAG for STP



Existing STP at Pahari

2.3 Project Design

2.3.1 Land Use of Site

The proposed Kankarbagh STP is located within the existing premises of the Pahari STP. Apart from the construction of the Kankarbagh STP, the total land area has been used for expansion (under construction) of the Pahari STP from 25 MLD to 60 MLD, staff quarters, laboratory, and other administrative buildings. In particular, it is estimated that a total of six (6) hectares of land will be used for the construction of the Kankarbagh STP and its supporting treatment infrastructure. The present site condition is as shown in the pictures below:



Construction work – Pahari STP



Construction work – Kankarbagh STP

Refer **Annex 2 & Annex 3** for the proposed Site Layout and Treatment Flow Diagram of the Kankarbagh STP. The Annexes provide the project design, various units of the STP, capacities, and treatment flow.

2.3.2 Site Conditions

The STP and the treatment scheme has been designed considering the following climatic and topographic data.

Parameter	Details
1. Ambient Temperature	Minimum 15°C; Maximum 45°C
2. Design Sewage Temperature	Winter 20°C; Summer 30°C
3. Relative Humidity	Minimum 58%; Maximum 85%
4. Site conditions	Tropical
5. Natural Ground Level at Site	50.00 m
6. Finished Ground Level at Site	HFL + 0.30m = 51.02m
7. Ground water table	3 m to 4 m
8. High Flood Level	50.72 m

2.3.3 Design Capacity

The STP has been designed for an Average Design Capacity of 50 MLD and a Peak Design Capacity of 112.5 MLD of influent (sewage) flow.

2.3.4 Raw & Treated Sewage Parameters

The Sewage Treatment Plant at Kankarbagh is designed considering the following influent sewage characteristics.

Parameter	Raw Sewage (Inlet)	Treated sewage (Outlet)
pH	6.0 - 8.5	6.5 - 9.0
BOD, mg/L	100 - 250	<20
COD, mg/L	500	-
TSS, mg/L	<500	<50
Faecal Coliform MPN/100 ml	$10^6 - 10^7$	<1000

2.3.5 Dewatered Digested Sludge Characteristics

Parameter	Details
Outlet concentration of dewatered sludge	More than 20% Solids
Faecal Coliform Limit, MPN/g of TS	Less than 20,00,000 MPN per gram of total dry solids (20,00,000 MPN/gTS)

2.4 Process Description

The sewage treatment is based on a biological treatment process. Further the sludge generated from the treatment plant shall be anaerobically digested to produce biogas which in turn will be used for generation of power through gas engines. The Kankarbagh STP is spread across six (6) hectares of land and will include the following treatment stages and components:

#	Treatment Stage	Components
9.	Preliminary Treatment	• Stilling Chamber
		• Mechanical Fine Screen
		• Manual Fine Screen
		• Grit Distribution Chamber
		• Grit Chamber
		• Bypass
10.	Primary Treatment	• Primary Clarifier Distribution Chamber
		• Primary Clarifier
11.	Secondary Treatment	• Aeration Tank
		• Process Air Blower Area
		• Secondary Clarifier Distribution Chamber
		• Return Activated Sludge Sump

#	Treatment Stage	Components
12.	Disinfection and Disposal	• Chlorine Contact Tank
		• Gas Chlorination System
		• Chlorine Leak Absorption System
		• Absorbent Tank
		• Caustic Solution Recirculation Pump
		• Chlorine Leak Blower
		• R1 Treated Water -disposed to Nallah through hybrid system
13.	Sludge Handling	• Digester Feed Sump
		• Anaerobic Sludge Digester
		• Digested Sludge Sump
		• Centrifuge
		• Polymer Dosing System
		• Supernatant Sump and Pumps
14.	Biogas Handling and Power Generation	• Gas Holder
		• Biogas Scrubber
		• Biogas Flare
		• R1 Biogas Engine- 635KVA capacity
15.	Heat Recovery System	• Hot Water Tank and Hot Water Recirculation Pumps
		• Jacket Water Waste Heat Recovery Unit
		• Exhaust Gas Waste Heat Recovery Unit
16.	Auxiliary Units Section	• Plant Water System
		• Bore Wells
		• Potable Water / Utility Water

A block diagram of the proposed treatment scheme with the components as indicated above have been provided in **Figure 4** below.

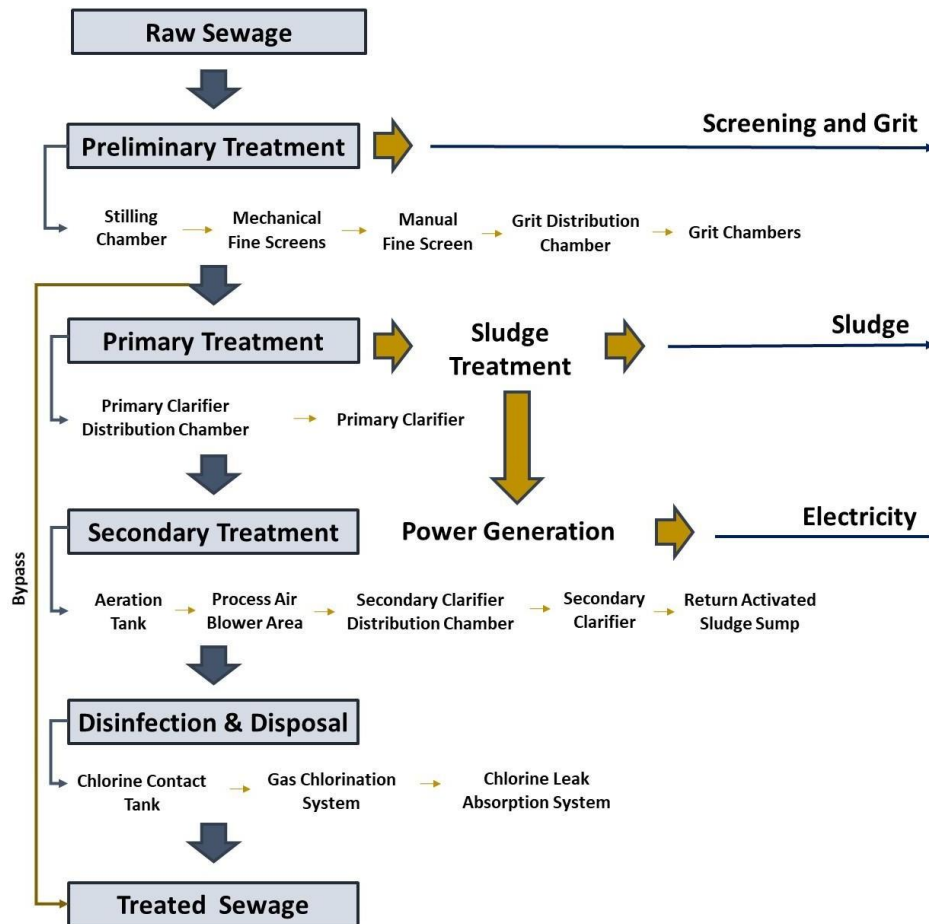


Figure 4: Block Diagram of Proposed Scheme

1. Preliminary Treatment

The preliminary treatment comprises of screenings and grit removal operations. During this operation, solid substances like floatables, rags, grit etc. are removed from the wastewater. This is achieved in two process steps:

- Fine solids and clogging constituents are removed from the sewage by fine screen units.
- In the grit chamber heavy particles (grit) with high settling velocities are removed by sedimentation.

2. Primary Treatment

This section receives the screened and de-gritted sewage. In this part of treatment plant, substantial amount of influent suspended solids and a portion of influent BOD are removed in the Primary Clarifier.

3. Secondary Treatment

The secondary treatment converts soluble or dispersed organic wastewater constituents which are not removed during Primary Treatment, into biomass. The treatment process is implemented for the removal of carbonaceous BOD removal using suitable microorganisms (bacteria) and supply of oxygen. The dissolved oxygen concentration maintained in the aeration tank shall be approx. 2 mg/l and air supply shall be carried out through air blowers. The aeration system comprising of blowers, fine

bubble diffusers shall be designed to maximize oxygen transfer and to adapt to the changing oxygen demands in biological treatment system.

The mixed liquor from the aeration tank will be distributed to the secondary clarifier system to separate the activated sludge from the treated wastewater. The secondary clarifier system comprises of four (4) clarifiers. The settled biomass from the clarifiers is then removed while some of it is partly recycled through the Return Activated Sludge (RAS) Sump.

4. Disinfection and Disposal Section

Secondary Treatment Section is followed by a disinfection system based on Chlorination to reduce the coliform level present in the treated sewage to the desired levels. After disinfection, the sewage is disposed off to the river through disposal pipe / channel.

5. Sludge Handling Section

The sludge from the primary and secondary treatment process shall be used for the production of biogas. The sludge from the primary and secondary process are collected in the Digester Feed Sump which aids in keeping the sludge in suspension and prevents any settling. The Anaerobic Sludge Digesters aid in digesting the thickened sludge in the absence of air resulting in the production of biogas with approx. 60% methane. The digested sludge is then transferred to the Digested Sludge Sump by gravity and dewatered using a centrifuge based system. Supernatants from digester, centrifuge feed sump and from centrifuge are received at the supernatant sump and pumped to the primary clarifier distribution chamber.

6. Biogas Handling Section ^{R1}

The biogas generated by the anaerobic digestion process will be used in co-generation plant in order to produce heat and electrical energy.

To ensure continuous supply of generated biogas, a gas holder of adequate capacity shall be constructed. Prior to utilization, the biogas shall be passed through the biogas scrubber plant where the Hydrogen Sulphide (H₂S) and Sulphur Dioxide gas (SO₂) will be removed. Caustic Soda solution shall be used for the biogas scrubbing so as to reduce the hydrogen sulphide present in biogas. The spent caustic would then be regenerated in a Biological Aerobic Reactor and recycled back to the scrubbing process. Pure elemental sulphur will be recovered as a by-product.

Gas flares (2 nos.) with drip trap, pressure regulator, flame arrestor and pilot burner will be installed to burn the biogas produced from the treatment plant under emergency conditions. ^{R1}Capacity of the flares will be 120% of gas generated from the plant. The biogas engine capacity is 635KVA in KKB plant

Biogas Engine shall be installed for generation of electricity from biogas. Cogeneration system will be provided inside the Gas Engine Building. Heat Recovery units, cooling system and Biogas Engines shall be housed in the Biogas Engine Building. Biogas engine supplied will include required exhaust ducting, HT radiator, Wet Ventilation System, Fresh and used lube oil system, Cooling water circuit for HT and LT system and Cooling water filling system.

7. Heat Recovery Section

A seasonal variation in the incoming raw sewage is expected during winter and summer season. For optimum performance of the Anaerobic Sludge Digester, the temperature in the digesters needs to be maintained at approx. 35°C. In order to maintain this temperature, the incoming sludge to digester will be heated to 35°C, when the incoming temperature is lower than 35°C.

The hot fluid required for heating shall be generated from the waste heat available from the Gas Engine.

8. Auxiliary Units Section

The auxiliary units of the STP shall consists of the Plant water system, Bore wells, Potable water/ utility water.

Plant water pump shall be provided to serve the plant water need which included the water required for screens, grit washer, sludge line flushing water and landscaping at site. This water shall be sourced from the treated sewage.

Bore Well Pumps are provided for pumping fresh groundwater to a Service/Potable Water Tank. The water shall be used for multiple applications such as polymer solution preparation, human domestic potable needs, laboratory potable water needs, admin building and toilet flushing.

The potable water from the tank shall be softened in a Water Softener. Regeneration of the Softener shall be carried out using brine solution pumped using the Diaphragm Type Brine Transfer Pumps.

The softened water shall be used for applications such as engine LT, HT circuit, chlorine leak absorption, scrubber system, hot water recirculation tank and for other soft water requirements

2.5 Project Phasing and Schedule

A project phasing schedule has been developed for the overall project and is as provided below: **R1**

CONSTRUCTION PLAN & MILESTONE SCHEDULE (KANKARBAGH STP)						
Project : Kankarbagh STP						
Activity	Kankarbagh STP	Milestone 1	Milestone 2	Milestone 3	Milestone 4	Milestone 5
Project Part: KKB STP						
- Engineering	6.00%	5.9%	0.1%			
- Civil Works	49.00%	7%	15%	12%	8%	7%
- MEI Works (Supply + Erection)	45.00%	7%	5%	8%	12%	13%
		20%	20%	20%	20%	20%

2.5.1 Current Project Phase

The pre-construction activities are currently ongoing and can be understood through the photos presented in **Figure 5**. A visit was conducted to the project site as part of the ESIA site visit. The ongoing pre-construction activities included levelling of site area and emptying of water from the existing tank in the site area and the detailing schedule as annexure



Figure 5: Site Photos of Pre-Construction Activities

3 Legal and Other Requirements

The E&S legal requirements applicable to the project at the national, state, and local level covering various components through the lifecycle of the project have been identified in the **Section 3.1**. Similarly, the investor requirements have also been identified in **Section 3.2**.

3.1 E&S Legal Requirements for STP Facility

The environmental regulations in India are drafted to address protection of environment and natural resources that form the input to any project or activity as well as for management and handling of pollutants released from a project or activity.

The Ministry of Environment, Forests and Climate Change (MoEF&CC) constituted under the Environment Protection Act at the central government level is the nodal agency for planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes. The State Pollution Control Boards, constituted under the Water Act, are responsible for implementing provisions of the Acts and Rules addressing prevention and control of pollution. Over a period of time their scope has been widened to all forms of pollution.

The key environmental and social regulations that an infrastructure project needs to be screened against are as follows:

- Environmental Clearance – In accordance with the provisions of Environmental Impact Assessment (EIA) Notification 2006, Schedule I, the STP project is not required to obtain an Environmental Clearance under the Environmental Impact Assessment Notification 2006 from the State or Central Authority.
- Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR Act) – The land for the project has been allotted by Patna Municipal Corporation. Hence provisions of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 are not applicable.

3.1.1 Applicable Environmental Regulations R1

Regulation	Brief	Action Required
1. Environment (Protection) Act, 1986	The Act has been framed as an umbrella Act which provides for both protection and improvement of environment. A number of Rules, Notifications and Authorities are formulated under this Act for prevention of pollution, and protection of environmentally sensitive locations.	Construction and O&M Phase: Submit an environmental audit report for the financial year ending the 31 st March in Form V to the Bihar State Pollution Control Board (BSPCB) under each of the Consent Orders granted to the project and/or its components
2. Water (Prevention and Control of Pollution) Act, 1974	The Act provides for the prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water in the country	Construction Phase: <ul style="list-style-type: none"> • Obtain a Consent to Establish from BSPCB for carrying out construction activities • Obtain a Consent to Operate from BSPCB for establishing and operating a batching plant.
3. Air (Prevention and Control of	The Act provides for prevention, control, and abatement of air pollution from an establishment and primarily	

Regulation	Brief	Action Required
Pollution) Act, 1981	addresses outputs of development activities.	O&M Phase: <ul style="list-style-type: none"> Obtain a Consent to Operate from Bihar State Pollution Control Board for operation of the Sewage Treatment Plant
4. Environmental Protection Second Amendment Rules 2002 (DG Set) & 2004	The Rule provides regulations to control noise limits and emission limits for a Diesel Generator.	Construction Phase: <ul style="list-style-type: none"> Diesel generator set should be provided with acoustic enclosure Diesel generator stack height should meet the specifications in the Consent order.
5. The Noise Pollution (Regulation and Control) Rules, 2000	It provides for regulations to control ambient noise levels in public places from sources such as industries/ construction works/ community events, etc.	Construction Phase: <ul style="list-style-type: none"> Adopt measures to control and mitigate noise levels from construction equipment and activities. Monitor ambient noise levels at regular intervals to ascertain operations are within permissible limits. O&M Phase : <ul style="list-style-type: none"> Monitor ambient noise levels on a periodic basis (at least once a year) to ascertain operations within permissible limits.
6. The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2016	Hazardous Waste Management Rules are notified to ensure safe handling, generation, processing, treatment, package, storage, transportation, use reprocessing, collection, conversion, and offering for sale, destruction, and disposal of Hazardous Waste.	Construction and O&M Phase: <ul style="list-style-type: none"> Obtain an Authorization from the BSPCB for handling and management of hazardous waste mainly generated in the switchyard and from DG sets (if any) for backup power. Comply with conditions of the authorization. Store hazardous waste (waste oil, oil & grease laden cotton, empty paint tins, spent filter, spent media etc.) on impermeable surfaces protected from environment Dispose hazardous waste to an authorized Transfer, Storage and Disposal Facility.
7. Construction and Demolition Waste Management Rules, 2016	The Rules apply to every waste resulting from construction, re-modelling, repair, and demolition of any civil structure of individual or organization or authority who generates construction and	Construction phase: <ul style="list-style-type: none"> Submit a Waste Management Plan with approvals from the local authority before starting construction or demolition

Regulation	Brief	Action Required
	demolition waste such as building materials, debris, and rubble.	<ul style="list-style-type: none"> Collection, segregation of concrete, soil and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority
8. Solid Waste Management Rules, 2016	The Rules were framed with an objective to segregate, collect, dispose, process, and treat municipal solid waste generated from a various areas including cities, townships, and private and government establishments. The Rules classifies various types of waste generators and outlines their duties.	<ul style="list-style-type: none"> Segregate the waste into three (3) streams, bio-degradable, non-biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors as per the direction or notification by the local authorities Do not throw, burn or burry the solid waste generated, on streets, in open public spaces outside the premises or in the drain or water bodies. Pay user fee for solid waste management, as specified in the bye-laws of the local bodies. Do not burn any horticulture waste.
9. E-Waste (Management) Rules, 2016	<p>The primary objective of the Rules is to ensure channelization of E-waste generated in the country for environmentally sound recycling which is largely controlled by the un-organized sector who are adopting crude practices that results into higher pollution and less recovery, thereby causing wastages of precious resources and damage to environment.</p> <p>The Rules apply to every manufacturer, producer, consumer, bulk consumer, collection centres, dealers, e-retailer, refurbisher, dismantler and recycler involved in manufacture, sale, transfer, purchase, collection, storage and processing of e-waste or electrical and electronic equipment listed in Schedule I, including their components, consumables, parts, and spares which make the product operational</p>	<p>Construction and O&M phase:</p> <ul style="list-style-type: none"> Ensure e-waste generated is channelized to authorized collection center's or registered dismantler or recycler or; returned to pick-up or take back services provided by producers. Maintain records of e-waste generated in Form 2. R1e-waste like bulbs, tubes and other electrical items
10. The Batteries (Management & Handling) Rules, 2001	The Rules were notified with the primary objective of channelizing the used lead acid batteries for environmentally sound recycling. These provisions of the Rules apply to every manufacturer, importer, re-conditioner, and assembler of such batteries to ensure that used batteries are collected	<p>O&M Phase :</p> <ul style="list-style-type: none"> Deposit used batteries with the dealer, manufacturer, importer, assembler, registered recycler, and re-conditioner or at the designated collection centers. R1Lead batteries like troche light batteries, DG set batteries, and so on

Regulation	Brief	Action Required
	back and sent to registered recyclers. Responsibilities are also fixed on other stakeholders such as dealers, recyclers, bulk-consumers, and auctioneers to maintain records and file annual returns	
11. Manufacture, Storage, and Import of Hazardous Chemicals (MSIHC) Rules 1989	The Rule was notified with a primary objective of preventing chemical accidents from industrial activities and mitigate impacts of chemical accidents. It classifies various hazardous chemicals based on its chemical characteristics and outlines measures to taken for safe usage and storage of the chemicals.	<p>O&M Phase:</p> <ul style="list-style-type: none"> • Take adequate steps to prevent major accidents and to limit their consequences to persons and the environment. • Provide persons working on the site with information, training, and equipment to ensure their safety. • Prepare on-site emergency plan and conduct mock drills. • Notify local authorities in case of a major accident to authority
12. Public Liability Insurance Act 1991	The main objective of the Public Liability Insurance Act 1991 is to provide for damages to victims of an accident which occurs as a result of handling any hazardous substance. The Act applies to all owners associated with the production or handling of any hazardous chemicals.	<p>O&M Phase:</p> <ul style="list-style-type: none"> • Obtain insurance policy against the liability for handling hazardous substance specified in the Act and submit copy of the same to BSPCB • In addition to the premium, every owner shall pay the insurer for being credited to the Relief fund. <ul style="list-style-type: none"> ○ Copy of the same shall be submitted to SPCB ○ Renewal before expiry of validity period
13. The Bihar Ground Water (Regulation and Control of Development and Management) Act, 2006 14. Central Ground Water Authority Guidelines to regulate and control Ground Water Extraction in India dated 1 June, 2019	An Act to promote water conservation, and tree cover and regulate the exploitation and use of ground and surface water for protection and conservation of water sources, land and environment and matters.	<p>Construction Phase:</p> <ul style="list-style-type: none"> • Approval from Authority for digging bore- well for water drawl during construction. • Obtain permission from Local Authority for cutting of trees. • Ensure protection of trees and their branches while developing their infrastructure or carrying on their activities <p>O&M Phase: R1</p> <ul style="list-style-type: none"> • Approval from Authority for digging bore- well for water drawl during O&M.

3.1.2 Applicable Occupational, Health & Safety Regulations

Regulation	Brief	Action Required
1. Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	An Act to regulate the employment and conditions of service of building and other construction workers. The Act stipulates health, safety, and welfare measures and for other matters connected therewith applicable to the construction workers	<p>Construction phase:</p> <ul style="list-style-type: none"> • Registration with Labor Department (for recording maximum number of workers to be present at site during construction) • Engagement of Contractor registered with the Labour Department • Ensure that Contractor employs measures on worker health and safety during construction
2. The Factories Act, 1948 and Bihar Factories Rules, 1950	<p>The main objective of the Act is to ensure adequate safety measures and at the same time also to promote health and welfare of the workers employed in factories as well as to prevent haphazard growth of factories. The Act is applicable to any factory using power & employing 10 or more workers.</p> <p>The Act along with Rules (state specific) outlines requirements to ensure occupational safety, health, and welfare of workers at work place</p>	<p>O&M phase:</p> <p>Applicability of factories license with respect to the operations of the STP should be confirmed with the local office of the Factories Inspectorate. If found applicable, the following key actions would require to be undertaken:</p> <ul style="list-style-type: none"> • WABAG should apply to the obtain license to work in a factory (Form No. 4) from Factories Inspectorate (DISH). • Obtain an approved factory layout/ plan from Factories Inspectorate (DISH) • Conduct structural stability of building by competent and authorized Civil/Structural Engineers • Obtain Fire NoC from Chief Fire Officer • Conduct health check-up of employees and/or non-employee workers • Establish Occupational Health Centre based on number of workers • File Annual Factory Returns for the calendar year every year before 31 January of the next year. • Adhere to Bihar Factories Rules (BFR), 1950 on labour safety and welfare.

Regulation	Brief	Action Required
3. Central Motor Vehicles Act 1988	<p>An Act that regulates all aspects of road transport vehicles. It also seeks to consolidate and amend the law relating to motor vehicles.</p> <p>The Act provides in detail the legislative provisions regarding licensing of drivers/conductors, registration of motor vehicles, control of motor vehicles through permits, special provisions relating to state transport undertakings, traffic regulation, insurance, liability, offences and penalties, etc.</p>	<p>Construction phase:</p> <ul style="list-style-type: none"> Construction equipment and transport vehicles (owned or hired) should possess valid driver's license; registration, permit for transportation, fitness certificate, and insurance <p>O&M phase: R1</p> <ul style="list-style-type: none"> Vehicles used (owned or hired) should possess valid driver's license; registration, permit for transportation, fitness certificate, and insurance and record maintenance
4. Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010	<p>The regulation consolidates the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of electricity industry, promoting competition therein, protecting interest of consumers and supply of electricity to all areas, rationalization of electricity tariff, ensuring transparent policies regarding subsidies, promotion of efficient and environmentally benign policies.</p>	<p>Construction phase and O&M phase:</p> <ul style="list-style-type: none"> Employ safety measures specified in the Regulation for all electrical work All earthing systems to be tested for resistance during the dry season once every year. Periodic inspection of LT/HT installation - at least once in five years Approval from Electrical Inspector for operation of generating unit >10 kW. Fire buckets filled with clean dry sand, ready for immediate use for extinguishing fires, in addition to fire extinguishers suitable for dealing with electric fires to be kept at site
5. The Static and Mobile Pressure Vessels (Unfired) Rules 1981	<p>These SMPV rules stipulate various safety guidelines for the storage and transport of compressed and liquefied gases filled in pressure vessels.</p>	<p>O&M phase:</p> <ul style="list-style-type: none"> The vessel shall contain the following fittings: <ul style="list-style-type: none"> pressure relief shut-off and emergency shut-off valves liquid level gauging device pressure gauge All vessels shall be hydraulically tested by a competent person at a pressure marked on the vessel in an interval of 5 years. Vessels to be stored in accordance to distances specified under the Rule.

