

# नमामि गंगे

## Environment and Social Due Diligence Report for Proposed Sewage Treatment Plant (50 MLD) and Sewerage Network (150 km) at Kankarbagh Zone Patna



## Environment and Social Due Diligence Report



April 2018

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## Abbreviation

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BUIDCO	Bihar Urban Infrastructure Development Corporation Ltd.
CTE	Consent of Establish
EMP	Environmental Management Plan
ESAMP	Environmental and Social Assessment & Management Plan
ESMF	Environmental and Social Management Framework
GAP	Ganga Action Plan
GoI	Government of India
HAM	Hybrid Annuity Model
IPS	Intermediate Pumping Station
MoWR	Ministry of Water Resources,
MLD	Million Liter Per Day
NRCP	National River Conservation Program
NGRBA	National Ganga River Basin Authority
NMCG	National Mission for Clean Ganga
NGO	Non-Government Organization
NOC	No Objection Certificate
PM	Particulate Matter
PPEs	Personal Protective Equipment
RD & GR	River Development and Ganga Rejuvenation
STP	Sewage Treatment Plant
SPS	Sewage Pumping Station
SPMG	State Program Management Group

# **ENVIRONMENTAL AND SOCIAL SAFEGUARD DUE DILLIGENCE FOR SEWERAGE AND STP SCHEME AT KANKARBAGH, BIHAR<sup>1</sup>**

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## **1.1 INTRODUCTION**

The Ganges has a long cultural and religious heritage, as also a deep historical bondage with the citizens of India. The river supports livelihoods of millions in the basin and also caters to their drinking water needs. Discharge of untreated sewage and industrial wastewater, non-point pollution sources from religious activities along the river, agricultural runoff as well as poor municipal solid waste management are the main causes of pollution in river Ganga.

Conservation and cleaning of river Ganga is a continuous and collective effort of Central and State Government, local bodies and general public. The first initiative commenced in 1985 under Ganga Action Plan (GAP) and extended to two phases over more than two decades. GAP-I completed in 2000 while GAP-II started in 1993. Later the programme was merged with National River Conservation Programme (NRCP). The Government of India (GoI) constituted the National Ganga River Basin Authority (NGRBA) on 20th February 2009, for the comprehensive management of the river. In 2014, the Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD & GR and GoI) have taken up an integrated and comprehensive approach towards Ganga Conservation Mission named “NamamiGange”. It envisaged as a flagship programme by integrating all the previous and currently ongoing initiatives by enhancing efficiency, extracting synergies and supplementing them with more comprehensive and better coordinated interventions. The NGRBA is implementing the program with financial assistance from The World Bank in five major states (Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal) along the main stem of Ganga.

Under NamamiGange programme a holistic approach has been adopted to clean the river. Under this program a major initiative has been taken to develop an adequate sewage treatment infrastructure in Patna to keep Ganga clean which will be implemented by Bihar Urban Infrastructure Development Corporation Ltd. (BUIDCO), a company owned by Government of Bihar (GoB) to implement and accelerate urban infrastructure projects in the State.

This report presents the major findings of the Environmental and Social safeguard due diligence exercise carried out for Sewerage and STP Scheme at Kankarbagh, following the principles of ESMF of NamamiGange.

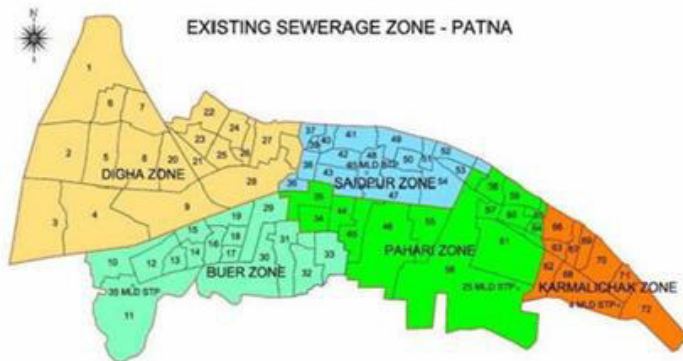
## **1.2 PROJECT DESCRIPTION**

Patna town is subdivided into six sewerage zones – Digha, Beur, Saidpur, Kankarbagh, Pahari and Karmalichak. It is estimated that the total waste-water generated in the town is 210 MLD. Around 20% of the city area of Patna Municipal Corporation has Sewerage Network. Out of 210 MLD, 50MLD is proposed to be treated under Kankarbagh Sewerage System. Kankarbag zone is created by taking part from Beur and Pahari zone. It is located at the central south part of the city. The Patna Gaya road and railway line runs along the western boundary of this zone. The northern margin of this zone is marked by the Eastern

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<sup>1</sup>This Environmental and Social Safeguards Due Diligence Report is prepared by the Safeguard Expert of Executing Agency BUIDCO with co-ordination from Safeguard Specialists of National Mission for Clean Ganga (NMCG).

Railway main line and the southern margin is bounded by the Badshahi canal.. Current population of this zone is about **2.1 lakh**. It covers an area of approximately 900 acres (Consisting of 11 ward numbers 29-35, 44-46 and 55).



**Figure 1: Existing Sewerage Zones of Patna City**



**Figure 2: Main Drain at Kankarbagh zone-Yogipur drain**

In Kankarbagh zone, one major drain i.e Yogipur drain of length 4.39 km and 2-3 small drains, carry the waste water/sewage and sullage which ultimately discharges into Punpun river. Previously, there was no separate STP for Kankarbagh zone. It was part of the Beur and Pahari zone therefore; the sewage flow from this zone was designed to route to the STPs of Beur and Pahari zone for treatment. This STP was constructed during Ganga Action Plan -II in 1994 at Pahari Village area under Pahari Sewerage Zone. The technology was based on Aerobic Lagoon type with 25 MLD treatment capacity. However, the system were not fully operational as they were treating only 10 MLD of sewage against designed capacity. Some of the reasons for lesser inflow are improper maintenance of the sewer network due to siltation, dumping of refuse, debris, damaged pipes & manholes etc.

Kankarbagh Zone is one of the highly populated and one of the core areas of the city. Population of this area have been projected to 277,227 for year 2020, 428820 for year 2035 and 663,310 for year 2050 respectively for final design for different design years.

### 1.3 DISCRIPTION OF PROJECT COMPONENT

The Proposed project system is designed for 30 years period. The following component is proposed in the DPR

- 2nos of Intermediate Pumping Station (IPS)
- 150km. Sewer Network
- RCC Effluent Channel:1.6km
- One STP (50MLD) with SBR technology
- O&M of Sewerage System for 15yrs.

In present proposal discharge from the drains will be collected in sump/pump house, to be pumped through Rising main up to treatment plant and treated effluent will be discharged through an RCC channel up to nala located at southern part of Pahari Zone & discharged ultimately to Punpun River or can be used for agriculture purpose after more treatment if required. As per DPR, the total cost of the proposed



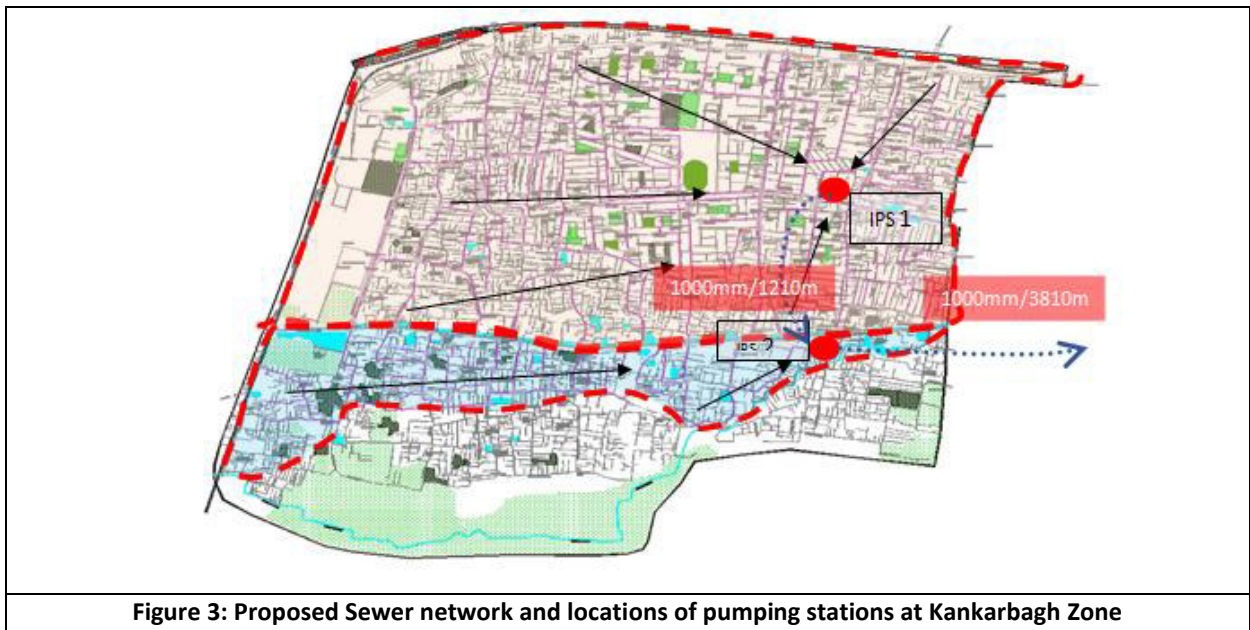
projects is estimated to be **Rs. 578.89 crore**. Schematic Map depicting the project locations is given in **Figure 33** and site photographs are given in **Figure 4 4** and

**Figure 5.**

#### **1.4 ENVIRONMENTAL AND SOCIAL PROFILE OF THE SUB-PROJECT AREAS**

Patna city is located on the south bank of river Ganga. The city has a very long river line surrounded on three sides by rivers – The Ganga, Sone, and Punpun. The geographical location of the Patna Urban Area is on southern bank of River Ganges at latitudes 25°35'34.62"N and longitudes 85° 8'12.51"E.

**Physiography & Soil:** Patna is located on the southern bank of river Ganga, above Mean sea level of 53m. Patna city is a part of the Indo Gangetic alluvium. The district forming a part of the flood plains of the Ganga has a monotonously flat relief. The region is underlain by alluvial sediments of quaternary age. The quaternary sediments are deposited unconformable on the Archaean basement. The district has mainly four types of soils ranging from moderately well drained to poorly drained, acidic to slightly alkaline and medium to heavy textured.