Regulation	Brief	Action Required
		<ul style="list-style-type: none"> Electrical wires shall not pass over any storage vessel. Electrical wires installed within safety zone shall be insulated cables of approved type.
6. The Boilers Act, 1923 amended upto 2007	The Act stipulates requirement for safety of steam boilers and steam pipes. The Act identifies defines boilers and further aids in classifying them as IBR and non-IBR boilers. It also outlines management and safety measures for operation.	O&M phase: <ul style="list-style-type: none"> Every boiler has to be registered with the Chief Inspector of Boilers

3.1.3 Applicable Employee and Labour Welfare Regulations ^{R1}

Regulation	Brief	Action Required
1. Child and Adolescent Labor (Prohibition and Regulation) Act, 1986 and Amendment Act 2016	An Act to prohibit the engagement of children in certain employments and to regulate the conditions of work of children and adolescents in certain other employments.	Construction and O&M phase: <ul style="list-style-type: none"> Ensure that child labor is not engaged for any activity
2. Minimum Wages Act, 1948	An Act to provide for fixing minimum rates of wages in certain employments to ensure level of income for a worker which will provide a basic standard of living including good health, dignity, comfort, education and provide for any contingency	Construction phase and O&M phase: <ul style="list-style-type: none"> Ensure payment of wages to workers (employed, on contract, through a contractor) as per minimum wages notified
3. The Equal Remuneration Act, 1976	An Act to provide for the payment of equal remuneration to men and women workers and for the prevention of discrimination, on the ground of sex, against women in the matter of employment and for matters connected therewith.	Construction phase and O&M phase: <ul style="list-style-type: none"> Pay equal remuneration to employees of all genders performing same work or work of a similar nature. Employer will not make any discrimination while making recruitment for the same work or work of a similar nature, except where such work is prohibited or restricted by or under any law for the time being in force
4. Employees' State Insurance Act (ESI), 1948	An Act to provide for certain benefits to employees in case of sickness, maternity and injury during employment and to make provision for certain other matters in relation thereto. The ESI is a self- financing social security and health insurance scheme for Indian workers.	Construction phase and O&M phase: <ul style="list-style-type: none"> Ensure deduction and payment of ESI for workers (employed, on contract, through a contractor)

Regulation	Brief	Action Required
Insurance Act (ESI), 1948	in relation thereto. The ESI is a self-financing social security and health insurance scheme for Indian workers.	<ul style="list-style-type: none"> Ensure deduction and payment of ESI for workers (employed, on contract, through a contractor)
5. The Employees' Provident Funds (EPF) and Miscellaneous Provisions Act, 1952 amended up to 1996	The EPF is a social security mechanism to ensure employees better future on retirement and of dependents during death. It seeks to provide for institution of provident funds, pension funds and deposit linked insurance funds for employees in factories and other establishments.	<p>Construction phase and O&M phase:</p> <ul style="list-style-type: none"> Ensure deduction and payment of provident fund for workers (employed, on contract, through a contractor)
6. Employee Compensation Act 1923 and Amendment Act 2009	This Act aims at providing financial protection in form of insurance/medical benefits to workmen and their dependents in case of accidental injury by means of payment of compensation by the employers.	<p>Construction phase:</p> <ul style="list-style-type: none"> Ensure that Contractor obtains insurance for construction workers <p>O&M phase:</p> <ul style="list-style-type: none"> Obtain insurance for workers (employed, on contract, through a contractor)
7. The Payment of Gratuity Act, 1972	An Act to provide for a scheme for the payment of gratuity (type of retirement benefit) to employees engaged in factories, mines, oilfields, plantations, ports, railway companies, shops, or other establishments.	<p>O&M phase:</p> <ul style="list-style-type: none"> Payment of gratuity to employees as per requirements under the Act
8. The Maternity Benefits Act, 1961	An Act to regulate the employment of women in certain establishments for certain periods before and after child-birth and to provide for maternity benefit and certain other benefits.	<p>O&M phase:</p> <ul style="list-style-type: none"> Ensure provision of leaves as specified in the Act.
9. The Payment of Bonus Act, 1965	The Payment of Bonus Act, 1965 provides for the payment of bonus to persons employed in certain establishments, employing 20 or more persons, on the basis of profits or on the basis of production or productivity and matters connected there with.	<p>O&M phase:</p> <ul style="list-style-type: none"> Payment of bonus for an accounting year as per provisions of the Act
10. The Contract Labour (Regulation and Abolition) Act, 1970	An Act to regulate the employment of contract labour in certain establishments and to provide for its abolition in certain circumstances and for matters connected therewith	<p>Construction phase and O&M phase:</p> <ul style="list-style-type: none"> Engagement of Contractor registered with the Labour Department
11. The Industrial Disputes Act, 1947	An Act to make provision for the investigation and settlement of industrial disputes, and for certain other purposes. The objective of the Act is to secure	<p>O&M phase:</p> <ul style="list-style-type: none"> Provisions of the Act are to be followed during laying-off of workers

Regulation	Brief	Action Required
	industrial peace and harmony by providing mechanism and procedure for the investigation and settlement of industrial disputes by conciliation, arbitration and adjudication which is provided under the statute.	<ul style="list-style-type: none"> Provisions of the Act are to be followed during laying-off of workers
12. The Private Security Agencies (Regulation) Act, 2005	An Act to provide for the regulation of private security agencies in India.	Construction phase and O&M phase: <ul style="list-style-type: none"> Ensure security agencies hired are registered under the PSARA Act
13. The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013	An Act to provide protection against sexual harassment of women at workplace and for the prevention and redressal of complaints of sexual harassment and for matters connected therewith or incidental thereto.	Construction phase and O&M phase: <ul style="list-style-type: none"> Constitute an Internal Complaints Committee. Develop a procedure for recording and resolving complaints related to sexual harassment. Conduct enquiry on receipt of complaint as per the procedure. Submission of Annual Report to the District Officer with details on the number of cases filed and their disposal.

3.2 Word Bank Environmental and Social Framework

3.2.1 Application of World Bank E&S Standards

The applicability of World Bank Environmental & Social Standards (ESS) to the project has been assessed based on review of the project information and baseline studies. ^{R1}

Performance Standard	How the World Bank ESS Standard is applicable?	Statement on Applicability
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts	The STP project in the construction and O&M phases has the potential to cause environmental and social impacts.	Applicable
ESS 2: Labor and Working Conditions	Workers for various activities and security guards will be employed / contracted during construction and operation phases of the project.	Applicable
ESS3: Resource Efficiency and Pollution Prevention and Management	The project during construction and O&M phases: <ul style="list-style-type: none"> will consume natural resources 	Applicable

Performance Standard	How the World Bank ESS Standard is applicable?	Statement on Applicability
	<ul style="list-style-type: none"> will generate - noise, various forms of waste, wastewater and release air emissions; has the potential to impact the environmental components in the project influence area such as soil contamination due to seepage of chemicals and untreated wastewater 	
ESS4: Community Health and Safety	The project through its activities (direct and associated activities) has the potential to impact the community health, safety, and security such as health impacts from pollution generated from the facility, impacts due to increase in transport vehicles on internal roads (during construction), explosions and emergencies etc.	Applicable
ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement	No land acquisition has been carried out for the Project. The land allocated for the project belongs to Patna Municipal Corporation. Further, there were no encroachments or squatters identified on the allotted land area.	Not Applicable
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	The project is not located in close proximity to protected areas or areas rich in biodiversity.	Not Applicable
ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	The project is not located in proximity to a Scheduled Area or tribal area.	Not Applicable
ESS8: Cultural Heritage	There are no places of archaeological importance located near the project.	Not Applicable
ESS9: Financial Intermediaries	The project is an infrastructure development project.	Not Applicable
ESS10: Stakeholder Engagement and Information Disclosure	The project involves interaction and participation of various stakeholders and covers aspects indicated in ESS1, ESS2 and ESS4.	Applicable

R1 World Bank E&S Safeguard Policies

WB Operational Policies	How the World Bank Operational Policies is Applicable	Statement on Applicability
Environmental Assessment (OP4.01)	Digha STP and laying of Networks under DK Sewerage Projects fall under the Category A as per OP4.01. Therefore, they will automatically trigger EA safeguards. The activities include, construction of new 100 MLD STP at Digha Diara and laying of network by open excavation and/or micro tunnelling, collection, transportation and treatment of sludge/slurry to be generated from project activities during construction and during operation of the facilities.	Applicable

Natural habitats (OP4.04)	Drainage systems that will be set up will be directing the waste and storm water into the natural habitats – mainly wetlands. The sludge/slurry to be generated will be discharged/disposed of at some land fill sites, drainage channels or wetlands. Therefore, it is likely that OP 4.04/BP 4.04 will be triggered	Applicable
Pest Management (OP4.09)	It is expected not to require major pest management measures.	Not Applicable
Physical Cultural Resources (OP4.11)	This policy may be triggered by sub-projects under this in those areas where cultural property, historical, religious and unique natural value-this includes remains left by previous human inhabitants and unique environment features may be affected during widening and strengthening work of the sub-projects.	Not Applicable
Involuntary Settlement (OP4.12)	The project entails no land acquisition but it may impact (minimal) livelihood of non- title holders at STP site. This is likely to trigger OP 4.12.	Applicable
Forests (OP4.36)	There are no forest areas within Patna which may be affected by the project construction works. As such the WB OP 4.36 will not be triggered.	Not Applicable
Indigenous Peoples (OP4.10)	The policy is not triggered as the geographical areas in consideration are not likely to have indigenous people as defined by the Bank policy.	Not Applicable
Safety of Dams (OP4.37)	The policy is not triggered as it will not involve the construction or maintenance of dams as defined by the Bank policy.	Not Applicable
Consultation and Disclosure (OP17.5)	For all Category A projects, the borrower needs to consult with the project affected people and beneficiaries about environmental and social concerns related to the project. Therefore, OP 17.5 will be triggered.	Applicable

3.2.2 World Bank Group's EHS Guidelines

The IFC Performance Standards 3 refers to World Bank Group's EHS Guidelines. The following Guidelines will be applicable to the STP:

- a) General EHS Guidelines (April 2007)
- b) EHS Guidelines for Water and Sanitation (December 2007)

3.3 Project Categorization

The World Bank E&S Framework classifies projects as High Risk, Substantial Risk, Moderate Risk or Low Risk, taking into account the following:

- the type, location, sensitivity and scale of the Project including physical considerations;
- the nature and magnitude of the potential E&S risks and impacts, including the type of development (greenfield or brownfield, e.g. rehabilitation, maintenance or upgrading activities); the nature of the potential risks and impacts (e.g. whether they are irreversible, unprecedented or complex); resettlement activities; presence of Indigenous Peoples; and possible mitigation measures considering the mitigation hierarchy;
- the capacity and commitment of the Borrower to manage such risks and impacts in a manner

consistent with the World Bank ESSs;

- other areas of risk that may be relevant to the delivery of E&S mitigation measures and outcomes, including the nature of the mitigation and technology being proposed, considerations relating to domestic and/or regional stability, conflict or security.

The project is classified as **Moderate Risk** for the following reasons:

- The project impacts during construction and O&M phase are expected to be few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
- The project does not trigger involuntary resettlement.
- There are no Indigenous People in project influence area.
- There are no Protected Areas (Wildlife Sanctuaries and National Parks) in project influence area.
- Based on the project activities and its location, the project is not expected to result in any irreversible or unprecedented impacts.

A detailed assessment of the impacts has been presented in the **chapter 6** of this report.

4 Baseline Environmental and Social Status

4.1 Approach for Baseline Studies

For conducting baseline studies, the study area was delineated, environmental and social (E&S) sensitive receptors were identified through secondary data processing and baseline environmental monitoring was conducted for collecting primary data.

4.1.1 Project Influence Area

A three (3) km radius from the centre of the project was defined as the project influence area (“study area”) for the conducting the baseline studies and impact assessment. The study area was defined based on the nature and mode of impact of project development on the E&S sensitive receptors. Refer **Figure 6**. The rationale for defining the 3 km buffer is presented below.

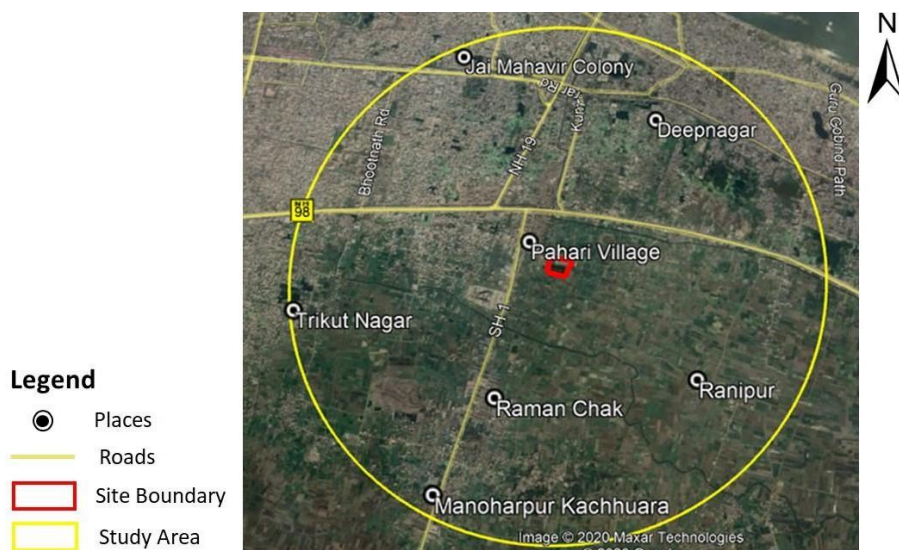


Figure 6: Site Boundary and Study Area

Rationale for defining a 3 km buffer area:

The extent of impacts arising from the project during construction and O&M phases will be local impacts and limited to immediate vicinity of the project area.

The rationale for delineating 3 km radius as the project influence area is listed below:

- f) A study of receptors present around the project area was conducted. A limited number of receptors were found present in the delineated project influence area that could potentially be impacted due to the project activities.
- g) Land for setting up the STP belongs to Patna Municipal Corporation. There were no encroachers or squatters identified on the allotted land.
- h) The source of water during construction will be a combination of ground water and tanker water. During operation and maintenance phase, the water used shall be a combination of ground water and recycled sewage (treated) water.
- i) Sewage treated in the STP shall be discharged as per statutory limits.
- j) The wastewater discharges and fugitive emissions are not expected to traverse beyond 3 km.

Thus, a 3 km buffer would be sufficient to study the impacts on the community and other sensitive receptors as indicated above.

4.1.2 Identifying Environmental and Social Sensitive Receptors

The sensitive receptors in the study area defined above were identified by undertaking a mapping exercise. Refer **Annex 4** for sources of data referred. These include:

- Settlements
- Water bodies
- Archaeological sites
- Tribal/Scheduled Areas
- Defence installations
- Highway/airports/railway station
- National Parks/Wildlife Sanctuaries
- Reserved/Protected Forest
- Ecological Sensitive Areas
- Important bird areas
- Ground water development status
- Socio-economic analysis
- Cropping pattern
- Meteorology

The Important Bird Areas were identified as per database created by Bombay Natural History Society, Birdlife International and eBird Hotspots. Archaeological sites were identified as per information provided by the Archaeological Survey of India (which includes world heritage sites, excavations, state protected monuments and museums).

The classification of the project area under natural hazards zones were also identified such as earthquakes and cyclones (based on hazard maps prepared by Building Materials and Technology Promotion Council).

Land use land cover (LULC) analysis was carried out using LISS-III imagery freely accessible from National Remote Sensing Centre (NRSC – Bhuvan) and Landsat 8 from USGS. The LULC includes the following layers:

- Agricultural Fallow
- Agriculture Cropland
- Deciduous/Scrub/Semi-Green Forest
- Built-up
- Wetlands/Waterbodies/Rivers/Streams

4.1.3 Baseline Environmental Monitoring Sampling Plan

The sampling locations were selected based on monitoring protocols developed with reference to the Central Pollution Control Board (CPCB) Guidelines for baseline environmental quality monitoring (ambient air, ambient noise, and water). See **Annex 5** for monitoring protocol and details. The ground

water samples were collected from existing tap water sourced from bore wells on-site and off-site. Air quality monitoring stations were identified based on the wind pattern as well as the existing and potential traffic flow in the study area. Noise monitoring locations were chosen based on their proximity to sensitive receptors such as settlements, roads, existing and potential traffic movement, and wind pattern in the study area.

The number of samples for baseline environmental monitoring, parameters and frequency has been provided in **Table 1** below.

Table 1: Environmental Monitoring Samples ^{R1}

Aspect	Number of samples	Parameters
Ambient Air Quality	3 locations and two sample at each location for 48 hours	4 parameters to be analyzed (PM ₁₀ , PM _{2.5} , SO ₂ , NO _x).
Aspect	Number of samples	Parameters
Ambient Noise Quality	3 locations for 24 hours with hourly averages in dB(A)	-
Groundwater	2 locations 1 sample at each location	Parameters as per IS 10500:2012 Drinking Water Standards (36 parameters including physical, bacteriological, and heavy metals).

The monitoring results were analysed in comparison to national standards and the guideline values provided by the World Bank Group EHS General Guidelines. A detailed description of the baseline environmental monitoring is provided in the **sub-section 4.3**.

4.1.4 Site Visit

A five (5) day field visit was conducted to the study area for understanding the site context, validating the sensitive receptors identified through the desktop review, conducting baseline environmental monitoring, and holding stakeholder consultations. A brief description of the activities carried out is presented below:

- a) Opening meeting with WABAG representatives – Discussions were conducted with WABAG representatives to understand the project timelines, project operations, components siting, material handling and process flows, waste management practices etc.
- a) Verification of data layers – The sensitive receptors in the study area mapped during the desk-based exercise were verified on site through visual inspection during transect walks. During the site visit, local E&S sensitive receptors were also identified in addition to those identified through desktop review.
- b) Stakeholder Consultations – Interactions were carried out with project stakeholders including (but not limited to) local authorities and neighbouring communities to understand existing community infrastructure, presence of cultural heritage sites and local areas of importance (temples, mela grounds, community activity areas). The stakeholders were also appraised on the development of the STP and its benefits in management of pollution in the River Ganga. Response to queries of the stakeholders on the above mentioned aspects was also carried out. The consultations were conducted around the study area in small informal groups. The consultations were conducted during the ongoing pandemic across the country. Adequate safety measures were employed and thus conducted in small groups. The consultations were carried out using a semi-structured questionnaire.

- c) Baseline environmental monitoring – based on the sampling plan described in sub-section 4.1.3.

4.2 Meteorology

Satellite derived climate data for nine (9) locations in and around the study area was acquired from National Centre for Environmental Predictions (NCEP) Database and has been utilized for identifying the meteorology of the study area. It has been established through various research that satellite derived data corresponds to observed data for any location.

4.2.1 Rainfall

The annual mean rainfall across the study area over 30 years (1984 to 2013) shows variations and ranges between 1,084 – 1,127 mm from north-east to south-west direction.

The **Figure 7** presents the variation in mean rainfall for 30 years over twelve months of the year. The monsoon season spans from July to October and the highest levels of precipitation are experienced in the month of October (197 mm).

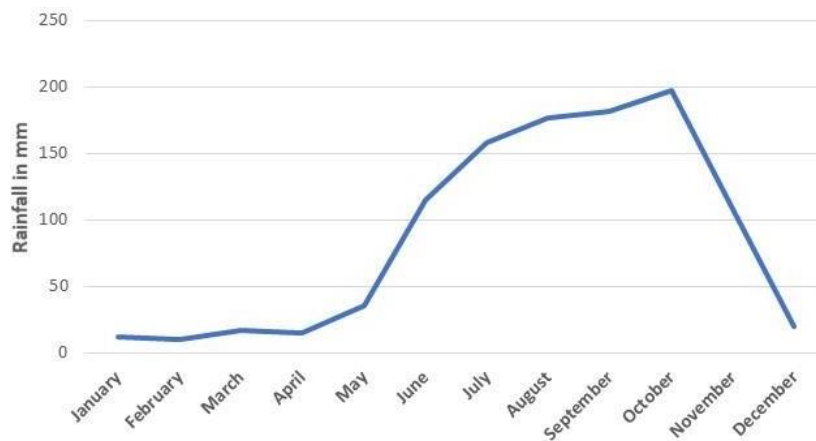


Figure 7: Variation in Rainfall in Project area

4.2.2 Temperature

The annual mean temperature across the study area is studied for 30 years. **Figure 8** presents the variations of temperature maximum, minimum and mean across twelve months of the year. Maximum temperatures are experienced from April to July (>35 °C) and minimum temperatures are experienced from November to February (15-18 °C).

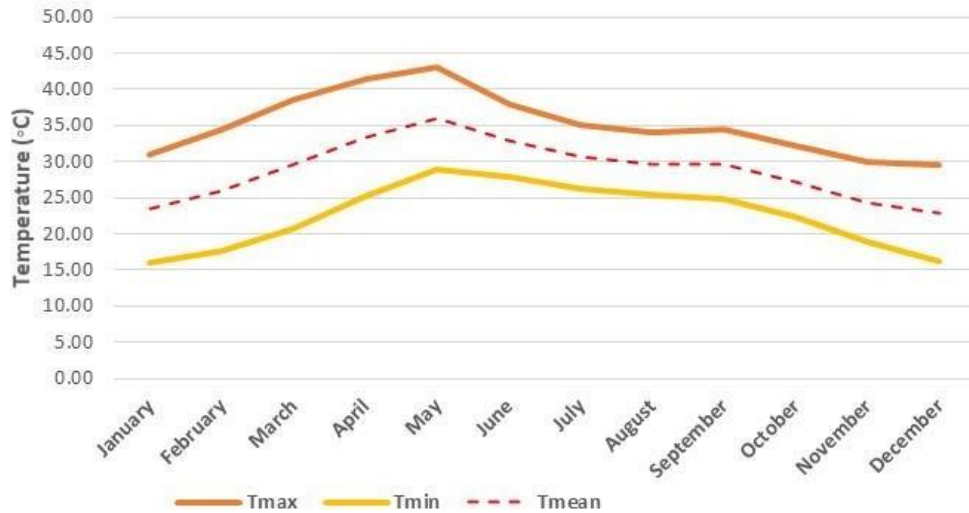


Figure 8: Temperature Variation in Project Area

4.2.3 Wind Speed

The predominant wind direction is observed to be from south-west to north-east direction. Refer **Figure 9** for the annual wind rose at Patna² indicating the direction of wind flow in terms of number of hours per year. Higher wind speeds (5 – 10 m/s) are experienced from the west-north-west and west direction of the study area.

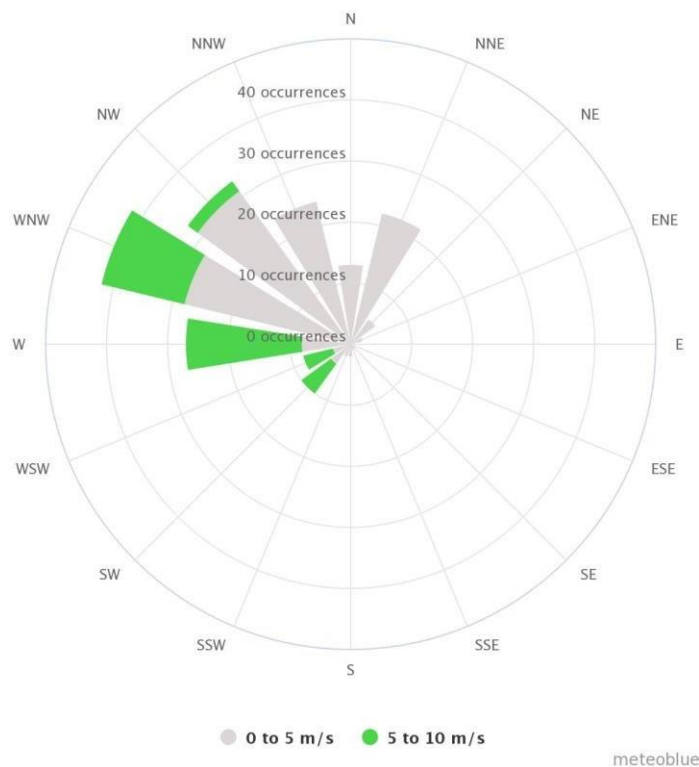


Figure 9: Wind Rose Diagram, Patna

4.3 Physical Resources

4.3.1 Air Environment

The baseline air quality was monitored at three locations. The siting of the air quality monitoring stations was carried out based on the prevalent wind direction and presence of sensitive receptors. The criteria for selection of each monitoring station is also given below. Refer **Figure 10** for locations of the monitoring stations. One location (AAQ1) is located in the downstream direction while two locations (AAQ2 and AAQ3) are located in the upstream direction of wind.

Monitoring Locations	Criteria for selection
AAQ 1 – Outside Main gate, Kankarbagh STP	The location chosen was at the main entrance of the project site. The location represents the baseline condition and is located in the downstream end of the wind direction.
AAQ 2 – Yadav Colony, Kankarbagh	The locality chosen is a settlement located in the second highest predominant wind direction of the site (West – North-West) and was in close proximity to the site.

² <https://www.meteoblue.com> retrieved on 05.11.2020.

Monitoring Locations	Criteria for selection
AAQ 3 – Service road, near SH 1	The location chosen was in the upstream of the impact zone and is adjacent to the highway. It was understood that this shall be the major access route to the project site.

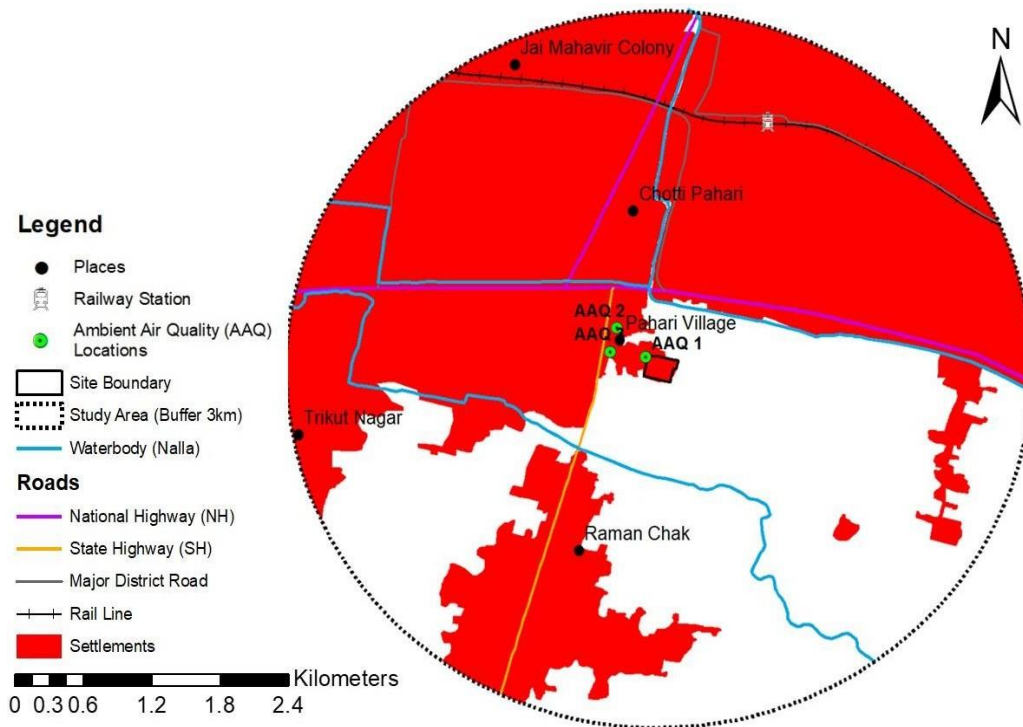


Figure 10: Ambient Air Quality (AAQ) Monitoring Locations

Summary Table of Monitoring Results

Refer **Annex 6** for detailed monitoring results and **Annex 7** for photographs of the ambient air monitoring stations.

Table 2: Ambient Air Quality Monitoring Result

Parameters	CPCB Standard (24 hours)	WHO Guidelines	Result					
			(AAQ 1) Outside Main gate, Kankarbagh STP		(AAQ 2) Yadav Colony, Kankarbagh		(AAQ 3) Service road, near SH 1	
			Day 1	Day 2	Day 1	Day 2	Day 1	Day 2
PM ₁₀ µg/m ³	100	50	86.48	82.26	60.28	62.86	76.38	75.34
PM _{2.5} µg/m ³	60	25	48.75	45.86	37.84	40.24	56.42	54.18
SO ₂ µg/m ³	80	20	32.46	28.80	24.6	20.12	39.05	42.48
NO _x µg/m ³	80	40	22.48	24.16	18.66	18.42	32.29	29.15

Analysis of Monitoring Results

The pollutant concentrations in the ambient air in the study area were compared with National Ambient Air Quality Standards (NAAQS) of Central Pollution Control Board (CPCB) and WHO guideline values provided in the World Bank Group's General EHS Guidelines. Refer **Table 2**. The 24-hour average concentration of NO_x on two consecutive days of monitoring in the study area were observed to be well within NAAQS standard and WHO guideline values. The SO₂, PM_{2.5} and PM₁₀ levels were well within NAAQS standard values but exceeded the limits provided by the WHO guidelines at all locations monitored.

4.3.2 Ambient Noise Level

The baseline ambient noise levels were monitored at three locations for 24 hours. Siting was carried out based on the potential high traffic routes and location of sensitive receptors around the project area. The criteria for selection of monitoring station is presented below. Refer **Figure 11** for locations of noise monitoring stations.

Monitoring Locations	Criteria for selection
N1 – Near Main gate, Kankarbagh STP	The location chosen was in close proximity to the main entrance of the project site. The location represents the baseline condition.
N2 – Yadav Colony, Kankarbagh	The location is a residential area (sensitive receptor) located in close proximity to the project site.
N3 – Service road, near SH 1	The site chosen is located adjacent to the highway and will be used as the major access route to the project site.

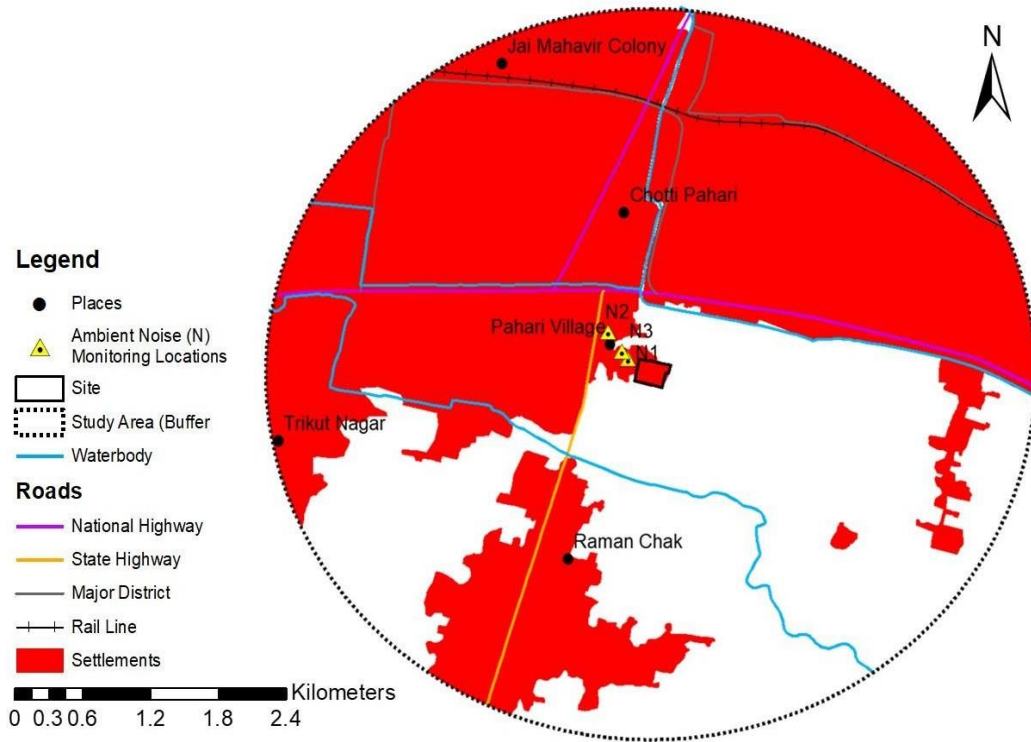


Figure 11: Ambient Noise (N) level Monitoring Locations

Summary Table of Monitoring Results

Refer **Annex 6** for detailed results and **Annex 7** for photographs of the Ambient Noise Monitoring locations.

Table 3: Noise Level Monitoring Results

Receptor	Parameters	CPCB Standards	EHS Guidelines	Result		
				(N1) Near Main gate, Kankarbagh STP	(N2) Yadav Colony, Kankarbagh	(N3) Service road, near SH-1
Residential Area	Noise Level Day dB(A)	55	55	55.75	55.43	-
	Noise Level Night dB(A)	45	45	47.38	45.59	-
Commercial Area	Noise Level Day dB(A)	65	55	-	-	64.66
	Noise Level Night dB(A)	55	45	-	-	55.27

Analysis of Monitoring Results

The ambient noise levels monitored at site were compared with CPCB standards for ambient noise (for residential, commercial, industrial, and silent zones) and World Bank Group's EHS Guidelines (refer **Table 3**). The average ambient noise levels obtained for all the locations were observed to be exceeding the permissible limits of the CPCB standards and EHS guidelines for both day and night noise levels.

4.3.3 Topography and Soils

The site boundary and study area (buffer 3 km) fall under the urban Patna (Patna Sadar and Patna city). The study area falls under the high dense built fabric. However, vast open agricultural plots are observed in the north, south and east of the project site while settlements are observed to the west. The topography is flat plains as the study area is part of Indo-Gangetic flood plains. The predominant slope observed is from south-west to north-east. The average slope across the site is 5.4% from south-west to north-east and average slope is 2.4% from south-east to north-west. The type of soil found is gangetic alluvium. However, since the project is a brownfield project and there is no change in existing landuse, no baseline soil analysis was conducted.

4.3.4 Surface Water

The **Figure 12** presents the water network (nalla) in the study area. As seen in the map, there is no immediate surface water body within the study area and hence no baseline environmental monitoring for surface water quality was conducted. The River Ganga is the nearest surface waterbody (aerial distance of approx. 1.02 km) and is located towards north of the study area.

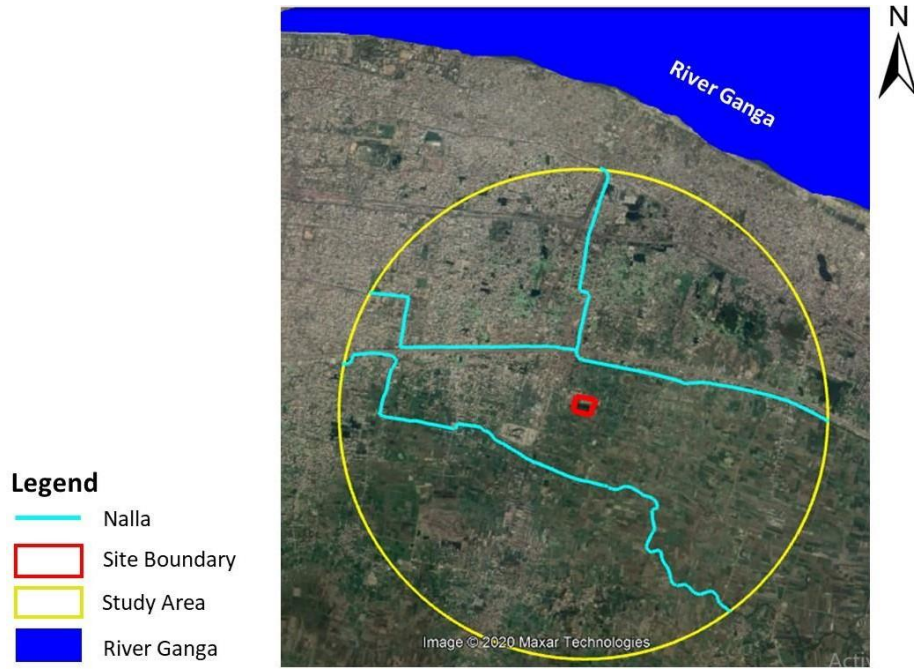


Figure 12: Location of Surface Water

4.3.5 Ground Water Development

The study area falls under the Patna District and specifically in two sub-districts - Patna Sadar and Patna city. As per the 'Dynamic Ground Water Resources of India' dated June 2017 published by Central Ground Water Board (CGWB), Patna Sadar falls under "critical" zone while Patna City falls under "safe" zone for ground water development. Refer **Figure 13**. Although the project site falls under Patna City, it is in close proximity (approx. 1.08 km) to the boundary of Patna Sadar (critical zone).

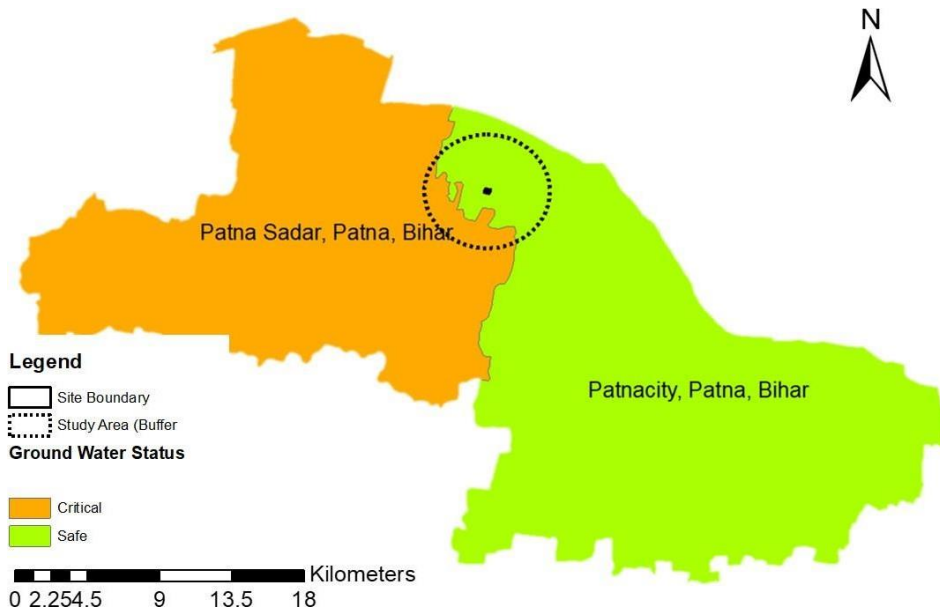


Figure 13: Ground Water Status

The baseline groundwater quality in the project influence area was monitored at two locations. These locations were selected with the objective of obtaining baseline values with one location on-site and

the other off-site. The criteria for selection of sampling location is presented below. Refer **Figure 14** for groundwater monitoring locations.

Monitoring Locations	Criteria for selection
GW 1 – On site, Bari Pahari, Kankarbagh	Proximity to site location
GW 2 – Off site, Bari Pahari, Kankarbagh	

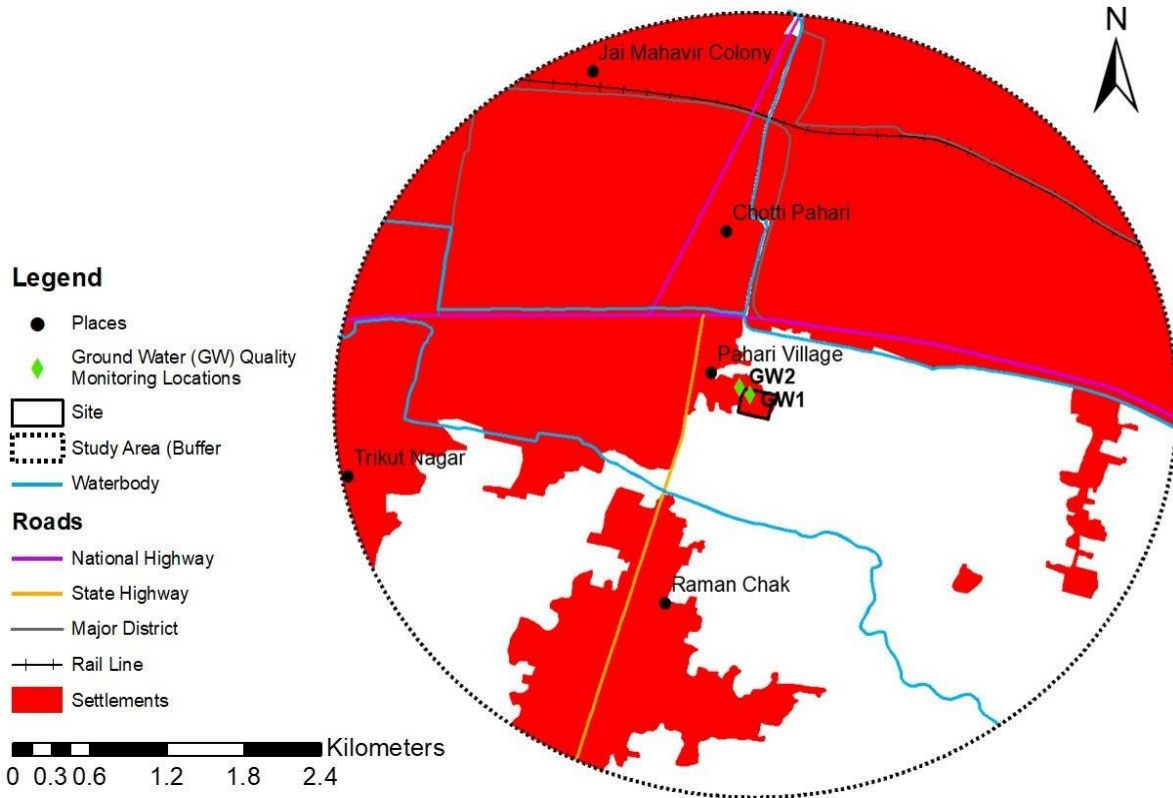


Figure 14: Ground Water (GW) Monitoring Locations

Summary Table of Monitoring Results

Refer **Annex 6** for detailed monitoring results and **Annex 7** for photographs of the ground water monitoring locations.

Table 4: Ground Water Quality Monitoring Result

Parameter	IS 10500:2012		Result	
	Acceptable Limit	Permissible Limit	On-site (GW 1)	Off-site (GW 2)
Colour (Hazen)	5	15	1.24	1.06
Taste	Agreeable	Agreeable	Agreeable	Agreeable
Turbidity (NTU)	1	5	1.2	1.4
pH at 25 °C	6.5-8.5	No relaxation	7.59	7.4
Total dissolved solids (mg/L)	500	2000	465	478
Total alkalinity as CaCO ₃	200	-	174.2	194.1

Parameter	IS 10500:2012		Result	
	Acceptable Limit	Permissible Limit	On-site (GW 1)	Off-site (GW 2)
Total Hardness as CaCO ₃ (mg/L)	200	600	322.04	399.84
Calcium as Ca (mg/L)	75	200	43.904	101.136
Magnesium as Mg (mg/L)	30	100	67.587	72.585
Chloride as Cl ⁻ (mg/L)	250	1000	30.039	64.923
Sulphate as SO ₄ (mg/L)	200	400	38.67	53.91
Iron as Fe (mg/L)	0.30	No relaxation	0.27	0.28
Manganese as Mn (mg/L)	0.1	0.3	BLQ	BLQ
Fluoride as F (mg/L)	1	1.5	0.87	0.99
Copper as Cu (mg/L)	0.05	1.5	0.02	0.05
Residual Chlorine (mg/L)	0.2 - 1	-	Nil	Nil
Zinc as Zn (mg/L)	5	15	1.28	1.56
Phenolic Substances (mg/L)	0.001 - 0.002	-	Nil	Nil
Anionic Detergent (mg/L)	0.2 – 1	-	BLQ	BLQ
Mineral Oil (mg/L)	0.5 - NR	-	Nil	BLQ
Arsenic as As (mg/L)	0.01	0.05	0.012	0.009
Cadmium as Cd (mg/L)	0.003	No relaxation	BLQ	BLQ
Total Chromium as Cr (mg/L)	0.05	No relaxation	BLQ	BLQ
Cyanide as CN (mg/L)	0.05	No relaxation	Nil	Nil
Lead as Pb (mg/L)	0.01	No relaxation	Nil	Nil
Selenium as Se (mg/L)	0.01	No relaxation	Nil	Nil
Mercury as Hg (mg/L)	0.001	No relaxation	Nil	Nil
Pesticides (mg/L)	Absent	-	Nil	Nil
Nickel as Ni (mg/L)	0.02	-	BLQ	BLQ
Boron as B (mg/L)	0.5	-	0.86	0.65
MPN Count/100 ml	10	-	6	8
E.Coliform Count // 100	Nil	-	Nil	Nil

BLQ – below limit of quantification, LOQ – limit of quantification

Analysis of Monitoring Results

The parameters analysed in the ground water sample were compared with IS 10500:2012 drinking water standards. Refer **Table 4**. The parameters of Total dissolved solids, Total alkalinity as CaCO₃ and Total Hardness as CaCO₃ (mg/L) are beyond acceptable limits at all locations while the parameters of Magnesium as Mg (mg/L) and Chloride as Cl⁻ (mg/L) were exceeding acceptable limits but were within permissible limits at GW1 and GW2, respectively. All other parameters were well within the acceptable limits prescribed by the standards.

4.4 Natural Hazards

Seismology – The study area lies in Zone IV i.e. High Damage Risk Zone (MSK VIII) according to the Building Materials and Technology Promotion Council (BMTPC) Earthquake Hazard Map. The region has not experienced any major earthquake in the last decade.

Cyclones – The study area lies in the Very High Damage Risk Zone B (50 m/s) according to the BMTPC Wind and Cyclone Hazard Map. The project location experiences cyclones periodically, latest being in May 2020.

Floods – The study area is located in an area vulnerable to floods according to the BMTPC Flood Hazard Map.

4.5 Ecological Resources

4.5.1 Protected Areas/Forests

There are no Reserved/Protected Forests present in the study area. There are no national parks, wildlife sanctuaries and Ramsar sites around the project site. Furthermore, there are no ASI sites located within the project influence area.

4.5.2 Important Bird Areas

There are no Important Bird Areas (IBA) and e-Bird hotspots located in the study area.

4.5.3 Ecology/Flora and Fauna

There are two major forest types in Bihar: Tropical Moist Deciduous and Tropical Dry Deciduous. Sal (*Shorea robusta*) is the major forest species, which covers about 55% of the forest area in the State. (Ministry of Environment and Forests 1999).

The most common flora found within the region include Peepal (*Ficus religiosa*), Sal (*Shorea robusta*), Kendu (*Diospyros melonoxylon*), Salai (*Bosewellia serrata*), Bahera (*Terminalia bellirica*), Mahua (*Maduca Indica*). The other species of flora found are *Holarrhena antidysenterica*, *Ziziphus xylopyrus*, *Flemingia Chappar*, *Butea superba*, *Butea parviflora*. The common fauna in the area mainly include Gangetic Dolphins, Flying foxes, Hyenas, Wild Dogs, Monkeys, Squirrels etc.

4.6 Economic Development

4.6.1 Land Use Land Cover

Land Use Land Cover (LULC) classification has been conducted for the entire study area comprising of project area and the study area. Refer **Figure 15** and **Figure 16**. It can be observed that the major land cover in the study area is settlements (61%) followed by agriculture fallow land (38%).