**Figure 3: Proposed Sewer network and locations of pumping stations at Kankarbagh Zone**



Figure 4: Site location for IPS 1 & 2

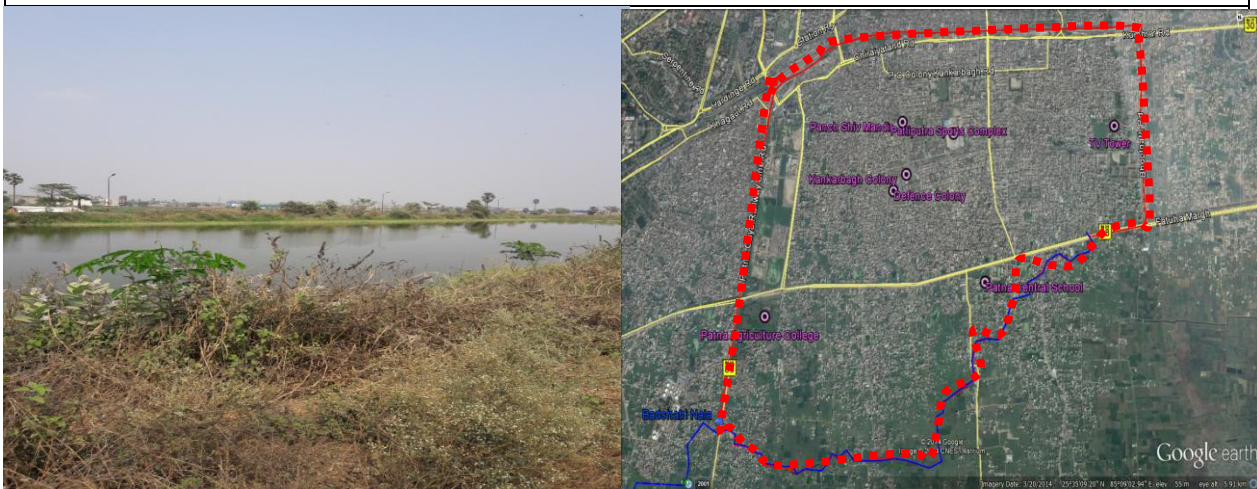


Figure 5: Location of STP- from Google Earth and actual Photograph of Site

**Seismicity:** As per seismic hazard map of Bihar, it has three earthquake hazard zones i.e. Zone V, Zone IV and Zone III. Patna district lie in seismic Zone IV. In consideration, special measures should be incorporated in designing of water / waste-water retaining structures. (Viz., Sewage lifting Station or Wastewater Treatment Plants, as per provision of the Code).

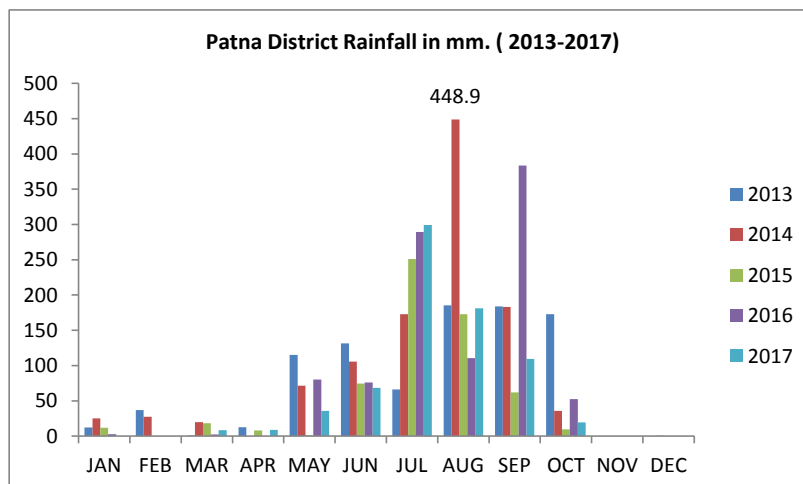
**Climate:**The climate is influenced by tropical type. The maximum temperature often exceeds 38.4 degree Celsius in month of May. The winter temperature falls below 9.3 degree Celsius. Maximum rainfall occurs during the monsoon in August by south west monsoon.



Figure 6: Map showing seismic Zones in Bihar

**Table 1: Maximum and Minimum Temperature Profile of Patna District**

Patna Mean Temperature °C (1951-2000)												
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Min.	9.3	11.6	16.4	22.1	25.1	26.7	26.1	26.1	25.3	21.6	14.8	10.1
Max.	23	26.1	32.4	37.4	38.4	36.7	32.9	32.5	32.2	31.7	28.9	24.6



**Figure 7: Patna District Rainfall Record (2013-2017)**

**Water:**The Surface water quality (as per data provided by SPCB) near to Kankarbagh Zone (Punpun River water quality near railway bridge)has been presented in ESAMP report. Inland Surface Water quality parameters such as BOD, COD, DO, TSS were observed within limit but Coliform pollution has been witnessed at higher level, it reflects the untreated sewage pollution in the River Punpun.

The groundwater potential is very high in this region. The aquifer character is mostly unconfined. The main source of supply of drinking water is Surface and Ground Water. The ground water table in the region varies from 2-5 m bgl (below ground level) during post monsoon and 5-10 m bgl during pre-monsoon.

**Air& Noise:** The ambient air quality and noise record in the project influence area (Collector ghat,Dr TN Banerjee Ghat,Gulvi ghat) are observed under permissible limit. However, the PM10 and PM2.5 level near collector ghat is found in the higher range, it may be due to the market activities and associated dust generation.

**Sensitive area:** None of the project area involves forest land, or is located close to any ecologically sensitive areas. No archeologically protected monument is located in close proximity. No issue related to indigenous people or involuntary resettlement is identified in the project. Detail baseline status of the project influence area is mentioned in ESMAP report.

**Socioeconomic Profile:** As per 2011 census, total population of Patna urban is 5,838,465 of which 1,684,222 lives within the municipality boundary. Table 2 presents the sex ratio of Patna Corporation area which is slightly less than the sex ratio of Patna district. At the same time, the literacy rate of the Corporation area is higher than the district. The work force participation rate of Patna Corporation area is 34% which is slightly less than the district level workforce participation rate (38%). Main workers in the Patna Corporation area constitute 84% of the working population. Among the main workers, the cultivators are the lowest in proportion (2%) whereas the other workers constitute the highest (89%).



Main workers constitute 73% of the working population at the district level. The composition of Scheduled Caste population in the Patna district is 16% against composition of 9% at the Corporation level.

**Table 2: Census Profile of Patna Municipal Corporation and Outgrowth**

District / Corporation	Population 2011	Sex Ratio	Literacy %	WPR%	Main worker (%)	Main Cultivat or workers	Main Agricultural workers	Main HH workers	Main other workers	% SC to Total Population
Patna (M Corp. + OG)	1684297	885	83.37	34	83.57	2.25	3.92	4.46	89.36	9.02
Patna District	5838465	896	70.68	38	72.87	16.17	29.15	4.18	50.50	15.77

Source: Census of India, 2011

## 1.5 THE DUE DILIGENCE PROCESS

The due diligence process was accomplished through detailed interactions with implementing agency, site visits and consultation with communities at site wherever feasible. Detailed Project Reports (DPR), and Environmental and Social Management Action Plan (ESMAP) are also reviewed.

## 1.6 ENVIRONMENTAL AND SOCIAL SAFEGUARDS DUE DILIGENCE – FINDINGS

### 1.6.1 Environmental and Social Assessment

BUIDCO has carried out detailed environmental and social assessments with the help of a Consultant (M/s GKW Consult) and the ESMAP is in place. The ESMAP includes detailed description of the project, screening and categorisation, regulations and legal framework, baseline environmental and socio-economic status, potential impacts in various stages (pre-construction, construction and operational stages), environmental and social management plans, institutional arrangements for monitoring and evaluation and grievance redress mechanism.

The E&S Screening shows that the project falls in 'low impact' category (please refer Annexure 1). The major outcomes of the screening are given under:

- The Sewerage and STP Scheme at Kankarbagh is neither located in any eco-sensitive area nor it is located in any adjoining eco-sensitive area.
- There is no land acquisition envisaged or involved in the project. The STP site is proposed in the existing STP site of Pahari STP which is presently belongs to Bihar Rajya Jal Parisad (BRJP). The pumping station lands also belongs to BRJP. The identified sites are free from any form of encroachments.
- The screening also reiterates that the project will not adversely affect the livelihood.
- The project will not have any adverse impact on the tribal population.
- The limited impacts likely to be on the environment are suggested to be mitigated by way of project specific environmental management plan.

### 1.6.2 Implementation Arrangement

Urban Development & Housing Department, Government of Bihar is functioning as the State Program Management Group (SPMG) for the implementation of NBRGA projects. Under the SPMG, Bihar Urban Infrastructure Development Company (BUIDCO) is functioning as the Executing Agency. The Sewerage

and STP Scheme at Kankarbagh will also be implemented under the same structure.

One Environmental Safeguard Official placed at SPMG is functioning as the focal point for environment and social safeguards. The Contract for implementing the Sewerage and STP Scheme at Kankarbagh is based on Hybrid Annuity Model.

### **1.6.3 Compliance to Regulatory Requirements**

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

- Consent to Establish (CTE) for the STP is mandatory to obtain under Water (Prevention and Control of Pollution) Act 1972 of Government of India.
- Permission for use of water for construction purpose from irrigation department/CGWA (for Surface or Ground Water) respectively.
- Labour license requires to be obtained by the Operator prior to construction.

### **1.6.4 Land Requirements**

The designated land identified for establishing various project components (STPs and Pumping Stations) belongs to Patna Municipal Corporation. There is no encroacher or squatter found in the designated land. Hence, the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 is not triggered. The STP at Kankarbagh requires a land of approximately 6 ha, whereas construction of two Intermediate Pumping Stations requires 35mx30m area of land respectively. The identified land for STP is situated in Pahari Village area at southern part of Patna situated in Pahari Sewerage Zone. In this location already a Lagoon type STP (25mld) exist which is planned to be upgraded to a 60 MLD STP under Pahari STP scheme already approved under Namami Gange programme. The rest of the land will be utilised for this Kankarbagh STP. The identified land for 2nos of pumping stations belongs to Govt land. Intermediate Pumping Station 1(IPS1) is proposed at Yogipur/Ganga Bhawan (Storm water pumping station campus, BRJP land) whereas another one (IPS2) is proposed near Khemini Chak & Ford Hospital (NH-98).