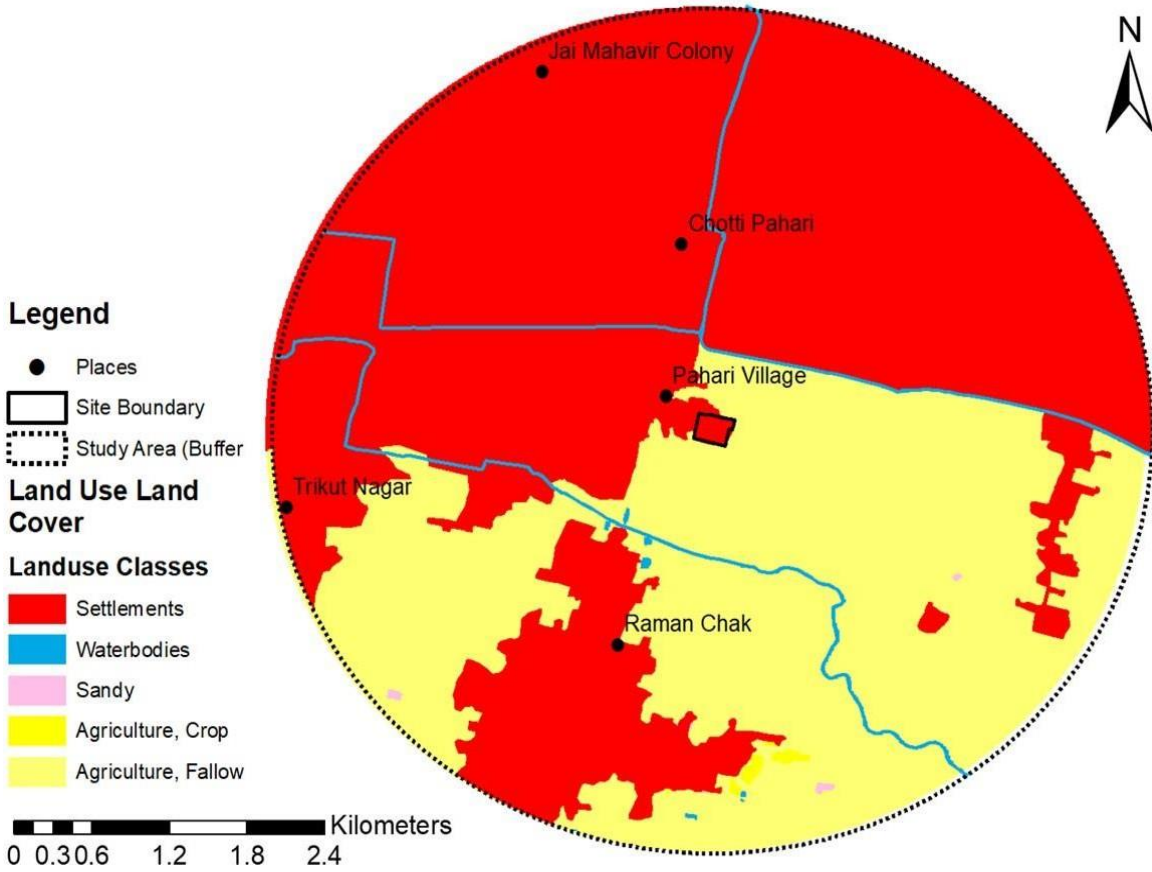


Figure 15: Land Use Land Cover of Study Area

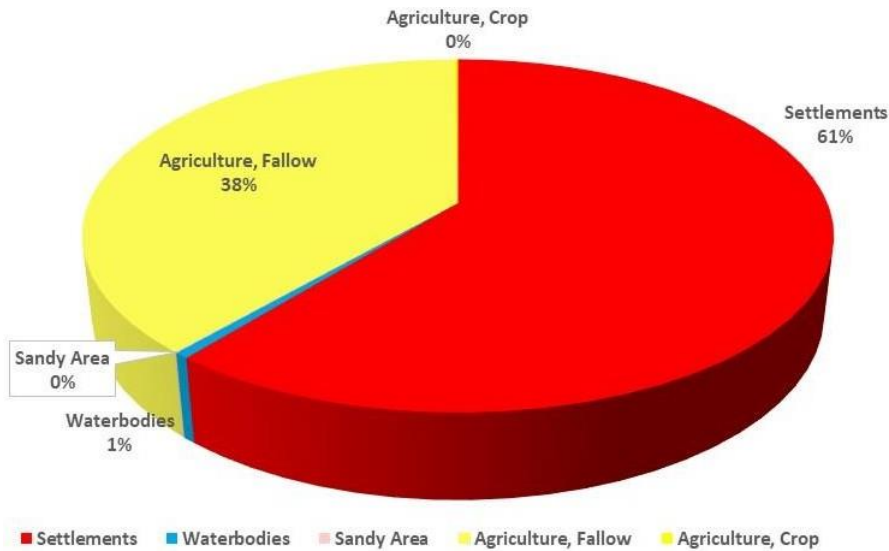


Figure 16: LULC Analysis

4.6.2 Transportation

The Patna District is among the leading districts in terms of share (5.2 %) in total State Highway (SH) network. The project area is accessible from the State Highway (SH)-1 (Sadikpur-Pavera-Masaurhi) connecting to the National Highway (NH)-30 (Patna-Bhaktiyarpur Road). In addition, two national highways (NH 19 & 98) also pass through the Study area.

The nearest railway station is the Gulzarbagh Railway Station (approx. 3.8 km north of the site) while the major railway station is the Patna Saheb Railway Station (approx. 5.5 km north-east of the site). The nearest airport to the project site is Patna Airport which is located at a distance of approx. 15.2 km to the west of the site. Refer **Figure 17** for transport network in study area.

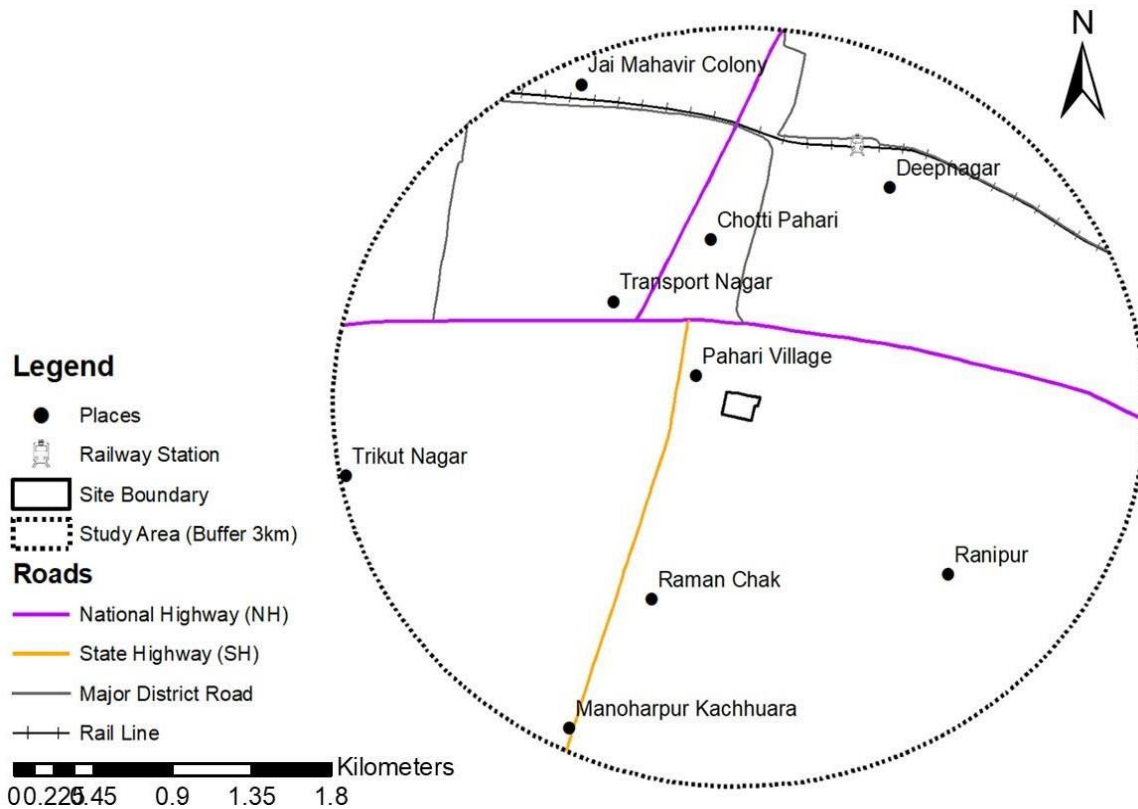


Figure 17: Transportation Network in Study Area

4.6.3 Industrial Development

The economy of Patna has seen sustained economic growth since 2005. As of 2015, GDP per capita of Patna was ₹1,06,000 and its GDP growth rate is 7.29 per cent. The rate of urbanization was as high as 43.1 percent in Patna.³ This growth has been due to the increased businesses in the Fast-Moving Consumer Goods (FMCG) industry, agriculture related industries and service sector. Eight (8) industrial clusters are under development in the City under the Chief Minister Micro and Small Industries Cluster Development Scheme, one of which includes an apparel park in the City.

The areas towards the north and west are densely fabricated with residential and commercial establishments and the areas towards the south and east of the study area comprise of agriculture. Minimal to no industrial establishments are observed in the study area.

4.6.4 Agricultural Development

Bihar is an agriculture dominated State with 80% of the population engaged in farming or agri related activities. The study area lies within the 'Middle Gangetic Plain' agro-climatic zone of the country as classified by the Planning Commission of India. The major crops grown in the study area are paddy, wheat, gram, and seasonal vegetables.

³ <https://patna.nic.in/economy/> retrieved on 16.10.2020.

4.6.5 Power Sources

The Bihar State Electricity Board (BSEB) is responsible for the management of generation, transmission, distribution, and other electricity-related activities in Bihar. The power supply in the study area is distributed via BSEB, Patna Division.

4.7 Social and Cultural Resources

Socio-economic analysis has been conducted for the Patna District and its sub-divisions using Census of India data for 2011⁴. The literacy rate and occupational pattern in the study area are also presented in the subsequent sub-sections. The City of Patna is divided into six sub-divisions and 23 community development blocks. The study area falls under two sub-divisions – Patna Sadar and Patna City

4.7.1 Population and Communities

The population density (persons/sq. km.) in Patna District including Patna (rural) and (urban) population has been presented in **Figure 18**. The population density in Patna District (Rural and Urban) is 1823.38 persons/sq.km while the population density in Patna (urban) is 9321.24 persons/sq.km.

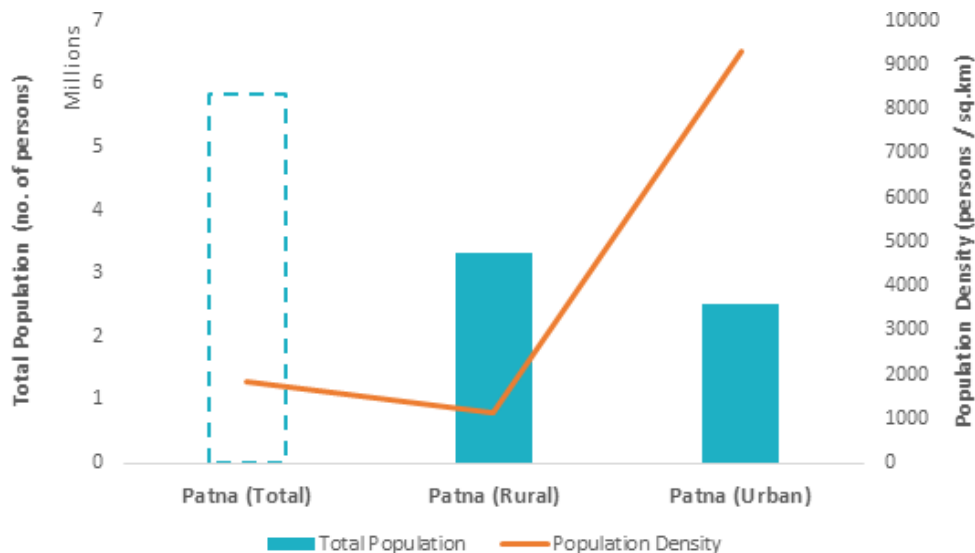


Figure 18: Population Density in the Study Area

The average literacy rate in Patna District is 59.26%. The average female literacy rate in the district is 51.87 % while the male literacy rate is 65.88 %. The male literacy rate was observed to be higher than the female literacy rate across the district, both in the urban and rural centre. Refer **Figure 19**.

⁴ More recent demography data is not available with the District Statistical Office.

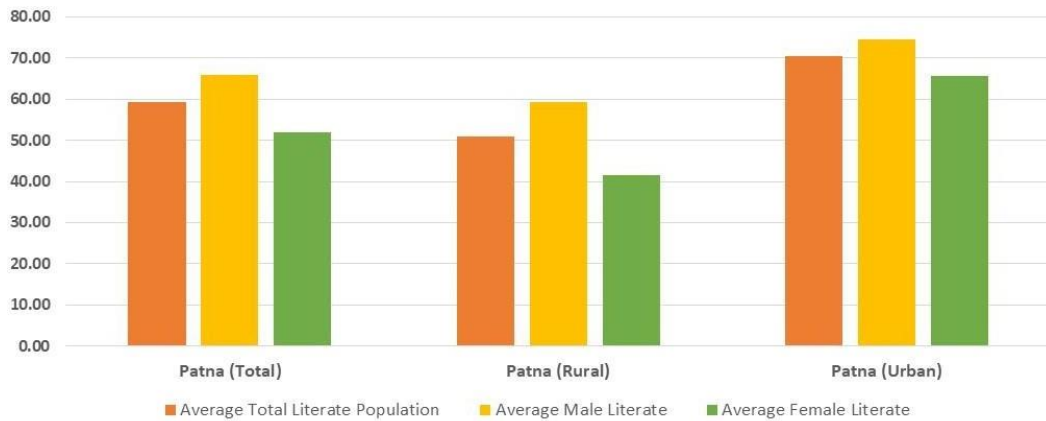


Figure 19: Literacy rate in Study area

4.7.2 Scheduled Areas

There are no Scheduled Areas in the study area.

4.7.3 Scheduled Caste and Scheduled Tribes

The proportion of Scheduled Castes (SC) and Scheduled Tribes (ST) in the study area has been presented in the **Figure 20**. The study area has notable proportion of SC population. The ST population in the district, including rural and urban is negligible. The SC population is found highest in Patna (rural) 19.98% compared to Patna (urban) with 10.21%.

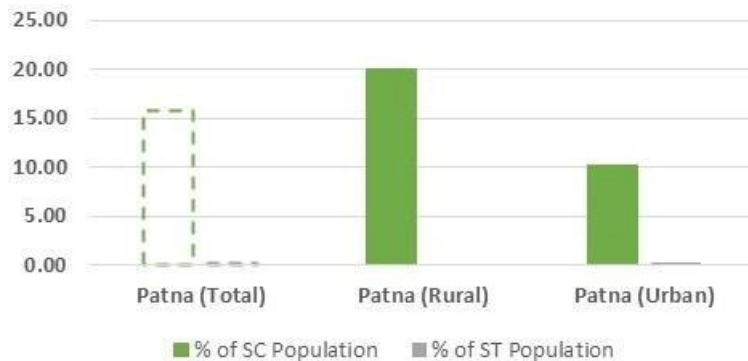


Figure 20: SC and ST Population in Study Area

4.7.4 Occupational Pattern

The proportion of working and non-working population in Patna District has been presented below (**Figure 21**). The proportion of non-working population in Patna District (67.77%) is more than that of working population (32.23%).

Amongst the working population, the proportion of main and marginal workers is represented in **Figure 22**. The proportion of main workers is higher than that of marginal working population.

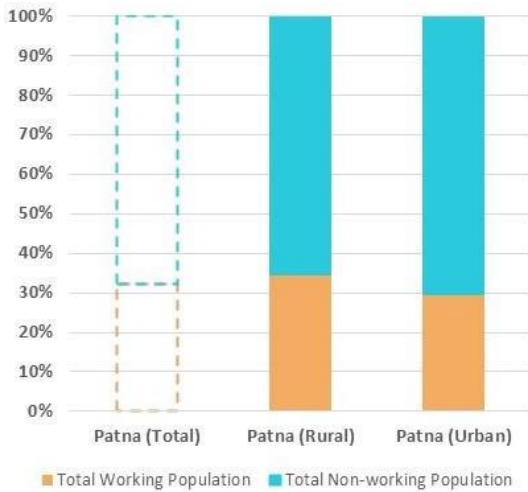


Figure 21: Working and Non-Working Population in the Study Area

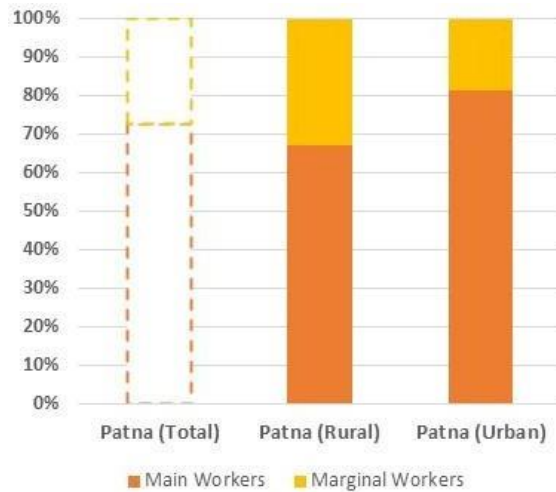


Figure 22: Main and Marginal Workers in the Study Area

The distribution of working population among main and marginal workers across key sectors has been presented in Figure 23 and

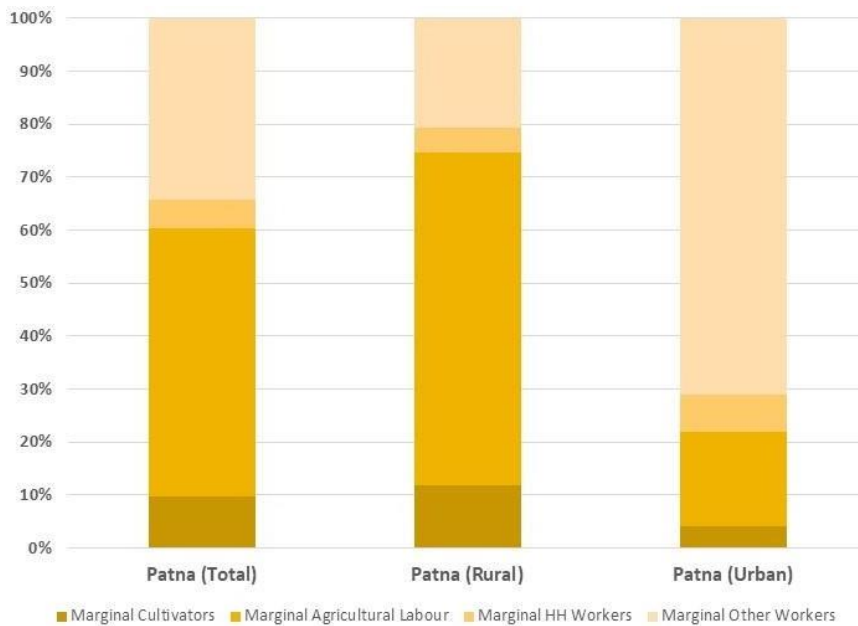


Figure 24. Amongst the main workers, the proportions of other workers (50.50%) dominate the work force in Patna (Urban) while agricultural labourers (29.15%) dominate in Patna (Rural). A similar pattern is observed in marginal workforce as well.

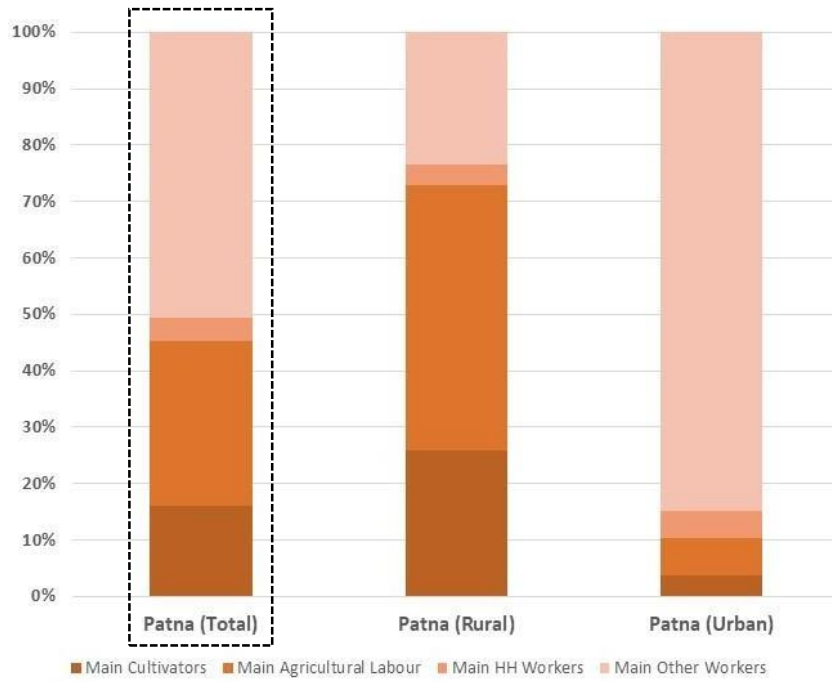


Figure 23: Distribution of Main Workers in the Study Area

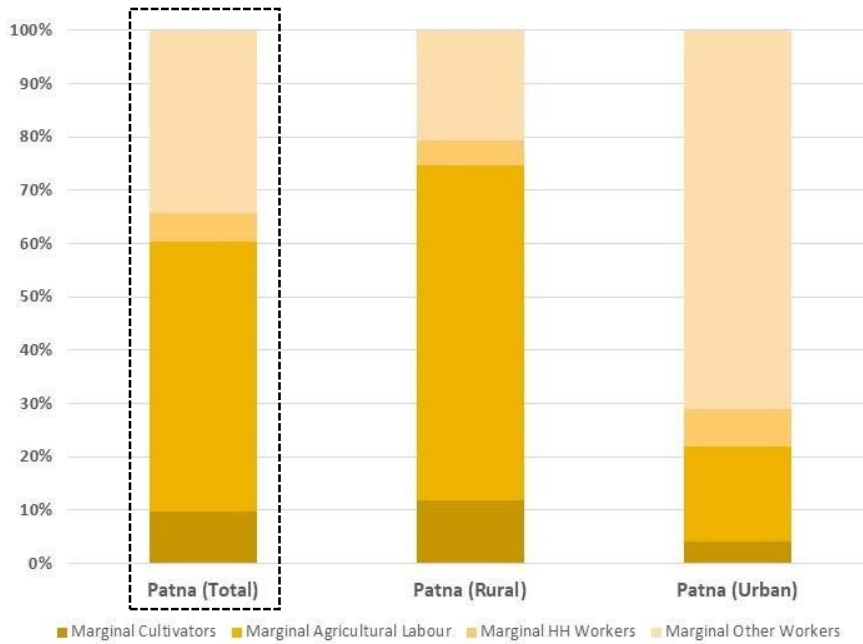


Figure 24: Distribution of Marginal Workers in the Study Area

4.7.5 Physical and Cultural Heritage

There are no ASI monuments in the study area. Small local religious places were present in each village. Through consultations with neighbouring communities, it was identified that no major cultural event is held in the nearby villages, higher community engagement is expected during religious festivals, such as Durga Puja and Chathh Puja.

4.8 Stakeholder Consultation

The primary objective of stakeholder consultation was to understand the acceptance and obtain impressions of the stakeholders about the project and discuss issues envisaged by the local community that may be encountered due to the project. The other objectives of the consultations included understanding of the existing local socio-economic status, social fabric, and local sensitive receptors.

4.8.1 Approach and Methodology

Decentralized consultations were carried around the project area in small informal groups. The consultations were carried out by a team comprising of the Consultant, representatives from the WABAG team and one representative from the BUIDCO team.

For the purpose of consultation, the stakeholders of the project were classified under Project Affected Parties and Other Interested Parties. Consultations were carried out with the project affected parties in the project area at four different locations in small informal groups comprising of 3 to 4 personnel. Consultations with the members of the other interested parties were carried out in-person. (Refer **Figure 26**).

Consultations were also carried out with the *Ward Parishad* (Mr. Balaram Singh Mandal) who was identified as a key figure in project related engagements. Discussions were recorded through Minutes of Meeting (refer **Annex 8**), Attendance Sheet (refer **Annex 9**) and Photographs (refer **Annex 10**).

The locations of the consultations conducted within the Study area has been provided in **Figure 25**.

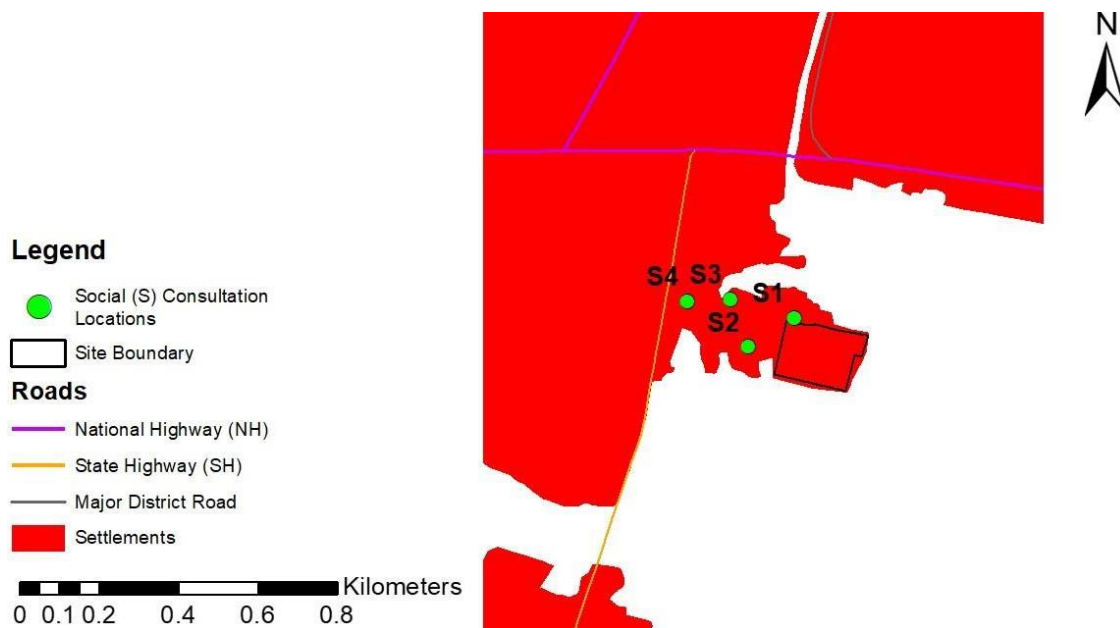


Figure 25: Social Consultation Locations

4.8.2 Summary of Consultation

The discussions topics of the Stakeholder Consultation were:

Aspects	Details
Project Information Disclosure	What is the project about?
	Who is in-charge of the project?
	How is project supervision being carried out?
	Role of WABAG in project implementation
	Layout Plan of STP (Printed)
	STP Model and process
	Contact details of Project Manager, Contractors, & Security Personnel for reporting of grievances (if any)
	Route used to access project location
Project Timeline Disclosure	Date of Commencement
	Construction Timeline with nature of activities
	Tentative date of completion of project
Anticipated Impacts and identified mitigation measure on the listed aspects	Community
	<u>Construction Phase:</u>
	• Dust
	• Noise
	• Solid Waste generated due to labour camp
	• Material storage
	• Labour camps
	• Barricading the project site
	• Security
	• Water Usage
	<u>Operation & Maintenance Phase:</u>
	• Air emission
	• Odour
	• Hazardous Wastes
	Shops or commercial establishments
	<u>Construction Phase:</u>
• Dust	
• Noise	
• Traffic volume	
Access to prominent places	Access to River Ganga (ghat) especially during festivals like Chhath Puja or any other prominent religious place within study area.
Benefits of the Project	Positive impacts and benefits of the project for overall city development and management of pollution in River Ganga.
Suggestions/ queries of Stakeholders	Suggestions from stakeholders on impact mitigation for identified E&S impacts.
	Response to queries of stakeholders on the above mentioned aspects

An excerpt of queries raised and their responses during the stakeholder consultation is provided in **Table 5** below. Refer **Figure 26** for the photographs of the consultation.