### **1.6.5 Construction & Occupational Health and Safety**

The Operator who will be procured for the project on Hybrid Annuity Model, is liable to develop a project specific EMP. The Operator should ensure that the following aspects are included and implemented on site, complying with the provisions given in ESMF:

- There are number of schools, colleges and hospitals situated in Kankarbagh. Due mitigation measures should be taken to reduce the disturbances to the educational / medical institutions located alongside the project locations at Kankarbagh, especially during the excavation works for laying of sewer pipes.
- Traffic Management Plan should be prepared for reducing traffic congestion and mitigating disturbances to public during the excavation works.
- Operator should adopt appropriate implementation mechanism for restoration of topsoil (to control soil disturbance), dust suppression, use of DG sets in acoustic enclosure with proper stack height (for betterment of Air), restoration of construction sites, etc.

- Appropriate training to be imparted to construction labourers regarding health and safety aspects. Operator should provide the workers with PPEs and they should be encouraged to consistently use the PPEs
- Proper civil work schedule should be in place and be included as part of EMP.
- Properly insulated electrical works should be provided at respective STPs and in construction sites elsewhere.
- Integration of adequate safety aspects (Protection rails along walk ways at height) in STP.
- Adhering to the monitoring and reporting of the environment Management Measure applicable to the construction stage wise.

#### **1.6.6 Stakeholder Consultations**

Local communities were consulted during the preparation stage of ESMAP, which included consultations with various community groups (slum dwellers, shop owners, rickshaw pullers, student/teacher community, local residents, etc.).

The project specific EMP to be prepared by the Operator should address respective suggestions provided by or feedback obtained from the local community during the preparatory stage consultations:

- Excavation works on roads should be done with proper planning in order to avoid or minimise the disturbance to local residents.
- Restoration of excavated roads/sites should be carried out on priority basis.
- Excessive amount of noise while during excavation works should be avoided.
- Appropriate measures should be adopted for dust suppression during construction works.
- Construction works should be regulated according to school timings, especially in adjacent areas of educational institutions.

#### **1.6.7 Grievance Redress Mechanism**

ESMAP suggests for establishing grievance redress cell (GRC) with dedicated project officer and system involving representative of EA and ULB, wherein respective Project Engineer at BUIDCO function as the Grievance Redress Officer, assisted by a representative of the Operator.

Operator should display the name and contact information of GRO at the project site and also disclosed on website of ULB, EA and SPMG. BUIDCO should coordinate with ULB for generating toll-free numbers and displayed in work sites for registering grievances.

### **1.7 FINDINGS OF GAP ANALYSIS**

As prescribed in the ESMF, a Gap Analysis with respect to major environment and social attributes has been done and the major observations are presented in Table 3:

**Table 3: GAP Analysis: Findings**

Sl.no.	Key Principles and Attributes	GAP	Remarks
1.	Assessment of environmental and social Impacts	Complied	<ul style="list-style-type: none"> <li>▪ BUIDCO has carried out detailed environmental and social assessments with the help of a Consultant (M/s GKW Consult) and the ESMAP is in place. The environmental and social screening categorises the project as having 'low impact'.</li> <li>▪ The project will be implemented under Hybrid Annuity Mode.</li> <li>▪ The project does not trigger EIA notification 2006 and RFCTLARR Act, 2013. The Duration of associated impact shall be during construction phase. This can be mitigated through proper project specific Environmental and Social Management Plan (ESMP) shall be prepared and implemented by the HAM Operator under the supervision of BUIDCO/Appointed project engineer.</li> </ul>
2.	Implementation of Mitigation and Management Measures	To be complied during construction and operation stages	The HAM Operator to be procured on Hybrid Annuity Model is mandated to prepare the project specific EMP.
3.	Principle of Avoidance	Complied	Analysis of alternative is provided in the ESMAP. Location and siting of feasible location are detailed out in ESMAP.
4.	Linkages with other projects	Not Applicable	Kankarbagh is a separate sewerage zone of Patna. There is no linkage of projects. The STP site is merged at the Pahari STP site. The Kankarbagh STP will also be constructed at the existing Pahari STP site. The land is a Govt. land and belongs to BRJP.
5.	Involuntary restriction of access to legally designated parks and protected areas	Not Applicable	All the sub project components are planned within government land; there is no involvement of any designated parks and protected areas.
6.	Recognition of untitled persons such as squatters and encroachers including customary rights	Complied	As described in ESMAP, the identified land for establishing various project components belong to Bihar Rajya Jal Parisad i,e Govt land. There are no encroachers or squatters exist within the identified land.
<b>Planning</b>			
1.	Threshold for Resettlement Plan (RP)	Not Applicable	The project does not trigger land acquisition and hence do not require any resettlement plan
2.	Need to replace / restore CPRs	Not Applicable	The project does not have any impact on CPRs
3.	Participation of local people in project planning	Complied	Consultation with local residents and various stakeholder groups are conducted during planning stage.
4.	Cut-off date	Not Applicable	The project neither triggers land acquisition nor have any adverse impact on livelihood or on encroacher and squatters.
5.	Definition of a family for R&R assistance	Not Applicable	
6.	Need and scope of census and socio-economic surveys	Not Applicable	
7.	Compensation	Not Applicable	



Sl.no.	Key Principles and Attributes	GAP	Remarks
<b>Resettlement Assistance</b>			
1.	Cash assistance over and above compensation	Not Applicable	The project neither triggers land acquisition nor have any adverse impact on livelihood or on encroacher and squatters.
2.	Assistance to poorest of the poor or vulnerable category of people	Not Applicable	
3.	Provision of infrastructure and public services at resettlement sites	Not Applicable	
<b>Implementation</b>			
1.	Implementation of RP	Not Applicable	The project neither triggers land acquisition nor have any adverse impact on livelihood or on encroacher and squatters.
2.	Participation of civil society in implementation of RP	Not Applicable	
3.	Opportunity for PAPs to participate in planning, design and implementation	Not Applicable	
4.	Disclosure of Resettlement Plan	Not Applicable	
<b>Grievance Redressal Mechanism</b>			
1.	Procedure for dispute resolution and appeals	Complied	<ul style="list-style-type: none"> <li>▪ ESMAP suggests for establishing grievance redress cell (GRC) with dedicated project officer and system involving representative of EA and ULB, wherein respective Project Engineer at BUIDCO function as the Grievance Redress Officer, assisted by a representative of the Operator.</li> <li>▪ Operator should display the name and contact information of GRO at the project site and also disclosed on website of ULB, EA and SPMG. BUIDCO should coordinate with ULB for generating toll-free numbers and displayed in work sites for registering grievances</li> </ul>
2.	Composition of Grievance Redress Committee		
3.	Participation of representative of PAPs and civil society		
<b>Monitoring</b>			
1.	Independent monitoring	Complied	ESMF provides for independent environment and social compliance monitoring / audit by third party inspection agency for each of the sub projects. ESMAP should be accordingly amended for implementation.
2.	Periodic evaluation and monitoring	Complied	Internal Monitoring framework provided in ESMAP should be updated to include parameters such as, formation of GRC, site specific restoration of excavated roads/construction sites, dust pollution, greenery maintenance along the periphery of project site, environmental monitoring (air, noise, soil, water) and inclusion of project specific EMP in the Bid / Contract Document.

## **1.8 RECOMMENDATIONS**

BUIDCO has carried out detailed environmental and social assessments with the help of a Consultant (M/s GKW Consult) and the ESMAP is in place. The environmental and social screening categorises the project as having 'low impact'.

The project does not trigger EIA notification 2006 and RFCTLARR Act, 2013. The Duration of associated impact shall be during construction phase. This can be mitigated through proper project specific Environmental and Social Management Plan (ESMP) prepared and implemented by the Operator under the supervision of BUIDCO.

Based on the findings of due diligence exercise, the following recommendations are provided with an objective to ensure compliance with the ESMF:

### **Design and Planning Aspects**

- Consent to Establish under Water (prevention and Control of pollution) Act. 1972 shall be obtained for the establishment of Sewage Treatment Plant, as this needs to be obtained prior to start of construction work.
- Consent conditions shall be complied with and compliance report shall be submitted periodically to the Bihar State Pollution Control Board.
- A detailed project specific EMP requires to be prepared by the Operator during the project execution/operation stages and should obtain approval from NMCG and the World Bank (ESMAP along with Compliance Report prepared complying with the provisions of ESMF is provided in Annexure 2).
- The EMP once approved by the NMCG and World Bank should be integrated in the Bid/Contract documents, with necessary amendments (if necessary) or agreements with the Operator, and should be fully complied during the execution/operation stages.
- Periodic progress reporting (monthly, quarterly and yearly) requires to be done by the Operator, and the frequency of submission to EA/SPMG should be mentioned in the EMP.
- Tree plantation along with landscaping around the STP is advised in order to improve the aesthetic value and also to control bad odour.
- Permission for tree felling (if any) should be obtained from the Forest Department.
- Permission for use of water for construction purpose from irrigation department/CGWA (for Surface or Ground Water) respectively.
- Labour license requires to be obtained by Operator prior to construction.
- Pollution under Control Certificate should be obtained for Construction Vehicles.
- Earth materials should be procured from approved / licensed quarries.
- Higher capacity DG sets should be complied with CPCB norms, adequate Stack Height and Acoustic Measure should be mandated.
- Formal Intimation to line department to be given regarding excavation works in order to avoid or minimise the damages to existing utilities in the construction site.
- The Sewerage lines are planned beneath the existing road, so an alternative traffic management plan, diversion plan or avoidance to congestion plan should be in place.
- Independent Environment and Social/Compliance Monitoring Audit by the third party independent inspection agency should be carried out annually, as per the ESMF requirements of NGRBA program.

## Design and operational specific

- Appropriate sludge management plan should be in place. Sludge generated from the 50MLD STP should be disposed in designated places without causing difficulty to public life.
- Specific site needs to be identified for intermittent storage of waste from SPS and STP sites. A preliminary site for intermittent storage of waste from SPS and STP has been planned at Beria chak site which is about 4-5 km away from the STP site. Operator should also explore an alternate site before commencing the construction works.
- Consideration should be given for constructing garland drain around the site with small opening intermittently in the boundary wall allowing rainwater to drain-off without accumulating in the adjacent residential areas.
- Excavated materials should be used for backfilling of the trench area, low lying areas of the site.
- Efficient site restoration measure should be developed and checked regularly by assigned engineer to avoid the public and traffic inconvenience.
- Maintenance of Site health (Air, water, Noise, Soil Quality) and safety of worker (OHS) should be checked regularly.
- No Land Acquisition is involved. Identified site is either in existing campus of sewerage system or on govt. Land. Independent Environment and Social/Compliance Monitoring Audit by the third party independent inspection agency as prescribed in the ESMF shall be carried out to understand the process of direct purchase of land.
- Advance notice to local residents / shop owners and vendors to avoid inconvenience to vendors/squatters shall be given.
- BUIDCO shall adopt the public relation activities to disseminate the necessary information about the project like (i) announcement on FM radio, (II) space in local newspaper, (III) printing and distributing pamphlets through local newspaper vendors, and (IV) putting up information boards at construction site.
- BUIDCO through the operator should ensure (i) adequate safety measures during construction, (ii) ensure uninterrupted access to residences and shops, (iii) sprinkle water to control dust, and (iv) restoration of sites without delay.
- Local community should be consulted before commencement of works at respective locations; this should be organized through awareness campaigns and disclosure of information related to the project components.
- EA (BUIDCo) is advised to hire services of local NGO/CBO for information dissemination and public consultation.
- It is required for EA (BUIDCo) to establish district specific grievance redress mechanism for the subproject as outlined in ESMF to address the grievances of the community and designate Grievance Redressal officer. Apart from that, a separate register shall be maintained by the Operator in weekly meetings to address the Grievances (if any discussed and resolved). If the matter will not be resolved in weekly meeting, it will be forwarded to higher level for decision.

## 1.9 IMPLEMENTATION SCHEDULE AND RESPONSIBILITY

Table 4 presents the implementation schedule, responsibilities and respective time frame.

**Table 4: Implementation Schedule and Associated Responsibilities**

Sl. No.	Action	Responsibility	Time-Frame
<b>ENVIRONMENT SAFEGUARD</b>			

1.	Prepare EMP & incorporate in Contract.	BUIDCo/SPMG	ESDDR and ESMAP along with Compliance Report has been enclosed in Annexure-2. Detailed ESMP shall be prepared by the HAM operator and obtain approval of NMCG and World Bank before the effective date.
2.	Obtain 'Consent' from State Pollution control Board for establishment and operation of STP	BUIDCo/SPMG/HAM operator	Immediate and ensure that work began after receiving the Consent.
3.	Initiate implementation of the recommended measures(presented in sect. 1.8)	BUIDCo/SPMG	Throughout the project period
<b>DETAILED ENVIRONMENTAL MANAGEMENT PLAN</b>			
4.	Prepare detailed ESMP& part of contract and obtain the approval of NMCG/ Word Bank.	HAM Operator	Within 3 months
5.	Implementation of detailed ESMP and ESHS guidelines as per the bid document and approval of NMCG/World Bank	Ham Operator	Throughout the project period to be implemented by the HAM operator and supervised by the project engineer and then by BUIDCo and SPMG.
<b>SOCIAL SAFEGUARD</b>			
6.	Hire NGO/CBO for information dissemination	Operator	Immediate / Prior to Disbursement of retroactive claim under the project
7.	Prepare IEC material	Operator	One Month after Action no 5
8.	Establish GRC	BUIDCO	Immediate / Prior to Disbursement of retroactive claim under the project
9.	Designate Grievance Officer	BUIDCO	Immediate
10.	Information dissemination	Operator	Continuous after Action 6
11.	In- Country disclosure of this DDR	BUIDCO	Immediate



# ANNEXURE-1

## Environmental & Social Screening and Categorization

Environmental and Social Information Format for Screening			
<b>Project Title:</b>		<b>Comprehensive Wastewater Management Programme Town: Patna (Kankarbagh Zone)</b>	
<b>Implementing Agency:</b>		<b>Bihar Urban Infrastructure Corporation Ltd.</b>	
<b>Project Cost:</b>		<b>578.89 Crore</b>	
<b>Project Components:</b>		<ul style="list-style-type: none"> <li><b>2 nos of Intermediate Pumping Station (IPS)</b></li> <li><b>150km Sewer Network</b></li> <li><b>RCC effluent channel:1.6km</b></li> <li><b>One STP (50MLD) with SBR technology</b></li> <li><b>O&amp;M of sewerage system for 15yrs.</b></li> </ul>	
<b>Project Location:</b>		<b>Kankarbagh Zone ,Patna</b>	

Sl. No.	Screening Criteria	Assessment of Category (High/ low)	Remarks /Explanatory note for categorization
<b>1</b>	Is the project in an eco-sensitive area or adjoining an eco-sensitive area? (Yes/No) If Yes, which is the area? Elaborate impact accordingly.	No impact	Patna is not located near any eco-sensitive area and there is no such area within 100 kms.
<b>2</b>	Will the project create significant/ limited/ no social impacts?	No Impact	There will be no land acquisition required for the project. New STP will be developed in the premise of existing STP land.
	Land acquisition resulting in loss of income from agricultural land, plantation or other existing land-use.	No Impact	STP at Kankarbagh will be constructed on present Pahari STP site, therefore no land acquisition or tree cutting is required.
	Land acquisition resulting in relocation of households.	No Impact	Not Applicable
	Any reduction of access to traditional and river dependent communities (to river and areas where they earn for their primary or substantial livelihood).	No Impact	Not Applicable
	Any displacement or adverse impact on tribal settlement(s).	No Impact	No land acquisition or relocation of settlement is required.
	Any specific gender issues.	No Impact	No gender issues observed/raised in the public consultation. .
<b>3</b>	Will the project create significant / limited / no environmental impacts during the construction stage? (significant/limited/ no impacts)	Low and short term Impact	The STP is going to be constructed on present STP site. Therefore, there is only limited environmental impact.

			<p>The proposed lifting stations will be constructed in the open areas which will minimise the impact</p> <p>The proposed sewer line will be under the road with minimum 3m or more road width.</p>
	Clearance of vegetation/ tree-cover	Low Impact	No major tree cutting is required.
	Direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials adversely affecting water quality and flow regimes.	Low and short term impact	<p>No such major construction. The STP will be SBR type prefabricated units with minimal civil works.</p> <p>The laying of sewer lines will not produce any significant amount of waste. Laying will cause some traffic disruption of temporary nature. Sensitive locations like schools, hospitals will have special problems which will be taken care of during construction.</p>
	Flooding of adjacent areas	Low Impact	<p>Dewatering for construction will not generate significant amount of water to flood adjacent areas</p> <p>Back-up power system has been proposed in the pumping stations so that it will not create flooding in case of power failure.</p>
	Improper storage and handling of substances leading to contamination of soil and water	Low and short term impact	No such material will be used which may contaminate or create pollution.
	Elevated noise and dust emission	Low and short term impact	<p>Proper measure will be taken during sewer lying to minimise the noise and dust emissions.</p> <p>The contractor has to submit the method statement to comply with Air Act, 1981 &amp; Noise Rules as per EP Act, 1986 before construction.</p>
	Disruption to traffic movements	Low and short term Impact	Proper diversion of traffic will ensure less disruption during construction.
	Damage to existing infrastructure, public utilities, amenities etc.	Low and short term Impact	Utility mapping of the existing infrastructure and relocation of the same if required will minimise the damage on existing infrastructure.
	Failure to restore temporary construction sites	Low and short term Impact	The roads will be reinstated to its original conditions after lying of sewer line.

	Possible conflicts with and/or disruption to local community	No impact	The local community will be made aware of the temporary nature of disruption.
	Health risks due to unhygienic conditions at workers' camps	Low Impact	Adequate sanitation facilities and safety arrangement will be provided to the workers to tackle on-site hazards.
	Safety hazards during construction	Low and short term Impact	Proper health and safety statement will be submitted by the contractor and approved by The Engineer prior to the construction.
<b>4</b>	Will the project create significant / limited / no environmental impacts during the operational stage? (Significant / limited / no impacts)	Limited	STP will have minimal odour and noise pollution.
	Flooding of adjacent areas	Low Impact	Back-up power for the pumping stations will ensure minimum flooding and odour nuisance in case of power failure. Properly designed sewer line will minimise the impact on environment.
	Impacts to water quality due to effluent discharge	Low Impact	The characteristics of the treated waste water from FAB reactor will be within limit set by CPCB/MoEF.
	Gas emissions	Low Impact	SBR is a compact system and the possibility of the Gas emission is very less.
	Safety hazards	Low Impact	Mechanised system and trained people will be used to run the Pumping stations and STPs will reduce the risk of safety hazards
<b>5</b>	Do projects of this nature / type require prior environmental clearance either from the MOEF or from a relevant state Government department? (MOEF/ relevant State Government department/ No clearance at all)	No clearance required	The project is not an environmental sensitive project and does not require clearance as Environmental Impact Assessment Notification 14th Sep-2006
<b>6</b>	Does the project involve any prior clearance from the MOEF or State Forest department for either the conversion of forest land or for tree-cutting? (Yes/ No). If yes, which?	No clearance required	No
<b>Overall Assessment</b>		Low	



# ANNEXURE-2

**(ESMAP with Compliance Report)**

### Compliance on the Comments of NMCG

Comments of NMCG	Reply of Consultant
1. The executive summary also needs to include the summarized EMP and Public Consultation details.	EMP (pg iv-vi) and Public consultation(pg iii) included in the summary
2. Section 1.1, 1.2 and 1.3 to be clubbed as a single section as Namami Gange initiate. The NGRBA programme is now a subset of the Namami Gange programme. Unnecessary items like in section 1.2 and 1.3 may be deleted.	Changes have been done as per suggestion
3. Section 1.4, do we really need to refer the Environment and Social Management framework here? What is being meant to say here is not clear.	This section has been deleted to eliminate confusion.
4. There need to be one section on need of project.	Section (1.2/ pg. 2) added as per suggestion
5. Then another section on need of preparing ESAMP report for the project.	Section (1.3/pg 2-3)added as per suggestion
6. The structure of the report should mention the chapter name and then only define the content. Here the baseline status of Kankarbagh zone is needed to be captured nor the entire PMC. Consultant should adjust scope accordingly.	Structure of the report has been revised (pg 3).
7. There is no mention for a section on analysis of alternatives. It is very important and needed.	Mentioned, detail section has been included under Chapter 6, section 6.2
8. There need to be a section on conclusion and recommendation.	Section added as per suggestion under Chapter 9
9. Section 2.1. Instead of mentioning Patna Municipal Corporation we may say Patna city and should be supported by some photographs. But this should be a very brief description. Then the description should concentrate on Kankarbagh zone.	The name has been changed, photographs included. Description of Kankarbagh zone has been given along with photograph (pg. 5-6)
10. The chapter 2 is written in too brief manner. The details of the project along with zone maps etc. may be taken from the DPR and	This chapter has been revised as per suggestions.