Table 5: Excerpt of Stakeholder Consultation

#	Topic covered	Queries / Concerns raised by stakeholders	Responses by Project Team
1.	Anticipated Impacts	The STP pond is open and not covered because of which there exists a problem of mosquito breeding and foul odour especially during monsoon.	As of now the Kankarbagh STP is being emptied and pre-construction work (site levelling) is being undertaken. As per the approved design of STP, it will be fully covered once operational. Periodic fumigation will be carried out through the project lifecycle and periodicity will be increased during the monsoon.
2.	Anticipated Impacts	Increase in noise and vehicular traffic in the locality.	The measures planned to be taken to minimize noise and regulate traffic were explained. Document procedures (EHS Manual - Construction and O&M phase) have been developed to ensure minimum noise generation. All work will be carried out as per the Manual. Acoustic hoods and rooms will be installed in the blower and biogas engine room to reduce ambient noise.
<p>Remarks: It was understood that the community had previously experienced similar issues (unresolved) resulting from operations of the Pahari STP which is adjacent to the proposed Kankarbagh STP. Thus, they desired to understand the difference in the management measures to be employed in this project by WABAG.</p>			
3.	Project Information Disclosure Benefits of the Project	Provide know-how of the STP and its benefits to the locality	The design and working of STP was explained. The network layout was explained. Installation of underground pipes network and connection to each household will be carried out thus solving any problems related to open drains, overflowing of nallas and waterlogging during monsoon. The process of treatment including ASP technology and working of the STP right from collection to discharge was explained. The various locations for discharge, namely Badshahi canal, and irrigation was mentioned.
4.	Project Information Disclosure	How will management of solid waste generated during the treatment process be carried out?	The final solid waste generated is process waste will be in a form of digested sludge. R1 The sludge from the process shall be used for production of biogas and the final digested sludge shall be collected and disposed to municipal solid waste treatment facilities provided by the BUIDCO

#	Topic covered	Queries / Concerns raised by stakeholders	Responses by Project Team
<p>Remarks: The stakeholders consulted were partly aware of general STP operations. They were keen to understand further specific details of the project and its benefits to the community.</p>			
5.	Project Information Disclosure	Details of contact personnel in case of any query/ issue	The contact details of Project In-charge and security personnel were provided. In addition they were informed that the number will be displayed on a board near the main entrance of STP premises.
<p>Remarks: Although informed as part of the consultation process, this query with details was specifically asked by the women in the group.</p>			
6.	Project Timeline Disclosure	Revised estimated completion date of project due to current delays resulting from the Covid19 lockdown.	R1 The construction plan is as per the annexure 2.5. There is no encroachment and site is being barricaded to avoid external entry once construction picks up post monsoon.
<p>Remarks: This query was raised during in-person meeting with <i>Ward Parishad</i></p>			



Consultation at point S1



Consultation at point S2



Consultation at point S3



Consultation at point S4



In-Person consultation with Ward Parishad



Project Information displayed at entrance gate

Figure 26: Stakeholder Consultation conducted within Study Area

5 Analysis of Alternatives

5.1 Site Selection

The proposed Kankarbagh STP is located on land allotted and owned by the Patna Municipal Corporation. The site premises comprises of two STPs (Kankarbagh and Pahari), administrative building, staff quarters, laboratory, and project offices (temporary). Of these, the Kankarbagh STP shall be constructed over a land area of six hectares. Thus, aspects of land acquisition and resettlement are not triggered which also results in reduction of project costs.

The project site is also not in close proximity to any significant E&S sensitive receptors such as forests and important bird areas. The project site is bordered by settlements on the west and by open agricultural lands to the north, east and south. Thus, the project is not exposed to large number of settlements. The location of the STP and the sewerage network are developed as part of the approved City Development Plan. The site is topographically flat and thus does not result impacts related to elevation and land-use change. Large scale public awareness and acceptance of the project was noted during consultations.

5.2 Technology and Operations

The Kankarbagh STP is an Activated sludge process (ASP) based technology and has been approved by the State Development Authority as part of the bidding process. The activated sludge process is a multi-chamber reactor unit that uses highly concentrated microorganisms to degrade organics and remove nutrients from wastewater, producing quality effluent. In this system, sewage is added as a continuous, treated to remove undesirable components, and then discharged. Equalization, aeration, and clarification can all be achieved.

To optimize the performance of the system, the activated sludge is a process with high concentration of microorganisms, basically bacteria, protozoa and fungi, which are present as loose clumped mass of fine particles that are kept in suspension by stirring, with the aim of removing organic matter from wastewater

ASP systems have been successfully used to treat both municipal and industrial wastewater. They are uniquely suited for wastewater treatment applications characterized by low or intermittent flow conditions.

Further, the sludge generated from the primary and secondary treatment will also be used for biogas generation through an anaerobic digestion process. This biogas will further be used in a co-generation plant to produce heat and electrical energy which will be reused in plant operations thus reducing energy requirements.

The treated effluent from the plant will be stored in plant water sump and reused for plant water requirements. It is also envisaged that the treated effluent may also be provided to the nearby agricultural fields for irrigation purposes. This will result in reduction freshwater usage.

6 Environment and Social Impact Identification and Assessment

6.1 Methodology of Impact Assessment

The impacts have been assessed for the Kankarbagh STP Project near Pahari Village, Kankarbagh. The environmental and social sensitive receptors present in the study area were identified. The presence and status of these receptors were validated during the field visit through visual inspection and stakeholder discussions. The activities during pre-construction, construction and operation and maintenance phases that could potentially impact the environmental and social sensitive receptors present in the study area are identified.

6.1.1 Impact Identification

For identification of E&S impacts, the following resources were referred:

- a) Applicable local, State, National environmental and social legal regulations
- b) World Bank Environmental & Social Framework (2017)
- c) World Bank Group’s Environmental, Health & Safety Guidelines (WB-EHS) – General (2007), and Water and Sanitation (2007)

6.1.2 Impact Classification

The adverse impacts of project activities on environmental and social receptors in the study area have been classified based on the following attributes:

- Nature of impact – reversible/can mitigate or irreversible impact
- Duration of activity – long or short term
- Extent of impact – regional or local impact
- Order of impact – direct or indirect impact

Using the above attributes, the adverse impacts have been classified as ‘low’, ‘moderate’ or ‘high’ to enable prioritization of mitigation measures as shown below.

NATURE \ EXTENT	Short Term (Duration of activity ≤ 6 months)		Long Term (Duration of activity > 6 months)	
	Regional	Local	Regional	Local
Irreversible	High	Medium	Very High	High
Reversible	Medium	Low	High	Medium

The site context will determine likelihood of the impact, where this is found negligible, the impact is scaled down. The impact classification may be lowered or elevated basis the site context.

The assessment largely focusses on identifying **Direct Impacts** caused due to the project activities for planning preventive and mitigation measures. Addressing direct impacts would inherently break the chain of indirect impacts. Indirect impacts where critical have been identified.

6.1.3 Project Stages

The impacts on various sensitive receptors present in the study area have been grouped based on the stage of project.

- **Pre-construction and Construction Phase:** Activities related to planning of the STP; land preparation, civil work, and installation of various equipment.
- **Operation and Maintenance Phase:** Activities post operation of the STP such as treatment of sewage, material storage, waste management etc.

6.2 Positive Impacts

The Kankarbagh STP project is being developed under a Ganga conservation mission named “Namami Gange”. It is estimated that at present the total wastewater generated in Patna is approximately 210 MLD. However, only 20% of the city area has a physical coverage of an underground sewer network. Further, the Kankarbagh Zone is one of the highly populated and core areas of the city with no dedicated sewage treatment mechanism. The sewage was presently being treated through other STP’s in the nearby zones.

This project will thus enable lowering of treatment loads in the other connected STP’s, ensure adequate treatment and eventually lower pollution loads in the River Ganga. Further, availability of a dedicated STP will ensure the channels are not flooded during monsoon thus preventing waterlogging and associated impacts.

The STP has also been designed in a way to promote and incorporate principles of resource efficiency and waste utilization. The sludge generated from the treatment process will be used to generate biogas which will be used for electricity and heating requirements in the STP operations. The treated sewage will also be reused for plant operations and may also be provided for irrigation of the surrounding agricultural fields.

The project would also generate employment opportunities for locals during construction and operation phases of the project.

6.3 Areas of No Significant Impact

1.1.1 Physical Cultural Resources

There are no places of cultural heritage or archaeological importance in the study area (buffer 3 km). Small local religious places were present in each village, that are not expected to be impacted by the project activities. Hence **no impacts on physical cultural resources** are anticipated from the project.

1.1.2 Scheduled/Tribal Areas

There are no Scheduled/Tribal Areas documented or notified in the study area. Hence, **there will be no impact on tribal areas due to the project.**

1.1.3 Protected Areas/ Forests

The study area does not comprise of any Reserved/Protected Forests, National parks, Wildlife sanctuaries and Ramsar sites. There are no Important Bird Areas (IBA) in the study area. As the project is being developed in a plot of an existing STP, minimal cutting of trees is envisaged. Hence **no impacts on protected areas/forests** are anticipated from the project.

6.3.1 Land Use Change

The proposed Kankarbagh STP is located on a site allotted and owned by the Patna Municipal Corporation. The site premises at present comprises of the existing Pahari STP and associated infrastructure. The Kankarbagh STP will be constructed within the same premises over a land area of six hectares. Thus, no change in land use is identified.

Further, no encroachers or squatters were identified in the designated land. Hence, aspects related to compensation, resettlement and rehabilitation are not triggered.

6.4 Project Activities

6.4.1 Construction Phase

The construction phase of the STP will include the following key activities:

- Site Preparation (clearance of existing vegetation, fencing to avoid intrusion)
- Earthwork (earth moving and filling, land grading, levelling, and compaction)
- Construction and use of haul roads
- Operation of heavy vehicles/ machinery/ equipment
- Use of diesel generator sets and diesel-powered vehicles
- Labour camps and site office/control room
- Storage of construction material
- Transportation of raw material and construction spoil
- Storage of scrap, solid waste, hazardous waste, and construction debris
- Maintenance of equipment/machinery

6.4.2 Operation and Maintenance Phase

The operation phase at STP will include the following key activities:

- Operation of sewage treatment plant and its components
- Operation and maintenance of chlorine dosing system
- Biogas and electricity generation
- Sludge management, treatment, and storage
- Operation and maintenance of the waste heat recovery system
- Operation of process air blowers
- Maintenance of the STP infrastructure
- Chemical and material storage
- Laboratory testing of raw and treated sewage
- Staff quarters and canteen facilities
- Overall maintenance of STP infrastructure
- Maintenance of vegetation (de-weeding, maintenance of greenbelt/buffer)

6.5 Impacts during Project Development / Planning

6.5.1 Viewscape Impacts

At present, the viewscape of the neighbouring community was limited to the small scale Pahari STP. However, construction of the Kankarbagh STP will result in emergence of various associated

infrastructure for STP operations. In addition, upgradation of the existing Pahari STP is also ongoing. Thus, it is expected that view of the neighbouring community will be obstructed due to the constructed components of the project, which otherwise was largely an open landscape.

During the construction phase, there will be an increase in the movement of vehicles, thus affecting the calm and serene view from the village.

There are no archaeologically important places in close vicinity of the project area.

Nature	Extent	Duration	Impact	Remarks
Irreversible	Local	Long term	Medium	<i>The STP is being constructed in a land which includes an existing STP. Further, there are no archaeologically important places in the study area. Hence, the viewscape impacts are lowered from 'High' to 'Medium'.</i>

6.6 Impacts During Pre-Construction & Construction Phase

The impacts during construction have been discussed in the subsequent sub-sections.

1.1.4 Alteration of Natural Drainage Pattern

The project site is located within the premise of the existing Pahari STP. The existing site area is largely a flat land with minimal variation in slope. The existing drainage channels are however not adequate for the expanded capacity and can potentially resulting in flooding.

Extraction of raw material required for construction such as soil from borrow pits and aggregates from quarries could disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding, water logging and water pollution. Extraction of rocks and sand from riverbeds can endanger bridges and cause continuous degradation of the river regime.

Nature	Extent	Duration	Impact	Remarks
Reversible	Local	Long Term	Low	<i>The impact has been lowered from 'Medium' to 'Low' as site levelling activity has been completed and capacity of existing drains are under upgradation.</i>

6.6.1 Natural Resource Consumption

The various construction equipment typically consumes diesel fuel for operations. The transportation of raw material and hauling of construction spoil for disposal is also expected to consume petrol or diesel fuel. Labour camps set up during construction could be using kerosene or local fuel wood for domestic / cooking purposes. This is likely to increase consumption and burning of fossil fuels in the project area. Construction activities (foundation casting and admin building) consume water. Labour camps will consume water for domestic and sanitation purposes. It was reported that groundwater from the designated tap located on site is being used for construction purposes.

The ground water table in the project area is high and in the safe zone for development. The quantity of fuel consumed can be optimized through engineering controls. Use of raw materials for construction can be optimized with better choice of materials. Indiscriminate use of groundwater can be controlled through implementation of good management practices.

Nature	Extent	Duration	Impact
Reversible	Local	Short Term	Low

6.6.2 Loss of Flora and Fauna

The project site is located on the plot of an existing STP which has minimal vegetation. This was validated through review of historical imageries available for the location (free access). The site area and study area are also not located in any designated protected forest areas at state or local level. The impact of loss of flora (minimal extent) will be permanent but restricted to the project area.

Nature	Extent	Duration	Impact	Remarks
Reversible	Local	Long Term	Low	<i>The impact has been lowered from 'Medium' to 'Low' based on the extent of vegetation on-site.</i>

6.6.3 Soil Erosion

The removal of vegetation during site clearance and levelling could loosen the soil, causing soil erosion. As the project is being developed on an existing STP land, there will not be any loss of fertile topsoil. Extraction of materials like soil from borrow pits and material aggregates/stones from quarries could alter the vegetation leading to accelerated soil erosion.

The impact of soil erosion will be experienced in the immediate vicinity of the project area which includes farmland and the open *Nallah*. The study area also receives good rainfall during the months from July to October. Hence impact from soil erosion during monsoon is likely to be experienced.

Nature	Extent	Duration	Impact	Remarks
Reversible	Local	Short term	Low	<i>Although the construction shall span across the rainy season, an embankment has been built around the project site. Thus, ensuring that soil is retained within the site area. Hence the impact has been retained as 'Low'.</i>

6.6.4 Air Pollution

The main sources of air pollution during construction will potentially be fugitive dust emissions and exhausts from transportation vehicles and construction equipment.

The soil in the site area is alluvium soil and is unlikely to contribute much to the particulate matter emissions. Thus, it is expected that fugitive dust emission generation from the various pre-construction activities of site clearance and levelling and various construction activities such as excavation and earthworks, haul roads, stockpiles of excavation spoil etc. will be minimal.

The transportation of raw materials to the site will lead to increase in fugitive dust emissions along the approach roads and emission of SO₂, NO_x, CO into the ambient air by movement of vehicles, thus causing increase in air pollution.

The use of diesel generator sets, and construction equipment will increase the concentration of pollutants (SPM, SO₂, NO_x, CO) in the project area and immediate vicinity due to burning of fuel. The

burning of fuel wood for cooking purposes in the labour camp will release air emissions, thus affecting the local ambient air quality.

Increase in air pollution levels could lead to various respiratory disorders in humans and animals. The impact of air pollution will be experienced in immediate vicinity of the project area. The nearest large settlement at Pahari village is about 0.5 km from the project location through which the existing approach road to site traverses will be affected the most. Apart from the Pahari village, smaller settlements located towards the west of the project site will also be affected due generation of pollution on-site.

The baseline for SO₂, PM_{2.5} and PM₁₀ were within NAAQS standard but exceeded the limits provided by the WHO guidelines.

R1 Mitigation measures:

- The Sprinkler systems will be used to suppress the fugitive dust emission during construction phase.
- The DG sets will be installed with emission standards in compliance with the CPCB guideline
- The concessionaire will ensure to maintain the stack height as per the CPCB guideline of $H = h + 0.2 * \text{capacity of DG sets in KVA}$ where H is the total height of the stack in meters and h is the height of the building in meters where the DG set will be installed.
- Biogas-scrubbers will be used to remove the hydrogen sulphide (H₂S) traces present in the biogas generation during anaerobic treatment process

Nature	Extent	Duration	Impact	Remarks
Reversible	Local	Short term	Medium	Due to close proximity to Pahari village, and baseline values of PM _{2.5} and PM ₁₀ being high with reference to the WHO guidelines prescribed in the IFC EHS guidelines, the impact is elevated from 'Low' to 'Medium'

6.6.5 Noise Pollution

The operation of construction equipment and other construction activities such as movement of materials/vehicles will increase the noise levels in the vicinity during the construction phase. Typical noise levels due to standard construction equipment compiled from various Indian sources is provided below.

Equipment	Equipment Noise Level (dBA)	Equipment	Equipment Noise Level (dBA)
Crane	76	Pneumatic Tools	85
Jack Hammer	88	Truck	88
Concrete Mixer	85	Loader	85
Concrete Pump	82	Pile Driver	89
Concrete Vibrator	76	Rock Drill	98
Backhoe	80	Impact Wrench	85
Dozer	85	Generator	81

The impacts on ambient noise levels during construction will be directly experienced in the project area and immediate vicinity (not beyond 0.5 km). Thus, impacts related to increased noise levels

maybe experienced in the Pahari village and the settlements in the immediate vicinity to the west of the project site.

The average ambient noise levels obtained for all ambient noise monitoring stations will not exceed limits prescribed in the CPCB standards and EHS guidelines.

R1 Mitigation measures:

- The DG sets will be installed with emission standards in compliance with the CPCB guideline. The concessionaire will ensure to maintain the stack height as per the CPCB guideline of $H = h + 0.2 \times \text{capacity of DG sets in KVA}$ where H is the total height of the stack in meters and h is the height of the building in meters where the DG set will be installed
- No construction activities will be done during night time to maintain ambient noise quality
- Provision of green belt in and around the plants

Nature	Extent	Duration	Impact	Remarks
Reversible	Local	Short term	Medium	<i>Due to close proximity to settlements, and baseline noise levels exceeding CPCB standards and EHS guidelines, the impact is elevated from 'Low' to 'Medium'</i>

6.6.6 Surface Water Pollution

The removal of vegetation during site clearance and levelling could loosen the soil, causing soil erosion. This loosened soil can cause siltation in the nearby *nallahs* specifically during the rainy season. Wastewater generated during construction could flow into the open *nallahs*. Wastewater from transit mixers, construction debris may be dumped along the open *nallahs*. These activities could impact the overall water quality in the *nallahs* and obstruct the water flow. The project area receives high rainfall and is prone to waterlogging due to the existing lower level than the surrounding area.

Nature	Extent	Duration	Impact	Remarks
Reversible	Local	Short term	Low	<i>The impact is retained as low as there are no major surface waterbodies present in project area.</i>

6.6.7 Soil Contamination

Spills of fuel, oil and grease from construction equipment and transport vehicles, chemicals such as paints, improperly managed wastewater generated from construction activities on unpaved areas etc. can contaminate soil. Absence of sanitation provisions for labour camps could lead to open defecation, thus causing soil contamination.

The waste generated during construction, such as scrap, debris, concrete waste, hazardous waste (waste oil from DG set and equipment, oil filters, oil soaked cotton), food waste from labour camp, if not stored in an environmentally safe manner can also cause soil pollution. The impact of soil contamination will be limited to the project area.

The ground water quality in the project site area exceeded acceptable limits for parameters such as TDS, alkalinity, hardness while also exceeding the permissible limits for magnesium and chloride prescribed in the IS 10500:2012 drinking water standards.

Nature	Extent	Duration	Impact	Remarks
Reversible	Local	Short term	Low	<i>As the baseline ground water quality not exceeds permissible limits on some key parameters, the impact is elevated from 'Low'</i>

6.6.8 Groundwater Pollution

The groundwater table in the project area is high. During excavation, there is a potential for groundwater contamination particularly if pits / cuts are left unfilled / uncovered for a long time. The activities causing soil pollution can leach into the ground and thus indirectly impact the ground water quality.

The impacts of ground water contamination will be experienced in the local area. The contamination could potentially spread to the region based on aquifer flows. The ground water quality in the project site area exceeded acceptable limits for parameters such as TDS, alkalinity, hardness while also exceeding the permissible limits for magnesium and chloride prescribed in the IS 10500:2012 drinking water standards.

Although the project area falls in the “safe” zone for ground water development, it is located in close proximity (approx. 1.08 km) to the boundary of Patna Sadar sub-district which is classified as a critical zone for ground water development.

Nature	Extent	Duration	Impact
Irreversible	Local	Short term	Medium

6.6.9 Occupational Health and Safety

The construction activities include site preparation, infrastructure and utilities installation, construction of structures. The construction workers and technicians would be exposed to various health and safety hazards that could cause injury or ill health.

The potential safety hazards include:

- Slips, trips and falls due to uneven surfaces, obstacles, trailing cables
- Fall during work at height
- Burns due to hot works
- Electrical shocks
- Collision with construction equipment and transportation vehicles
- Overturning of cranes
- Emergencies such as fire, structure collapse

The potential health hazards include:

- Manual handling and musculo-skeletal disorders due to typical construction activities such as lifting, lowering, pushing, pulling and carrying that can cause injury.
- Hand-arm vibration due to operation of hand-held or hand-guided power-tools and machines, such as pokers and compactors, sanders, grinders and disc cutters, hammer drills, chipping hammers, chainsaws, scrabbles and needle guns.
- Temporary or permanent hearing loss from exposure to high noise levels during operation of construction equipment.
- Heat stress and working during high temperatures.
- Dermatitis that can arise from contact with substances such as wet cement, asphalt, solvents used in paints, glues or other surface coatings etc.
- Exposure to fugitive dust emissions and exhausts from construction equipment that could cause respiratory disorders.

- Exposure to disease carrying vectors due to poor construction waste management practices.
- Exposure to operation of cranes which could overturn and installation of large structures that could collapse causing severe bodily injury.

Nature	Extent	Duration	Impact	Remarks
Reversible	Local	Short term	Medium	Workers will have direct exposure continuously during construction, hence impact classification elevated to 'Medium' from 'Low'

6.6.10 Community Health and Safety

During peak construction phase, a portion of the labour requirement will be met from nearby villages. A few migrant labour will also be engaged through labour contractors for whom labour camps will be established. The migrant labours could have cultural differences with the resident population, resulting in potential conflicts on issues related to the environment, safety and privacy issues of the women in the surrounding villages, spread of various communicable diseases, nuisance caused by them due to improper sanitation facilities, etc.

For transportation of raw materials, the traffic from heavy vehicles is expected to increase along the state highway and village roads. This can lead to congestion on road networks around and within the site and deterioration of the road surfaces. This increase in traffic can be a nuisance to the villages in the project area, especially Pahari village.

All activities during construction causing air pollution, increasing noise levels and dust emissions have the potential to indirectly affect the health of the local community. Indiscriminate use of water for construction purposes could result in depletion of the resource for use by the neighboring community. The security personnel appointed for protection of the project area during construction could pose risks to the community due to misbehavior.