Comments of NMCG	Reply of Consultant
included in this chapter to enrich it.	
11. Also care must be taken to provide description specific for the sewerage zone instead of entire Patna.	Consultant has tried to give specific description as per information available.
12. The construction methodology to be adopted is required to be given in the report along with the implementation schedule.	Section added( 2.5) as per suggestion
13. The updated project cost must be included.	Section added (2.6) as per suggestion
14. Chapter-3: The screening table must give the sl. No. as per our ESMF framework and at the end of the table the overall impact category should be defined.	Screening table has revised.
15. Introduce the Environment, Health Safety and Social polices of World Bank in some of the section.	Section added (4.6) as per suggestion
16. Chapter4: The applicable rules given in the table is not exhaustive kindly make it exhaustive.	The table has been revised
17. The forest rights act need to be included.	Included as per suggestion
18. Other applicable rules and regulations should include	All other applicable rules and regulations have been included as per suggestions.
19. Baseline Chapter5: The Air and Water quality data seems not generated in the Kankarbagh zone. The same need to be generated or sourced from secondary sources and to be given in the report. The report must also include the noise quality data and soil quality data. The data presently provided do not give any kind of source. Further there need to be specific write up on the geology, seismicity, physiographical features, flora, fauna etc. Currently the write up is very scanty and do not provide necessary information.	Consultant has tried to give maximum zone specific data as available.
20. Impact Chapters: Impact chapter must mention the generic and specific impacts from the various construction aspects and construction methodologies both for the	Both generic and specific impacts have been mentioned



Comments of NMCG	Reply of Consultant
construction and operation stage.	
21. Section 7.2: Table 13, a flow chart of responsibility to be developed. The current table may be deleted. The Hybrid annuity aspect to be introduced. The STP will be on Hybrid Annuity mode and Sewerage network on DBOT mode.	Flow chart has been given under 8.1 (pg 70). Others have been revised as per suggestions
22. EMP: The 1st item is STP and then why in bracket (Trunk sewer line is written?). Also the responsible agency for the STP case is the concessionaire while for the network it would be the DBOT operator.	Revised as per suggestion.
23. There is no environmental monitoring plan provided. Please include.	Included under 7.3 (pg 92)
24. Also a chapter on Social Management Plan to be included.	Social management plan has been added under Chapter 8
25. All the land details for the STP and IPS to be given along with plan and NOC from BUIDCo.	Consultant has informed that, all the NOC will be given by BUIDCO during final submission of report.
26. A chapter on public consultation carried out during the project with photographs (with date) to be given and signature of the representatives present to be included.	Photographic evidence of public consultation has been given in Annexure IV.

## **Preparation of Detailed Project Report on Sewerage for Kankarbagh Zone of Patna, Bihar-Comprehensive Waste Water Management, Digha and Kankarbagh**

**Client:** Bihar Urban Infrastructure Development Corporation Ltd. (BUIDCo), Govt. of Bihar

Report no.: 23-35-00027\_FDPR\_SEW\_08\_R3

Submitted: February 18, 2018



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# **FINAL DETAILED PROJECT REPORT**

## **(Comprehensive Wasterwater Management)**

**Programme Town: Patna (Kankarbagh Zone)**

### **(Environment and Social Assessment Management Plan)**

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## LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AAQ	Ambient Air Quality
AOI	Aeration of Interest
BOD	Biochemical Oxygen Demand
BUIDCO	Bihar Urban Infrastructure Development Corporation Ltd
BPL	Below Poverty Level
CPWD	Central Public Works Department
CDP	City Development Plan
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organisation
CSP	City Sanitation Plan
CW	Civil Works
CGWB	Central Ground water Board
DBO	Design, Build & Operate
DFID	Department for International Development
DO	Dissolved Oxygen
DPR	Detailed Project Report
EA	Execution Agency
EMP	Environmental Management Plan
ESMF	Environmental and Social Management Framework
E&M	Electrical & Mechanical
FR	Feasibility Report
GAP	Ganga Action Plan
GoB	Government of Bihar
GoI	Government of India
GPD	Ganga Project Directorate
IPS	Intermediate Pumping station
I&D	Interception & Diversion
lpcd	Liter per capita per day
MLD	Million Litres per Day
MoEF	Ministry of Environment & Forests
MoUD	Ministry of Urban Development
MPS	Main Pumping Station
NGRBA	National Ganga River Basin Authority
NRCD	National River Conservation Directorate



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NRCP	National River Conservation Plan
NGRBP	National Ganga River Basin Project
NMCG	National Mission for Clean Ganga
NH	National Highway
O&M	Operation and Maintenance
SBR	Sequential Batch Reactor
SPCB	State Pollution Control Board
SPMU	State Project Monitoring Unit
SPUR	Support Programme for Urban Reforms
STP	Sewage Treatment Plant
SWM	Solid Waste Management
SPCB	State Pollution Control Board
SPMG	Strategic Pricing Management Group
SLB	Service Level Benchmark
ULB	Urban Local Bodies

## **EXECUTIVE SUMMARY**

### **Introduction**

River Ganga possesses significant economic, environmental, and cultural values in India. Rising from the Himalayas and flowing into the Bay of Bengal, the river traverses a course of more than 2,500 km through the plains of northern and eastern India. However increasing population in the basin and haphazard urbanization and industrial growth has significantly impacted the water quality of River Ganga, particularly during the dry seasons. The primary sources of pollution are untreated sewage and industrial wastewater.

Conservation and cleaning of river Ganga is a continuous and collective effort of Central and State Govt, local bodies and general public. The first initiative in this regard commenced in 1985 under Ganga Action Plan (GAP) and extended to two phases over more than two decades. GAP-I completed in 2000 and GAP-II started in 1993. Later the programme was merged with National River Conservation Programme (NRCP). The Government of India (GoI) constituted the National Ganga River Basin Authority (NGRBA) on 20<sup>th</sup> February 2009, for the comprehensive management of the river. In 2014, the Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD & GR, GoI) has taken up an integrated and comprehensive approach towards Ganga Conservation Mission named “Namami Gange”. It envisaged as a flagship programme by integrating all the previous and currently ongoing initiatives by enhancing efficiency, extracting synergies and supplementing them with more comprehensive and better coordinated interventions. NGRBA has been dissolved with effect from 7<sup>th</sup> October, 2016 consequently under National Council for Rejuvenation, Protection and Management of River Ganga (referred as National Ganga Council) vide notification no. S.O.3187 dt. 07/10/2016 under EPA 1986. Under Namami Gange programme a holistic approach has been adopted to clean the river.

The first Sewage Treatment Plant (STP) in Patna was constructed in 1936. The city has partial sewerage system, only 20 percent of PMC area. This system is pretty old and a major part of the system is chocked and do not function properly. In Absence of a proper functioning wastewater disposal system in entire area of Patna city has resulted in disposal of wastewater including both effluents from septic tanks and sullage, being discharged into the city drains, which are mostly open and finally terminates into receiving river, Ganga. Therefore there is an urgent need in the city to establish a functional sewerage system as early as possible.

### **Project Description**

This zone is named after the Kankarbagh Colony which was Asia's largest colony during 1960s. Kankarbagh zone is created by taking part from Beur and Pahari zone. It is located at the central south part of the city. The Patna Gaya road and railway line runs along the western boundary of this zone. The northern margin of this zone is marked by the Eastern Railway main line and the southern margin is bounded by the Badshahi canal. For the proposed Sewerage system, 2 No. Sewage pumping station have been proposed to allow wastewater collected from one area to STP. The design capacity of the proposed STP is 50 Mld. SBR is selected as preferred treatment technology for the said STP. BUIDCO has agreed to extend a land measuring approx. 6 Hectares at Pahari Village area at southern part of Patna situated in Pahari Sewerage Zone for

construction of new STP. In this location already a Lagoon type STP (25mld) exist which is planned to upgrade into 97mld (SBR). The rest of the land will be utilised for this Kankarbagh STP.

### **Approach and Methodology**

The approach to the ESAMP preparation has been a mix of technical as well as participatory exercise. It is based on an initial Environmental and Social screening of Patna city. The project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. The extent of assessment required to identify and mitigate the impacts largely depends upon the complexities of project activities. The details of screening criteria are given in Chapter 3 (Table3.2). The screening conclusions indicate that the kankarbagh zone is not located near any eco-sensitive area. Further the proposed project will not involve any compulsory acquisition of land or displacement of any indigenous people. Hence it can be categorised as a “Low” impact project.

### **Regulations and Legal Framework**

The national, state and local environmental and social regulatory requirements that are applicable to the investments proposed are given in this section. The proposed scheme involves construction of STP, pumping station and sewerage network these require to follow the Water Act and SPCB clearance prior to constructions. The following laws and regulations are applicable to the environmental and social aspects of the investments implemented under this programme:

- Policy and Regulatory Framework of Government of India (GoI)
- Environmental Policy and Regulations of the respective State Governments
- Legislations applicable to construction activities
- Applicable laws and regulations related to social act
- World Bank operational policy
- Other legislations related to construction activities etc.

### **Baseline Status**

Patna is the capital of Bihar. It is the second largest city in eastern India after Kolkata. It is a densely populated and fast growing city. It comprises of 72 municipal wards. The Patna Municipal Corporation (PMC) covers an area of 100 sq. km with population of 16.83 lacs as per 2011 census.

The city is located on southern bank of river Ganga. The city has a very long river line surrounded on three sides by rivers – Ganga, Sone, and Punpun. The area does not depict any undulations in terrain. The city has an average elevation of 53 meters. The climate is influenced by tropical type. Maximum rainfall occurs during the monsoon in July and August. The city forms part of Indo-Gangetic alluvial plains and has fertile soil. The soil permits fast percolation of rain water, since that the ground water table in the region vary from 2-5 m bgl (below ground level) during post monsoon and 5-10 m during pre-monsoon.

The detail of surface and ground water profile, air quality, noise, solid waste management, flora and fauna are described under this chapter.

### **Environmental and Social Impacts**

The proposed scheme has environmental and social impacts during constructions of STP, pumping station and sewerage network. A detailed assessment of potential environmental and social impacts of the project, with proper highlight of the issues and their effective mitigation measures that has been or has to be considered during the design, construction and operation of the project are addressed under this section.

Such as, air quality of the project area could be affected during the construction phase as well as during the operational phase by temporary increase in level of suspended solid particles and other minute particles from the construction activity and the construction material. The Residual impact will not be significant however it will have a short term adverse impact on the residents which will be taken care of by proper mitigation measures.

Noise may be generated from different stages of the construction works. Water quality will be impacted during construction phase due to suspended solids runoff from excavation sites and spoil heaps and from dewatering of trenches and foundations, when water containing high concentration of suspended solids may be discharged to water courses. A large proportion of the soil material that will be excavated during the construction phase may create some hazard to daily life. Workers need to be mindful of the occupational hazards which can arise from working in trenches and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures.