The impacts related to community, if not appropriately managed, could lead to agitation.

Nature	Extent	Duration	Impact	Remarks
Reversible	Local	Short term	Medium	The impacts related to community, if not appropriately managed, could lead to agitation. Hence impact classification elevated to 'Medium' from 'Low'

6.7 Impacts During Operation and Maintenance Phase

6.7.1 Natural Resource Consumption

Freshwater (soft water and borewell water) will be consumed for running of the treatment infrastructure such as chlorine leak absorption, scrubber system, hot water recirculation, plant cleaning, toilet, flushing, cooking, drinking, landscaping etc. This will result in consumption of water in large quantities.

Activities related to operations phase which include operations of the treatment system, air compressors, motor pumps, biogas system, laboratory testing, administrative processes, sludge handling system, heat recovery systems, general lighting etc. will use electricity for operations. Energy from the biogas plant will be used to heat process water. Fuel such as diesel will be consumed in DG sets for backup power.

The consumption of electricity, fuel, and water will continue through the life of the STP operations.

Leakages in the water supply lines, inefficient use of water by the individual components will result in depletion of the surface and ground water resources.

Similarly, inefficient use of electricity by the individual units of the STP could result in excess consumption of electricity thus indirectly depleting the natural resources used for generating the electricity. The use of inefficient common lighting systems and use of pumping systems to draw water from the bore wells will also result in consumption of electricity. Various equipment may be used for cleaning of STP area and stormwater drains that operate on diesel fuel.

The efficiencies in use of water and electricity can be improved through adoption of industry best practices.

Nature	Extent	Duration	Impact
Reversible	Local	Long term	Medium

6.7.2 Soil Contamination

Hazardous waste will be generated (used oil, oil rags, mineral oil) will be generated due to operation and maintenance of various equipment and machinery in the STP. Other hazardous wastes generated on-site could include spent media, filtration membranes, chemicals added in the treatment process, such as lime, polymer and coagulants and also spent caustic from chlorine leak absorption system. . Spent media may include filter media (including sand, coal, or diatomaceous earth from filtration systems), granular activated carbon [GAC], etc.

Unscientific storage and disposal of hazardous waste (on unpaved areas, open to environmental factors) could lead to soil contamination. Similarly, spillages of chemicals and oil could also contaminate the soil.

Operation of the STP will also result in the generation of sludge. The sludge from the primary and secondary treatment shall be used for biogas generation. The spent sludge post treatment will include polymers, organic compounds, microorganisms etc. In addition, the sludge may also contain heavy metals (Cd, Zn, Cu and Ni), organic contaminants, and other pathogenic organisms. This sludge may be reused in the plant premises as compost or maybe sent to the city solid waste treatment facility. Sludge containing heavy metals in high concentration if reused can lead to contamination of the soil.

Various solids shall be generated from the preliminary treatment processes and also from the cleaning of drainage systems in the plant premises. These include grit, sand, gravel, food particles and other heavy solids. These wastes generated if not disposed properly will degrade and contaminate the land.

Leaks and overflows from the tanks containing untreated sewage and other hazardous chemicals can also cause contamination of soil. The contamination may extend to the neighbouring farmlands in case of breaches and may lead to adverse impacts to the agricultural crops.

The impact on soil quality from the various waste streams generated on site can be managed through adoption of good practices and will be limited to the project vicinity.

Nature	Extent	Duration	Impact
Reversible	Local	Long term	Medium

6.7.3 Air Pollution and Odours

Air emissions from sewage treatment and anaerobic digester operations may include hydrogen sulphide, methane, volatile organic compounds, and chlorine gas used for disinfection processes.

Hydrogen Sulphide will be generated from biogas generation and improper handling of sludge from the primary and secondary treatment. This could impact the ambient air quality in the immediate vicinity.

The vehicular movement will be limited in the O&M phase, however the baseline levels of SO₂, PM_{2.5} and PM₁₀ were within NAAQS standard but exceeded the limits provided by the WHO guidelines.

The project is not expected to increase traffic volumes or change other existing conditions to such a degree as to increase air pollutants emissions. Therefore, no long term impacts to air quality are anticipated in terms of vehicular exhaust.

The other major contributing factor for ambient air pollution is odour. The major sources of odour include incomplete treatment of sewage and sludge and leakages from the anaerobic digestion process and chlorine gas. Odour generated from Hydrogen Sulphide gas is expected to be the most common source.

Exposure of receptors to hydrogen sulphide levels above 5 PPB can lead to nuisance to workers within the project site and communities in close vicinity of project.

R1 Mitigation measures:

- The Sprinkler systems will be used to suppress the fugitive dust emission during construction phase.
- The DG sets will be installed with emission standards in compliance with the CPCB guideline
- The concessionaire will ensure to maintain the stack height as per the CPCB guideline of $H = h + 0.2 * \text{capacity of DG sets in KVA}$ where H is the total height of the stack in meters and h is the height of the building in meters where the DG set will be installed.
- Biogas-scrubbers will be used to remove the hydrogen sulphide (H₂S) traces present in the biogas generation during anaerobic treatment process

Nature	Extent	Duration	Impact
Reversible	Local	Long term	Medium

6.7.4 Impacts due to Leakages and Overflows

The various wastewater streams resulting from the sewage treatment operations include filter backwash, softener reject, supernatant from sludge dewatering. These waste streams may also contain suspended solids and organics from the raw water, high levels of BOD, dissolved solids, high or low pH, heavy metals, etc.

Any malfunction of the STP will affect the quality of treated sewage that may be applied for various purposes such as landscaping, plant washing, provision for irrigation to nearby fields or discharge into the neighbouring freshwater bodies.

Leaks and overflows from the sewerage system can cause contamination of soil, groundwater, and surface water. Depending on the level of groundwater, leaks in gravity mains may also allow groundwater into the sewer system, increasing the volume of wastewater requiring treatment and potentially causing flooding and treatment bypass.

Overflows and treatment bypass can also occur in case of higher hydraulic loading greater than

treatment capacities. This may occur due to high flows during heavy rains, power loss, equipment malfunction or blockages in the internal plumbing system.

The overflows and leakages could also potentially cause contamination of the neighbouring fields due to runoffs. This in turn could also potentially result in exposure of farmers and workers to pathogens, thus resulting in health impacts to the community.

The leakages and overflows if not managed scientifically could leach into the ground water, thus impacting ground water quality. In case of emergencies where operational difficulties may be experienced, the untreated /partially treated sewage would need to be bypassed directly into the freshwater bodies. This would produce adverse impacts on the water quality and aquatic flora and fauna during the period of release and for a short term afterwards.

The overall environmental impact for all the above mentioned aspects are reversible in nature and local that will continue throughout the lifecycle of the STP and can be mitigated by adopting industry best practices.

Nature	Extent	Duration	Impact
Reversible	Local	Long term	Medium

6.7.5 Occupational Health and Safety Impacts

The occupational health and safety impacts resulting from the O&M phase will primarily include accidents and injuries, exposure to hazardous chemicals and pathogens, occupational noise and exposure to natural and man-made emergencies.

- **Accidents and Injuries**

Accidents and injuries in the STP can be caused due to:

- Slips, trips, and falls due to wet floors and slippery walkways
- Falls into treatment tanks, clarifiers, trenches, confined spaces (manholes, pipelines, storage tank, digesters etc.
- Splashes of hazardous chemicals and liquids
- Exposure to poisonous gases
- Cuts, pricks, abrasions, and contusions from operation of sharp tools and rotating equipment
- Strains and sprains from handling of heavy equipment, material etc.
- Electrocutation from handling of energized circuits
- Burns from contact with high temperature liquids and equipment

Work at the STP may also involve entry into confined spaces, including manholes, sewers, pipelines, storage tanks, wet wells, digesters, and pump stations. Getting trapped at confined space may also result in asphyxiation resulting from increased carbon dioxide levels.

- **Exposure to Hazardous Chemicals and Pathogens**

Work in the Sewage Treatment Plant involves exposure to potentially hazardous chemicals, including strong acids and bases, chlorine, hydrogen sulphide, methane, and ammonia. The potential sources of exposure include the chemical storage yard, chlorine generator system, anaerobic digestors, sludge bed, clarifiers, and laboratory.

In addition, the water may also contain heavy metals. Untreated sewage may also result in exposure to various pathogen include viruses, bacteria, molds, fungi and other microorganisms. The process of sewage treatment can generate bioaerosols containing the above mentioned pathogens. These microorganisms can remain suspended in the air for long periods of time, retaining viability or

infectivity. Workers may also be exposed to endotoxins, which are produced within a microorganism and released upon destruction of the cell and which can be carried by airborne dust particles.

The various routes of exposure include hand to mouth contact, skin contact (splashes), and inhalation of aerosols and poisonous gases etc. Pathogens may also enter the body through cuts and abrasions.

- **Occupational Noise**

Workers shall be directly prone to the exposure to excessive noise levels from operating machinery such as air compressors and pumping systems and motors. Increase in noise may also be experienced in the treatment systems where flow of water and bubbling exists.

- **Exposure to Operational, Natural and Man-made emergencies**

The various emergency situations that could occur on-site include:

- a) **Operational**

- Fire and explosion in the STP premises
- Leakage of Hydrogen Sulphide/ Chlorine gas
- Explosion from biogas flaring and methane release
- Collapse of sheds or structure etc.

- b) **Natural calamities such as earthquakes, floods, and cyclones**

- c) **Man-made**

- Bomb threat or criminal attack
- Riots & Public violence

The various emergencies will have an impact to workers’ health and could potentially impact the neighbouring community as well.

All workers, and visitors would be exposed to these hazards based on the various situations. These impacts can be managed and mitigated by adoption of industry best practices and employing cost effective mechanisms

Nature	Extent	Duration	Impact
Reversible	Local	Long term	Medium

6.7.6 Community Impacts

- **Reuse of treated wastewater**

One of the proposed applications of treated sewage includes use of the treated water for seasonal irrigation of adjacent agricultural lands. Sewage if not treated adequately shall result in the farmers or workers being exposed to pathogens thus impacting the health of community. The water may also attract pests and vectors which may potentially damage the crops.

- **Exposure to Odour**

The process of wastewater collection, conveying or treatment has the potential to generate and release odours to the surrounding area. Odours from wastewater treatment facilities can be a nuisance to the neighbouring community. Bioaerosols can also carry disease-causing microorganisms. Furthermore, releases of hazardous gases, such as chlorine, could adversely affect nearby residents. Exposure of receptors to levels of hydrogen sulphide above 5 PPB can also lead to odour nuisance within the project site and in the close vicinity of project.

- **Unavailability of natural resources**

Indiscriminate use of ground water for O&M of the STP could result in unavailability of the resource for domestic use by the neighbouring community.

Improper waste management by the STP could result in land contamination that could leach into the ground water and further deteriorate the quality of ground water thus rendering it unusable by the neighbouring community.

Ineffective treatment of sewage could result in the pollution of the freshwater bodies thus rendering them not-useable.

- **Other Impacts**

Other impacts may include:

- The security personnel appointed for protection of the plant could pose risks to the community due to misbehaviour.
- During operation phase, inflow of persons is expected. This will result in establishment of supporting facilities and attract labour for employment. New persons coming in could have cultural differences with the resident population, potential conflicts may arise on issues related to the environment, safety, and privacy issues of the women in the surrounding villages, spread of various communicable diseases, etc.
- Any kind of fire emergency or chlorine leakage that occurs in the STP could indirectly affect the health of the local community.

The overall impacts related to community, if not appropriately managed, could lead to agitation. However, it is expected that the impact will be restricted to immediate vicinity of the project area and can be addressed through implementation of mitigation measures and management of human resources.

Nature	Extent	Duration	Impact
Reversible	Local	Long term	Medium

6.8 Summary of E&S Impacts

1.1.5 Project Development/ Planning Impacts

Nature of Impact/ Activity	Impacted EHS Component	Impact Classification
1. Viewscape impacts due to proximity of settlements to the project area	Local community	Medium

1.1.6 Pre- Construction & Construction Phase Impacts

Nature of Impact	Impacted EHS Component	Impact Classification
1. Increase in fugitive dust emissions causing air pollution from site clearance, excavation, raw material transportation, storage of excavation spoil, use of fuel wood in labour camps	Ambient air quality, community health, worker health	Medium

2. Increase in concentrations of PM ₁₀ , PM _{2.5} , SO ₂ from burning of fuel in construction equipment, transportation vehicles and cooking in labour camps.		
3. Increase in ambient noise levels due to operation of construction equipment.	Worker health	Medium
4. Soil contamination due to improper management of construction waste, spills and leaks, absence of sanitation provisions in labour camp.	Soil quality, Ground water, Local community	Medium
5. Ground water pollution due to leaching of materials and waste into the soil	Ground water Local community	Medium

Nature of Impact	Impacted EHS Component	Impact Classification
6. Exposure to physical, chemical hazards, exposure to noise, working with construction equipment, fugitive dust, emergencies at site	Construction workers	Medium
7. Exposure to migrant workers, air and noise pollution, project security personnel, obstruction to community activities and accidents caused in the nearby community due to construction activities	Local community	Medium
8. Alteration of natural drainage pattern due to site levelling	Landform, local community	Low
9. Resource consumption such as water, fuel, causing depletion	Local community	Low
10. Loss of flora due to site clearance impacting avian fauna habitat	Flora, avian fauna	Low
11. Soil erosion due to site clearance	community health	Low
12. Obstruction to flows in open <i>Nallahs</i> and deterioration of water quality due to soil erosion and dumping of construction waste	Surface water quality, local community	Low

6.8.1 Operation and Maintenance Phase

Nature of Impact	Impacted EHS Component	Impact Classification
1. Natural resource consumption causing depletion	Local community	Medium
2. Soil contamination due to leakages, spillages, and unscientific management of various types of waste	Soil quality Groundwater quality Local community	Medium
3. Air pollution through air emissions and odour generation from the operation of the treatment plant equipment and various treatment processes	Ambient air quality Local community	Medium
4. Leakages and overflows resulting contamination of soil, freshwater bodies, and groundwater	Surface water quality Groundwater quality Soil contamination Local community	Medium
5. Exposure to various occupational health and safety impacts including <ul style="list-style-type: none"> a. Physical hazards b. Biological hazards c. Chemical hazards d. Noise & vibration e. Odour Exposure to operational/natural/ manmade emergencies at project site	Local community STP workers and employees Visitors to the STP	Medium

Nature of Impact	Impacted EHS Component	Impact Classification
6. Community Impacts resulting from use of untreated wastewater, exposure to odour, resource depletion, influx of immigrant population, misbehaviour of security, and accidents and emergencies occurring in the STP	Local community	Medium

7 Environmental and Social Management Plan

7.1 Methodology of Developing ESMP

Based on the project activities during pre-construction, construction and O&M stages of the project, environmental, occupational health and safety, and community health and safety impacts have been identified in the previous Chapter.

For identification of management measures, the following resources were referred:

- World Bank Group (WBG) General EHS guidelines
- EHS Guidelines for Water and Sanitation (2007)

The hierarchy adopted for planning management measures is elimination, substitution, engineering control, administrative control, and personal protective equipment.

7.2 Institutional Arrangement for Implementation of ESMP

7.2.1 Implementation of ESMP

The overall responsibility of supervision and ensuring implementation of the ESMP will lie with WABAG during all phases of the project. The ESMP will be applicable to all Contractors and Sub- Contractors including labour contractors and their workers working in the project during all phases.

The ESMP would need to be inserted as part of the Agreement with the Contractors to ensure implementation. The Agreement should also include a clause on periodic reporting from the Contractors on status of implementation of the ESMP.

7.2.2 Management System at WABAG

WABAG has a certified Integrated Management System (IMS) as per ISO 9001:2015, ISO 14001: 2015, and ISO 45001:2018 international standards. The management system has been developed at the corporate level and is extended to all projects in India. Processes, Procedures, Work Instructions, Record Formats and other documents complement the IMS. This management system and procedures are then replicated with necessary modifications for each project based on legal requirements, EHS impacts, resource availability and processes carried out in the project.

7.2.3 Institutional Arrangement

An Environmental, Health & Safety (EHS) Department will be constituted for the project. The environmental and occupational health and safety aspects of project construction and O&M will be managed by this department. The employee welfare and grievance mechanism will be managed by the Human Resources Department of the project. These departments will report to the Project/ Plant Manager of the STP.

The EHS Department should comprise of an EHS Manager and EHS Engineer(s).

The EHS Manager should have at least 10-12 years relevant past experience of similar infrastructure projects and EHS Engineers should have 2-4 years of relevant past experience in similar infrastructure projects. The Manager and Engineers should have background qualifications in Environmental Science/ Environmental Engineering/ Environmental Planning/certification courses in Occupational Health & Safety.

The key responsibilities of the EHS Manager will be to:

- Review ESMP implementation status reports submitted by contractors during construction.
- Conduct periodic monitoring audits of the project during construction and O&M to check compliance to the ESMP.
- Investigate major accidents/ incidents, prepare report of findings, including recommendations to prevent recurrence and ensure implementation of approved course of action.
- Periodic reporting to Project/Plant Manager on status of implementation of ESMP.

The key responsibilities of the EHS Engineers would be to:

- Conduct regular monitoring of the project during construction and O&M to check compliance to the ESMP and report deviations to EHS Manager.
- Conduct training of Contractors or their personnel, where required, on implementation of the ESMP.
- Follow-up with Contractors to ensure legal compliance at all times.

7.3 ESMP for STP Plant

7.3.1 During Pre-Construction & Construction Phase

The ESMP for project development/ planning, pre-construction and construction phase impacts is presented in **Table 6**.

The legal requirements to be adhered during planning, pre-construction and construction phases of the project are provided in Section 3.1 of this report.

7.3.2 During for Operation & Maintenance Phase

The ESMP for O&M phase impacts is presented in **Table 7**.

The legal requirements to be adhered during operation and maintenance phase of the project are provided in Section 3.1 of this report.

R1 Table 6: ESMP for Pre-Construction & Construction Phases

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring guidance/ documents
1. Land for the project	Land	No Impact	a) Land transfer No Objection Certificate (NOC) must be obtained and signed from Patna Municipal Corporation	<ul style="list-style-type: none"> • Copy of NOC
2. Viewscape impacts due to proximity of settlements to the project area	Local community	Medium	a) Inform the local community about schedule of construction activity. b) Check feasibility of creating pleasant visual barriers such as setting up a plantation or construction barriers. c) Check feasibility to locate dump yards and traffic parking away from direct view of the settlements d) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG <ul style="list-style-type: none"> ○ Section 4.2, point B (Change of Scenic Quality) ○ Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	<ul style="list-style-type: none"> • Physical verification at site • Records under Construction Environment and Social Management Plan
3. Increase in fugitive dust emissions causing air pollution from site clearance, excavation, raw material transportation, storage of excavation spoil, use of fuel wood in labour camps	Air quality Community health Worker health	Medium	a) Limit the area of clearance and excavations to area required immediately for construction. b) Use water/non-ionizing surfactants for dust suppression. c) If possible, reduce activities during windy conditions. d) Build semi-pucca haul roads by spreading and compacting aggregate/metal e) Store construction material in covered sheds. f) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG	<ul style="list-style-type: none"> • Periodic air quality monitoring report during construction and comparison with baseline • Records under Construction Environment and Social Management Plan

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring guidance/ documents
			<ul style="list-style-type: none"> ○ Section 5.2 – Sediment and Erosion Control ○ Section 5.3 – Dust Control ○ Section 5.5 – Vehicle Emission ○ Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	
<p>4. Increase in concentrations of PM₁₀, PM_{2.5}, SO₂ and NO_x from burning of fuel in construction equipment and transportation vehicles and cooking in labour camps.</p>	<p>Air quality Community health Worker health</p>	<p>Medium</p>	<p>a) Conduct periodic preventive maintenance of construction equipment and transport vehicles for optimum engine performance.</p> <p>b) Ensure all vehicles have PUC Certificate.</p> <p>c) Cover the dumpers transporting construction spoil.</p> <p>d) Cover exposed earthworks and surfaces when not under active work</p> <p>e) Food should be provided by the contractor and cooking using firewood should be restricted in the labour camp.</p> <p>f) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG</p> <ul style="list-style-type: none"> ○ Section 5.2 – Sediment and Erosion Control ○ Section 5.5 – Vehicle Emission ○ Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	<ul style="list-style-type: none"> ● PUC Certificate of vehicles ● Physical inspection of labour camps ● Records under Construction Environment and Social Management Plan
<p>5. Increase in ambient noise levels due to operation of</p>	<p>Local community health</p>	<p>Medium</p>	<p>a) Conduct periodic preventive maintenance of construction equipment for optimum engine performance.</p>	<ul style="list-style-type: none"> ● Noise monitoring using a portable noise meter.

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring guidance/ documents
construction equipment and vehicles	Worker health		b) Limit idling of engines when not in use to reduce its contribution to noise emissions. c) Install signage's signalling no honking inside the site area d) Train drivers and workers on good noise management strategies e) Install noise barriers on-site if required f) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG <ul style="list-style-type: none"> o Section 5.7 – Noise Control o Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	Noise monitoring report. <ul style="list-style-type: none"> • Preventive maintenance schedules and associated bills • Physical site inspection • Records under Construction Environment and Social Management Plan
6. Soil contamination due to improper sanitation, spills of hazardous waste and other waste and improper management of wastewater	Soil quality Ground water Local community	Medium	a) Store hazardous waste such as waste oil, empty paint tins; diesel, oil and lubricant drums on impervious surface. b) Dispose hazardous waste to authorized dealers c) Dispose waste oil to authorized recyclers. d) Provide toilets with septic tank and soak pit and bathing areas for construction workers. e) Store scrap and waste materials in a dedicated area and practice good housekeeping in this area. a) Scrape off and collect the soil contaminated by diesel, oil, paint spills in a separate drum and dispose to TSDF. b) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG	<ul style="list-style-type: none"> • Waste disposal receipts • Physical site inspection • Records under Construction Environment and Social Management Plan

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring guidance/ documents
			<ul style="list-style-type: none"> ○ Section 6 – Construction Waste Management ○ Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	
7. Ground water pollution due to leaching of materials and waste into the soil	Ground water Local community	Medium	<ul style="list-style-type: none"> a) Implement measures recommended to prevent and mitigate soil contamination b) Ensure that waste materials are not thrown into excavated areas c) Dewater the excavation area through pumping and create an impermeable physical cut-off wall to exclude groundwater into the excavation area. d) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG <ul style="list-style-type: none"> ○ Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	<ul style="list-style-type: none"> ● Periodic ground water quality monitoring reports during construction and post completion of construction and comparison with baseline results. ● Records under Construction Environment and Social Management Plan
8. Exposure to physical, chemical hazards, exposure to noise, working with construction equipment, fugitive dust, emergencies at site	Construction workers	Medium	<ul style="list-style-type: none"> a) Implement measures recommended to prevent and mitigate impacts of air and noise pollution. b) Maintain good housekeeping in the construction area. c) Barricade excavated areas. d) Implement work permit system for work at height. e) Provide training to construction workers on safe work practices. f) Record and investigate injuries to workers. g) Provide PPE to construction workers 	<ul style="list-style-type: none"> ● Physical site inspection ● Accident records ● Records under Construction Environment and Social Management Plan

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring guidance/ documents
			<ul style="list-style-type: none"> ○ Safety shoes, hard hat/helmet, and hand gloves with grip facility to all workers ○ Nose masks for those working in dusty area ○ Earplugs for those working in high noise areas ○ Nitrile rubber gloves to those engaged in painting activities ○ Face shield for those engaged in welding <p>h) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG</p> <ul style="list-style-type: none"> ○ Section 8.4 – Social Management Plan ○ Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	
<p>9. Exposure to migrant workers, air and noise pollution, project security personnel, obstruction to community activities and accidents caused in the nearby community due to construction activities</p>	<p>Local community</p>	<p>Medium</p>	<ul style="list-style-type: none"> a) Implement measures recommended to prevent and mitigate impacts of air and noise pollution. b) Provide labour camp with sanitation, drinking water, medical, food and space for recreation activities after work. c) Employ security personnel from reputed security agencies. d) Implement the Grievance Redress Mechanism provided in the subsequent sub-section e) Employ good traffic management practices such as posting flagmen to guide vehicle movement, 	<ul style="list-style-type: none"> ● Monitoring guidance/ documents from respective sections ● Grievance register ● Records under Construction Environment and Social Management Plan