Traffic congestion will be caused by pipeline laying which may cause temporary inconvenience to residents, commercial operations and institutions.

### **Public Consultation**

It is a process in the project cycle in which an attempt is made to involve the public (stakeholders) in project preparation through consultation, focus group discussion, meeting etc. It is an integral part of the social assessment process which not only minimizes the risks and unwanted situation but also removes the gap between the community and the project formulators leading to timely completion of the project and make it successful and user friendly. The key stakeholders were local community, women group, vegetable seller, rickshaw puller, slum dwellers etc. the major outcome from the consultations are following:

- All the participants welcomed the project and agreed to take participation during implementation
- There will be no livelihood loss, no displacement of indigenous people.
- The vendor group were admitted temporary disruption in their business, but they were willing to co-operate in the project activity.
- Traffic congestions can be avoided by adaption of diversion etc.

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## **Environmental Management Plan**

The Environment Management Plan (EMP) is required to mitigate issues raised during implementation of the scheme. The DBO Operator shall have prime responsibility to adhere the EMP. The broadly summarized EMP as follows:

<b>ACTIVITY</b>	<b>Potential Impact/Concern</b>	<b>Duration of impact</b>	<b>Mitigation Measures</b>	<b>Responsible agency</b>
<b>Construction of STP, Pumping Stations</b>				
New STP will be constructed at existing STP site.	Discharge of untreated sewage from the existing STP.	Temporary/short term	The existing STP shall not be demolished till alternate arrangement for treatment made functional.	Concessionaire
Untreated water disposal into nearby stream.	Same as above	Long term	The concessionaire will ensure no discharge of untreated sewage into river. They will also ensure that the treated water quality shall comply with the prescribed standards.	
Breakdown of STP	Same as above	Temporary/short term	Provision of adequate holding capacity storage of sewage to prevent flow of untreated sewage to river.	
Flooding due to rain water run-off.	Same as above	Temporary/short term	Suitable drainage provision should be incorporated for diversion of rain water likely to be accumulated from peripheral catchment area of STP to natural drainage stream or area.	
Sludge disposal		Long term	Efficient sludge dewatering with minimum land involvement shall be adopted.  Provision shall be made for intermittent storage of digested sludge at STP site.  The digested sludge shall be utilised as manure or disposed to the priorly approved disposal site.	
Location of the site	Noise/Odour/fly nuisance	Long term	Ensure minimum noise generation at pumping station and STP site located near	

<b>ACTIVITY</b>	<b>Potential Impact/Concern</b>	<b>Duration of impact</b>	<b>Mitigation Measures</b>	<b>Responsible agency</b>
	hazards to neighbouring area		<p>schools, hospitals area.</p> <p>Sufficient tree plantation (at least two rows) around the periphery of STP site.</p> <p>Landscaping will be done to prevent spread of bad odour with large canopy/broad leaves trees will be planted.</p>	
Safety of labours, workers, operators etc.	Accidents leading to injury or death of workers, fire, exposure to toxic gas	Long term	<p>Ensure adequate provision of Handrails on both sides of walkways close to deeper tanks and STPs.</p> <p>All electric switches and panels should have adequate protection from rain water. Proper earthing will be done to prevent short circuiting.</p> <p>Ensure proper safety and emergency arrangements.</p>	
<b>Sewer network</b>				
Sewer line leakage/damage	Water pollution and possibility of mixing with water supply line	Temporary/short term	Regular monitoring of sewer line manhole leakages/ overflows. Immediate action shall be taken off to plug the restore sewer and other utility services if damaged leakages.	DBO operator

## **Cost Estimate**

Indicative Cost estimates for ESAM Plan (including Environmental Monitoring for construction and operation phases) has been presented below:

<b>Component</b>	<b>(INR)</b>
Cost of ESAMP (including Environmental Monitoring for construction and operation phases)	2.43 Crore



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## **CHAPTER 1: INTRODUCTION**

### **1.1 Namami Gange Initiative**

River Ganga possess significant environmental, cultural, religious and economical values along with deep historical bondage with citizens of India. The river supports livelihoods of millions in the basin and also caters to their fresh water needs. Despite its importance, extreme pollution pressures from increasing population and industrialization pose a great threat to the biodiversity and environmental sustainability of the Ganga, with detrimental effects on both the quantity and quality of its flows. Discharge of untreated sewage and industrial wastewater, non-point pollution sources from religious activities along the river, agricultural runoff as well as poor municipal solid waste management are the main causes of pollution in river Ganga.

Conservation and cleaning of river Ganga is a continuous and collective effort of Central and State Govt, local bodies and general public. The first initiative commenced in 1985 under Ganga Action Plan (GAP) and extended to two phases over more than two decades. GAP-I completed in 2000 while GAP-II started in 1993. Later the programme was merged with National River Conservation Programme (NRCP). The Government of India (GoI.) constituted the National Ganga River Basin Authority (NGRBA) on 20<sup>th</sup> February 2009, for the comprehensive management of the river. In 2014, the Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD & GR and GoI) has taken up an integrated and comprehensive approach towards Ganga Conservation Mission named “Namami Gange”. It envisaged as a flagship programme by integrating all the previous and currently ongoing initiatives by enhancing efficiency, extracting synergies and supplementing them with more comprehensive and better coordinated interventions. NGRBA has been dissolved with effect from 7<sup>th</sup> October, 2016 consequently under National Council for Rejuvenation, Protection and Management of River Ganga (referred as National Ganga Council) vide notification no. S.O.3187 dt. 07/10/2016 under EPA 1986.

Under Namami Gange programme a holistic approach has been adopted to clean the river. The various kind of pollution abatement schemes taken up for this initiative can be categorized into core and non-chore schemes. Core schemes include interception and Diversion (I&D) of sewerage discharging into river Ganga and creating treatment facilities for this intercepted sewage. Under Core scheme till 20<sup>th</sup> March, 2017 total 145 projects are sanctioned with an estimated cost of Rs. 10,730.71 crore.

Bihar Urban Infrastructure Development Corporation Ltd. (BUIDCO) is a Flagship company formed in 2009 owned by Govt. of Bihar (GoB) to implement and accelerate urban infrastructure projects in the State. As a major step taken to develop adequate sewage treatment infrastructure in Patna to keep Ganga clean, an

initiative has been taken up under Namami Gange programme. For this purpose, Patna city is subdivided into six sewerage zones – Digha, Beur, Saidpur, Kankarbagh, Pahari and Karmali Chak.

## **1.2 Need of the Project**

Bihar is an important state from the perspective of river Ganga as a total of 445 km (almost 18%) of its total length of 2525 kms flow through the state. The length of Ganga River flowing adjacent to Patna is around 30 kms. According to CPCB Bulletin (vol 1, July, 2016), the existing sewage treatment capacity in Ganga basin is 1230.7 MLD against the total generation of 4973.81 MLD. Therefore, only 25% of the total generated sewage can be treated in the existing STPs. Field survey revealed that, the installed treatment plants are not running on their design capacities due to following reasons:

- Less inflow of sewage from sewer network due to improper repair and maintenance and siltation
- Choking of pipeline due to dumping of refuse and debris in manhole
- Power shortage
- Shortage of skilled and unskilled labour and
- Paucity of funds.

The prevailing Sewerage system is inadequate and is at the point of breakdown. The city has an open combined system to carry both the dry weather flow and storm water and ultimately terminates into receiving river Ganga. It left enormous detrimental effect on overall City Sanitation especially during the monsoons. The drains overflow causing wastewater to remain stagnant for a considerable period in the low-lying areas of the town.

Therefore to provide better living conditions, health and personal hygiene of the people by increasing access of more people to safe sewage disposal and reduce frequency of occurrence of water and wastewater related diseases and mortality rate it is urgently needed to upgrade the existing Sewerage infrastructure of the area.

## **1.3 Need of preparing Environment and Social Management Framework for the Project**

Given the distributed nature of investments in multiple states, the investments under the program may entail environmental and social impacts. The environment and social framework is intended to help manage the social and environmental impacts through appropriate measures during the planning, design, construction and operation phases of various investments. The framework identified the adverse environment and social impacts and provide specific guidance on the policies and procedures to be followed for environmental and social assessment along with roles and responsibilities of the implementing agencies.

In this perspective, a detailed assessment of the environmental and social impacts of the project, with proper highlight of the issues and their effective mitigation measures that has been or has to be considered during the design, construction and operation of the project in will be provided. This will lead to the development of the Environmental and Social Impact Mitigation Plan which would provide the mitigation measures and the associated costs.

The Environmental and Social Impact Mitigation Plan will also associate with it the Communication and Public Outreach Plan and the Governance and Accountability Action Plan for strengthening both the components of Namami Gange Programme.

The specific objectives of this ESAMP report are:

- ✓ To reduce environmental impact/ health problems caused by open discharge of domestic wastewater
- ✓ To ensure that river Ganga is not polluted which is a priority of the state and central government
- ✓ To ensure whether final treated effluent adhering to latest discharge norms by CPCB

#### **1.4 The structure of the Report**

The detailed project report of Kankarbagh zone is being prepared by GKW Consult GmbH. The structure of the report will be as follows:

- In **Introduction** (Chapter 1) the initiative taken for Namami Gange project has defined along with the need of the project and need of preparation of ESAMP report for this project
- In **Project Description** (Chapter 2) a brief description of Patna city and Kankarbagh zone has given. It also describe the existing system and Proposed Sewerage Project.
- In **Approach and Methodology** (Chapter 3) the approached adopted towards the preparation of ESAMF starting from Screening and Categorisation has been narrated.
- In **Regulation and Legal Framework** (Chapter 4) various applicable laws and regulatory frameworks of state and national level related to Environmental and Social aspects as well as applicable World bank Operational Policies has been narrated.
- In **Baseline status** (Chapter 5) the baseline scenario of Patna city (Kankarbagh zone) in terms of geophysical, environmental and social features are narrated.
- In **Environmental and Social Impacts** (Chapter 6) the potential impacts caused by different project activities are elaborates (environmental and social) along with analysis of alternatives.
- In **Environmental Management Plan** (Chapter 7) the impacts specific mitigation measures are suggested. It also include the ESAMP costing.
- In **Social Management Plan** (Chapter 8) the impact specific mitigation measures are suggested.
- **Institutional Arrangement for Monitoring and Evaluation** (Chapter 9)
- **Conclusion and Recommendation** (Chapter 10)

## **CHAPTER 2: PROJECT DESCRIPTION**

### **2.1 About Patna City**

Patna is the capital of Bihar and is the second largest urban centre in eastern India, after Kolkata. It is Located at 25°20'North Latitude and 85°03'East Longitude. It is one of the oldest inhabited places in India. Ancient Patna, known as Pataliputra was founded in 490 BC by the king of Magadha. Throughout the history, Pataliputra was recognized as the capital by different rulers. The city is growing and expanding at a fast pace in terms of population, economics, business, and education. Patna Municipal Corporation is divided into 72 wards and extends over an area of approximately 100 km<sup>2</sup>. The city is well-connected with other major cities of India via roads, rails and air. The city is surrounded by three rivers - the Ganga on the northern side, the Punpun on the southern side and the Sone on the western side. Some of the important landmarks of Patna city is given in the picture below.



Patna International Airport



Patna Railway Junction



Mahabir temple

Chiraiyatand railways bridge patna

**Table 2.1 : Key information on Patna**

Established	490 BC
Area	100sqkms
Population	16,84,222 (census 2011)
Slum Population	77034 (census 2011)
No. of Wards	72
Nearest Highway	Patna is connected by national highway NH-2, 30 and 31

Source: CDP, Patna Municipal Corporation

### **2.1.1 Kankarbagh Zone**

Kankarbagh is one of the largest colonies of Asia established in 1916. The word Kankarbagh means garden of kankar (stone chips). It is an adjacent residential area in Patna. Area under this zone is around 900 acres. The zone is marked by Bhagalpur-Patna Road and railway line on west, Bhootnath Road on east, Eastern Railway main line on north and Badshahi nala on south. Kankarbagh Circle covers 11 Wards of Patna Municipal Corporation (ward number 29-35, 44-46 and 55). Some of famous landmarks at this zone are Panch Shiv Mandir, TV Tower in Bhootnath Road and Kumhrar or Kumrahar. Kumrahar is the remains of the ancient city of Pataliputra, located 5 km of east from Patna Junction railway station, on Kankarbagh Main Road.

The main area covered under this circle is New By-Pass road area, Kankarbagh road area, Chiraiyatad railways bridge area, Gandhi setu road area and Saidpur area. There are several Multi-Speciality Hospitals, bank and schools spread throughout the area. This zone is divided into sector wise and there are several children parks. Some popular parks are - Kumhrar Park, Shivaji Park and Lohia Nagar park etc. There is a sports complex also in this colony, known as Patliputra Sports Complex. Kankarbagh Sabzi Mandi (near auto stand) is the largest wholesale fruit, vegetable and fish market in this area. Other popular vegetable markets are Rajendra Nagar Sabzi mandi, Gandhi Nagar Sabzi mandi and Bhootnath Rd Sabzi mandi. Some of the famous landmarks in this zone are given below.





Patliputra Sports Complex



Malahi Pakdi Chowk, Kankarbagh

## **2.2 Existing Sewerage Facility in Patna**

Patna city has only a partial sewerage system which covering only 20 percent of total PMC area. The first Sewage Treatment Plant (STP) in the city was constructed in 1936. At present there are 4 nos. of STPs serving for whole city. There are five sewerage zones identified by PMC namely Digha, Beur, Saidpur, Pahari and Karmalichak. The locations of the existing STPs are under Saidpur, Beur, Pahari and Karmalichak zone.

The areas which are partially sewerage are Rajendra Nagar, Kankarbagh colony, Gardanibagh, Govt. residential and official areas etc. Sewerage system of these areas is pretty old and major part of the system is chocked and do not function properly. Under Ganga Action Plan (Phase-I), Interception and diversion (I&D) were constructed to intercept the major outfalls of the city namely Kurjee, Rajapur, Mandiri, Ananta Ghat, Krishna Ghat etc. and divert the wastewater to four sewage treatment plants. Nearly 78 kms of I&D sewers have been laid under GAP (Phase-2). The I&D sewers were not constructed for internal sewerage system to collect the municipal sewage from houses. In order to divert the untreated wastewater from outfalls to 6 I&D pumping station and 6 numbers of intermediate pumping stations (IPS) had been constructed at that time. In Absence of a proper wastewater disposal system in entire area of Patna town has resulted in generation of wastes, including both effluents from septic tanks and sullage, being discharged into the city drains, which are mostly open at present and ultimately terminates to the receiving river Ganga. Thus the Drainage network of the town has become an open combined system having enormous detrimental effect on overall city sanitation especially during the monsoons. The drains overflow causing wastewater to remain stagnant for a considerable period in the low-lying areas of the town.

The total length of road network in Patna town is about 1421 km and total length of pucca covered drains is about 460 km, which is coming to about 16.18% coverage of storm water drainage network. The drainage system of Patna town was laid about 200 years back and drains are in bad condition. The system comprises hierarchy of natural and man-made drains that ultimately discharge surface run off and sewage to River Ganga and Punpun. Natural nalas are the main carriers of the storm water. The existing Patna drainage system has 9 major, 6 medium and many minor drains. The details of major, medium drains are shown below :

**Table 2.2: Details of Major Drains of Patna City**

	Name of Drain	Length (In Kms)
1	Serpentine	7.00
2	Rajapur – Anandpuri Drain	1.58
3	Patel Nagar Drain	1.00
4	Mandiri Drain	1.68
5	Bakarganj	15.00
6	Kurjee	6.90
7	Saidpur	6.58
8	Srikrishnapuri Drain	4.60
9	Yogipur Drain – Belongs to Kankarbagh Zone	4.39

### **2.2.1 Status of existing STP in Kankarbagh zone**

Previously, there was no separate STP for Kankarbagh zone. The STP was constructed during Ganga Action Plan -II in 1994 at Pahari Village area under Pahari Sewerage Zone. The technology was based on Aerobic Lagoon type with 25 MLD treatment capacity. However, the system were not fully operational as they were treating only 10 MLD of sewage against designed capacity. Some of the reasons for lesser inflow are improper maintenance of the sewer network due to siltation, dumping of refuse, debris, damaged pipes & manholes etc.

Further the existing STP served for very few households which have central sewerage system facilities available. The sewer network are essentially the sanitary sewers and do not carry sullage (waste water) in the sewage system. These facts indicate that besides the complete sullage, the existing drains are carrying bulk of sewage discharge also.

It is noteworthy that at most of the places/ localities, all households are discharging their sewage/ sullage through open drains into the nallas. Discharge of sullage/ sewage into the drain causes septic condition resulting in foul odour and fly nuisance making the surrounding highly unhygienic. The system become

worsen during monsoon, when the same infrastructure is serving for dual purpose i.e. as sewers and drains.

### **2.3 Justification of the project for pollution abatement of river Ganga**

The CPCB has identified large number of polluted stretches along the entire course of River Ganga and its tributaries. The Ganga river under Patna Municipal Corporation (PMC) in Patna district of Bihar has been identified as one of the pollution contributing stretches by the Central Pollution control Board.

The rationale behind pollution abatement for Ganga is justified on account of following points:

- Patna, is the most populous urban area in Patna District of Bihar, with an estimated population of 16.8 Lakhs(2011). It is estimated that the total waste-water generated in the town is 210 Mld, of which a significant 80% and more gets discharged into the Ganga. The existing open drainage channels of Patna accommodates and transports the DWF flows and discharges to into the Ganga. The water quality in the drainage network as well as receiving river segments is unacceptable as per specified CPCB water quality standard.
- The DWF generated from domestic/commercial units is directly connected to the open Town Drainage Channels via road side surface drains making those as combined facilities and in turn converges to the receiving rivulet Ganga and pollutes the same which in turn causes considerable qualitative deterioration of the River Ganga. Thus, Improvement in the water quality of Ganga is one of mission objectives under this project.
- The Ganga river is used for bathing purposes as also serves the religious festivities during Chat puja. With significant discharges of untreated wastewater from the drains being directly discharged into the river, the health aspects of the people who directly use the river are severely compromised.
- The water supply requirements of the town of Patna and its adjoining towns is ground water. However, with large scale abstraction of ground water, it is anticipated that ground water levels will decline sooner than anticipated. Improvement in river water quality is essential to preserve the river flows and also to use them for potable drinking water purposes.

It is noteworthy that the benefits of an improved Sanitation can only be realized through provision of potable water, comprehensive wastewater management facilities including plugging the non point sources of pollution (like Low Cost Sanitation units / Community toilets / Crematorium / Dhobi Ghats etc) to eliminate open defecation, effective interception and diversion of drains, including piped drainage and or Sewerage system. This would also aid in improved health and better living conditions of the local people and aid in realizing the Millenium development goal of converting the town into an open defecation free town, with 100% safe disposal of Sanitary wastes.



## 2.4 Description of the Proposed Sewerage Project

This zone is named after the Kankarbagh Colony which was Asia's largest colony formed during 1960s. Kankarbagh zone is created by taking part from Beur and Pahari zone. It is located at the central south part of the city. The Patna Gaya road and railway line runs along the western boundary of this zone. The northern margin of this zone is marked by the Eastern Railway main line and the southern margin is bounded by the Badshahi canal.

Previously there was no specific STP for this zone. It was previously part of the Beur and Pahari zone therefore, the sewage flow from this zone was designed to route to the STPs of Beur and Pahari zone for treatment. The proposed Sewerage system will include 1 no. STP and 2 No. of Sewage PS which will allow to collect wastewater from entire area to the new STP. The design capacity of the proposed STP is 60 Mld. SBR is selected as preferred treatment technology for the said STP. BUIDCO has agreed to extend a land measuring approx. 6 Hectares at Pahari Village area at southern part of Patna situated in Pahari Sewerage Zone. In this location already a Lagoon type STP (25mld) exist which is planning to upgrade up to 97mld (SBR). The rest of the land will be utilised for this Kankarbagh STP. The figure given below is showing the outline of catchment area under this zone.



Figure 2.1: Kankarbagh Zone of Patna

According to proposed Sewerage zonation, the ward number 29-35, 44-45 lies in this zone. This zone has historical importance as the remains of the ancient city of Pataliputra has been excavated 5 km east of Patna Junction railway station, on Kankarbagh Main Road. The major landmarks at Kankarbagh are Panch Shiv Mandir, TV Tower in Bhootnath Road and Patliputra Sports Complex etc. Today, this area is developing into an uptown area with expanding and soaring residential apartments.

#### 2.4.1 Design periods for various components

The year of expected commissioning of the project is anticipated to be 2020. Considering the same as the base year, various components of the Sewerage scheme has been modelled and sized as per designated Design Periods. The components of this period are given below.