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring guidance/ documents
			<p>maintaining speed limit while traversing through village area.</p> <p>f) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG</p> <ul style="list-style-type: none"> o Section 8.4 – Social Management Plan o Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	
10. Alteration of natural drainage pattern due to site levelling	Landform, local community	Low	<p>a) Provide stormwater drainage within and at the borders of the site to channelize the stormwater during monsoon season.</p> <p>b) Procure aggregates and soil from authorized quarries and borrow areas.</p> <p>a) Consider natural drainage pattern of the site and its immediate surrounding during site levelling.</p>	<ul style="list-style-type: none"> • Physical verification at site • Quarry and borrow area approval copy
11. Resource consumption such as water and fuel causing depletion	Local community	Low	<p>a) Conduct preventive maintenance of construction equipment to ensure proper engine performance and optimum level of fuel consumption</p> <p>b) Optimize running hours of the equipment and machinery through proper planning of activities</p> <p>c) Use air nozzles on hose pipes used for water spraying during curing</p> <p>d) Plug any leaking pipelines</p> <p>e) Ensure that water taps are in closed position while not in use</p>	<ul style="list-style-type: none"> • Preventive maintenance schedules and associated bills • Physical site inspection • Training records

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring guidance/ documents
			f) Monitor usage of water and ensure optimization of usage for various activities a) Train workers and all relevant personnel on the aspects of resource conservation	
12. Loss of flora and fauna due to site clearance	Flora Avian fauna	Low	a) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG <ul style="list-style-type: none"> o Section 4.2 – Impacts Mitigation Measures - construction phase (Point A- Removal of Vegetation Cover and Soil Erosion) o Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	<ul style="list-style-type: none"> • Records under Construction Environment and Social Management Plan
13. Soil erosion due to site clearance and extraction of construction raw materials	Community health	Low	a) Plan and construct drainage lines or temporary bunds around construction areas and at the site boundary to prevent runoffs into the nearby agricultural lands b) Limit the area of clearance and excavations to area required immediately for construction. c) Preserve large trees on site, as feasible. d) Procure aggregates and soil from authorized quarries and borrow areas. e) Conduct compaction of the cleared areas. f) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG <ul style="list-style-type: none"> o Section 5.2 – Sediment and Erosion Control 	<ul style="list-style-type: none"> • Records under Construction Environment and Social Management Plan

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring guidance/ documents
			<ul style="list-style-type: none"> ○ Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	
<p>14. Surface water pollution due to soil erosion, release/runoff of construction wastewater and dumping of debris</p>	<p>Surface water quality Local community</p>	<p>Low</p>	<ul style="list-style-type: none"> a) Implement measures recommended to prevent and mitigate soil erosion and soil contamination. b) Make arrangements for temporary storage of construction debris and excavation spoil within the premises. c) The waste concrete from transit mixers could be used for paving surfaces where required. d) The waste materials that can be recycled should be disposed through an authorized vendor. e) Ensure that construction debris that is unusable at the site for any purpose and unsaleable is disposed to areas permitted by the Municipal Corporation f) It should be ensured that construction waste is not dumped along the riverside or near the open <i>Nallahs</i>. g) Refer the 'Construction Environment and Social Management Plan' prepared by WABAG <ul style="list-style-type: none"> ○ Section 5.6 – Disposal of Domestic Wastewater ○ Attachment 7 (Impacts Mitigation Measures Assessment for Pre- Construction / Construction Phase) 	<ul style="list-style-type: none"> ● Monitoring guidance/ documents recommended in respective items. ● Waste disposal/ sale receipts

Table 7: ESMP for O&M Phase

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
1. Natural resource consumption causing depletion	Local community	Medium	<p>A. <u>Measure for water efficiency</u></p> <p>a) Monitor usage of water and ensure optimization of usage for various activities</p> <p>b) Dry clean process areas with a scraper, broom, or specially designed vacuum cleaner before cleaning with water.</p> <p>c) Optimize water consumption for landscaping, cooking, washing, and flushing</p> <p>d) Plug any leaking pipelines</p> <p>e) Ensure reuse of treated sewage for landscaping, plant cleaning, flushing etc. where to reduce freshwater consumption</p> <p>f) Ensure that water taps, and valves are in closed position while not in use</p> <p>g) Train workers and all relevant personnel on the aspects of resource conservation</p> <p>B. <u>Measures for energy efficiency</u></p> <p>a) Conduct preventive maintenance of all equipment and machinery including pumps, air compressors and motors to ensure optimum level of energy consumption</p> <p>b) Use energy efficient lighting systems</p> <p>c) Monitor energy consumption across various equipment and treatment stage through use of energy meters.</p> <p>d) Use fuel efficient equipment for cleaning of roads and stormwater drains.</p>	<ul style="list-style-type: none"> • Preventive maintenance schedules • Physical inspection at site • Training records • Records under Environment, Social, Health and Safety Management Plan for Kankarbagh STP

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
			e) Optimize running hours of the equipment and machinery through proper planning of activities f) Ensure optimum utilization of biogas for co-generation of heat and electricity g) Ensure sufficient insulation in hot water systems to prevent loss of heat	
2. Soil contamination and groundwater pollution due to spillages and unscientific management of various types of waste	Soil quality Groundwater quality	Medium	a) Ensure disposal of all hazardous waste to authorised TSDF. In case of contamination, scrape off and collect the soil contaminated by hazardous materials in a separate drum and dispose to authorized TSDF b) Store the drums containing hazardous waste, mineral insulating oils and petroleum fuels on impervious surface c) Regenerate activated carbon d) Dispose waste oil to authorized recyclers e) Minimize the quantity of solids generated by the water treatment process through optimizing coagulation processes f) Where feasible, treat spent sludge for reuse as manure for landscaping g) Refer the 'Environment, Social, Health and Safety Management Plan for Kankarbagh STP' prepared by WABAG <ul style="list-style-type: none"> ○ Section 9 – Environment Management; (sub-section 9.3-Spillage control and 9.4-Waste Management) ○ OCP 005 (Handling of Chemicals and spill control) ○ OCP 016 (Handling of Wastes includes -Annexure- A) 	<ul style="list-style-type: none"> ● Hazardous waste disposal records ● Physical verification at site ● Physical verification of site for waste storage practices ● Records under Environment, Social, Health and Safety Management Plan for Kankarbagh STP

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
<p>3. Air pollution through air emissions and odour generation from the operation of the treatment plant equipment and various treatment processes</p>	<p>Ambient air quality Local community</p>	<p>Medium</p>	<p>a) Cover emission points (e.g., aeration basins, clarifiers, sludge thickeners, tanks, and channels), and vent emissions to control systems (e.g., compost beds, bio-filters, chemical scrubbers, etc.) as needed to reduce odours and otherwise meet applicable national requirements.</p> <p>b) Where necessary, consider alternate aeration technologies or process configurations to reduce volatilization.</p> <p>c) Refer the 'Environment, Social, Health and Safety Management Plan for Kankarbagh STP' prepared by WABAG</p> <ul style="list-style-type: none"> ○ Section 5.0 – Assessment and Management (Air quality) ○ Section 9 – Environment Management, sub-section – 9.1 (Air pollution control) ○ Section 11.9 – Traffic Management Plan 	<ul style="list-style-type: none"> ● Preventive maintenance schedules ● Physical verification at site ● Records under Environment, Social, Health and Safety Management Plan for Kankarbagh STP
<p>4. Leakages and overflows resulting contamination of soil, freshwater bodies, and groundwater</p>	<p>Surface water quality Groundwater quality Soil contamination Local community</p>	<p>Medium</p>	<p><u>Reject streams</u></p> <p>a) Recycle filter backwash into the process if possible</p> <p>b) Treat and dispose of reject streams consistent with national and local requirements</p> <p><u>Leakage and overflows</u></p> <p>c) Ensure construction of STP meets applicable standards and industry practices</p>	<ul style="list-style-type: none"> ● Physical verification at site ● Any complaint records from community ● STP maintenance records ● Monitoring records ● Records under Environment, Social, Health and Safety

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
			<p>d) Establish and conduct routine inspection and maintenance program which includes:</p> <ul style="list-style-type: none"> o Development of an inventory of system components o Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris o Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance o Monitoring of sewer flow to identify potential inflows and outflows <p>e) Implement a leak detection and repair program based on above identified information.</p> <p>f) Consider replacing mains with a history of leaks of with a greater potential for leaks because of their location, pressure stresses, and other risk factors</p> <p>g) Conduct repairs prioritized based on the nature and severity of the problem</p> <p>h) Minimize bypass of the treatment system by using separate storm water and wastewater systems and providing capacity sufficient to treat peak flows</p> <p>i) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation</p> <p>j) Equip pumps and motors with a backup power supply to ensure uninterrupted operation during power outages,</p>	<p>Management Plan for Kankarbagh STP</p>

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
			<p>and conduct regular maintenance to minimize service interruptions</p> <p>k) Implement an industrial source control program which includes monitoring and effective regulatory enforcement</p> <p>l) Wastewater treatment facilities should be well - designed, constructed, operated, and maintained to achieve the effluent water quality consistent with applicable national requirements.</p> <p>m) Based on an assessment of risks to human health and the environment, consider re-use of treated effluent.</p> <p>n) Facilitate discharge of fecal sludge and septage at storage and treatment facilities so that untreated septage is not discharged to the environment.</p> <p>o) Refer the ‘Environment, Social, Health and Safety Management Plan for Kankarbagh STP’</p> <ul style="list-style-type: none"> ○ Section 5.0 – Assessment and Management (Surface water quality) 	
<p>5. Exposure to various occupational health and safety impacts including</p> <ul style="list-style-type: none"> ○ Physical hazards ○ Biological hazards ○ Chemical hazards ○ Noise & vibration 	<p>Local community STP workers and employees Visitors to the STP</p>	<p>Medium</p>	<p>A. <u>Accidents and Injuries</u></p> <p>a) Install railing around all process tanks and pits and mandate use of a lifeline and personal flotation device (PFD) when workers are inside the railing, and ensure rescue buoys and throw bags are readily available</p> <p>b) Implement a confined spaces entry program that is consistent with applicable national requirements and internationally accepted standards.</p>	<ul style="list-style-type: none"> ● Physical site inspection ● Monitoring records ● Incident investigation records and health register ● Grievance register ● Training records

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
<ul style="list-style-type: none"> ○ Odour <p>Exposure to operational/natural/manmade emergencies at project site</p>			<ul style="list-style-type: none"> c) Valves to process tanks should be locked to prevent accidental flooding during maintenance d) Use fall protection equipment when working at heights e) Maintain work areas to minimize slipping and tripping hazards f) Use proper techniques for trenching and shoring g) Implement fire and explosion prevention measures in accordance with internationally accepted standards h) When installing or repairing mains adjacent to roadways, implement procedures and traffic controls, such as: <ul style="list-style-type: none"> ○ Establishment of work zones so as to separate workers from traffic and from equipment as much as possible ○ Reduction of allowed vehicle speeds in work zones ○ Use of high-visibility safety apparel for workers in the vicinity of traffic ○ For night work, provision of proper illumination for the workspace, while controlling glare so as not to blind workers and passing motorists ○ Locate all underground utilities before digging. <p>B. Hazardous chemicals</p> <ul style="list-style-type: none"> a) Implement a training program for operators who work with chlorine regarding safe handling practices and emergency response procedures. 	<ul style="list-style-type: none"> ● Work permit records ● Mock drill records ● PPE register ● Preventive maintenance schedule ● Records under Environment, Social, Health and Safety Management Plan for Kankarbagh STP

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
			<ul style="list-style-type: none"> b) Provide appropriate personal protective equipment (including, for example, self-contained breathing apparatus) and training on its proper use and maintenance. c) Prepare escape plans from areas where there might be a chlorine emission. d) Install safety showers and eye wash stations near the chlorine station and other areas where hazardous chemicals are stored or used. e) Limit wastes entering the sewer system to those that can be effectively treated in the wastewater treatment facility and reduce the amount of air-strippable hazardous compounds entering the system by controlling industrial discharges (e.g., by permit or similar system). f) Analyse incoming raw wastewater to identify hazardous constituents. g) Ventilate enclosed processing areas and ventilate equipment, such as pump stations, prior to maintenance. h) Use personal gas detection equipment while working in a wastewater facility. i) Continuously monitor air quality in work areas for hazardous conditions (e.g. explosive atmosphere, oxygen deficiency). j) Periodically sample air quality in work areas for hazardous chemicals. 	

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
			<p>k) Install engineering controls to limit worker exposure, for example collection and treatment of off-gases from air stripping.</p> <p>l) Prohibit eating, smoking, and drinking except in designated areas.</p> <p>m) Rotate personnel among the various treatment plant operations to reduce inhalation of air-stripped chemicals, aerosols, and other potentially hazardous materials.</p> <p>C. Chlorine system safety</p> <p>a) Install alarm and safety systems, including automatic shutoff valves, that are automatically activated when a chlorine release is detected.</p> <p>b) Install containment and scrubber systems to capture and neutralize chlorine should a leak occur.</p> <p>c) Use corrosion-resistant piping, valves, metering equipment, and any other equipment coming in contact with gaseous or liquid chlorine, and keep this equipment free from contaminants, including oil and grease.</p> <p>d) Store chlorine away from all sources of organic chemicals, and protect from sunlight, moisture, and high temperatures.</p> <p>e) Store sodium hypochlorite in cool, dry, and dark conditions for no more than one month, and use equipment constructed of corrosion-resistant materials.</p>	

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
			<p>f) Isolate ammonia storage and feed areas from chlorine and hypochlorite storage and feed areas.</p> <p>g) Minimize the amount of chlorination chemicals stored on site while maintaining a sufficient inventory to cover intermittent disruptions in supply.</p> <p>h) Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures.</p> <p>i) Develop and implement a plan for responding to accidental releases.</p> <p>D. Pathogens</p> <p>a) Wastewater and Sludge Treatment.</p> <p>b) Conduct safety training program for workers on safe handling, and personal hygiene practices to minimize exposure to pathogens and vectors.</p> <p>c) Use vacuum trucks or tugs for removal of faecal sludge instead of manual methods.</p> <p>d) Provide and require use of suitable personal protective clothing and equipment to prevent contact with wastewater (e.g., rubber gloves, aprons, boots, etc.).</p> <p>e) Provide prompt medical attention and cover any skin trauma such as cuts and abrasions to prevent infection and use protective clothing and goggles to prevent contact with spray and splashes.</p>	

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
			<p>f) Provide areas for workers to shower and change clothes before leaving work and provide laundry service for work clothes.</p> <p>g) Encourage workers at wastewater facilities to wash hands frequently.</p> <p>h) Provide worker immunization (e.g. for Hepatitis B and tetanus) and health monitoring, including regular physical examinations.</p> <p>i) Reduce aerosol formation and distribution, for example by:</p> <ul style="list-style-type: none"> ○ Planting trees around the aeration basin to shield the area from wind and to capture the droplets and particles ○ Using diffused aeration rather than mechanical aeration and using finer bubbles for aeration ○ Reducing aeration rate, if possible ○ Use of floating covers on the mixed liquor of the aeration basin ○ Suppression of droplets just above the surface, (e.g., by installing a screen or mesh above the basin) ○ Collection of droplets (e.g., by sedimentation, scrubber, electrostatic precipitator, or fabric filter) ○ Use of submerged effluent collector (such as pipes with orifices) rather than weirs <p>j) Avoid handling screenings by hand to prevent needle stick injuries</p>	

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
			<p>k) Maintain good housekeeping in sewage processing and storage areas</p> <p>l) Advise individuals with asthma, diabetes, or suppressed immune systems not to work at wastewater treatment facilities, especially composting facilities, facility because of their greater risk of infection</p> <p>m) Land Application</p> <p>n) Consider use of drip irrigation of treated wastewater, which minimizes worker exposure and the amount of water needed. Avoid use of spray irrigation of treated wastewater, if possible</p> <p>o) Provide field workers with personal protective equipment, such as rubber gloves and waterproof shoes</p> <p>E. <u>Operational noise</u></p> <p>a) Ensure adequate use of PPE (ear-plugs and earmuffs)</p> <p>b) Conduct periodic maintenance of the high noise generating equipment</p> <p><u>Other precautions</u></p> <p>a) Provide access to safe drinking water and sanitation (including hand washing) facilities</p> <p>b) Conduct worker health monitoring, including regular physical examinations</p>	

Nature of Impact	Impacted EHS Component	Impact Classification	Management Measures	Monitoring Guidance/ Documents
			Refer following sections of the 'Environment, Social, Health and Safety Management Plan for Kankarbagh STP' prepared by WABAG <ul style="list-style-type: none"> ○ Section 5.0 – Risk Assessment and Management (Occupational Health and Hygiene) ○ Section 5.0 – Risk Assessment and Management (Odour) ○ Section 5.0 – Risk Assessment and Management (Noise control) ○ Section 9.2 – Environment Management (Noise control) ○ Section 10 – Occupational Health and Hygiene ○ Section 11.11 – Fire Prevention ○ Section 14 – Emergency Preparedness and Response ○ OCP-015 – Emergency Response Plan 	
6. Community Impacts	Local community	Medium	Refer the 'Environment, Social, Health and Safety Management Plan for Kankarbagh STP' prepared by WABAG <ul style="list-style-type: none"> ○ Section 5.0 – Risk Assessment and Management (Community Health and Safety) 	<ul style="list-style-type: none"> ● Grievance register

7.4 Environmental & Social Monitoring Plan

7.4.1 ESMP Monitoring

The ESMP provides prevention and mitigation measures to be undertaken to reduce the environmental and social impacts due to project activities. Monitoring parameters and mechanism of monitoring are also provided.

During construction, quarterly monitoring of implementation of the ESMP should be conducted. During operation and maintenance phase of the project, implementation of the ESMP should be monitored on a half yearly basis.

7.4.2 Environmental Quality Monitoring

To ascertain effectiveness of implementation of mitigation measures recommended in the ESMP and to comply with legal requirements, environmental quality monitoring would need to be conducted. The ambient air quality, ambient noise and ground water quality will need to be monitored. The monitoring should be conducted at the locations where baseline environmental quality was monitored and analysed to note the change.

During construction, the monitoring would need to be conducted on a quarterly basis and during O&M the monitoring can be conducted on an annual basis.

Refer the table below for monitoring plan.

Aspect	Monitoring Locations	Number of samples	Parameters
Ambient Air Quality	<ul style="list-style-type: none"> • AAQ 1 (25°34'48.27"N, 85°11'38.76"E) outside main gate Ganga pollution, Bari Pahari, Kankarbagh, Patna. • AAQ 2 (25°34'56.26"N, 85°11'30.53"E), Yadav Colony Bari Pahari, Kankarbagh, Patna. • AAQ 3 (25°34'49.73"N, 85°11'28.54"E), Service road, near SH 1, Bari Pahari, Kankarbagh, Patna. 	3 locations and two sample at each location for 48 hours	4 parameters to be analysed (PM ₁₀ , PM _{2.5} , SO ₂ , NO _x).
Ambient Noise Quality	<ul style="list-style-type: none"> • N1 (25°34'49.00"N, 85°11'36.10"E), Near Ganga Pollution, Bari Pahari, Kankarbagh, Patna. • N2 (25°34'56.23"N, 85°11'30.53"E), Yadav Colony Bari Pahari, Kankarbagh, Patna. • N3 (25°34'50.98"N, 85°11'34.36"E) Service road, near SH1, Bari Pahari, Kankarbagh, Patna. 	3 locations for 24 hours with hourly averages in dB(A)	-
Groundwater	<ul style="list-style-type: none"> • GW1 (25°34'47.53"N, 85°11'41.29"E), On site, Bari Pahari Kankarbagh, Patna. 	2 locations 1 sample at each location	Parameters as per IS 10500:2012 Drinking Water Standards (33 parameters including physical,

Aspect	Monitoring Locations	Number of samples	Parameters
	<ul style="list-style-type: none"> GW2 (25°34'49.34"N, 85°11'38.49"E), Off site, Bari Pahari Kankarbagh, Patna. 		bacteriological and heavy metals).

7.4.3 Health and Safety Monitoring

The accidents and fatalities especially accidents that could result in lost work time, different levels of disability, or even fatalities among workers (whether directly employed or subcontracted) should be recorded. The aim of the monitoring program should be to reduce the accidents.

7.5 Stakeholder Engagement and Information Disclosure

7.5.1 Context of Stakeholder Engagement

As presented in World Bank's ESS 10, stakeholder engagement is an ongoing process that may involve, in varying degrees, the following elements spanning the entire life of a project:

- Stakeholder Analysis and Planning,
- Disclosure and Dissemination of Information,
- Consultation and Participation,
- Grievance Mechanism, and
- Ongoing Reporting to Affected Communities.

The World Bank defines stakeholder as a 'person, group, or organization that has a direct or indirect stake in a project/organization because it can affect or be affected by the Project/organization's actions, objectives, and policies.'

Stakeholders of the STP will include persons or groups that will have an interest in the Company's operations or have an ongoing relationship with the company and have the ability to influence the company operations. As provided in the guidance notes associated with ESS 10, engagement with suppliers, contractors, employees, or customers are not considered in this plan as these groups are parties to the core business function and subject to national regulations and/or established corporate policies and procedures.

This section puts in place a framework that will guide the stakeholder identification, analysis, and engagement process for the Kankarbagh STP.

7.5.2 Stakeholder Identification and Analysis

A. Stakeholders of WABAG

Considering the nature, activities and facilities, and potential adverse impacts of the STP, the following key stakeholders have been identified.

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
1. Neighbouring Communities	<ul style="list-style-type: none"> • Pahari Village • Neighbouring residents of the STP 	Other neighbouring communities within study area

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
	<ul style="list-style-type: none"> • Owners of agricultural land neighbouring the project site • Shop owners neighbouring the facility 	
2. Community Representatives	<ul style="list-style-type: none"> • Ward Parishad • Pahari Village Heads 	--
3. Industrial Establishments	<ul style="list-style-type: none"> • None present in project influence area 	--
4. Regulators	<ul style="list-style-type: none"> • BUIDCo • Patna Municipal Corporation • Other Regulators (State Pollution Control Board, Factories Department, Labour Department) 	--
5. Institutional Stakeholders	<ul style="list-style-type: none"> • Equity Investors • Lenders 	--
6. Other Groups	--	<ul style="list-style-type: none"> • Political Parties • Civil society organizations • NGOs • Media organizations

B. Stakeholder Analysis

Stakeholder Analysis involves a more in-depth look at the interests of the stakeholders, how they will be affected and what influence they have on a project.

The influence and priority have both been primarily rated as:

- **High Influence:** This implies a high degree of influence of the stakeholder on the project/ organization in terms of participation and decision making or high priority to engage with the stakeholder.
- **Medium Influence:** This implies a moderate level of influence and participation of the stakeholder in the project/ organization as well as a priority level to engage the stakeholder which is neither highly critical nor are insignificant in terms of influence.
- **Low Influence:** This implies a low degree of influence of the stakeholder on the project/ organization in terms of participation and decision making or low priority to engage that stakeholder.

The following table provides an analysis of the stakeholders for the Company specific to the Project.

Relevant stakeholders	Impact/ Influence of the Project on this stakeholder group	Impact/ Influence of the Stakeholder Group on the Project	Expectations, Opinions, Key Concerns of Stakeholders	Rating of Stakeholder Influence
Neighbouring Communities				
Neighbouring residents/	<ul style="list-style-type: none"> • Inconvenience during construction due to 	<ul style="list-style-type: none"> • Agitation in case of increased nuisance 	<ul style="list-style-type: none"> • Contribution to infrastructural development of the area 	High Influence

Relevant stakeholders	Impact/ Influence of the Project on this stakeholder group	Impact/ Influence of the Stakeholder Group on the Project	Expectations, Opinions, Key Concerns of Stakeholders	Rating of Stakeholder Influence
commercial shops near STP	<p>noise, fugitive dust and other forms of pollution.</p> <ul style="list-style-type: none"> • Inconvenience during operation & maintenance due to noise, emissions from the facility activities, odour, and other forms of pollution. • Increase in vehicular traffic and viewscape impacts • Accidental release of chlorine gas and toxic fumes endangering health. • Exposure to emissions from fire emergency at the facility that may impact the life and property. • Access to income generation opportunities • Harassment by security personnel posted by the STP 	<p>created from STP activities</p> <ul style="list-style-type: none"> • Public Interest Litigations. • Show Cause Notice from State Pollution Control Board • Compensation claims. • Complaints to Ward Office/ District Administration that can lead to stoppage of activities. 	<ul style="list-style-type: none"> • Economic and employment opportunities • Company adopts management systems on environment, health & safety to prevent adverse impacts on the community. • Company establishes a community grievance redress mechanism. • Company informs the community about high risk operations and actions to be taken in emergency situations. 	
Farmers owning land neighbouring the STP	<ul style="list-style-type: none"> • Soil contamination resulting from accidental discharge of untreated wastewater. • Impact on health of farmers and on produce due to release of pathogens/vectors from untreated wastewater • Source of treated water for irrigation of the agricultural lands • Unavailability of groundwater for pursuing livelihood like farming due to groundwater depletion caused by excessive consumption by the STP • Accidental release of chlorine gas and toxic 	<ul style="list-style-type: none"> • Public Interest Litigations. • Agitation in case of increased nuisance created from STP activities • Complaints to Ward office/ District Administration that can lead to stoppage of activities. • Compensation claims. 	<ul style="list-style-type: none"> • Company uses natural resources in a responsible manner. • Company ensures adequate treatment of sewage prior to discharge • Company adopts management systems on environment, health & safety to prevent adverse impacts on the community. • Company establishes a community grievance redress mechanism. • Company informs the community about high risk operations and actions to be taken in emergency situations. 	High Influence

Relevant stakeholders	Impact/ Influence of the Project on this stakeholder group	Impact/ Influence of the Stakeholder Group on the Project	Expectations, Opinions, Key Concerns of Stakeholders	Rating of Stakeholder Influence
	<p>fumes endangering health.</p> <ul style="list-style-type: none"> Exposure to emissions from fire emergency at the facility that may impact the life and property. 			
Other neighbouring communities within study area	<ul style="list-style-type: none"> Increase in vehicular traffic during construction and O&M phases. Unavailability of groundwater for community use due to groundwater depletion caused by excessive consumption by the STP. Degraded quality of ground water due to land contamination from improper disposal of waste causing leaching of contaminants into the ground water aquifer. Contamination of waterbodies used for recreation or drinking or other purposes due to inefficient treatment of sewage and bypass in case of emergencies. Harassment by security personnel posted by the STP 	<ul style="list-style-type: none"> Public Interest Litigations. Agitation in case of increased nuisance created from STP activities Show Cause Notice/ Closure Notice from State Pollution Control Board Complaints to Ward Office/ District Administration that can lead to stoppage of activities. 	<ul style="list-style-type: none"> Company adopts management systems on environment, health & safety to prevent adverse impacts on the community. Company establishes a community grievance redress mechanism. 	Medium Influence
Community Representatives				
Ward Parishad Pahari Village Heads	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Issue permits and approvals as applicable to the STP operations Complaints to regulatory authorities that can lead to penalties or stoppage of activities 	<ul style="list-style-type: none"> All applicable permits and approvals are obtained timely and periodically as applicable Concerns of villagers are addressed timely and appropriately 	High influence
Regulators				

Relevant stakeholders	Impact/ Influence of the Project on this stakeholder group	Impact/ Influence of the Stakeholder Group on the Project	Expectations, Opinions, Key Concerns of Stakeholders	Rating of Stakeholder Influence
BUIDCo	<ul style="list-style-type: none"> Fulfilling the institutions objective of improving the urban infrastructure 	<ul style="list-style-type: none"> Approve the project components. Issue directives to stop work based on complaints form stakeholders. 	<ul style="list-style-type: none"> The project is developed and operated in alignment with the institutions requirements. Complaints from stakeholders are addressed timely and appropriately. 	High Influence
Patna Municipal Corporation	<ul style="list-style-type: none"> Improving quality of life in the City. 	<ul style="list-style-type: none"> Issue permits and approvals as applicable to the project. Issue directives to stop work based on complaints from Ward Parishad. 	<ul style="list-style-type: none"> All applicable permits and approvals are obtained timely and periodically as applicable. Complaints of Ward Parishad are addressed timely and appropriately. 	Medium Influence
Applicable regulators (State Pollution Control Board, Factories Department, Labour Department)	<ul style="list-style-type: none"> Assistance in treatment of sewage and reduction pollution of the river systems 	<ul style="list-style-type: none"> Issue permits and approvals as applicable to the project. Levy penalties if STP Plant found non-compliant. 	<ul style="list-style-type: none"> All applicable permits and approvals are obtained timely and periodically as applicable. Conditions of the permits are implemented. 	High Influence
Institutional Stakeholders				
Equity Investors/ Lenders	<ul style="list-style-type: none"> Opportunity to grow financial resources Credit risk to equity investors and lenders due to stoppage of STP operations due to action from regulatory bodies or major accidents 	<ul style="list-style-type: none"> Provide financial and technical resources contributing to business growth 	<ul style="list-style-type: none"> STP operations is managed in alignment with environmental and social safeguards among other requirements Major incidents are communicated at the earliest 	Medium influence
Other Groups				
Civil society organizations NGOs	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> File PILs. Collective bargaining through public support. 	<ul style="list-style-type: none"> Project operates within the regulatory framework. Have a robust grievance redress mechanism. 	Medium influence
Political Parties	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Collective bargaining through public support. 	<ul style="list-style-type: none"> The Company operates within the regulatory framework. Have a robust grievance redress mechanism. 	Low influence

Relevant stakeholders	Impact/ Influence of the Project on this stakeholder group	Impact/ Influence of the Stakeholder Group on the Project	Expectations, Opinions, Key Concerns of Stakeholders	Rating of Stakeholder Influence
Media	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Publish adverse reports about the company. 	<ul style="list-style-type: none"> Project operates within the regulatory framework. Have a robust grievance redress mechanism. 	Low influence

7.5.3 Stakeholder Engagement Plan

A Stakeholder Engagement Plan for Kankarbagh STP project, that lists the stakeholders identified above, stage at which the engagement needs to be undertaken, purpose of engagement, mode of engagement, minimum information to be disclosed to the respective stakeholder, and responsible person for stakeholder engagement is presented below. The methods of communication can be either verbal or written, on the basis of the purpose of communication and the target stakeholder group.

Relevant Stakeholders	Stage of Engagement	Purpose of Consultation	Mode of engagement	Minimum Information to Disclose
Neighbouring Communities				
Nearby community Farmers owning land neighbouring the STP Other neighbouring population in the vicinity	Construction and Operations Phase	<ul style="list-style-type: none"> To maintain 'social license to operate' Alleviate community (or individual) grievances 	<ul style="list-style-type: none"> Consultations through one-to-one meetings/ group discussions Through written communication to Ward Parishad Response to queries raised (if any) 	<ul style="list-style-type: none"> Facility description and benefits Provide information about STP activities concerning the community in a proactive and timely manner in a language understood by community Offsite Emergency Preparedness and Response Plan Grievance redress contact details
Civil Society Organizations				
Ward Parishad Pahari Village Heads	Construction and Operations Phase	<ul style="list-style-type: none"> To maintain 'social license to operate' Alleviate community (or individual) grievances 	<ul style="list-style-type: none"> Through written communication 	<ul style="list-style-type: none"> Facility description and benefits Grievance redress contact details
Regulators				
BUIDCo Patna Municipal Corporation Regulatory bodies issuing various	Construction and Operations Phase	<ul style="list-style-type: none"> Various approvals, permissions and licenses related to setting up of the project Land NOC 	<ul style="list-style-type: none"> In-person meetings Official communications as required by the law and the permits issued. 	<ul style="list-style-type: none"> Information required by the law and under the permits issued

Relevant Stakeholders	Stage of Engagement	Purpose of Consultation	Mode of engagement	Minimum Information to Disclose
environmental, labour and factory safety related approvals		<ul style="list-style-type: none"> Submission of compliance related returns 	<ul style="list-style-type: none"> Response to queries raised, notices/ letters received 	
Institutional Stakeholders				
Equity Investors/ Lenders	Project Lifecycle	<ul style="list-style-type: none"> Inform investors about the growth and direction of the Company 	<ul style="list-style-type: none"> Investment/ Loan Agreement Official communication on overall E&S performance Response to queries raised 	<ul style="list-style-type: none"> All major incidents that may occur in the facility that may lead to disruption of business or create a negative impact on the facility or the group Information requirement stated in Loan/ Investment Agreement Reporting on E&S Key Performance Indicators
Other Groups				
Civil Society Organizations NGOs	Project Lifecycle	<ul style="list-style-type: none"> Discussion on specific issues of concern to environment and social issues Building and maintaining WABAG reputation 	<ul style="list-style-type: none"> Partnerships Response to queries raised (if any) 	None in specific
Political Parties	Project Lifecycle	<ul style="list-style-type: none"> Uninterrupted operations of the STP 	<ul style="list-style-type: none"> One-to-One meetings Receipt of verbal grievances 	None
Media	Project Lifecycle	<ul style="list-style-type: none"> Building and maintaining WABAG reputation 	<ul style="list-style-type: none"> Response to queries raised (if any) 	None in specific

7.5.4 Implementation of Stakeholder Engagement Plan

All communication with stakeholders (especially in-person meetings and group discussions) will be recorded in the form of minutes or any other relevant format across the project lifecycle. The following details on each stakeholder engagement should be maintained in the relevant format:

- Stakeholder group
- Location
- Date of communication
- Purpose of communication
- Mode of communication
- Stakeholder response
- Further action
- Reference document (if any)

7.6 Community Grievance Redress Mechanism

A project level Community Grievance Redressal Mechanism (GRM) should be established at project site to provide the affected communities a credible and effective channel of communication and allow them to communicate their grievances/concerns which they believe to be caused by the project activities.

This GRM should not hinder the legal process of grievance resolution route that the aggrieved may wish to adopt.

7.6.1 Institutional Arrangement for Grievance Redressal

A Grievance Redress Committee (GRC) should be established at the Project level. The Committee should comprise of Project Head, E&S Officer from BUIDCo and a third party representative appointed through mutual consent between BUIDCo and the project. The third-party representative appointed should either be a reputed member of the community or from a non-governmental organization (NGO).

The GRC should meet on a monthly basis to review the grievances received during the period and to take a stock of actions undertaken for grievances received in the previous month.

The Project Head should designate a Community Liaison Officer from its team for attending to community grievances and engaging with them on a regular basis.

7.6.2 Receipt & Recording of Grievance

The aggrieved members can communicate their grievances related to the Project to the Community Liaison Officer through the formal and informal avenues listed below. The officer will facilitate the aggrieved in communicating their grievance.

- Oral complaints communicated through remote-access methods such as phone calls or face to face to the Officer during group or individual meetings.
- Written complaints communicated through remote-access methods such as email or face-to-face, wherein individuals or a group submit their grievances to the officer.

All grievances received through oral or written format will be recorded. The following details will be recorded for each grievance:

- Date of receipt of grievance
- Name of aggrieved or anonymous
- Mode of communication – oral or written
- Name of person to whom the grievance was communicated
- Details of Grievance (as communicated by the aggrieved)

The Community Liaison Officer will provide a confirmation of receipt of grievance to the aggrieved within 48 hours of receiving the oral or written question or concern and inform them that they will receive a response in writing within 30 business days.

The Project should provide an option to submit anonymous complaints. However, no personal response can be provided for such grievances. Also, if insufficient information is provided and further investigation cannot proceed, such grievances can be closed without the possibility of resolution.

7.6.3 Review and Investigation of Grievances

All grievances received should be placed before the GRC during their monthly meeting. Each grievance should be reviewed whether it is in the scope of the project for resolution. Where the grievance is not within the scope of the Project, the Community Liaison Officer should explain to the complainant the reason and accordingly close the grievance. The same should be recorded.

Where the grievances that are found to be within the scope of the Project, the details should be reviewed. Relevant project documents and records should be reviewed. There may be a need for discussion with the aggrieved community members/ complainant for better understanding of the nature of the grievance and to discuss resolution options. Site visits and meetings with complainants should be conducted by the GRC for redressing grievances resulting from a physical incident. Proceedings of the site visit should be documented.

The Project should take full responsibility for investigating the details of grievances coming through its grievance mechanism, at no cost to the communities.

7.6.4 Grievance Resolution

Once the grievance is well understood, resolution options should be developed taking into consideration community preferences, project policy, past experience, current issues, and potential outcomes. The GRC should plan measures to resolve the grievance and set a timeline for implementation of the measures. The plans/ actions should be documented and monitored.

Where details of complainant are available, a formal response on the actions planned with implementation timeline for resolving the grievance should be communicated to the complainant within 30 days of receipt of the grievance. Where grievance review and resolution are delayed, the complainant should be provided regular updates on the progress.

The solutions for grievance resolution could include:

- altering or halting harmful activities or restricting their timing and scope
- providing monetary compensation
- providing an apology
- replacing lost property
- revising community engagement strategy
- renegotiating existing commitments or policy

7.6.5 Grievance Closure

The following actions should be undertaken for grievance closure:

- Grievance should be duly addressed through the actions / measures that are arrived at as described in this Section and closed by the GRC and where relevant and feasible, signed off by the complainant.
- The closure date of the grievance should be recorded and communicated to the aggrieved/complainant with acknowledgement received from the complainant (in any written format). This may be in form of minutes of meeting with an aggrieved person/ group signed off by its designated head or a written signature/thumb-print of an individual/written email etc.

7.6.6 Redressal of Anonymous Grievance

The procedure for redressing anonymous grievances should be as follows:

- An anonymous grievance will be received in writing in most circumstances. The grievance will be recorded and checked whether it is in the scope of the Project for resolution.
- The grievances found to be within the scope of the Project for resolution, will be resolved as per the procedure presented in Section 7.6.3 and 7.6.4 (barring the procedure on communicating to the complainant).
- The closure date of the grievance will be recorded.

7.6.7 Publicizing the C-GRM

The GRM should be publicized giving due consideration to the cultural characteristics and accessibility factors. The neighbouring community, community representatives, civil society organizations, female groups, vulnerable groups should be informed about the presence of the grievance redress mechanism, its objectives and its functions. the following features of the GRM should be communicated:

- Presence of a Community Liaison Officer and GRC for redressal of grievances.
- All complaints and constructive feedback will be taken seriously, whether submitted from a named source or anonymously.
- There will be no cost or fee associated with submitting a question or concern through the GRM.
- Interested and affected parties may submit queries or concerns without fear of retribution.
- The GRM does not impede or replace the grievance resolution process offered by the legal system of the country.

Contact details of the Community Liaison Officer should be communicated to the neighbouring community, community representatives, civil society organizations (if any). Contact details of the GRC members should also be made available as escalation contact. The contact details should be communicated through a display at the project site gate in a manner that it is easily visible.

Annexure: –Project schedule

CONSTRUCTION PLAN & MILESTONE SCHEDULE (KANKARBAGH STP)						
Project : Kankarbagh STP						
Activity	Kankarbagh STP	Milestone 1	Milestone 2	Milestone 3	Milestone 4	Milestone 5
Project Part: KKB STP						
- Engineering	6.00%	5.9%	0.1%			
- Civil Works	49.00%	7%	15%	12%	8%	7%
- MEI Works (Supply + Erection)	45.00%	7%	5%	8%	12%	13%
		20%	20%	20%	20%	20%

Annexure: –NOC

Self-Declaration on Land Ownership

This is to certify that all the Parcel of Land for construction of the facilities for the 103 MLD Sewerage Pumping Station 'B' at Digha Zone under the Namami Gange Project, (DEVELOPMENT AND OPERATIONS OF SEWAGE TREATMENT PLANTS AND SEWERAGE NETWORK AND ASSOCIATED INFRASTRUCTURE AT DIGHA & KANKARBAGH ZONE OF PATNA, BIHAR including 15 years O&M based on Hybrid Annuity Based PPP mode as per Letter of Award Ref: BUIDCo/YO-911/18-3386 dated 19th July 2019) described in greater detail in the below table are under the ownership and possession of BUIDCO (Bihar Urban Infrastructure Development Corporation). We further confirm that :

- (i) All compliances under the National and State laws related to acquisition if any of the subject land including resettlement activities if any were duly completed.
- (ii) There are no encumbrance or outstanding issues, dispute, grievance or court case(s) in relation to the subject land.
- (iii) During execution of the project, if it is found necessary to provide any additional land and / or ROW and / or hindrance free access to site, BUIDCo will undertake to expeditiously comply with such requirements and deal with any compensation or re-settlement issues as applicable under national and state laws or any other standard applicable as per Concession Agreement.

SPS 'B' Locations	Land Details	Ownership
Digha	Co-ordinates: N = 2836641.102 E = 308946.307 N = 2836612.108 E = 308965.908	Bihar Urban Infrastructure Development Corporation

Self
12/10/2024

Annexure –NOC –PCB

'CONSENT-TO-ESTABLISH' (NOC)**UNDER SECTIONS 25/26 OF THE WATER (PREVENATION AND CONTROL OF POLLUTION) ACT, 1974 AND 21 OF THE AIR (PREVENTION AND CONTROL OF POLLUTION) ACT, 1981****REFERENCE**

- i. Name and address of the Proponent: The Executive Engineer, Digha-Kankarbagh (DK) STP & Sewage Network Project Pvt. Ltd., Pahari, Patna Sadar, Patna; and
- ii. Application No. EG526ND17845/3587810, dated 12.01.2021 of the proponent to establish a Sewage Treatment Plant (STP) at Mauza-Pahari-14, Plot No./Khesra No.-1252,1249,1248,1246, Khata No.-1252, 1249, 1248, 1246, Campus Ganga Pollution Board, Pahari, Patna Sadar, Patna. Dist- Patna for capacity: 50.0 MLD.

AFTER CONSIDERING

- (i) The facts stated in their application;
- (ii) Bihar State Pollution Control Board's Notification No. 26 dated 08.11.2003 and as amended;
- (iii) Provisions of the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981; and
- (iv) Declaration dated 08.04.2021 and other document submitted online by the applicant.

NOC IN FAVOUR OF THE PROPONENT AT THE SAID SITE IS HEREBY ACCORDED SUBJECT TO THE FOLLOWING CONDITIONS**Specific Conditions**

1. That, Consent-to-Operate for the Sewage Treatment Plant (STP) shall be obtained from the Bihar State Pollution Control Board as required under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981;
2. That, they shall comply with provisions (whichever applicable) of The Water Act, 1974, The Air Act, 1981, The Environment (Protection) Act, 1986, Rules and notifications issued there under;
3. That, they shall maintain maximum possible distance from the river and ideally it should be more than 500m from the river;
4. That, they shall obtain prior permission for installation of bore well (if any required) and abstraction of groundwater from Central Groundwater Authority (CGWA)/Competent Authority, if required groundwater abstraction is ≥ 10 KLD;
5. That, they shall have to provide suitable and separate drainage system for sewer/other wastewater and storm water. No sewage or untreated effluent water would be discharged through storm water drains. A coloured drainage map shall be submitted to the Board;
6. That, they shall adopt rain water harvesting as provisions made by the local bye-law. If local bye-law provision is not available, adequate provision for storage and recharge should be followed as per CPCB guideline. Ensure proper management of storm water to optimum use and allow it to be by-passed during times of heavy rain to avoid any flooding problem inside the campus. Submit an action plan of well-designed rainwater harvesting system with storm water management;
7. That, the sewage shall be treated in Sewage Treatment Plant (STP) and after treatment; the water will be recycled for irrigation purposes, flushing of toilets, floor washing/cleaning, gardening/horticulture etc, with remainder if any, to be discharged into the public sewer system. They shall submit an action plan for use of treated sewage water in irrigation purposes and any other bulk use/in-house use;
8. That, the quality of treated sewage of STP shall have to comply with the following standards:

Sl No.	Parameter	Limiting concentration in mg/l, except pH
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2	BOD	10
3	Total Suspended Solids (TSS)	20
4	COD	50
5	Nitrogen-Total	10
6	Phosphorus-Total for discharge into Ponds, Lakes	1.0
7	Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100 ml)	Desirable-100 Permissible-230

9. That, sludge generated from the STP will be dried and later it will be used as manure in agriculture and for green belt development/gardening/horticulture;
10. That, diesel generating sets (DG Sets), if any; as source of backup power should be provided with an integral acoustic enclosure and the maximum permissible sound pressure level for new D.G. set shall be 75 dB(A) at 1 meter from the enclosure surface. The height of exhaust of DG sets should be as: Exhaust Stack Height formula:- (Ht of Building in meter + 0.2√KVA) m; it should be installed on pucca base with anti vibration pads;
11. That, they shall ensure all possible measures to be implemented to control noise pollution and the ambient noise levels should conform to the standards prescribed under the Noise Pollution (Regulation and Control) Rules, 2000, as amended to date viz. 75 dB(A) during day time and 70 dB (A) during night time;
12. That, they shall comply with the provisions (whichever applicable) of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. The used oil from DG sets as hazardous waste will be stored in HDPE drums in isolated covered facility. This used oil will be sold to authorized recyclers and record shall be maintained. Necessary care will be taken so that spills/leaks of used oil from storage are avoided;
13. That, they shall comply with the provisions (whichever applicable) of the E-Waste (Management) Rules, 2016. The e-waste generated shall be disposed off by handing over to the authorised collection centre and a record shall be maintained;
14. That, they shall comply with the provisions (whichever applicable) of the Plastic Waste Management Rules, 2016. They will make effort to discourage the use of plastics so that minimum generation of plastics wastes to be taken place;
15. That, in case of construction activities, they shall comply with the provisions (whichever applicable) of the Construction and Demolition Waste Management Rules, 2016;
16. That, the surface having unpaved and loose soil, if any, shall be adequately sprinkled with water to suppress dust;
17. That, maximum efforts will be made to retain existing tree cover as well as new sapling shall be planted during coming season; and
18. That, the project proponent shall submit half yearly compliance report of CTE condition in hard and soft copy. Soft copy of the report shall be mailed to the Board through e-mail ID: bspcb@yahoo.com.

General Conditions

1. That, they shall provide adequate fire safety measures and equipment as required under the Rules and obtain necessary permission/NOC from competent authority as required;
2. That, they shall obtain all mandatory clearance/ permission from all relevant agencies;
3. That, the Environmental Statement as prescribed in the E (P) Rules, 1986 [see rule 14] for the each financial year ending the 31st March, shall be submitted by the month of September every year;
4. That, maximize recycling of water and utilization of treated sewage water in irrigation/rain water in harvesting;

Annexure: Environmental monitoring Test report

FORESTS AND CLIMATE CHANGE
MOFCC Certificate

PHEET LAB

(Public Health Environment Engineering Testing) Lab

Recognized As Environmental Laboratory by MOEFCC, Govt of India Under Environment Protection Act 1986, issued vide Letter No - L/99/7/2021-INST LAB-HO-CPCB-HO/Pvt-327/1324 Dated 23rd May-2022

NABL & MOEFCC Accredited Lab for Testing of Water / Waste Water / Ambient Air / Stack Emission / Noise under
01 Roof, Located in Bhagirathi Lane, Opposite Malaria Control Office, Ashok Rajpath, Mahendru, Patna - 800006
E-mail : sharma.chanrabhan9@gmail.com & pheetlab@gmail.com
Web :- www.pheet-environment.com 9546991814

TEST REPORT

Sample/Report No. TC-675222000000404P Report Issue Date:- 09/07/2022
Name & Address:- M/S VA Tech Wabag Ltd, Pahari-Patna
Description of Sample :- Ambient Air
Order No:- Verval Order Sampling Duration : 8 Hours
Sample Receiving Date:- 06/07/2022 Sampling Date:- 06/07/2022
Date of Analysis:- 07/07/2022 End Date of Analysis:- 09/07/2022
Site:- STP, Pahari.

Sr.No.	Test Parameters	Units Of Measurements	NAAQ Standards E(P)A, 1986	Results	Method reference
1	PM 10	$\mu\text{g}/\text{m}^3$	100	82.66	IS-5182(Part 23)-1999-Reaff-2017
2	PM2.5	$\mu\text{g}/\text{m}^3$	60	53.98	Gravimetric Method
3	(SO ₂)	$\mu\text{g}/\text{m}^3$	80	18.27	IS-5182 (Part 2)-2001- Reaff -2017
4	(NO ₂)	$\mu\text{g}/\text{m}^3$	80	20.88	IS-5182(Part -6) :2006 -Reaff -2017

REMARKS

Analysed parameters of Ambient Air quality is within acceptable limit NAAQ Standards E(P)A, 1986

End of the Test Report, P1/1

Tested by

Chemist



MINISTRY OF ENVIRONMENT,
FORESTS, AND CLIMATE CHANGE
MOFCC Certificate

PHEET LAB

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01 Roof, Located in Bhagirathi Lane, Opposite Malaria Control Office, Ashok Rajpath, Mahendru, Patna - 800006
E-mail : sharma.chanrabhan9@gmail.com & pheetlab@gmail.com
Web :- www.pheet-environment.com 9546991814

TEST REPORT					
Sample/Report No. TC-67522200000405P			Report Issue Date:- 09/07/2022		
Name & Address:- M/5 VA Tech Wabag Ltd, Pahari-Patna.					
Description of Sample:- Ambient Noise					
Order No:- Verbal Order					
Sampling Date:- 06/07/2022					
Date of Analysis:-06/07/2022					
Site:- STP, Pahari.					
AMBIENT NOISE RESULT					
SL.NO.	Noise Location	Day			
		L Max	L Min	L eq	Test Method
1	STP, Pahari.	67.2	58.4	63.84	IS:9989
Noise (Ambient Standard)					
Area Code	Category of Area	Limit in dB (A) Leg			
		Day Time	Night Time		
A	Industrial Area	75	70		
B	Commercial Area	65	55		
C	Residential Area	55	45		
D	Silence Zone	50	40		
REMARKS					
Estimated Noise level is found in between the limit fixed for Residential & commercial area.					
End of the Test Report,			P1/1		

Tested by