**Table 2.3: Design period and Design Years**

Sl. Nos	Component	Design Period (Yrs)	Base Year	Design Year	Remarks
1	Land acquisition for STPs	30	2020	2050	Land will be required to add STP modules later. Accordingly, land should be acquired
2	Sewerage Network	30	2020	2050	Cost of civil works is economical for full design period.
3	Sewage Pumping stations (Civil works)	30	2020	2050	
4	Sewage Pumping stations (Electro-mechanical works)	15	2020	2035	Considering the Expected life of electrical and mechanical components.
5	STPs	15	2020	2035	Construction may be done with a modular approach in a phased manner as the population grows.
6	Rising mains	30	2020	2050	In case of low velocities, dual rising mains to be examined
7	Effluent Disposal and Utilities	30	2020	2050	Provision of design capacities in the initial stages itself is economical

#### 2.4.2 Effluent Standards

In general there are three effluent Standard available from different manual i.e. CPHEEO, NGRBA & CPCB. Consultant has selected effluent Standards prescribed by CPCB, Ministry of Environment, Government of India & it has been also recommended by CPHEEO in latest manual. All mentioned standard are given below:

**Table 2.4: Effluent Standards (NRCD)**

Parameters	Effluent Standards for Discharge into Water Bodies		Effluent Standards for Discharge on Land
	Existing Standards	Revised Standards on 3.02.2010	
pH	5.5 – 9.0		
BOD (mg/L)	30	20	100
TSS (mg/L)	50	30	200
Faecal	Desirable – 1,000		Desirable – 1,000

Parameters	Effluent Standards for Discharge into Water Bodies		Effluent Standards for Discharge on Land
	Existing Standards	Revised Standards on 3.02.2010	
Coliforms (MPN/100 ml)	Permissible – 10,000		Permissible – 10,000

As per CPCB latest update about effluent standard recommends:

- a. BOD not exceeding 10 mg/L,
- b. SS not exceeding 20 mg/L,
- c. Total Nitrogen as N not exceeding 10 mg/L,
- d. Dissolved Phosphorous as P not exceeding 2 mg/L and
- e. Faecal coliforms not exceeding 100 MPN / 100 ml.

Hence CPCB updated Effluent Standard has been adopted & tabulated below

**Table 2.5: Effluent Standard (CPCB)**

No	Characteristics	Standards			
		Inland Surface Water	Public Sewers, (A)	Land for Irrigation	Marine Coastal Areas
1	Colour and odour	(B)		(B)	(B)
2	SS	100	600	200	(C), (D)
3	Particle size of SS	(E)	-	-	(F), (G)
4	pH value	5.5 to 9.0			
5	Temperature	(H)	-	-	(H)
6	Oil and grease	10	20	10	10
7	Total residual chlorine	1.0	-	-	1.0
8	Ammoniacal nitrogen (as N)	50	50	-	50
9	Total Kjeldahl Nitrogen, (TKN) (as N)	100	-	-	100
10	Free ammonia (as NH <sub>3</sub> )	5.0	-	-	5.0
11	Biochemical Oxygen Demand	30	350	100	100
12	Chemical Oxygen Demand	250	-	-	250
13	Arsenic (as As)	0.2			
14	Mercury (as Hg)	0.01	0.01	-	0.01
15	Lead (as Pb)	0.1	1.0	-	2.0
16	Cadmium (as Cd)	2.0	1.0	-	2.0
17	Hexavalent Chromium (as Cr 6+)	0.1	2.0	-	1.0
18	Total Chromium (as Cr)	2.0	2.0	-	2.0
19	Copper (as Cu)	3.0	3.0	-	3.0
20	Zinc (as Zn)	5.0	15.0	-	15.0
21	Selenium (as Se)	0.05	0.05	-	0.05
22	Nickel (as Ni)	3.0	3.0	-	5.0
23	Cyanide (as CN)	0.2	2.0	0.2	0.2
24	Fluoride (as F)	2.0	15.0	-	15.0
25	Dissolved phosphates (as P)	5.0	-	-	-
26	Sulphide (as S)	2.0	-	-	5.0
27	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH)	1.0	5.0	-	5.0
	Radioactive materials				
28	Alpha emitters, micro curie/L	10 <sup>-7</sup>	10 <sup>-7</sup>	10 <sup>-8</sup>	10 <sup>-7</sup>
	Beta emitters, micro curie/L	10 <sup>-6</sup>	10 <sup>-6</sup>	10 <sup>-7</sup>	10 <sup>-6</sup>
29	Bio-assay test	(I)			
30	Manganese (as Mn),	2.0	2.0	-	2.0
31	Iron (as Fe),	3.0	3.0	-	3.0
32	Vanadium (as V),	0.2	0.2	-	0.2
33	Nitrate Nitrogen (as N),	10.0	-	-	20.0
34.	Faecal Coliform, MPN/100 ml for discharge	onto land		into water	
		(J)	(K)	(J)	(K)
		1,000	10,000	1,000	10,000

Table 2.6:  
Standards  
2013)

Effluent  
(CPHEEO

Sl. No.	Parameters	Parameters Limit (Standards for New STPs Design after notification date) *
1.	pH	6.5-9.0
2.	BOD (mg/l)	Not more than 10
3.	COD (mg/l)	Not more than 50
4.	TSS (mg/l)	Not more than 20
5.	NH <sub>4</sub> -N (mg/l)	Not more than 5
6.	N-total (mg/l)	Not more than 10
7.	Fecal Coliform (MPN/100ml)	Less than 100
<p>Note:</p> <p>(i) These standards will be applicable for discharge in water resources as well as for land disposal. The standards for Fecal Coliform may not be applied for use of treated sewage in industrial purposes.</p> <p>(ii) * Achievements of Standards for existing STPs within 05 years from the date of notification.</p>		

### 2.4.3 Population Projection for various Design Years

The areas under Patna Municipal Corporation is forming a part of the proposed project. The Municipal limits of PMC form part of Patna Urban Agglomeration Area (PUAA). The PMC boundaries cover an area of 100 sq. km with the present population of 16.83 lacs as per 2011 census, whereas the PUAA covers an area of 146.16 sq. km and has a population of 20.47 lacs. The city is developing rapidly as a commercial hub of Bihar.

Based on the census data for the last 5 decades, the population has been projected with decadal growth rate and average growth rate.

Table 2.7: Decadal Population for Patna town

Year	Population	Increment	Decade Rate	Growth	Average
1961	364,594				37.05
1971	475,300	110,706	30.36		
1981	813,963	338,663	71.25		
1991	956,417	142,454	17.50		
2001	1,366,444	410,027	42.87		
2011	1,684,222	317,778	23.26		

Table 2.8: Adopted Population for Patna Town

Year	2015	2020	2030	2035	2050
Adopted Method (Graphical Method)	1859242	2099640	2725656	3139730	4999170

#### 2.4.4 Ward wise Population projection for Kankarbagh Zone

Ward wise Population projection for various design years for Kankarbagh Zone is given below.

**Table 2.9: Kankarbagh Zone Ward Wise Population Projection**

Ward Wise Population Projection KankarBagh					
Ward No.	Area in hectare	Population 2011	Projected Population		
			2020	2035	2050
29	147.40	24863	34808	59541	97220
30 (part 50% )	94.40	19674	25509	43634	71246
31	117.10	39768	51563	54141	88404
32	102.40	25516	33084	56591	92405
33	29.60	17564	18442	18983	19540
34	79.90	17294	22423	38356	62629
35	68.40	18996	24630	42131	43367
44	163.10	22333	31266	78166	127631
45	84.20	27381	35502	37277	60868
	886.50	213389	277227	428820	663310

#### 2.4.5 Floating Population of the town

We have already mentioned that, Patna is a capital of Bihar state and so many people, from within state or other state, are coming and staying at city due their job, education etc. Patna also recognised as a centre of a Tourism. As per recent trend, Patna is one of the fastest growing city in India in term of Infrastructural development. Some of the renowned Institutes of India like AIIMS, IIT have been setup to enhance the education system of the city and thus would attract people of outskirt to sustain good quality life.

So In addition to the resident population, the Consultant has considered 15% of total population as a floating population as suggested by client during discussion on DPR meeting, to arrive at the final design population of the Zone.

**Table 2.10: Floating Population for Town**

Description	Projected Population		
	2020	2035	2050
Census population	277227	428820	663310
Floating Population @15% of	41584	64323	99497

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Projected population			
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#### 2.4.6 Contributing Population in Different Design Years

The Contributory Population of each Zone with flow has given below

**Table 2.11: Projected Contributing Population for Kankarbagh**

Sewerage Zone	Ward Details	Design Population			
		2020	2030	2035	2050
Kankarbagh	29,30(part),31 to 35, 44 & 45	277227	370791	428820	663310
	Total Population including Considering 15% floating Population	318811	426410	493143	762807

#### 2.4.7 Suggestive Treatment Units and linkages

The Treatment Plant Shall has the following major Treatment Units:

1. Inlet Chamber
2. Mechanical Fine Screen Channels
3. Mechanical Grit removal facility
4. SBR Process Units (With Air blower)
5. Chlorine Contact Tank
6. Sludge Sump cum pump House
7. Centrifuge

#### 2.4.8 Design Consideration for proposed project

##### Proposal for Sewerage Main

As earlier stated Kankarbagh being highly influential dense populated area of Patna city need a special care and during design and construction. All major area like Kankarbagh colony, Tilak Nagar, New Chitragupt Nagar, Rajendra Nagar, Lohiya Nagar, karbigahiya, Chiriyatalpur, Indranagar Bank colony, Ram Krishna Nagar, Bhupati Nagar, Amardeep Nagar, Ashok Nagar, Khemni chak, Yogipur Gaon are considered into design. To design of sewer network and make a proper distribution layout due existing and natural topography, Kankarbagh Zone has been further subdivided in to two sub zones.

The main/ Trunk network has been designed in view of that it would cater all major area. Proposed one major line which is covering PC Colony, Pateker Nagar, LIC colony coming from northern side of zone to IPS 1 by PC colony Kankarbagh road. Another main line proposed towards Rampekha Path to Hanuman Nagar to cater east Indira Nagar, Hanuman Nagar, Bankman colony etc. and discharged to IPS 1 at Hanuman nagar near existing Yagipur PS. For eastern part of Zone, a main line staring from Janakpur bus stop to IPS 1 has been proposed via Postal park road, Buddha Marg road to cater Mithapur, Budha Marg, Chiriyatand, Khas



mahal, sports complex etc. which are major influential area of Kankarbagh Zone. Accumulated waste water further diverted to IPS 2 near Ford hospital via Pumping main.

For other zone of Kankarbagh, all major area like Ramkrishna nagar, Madhuban colony Jaganpura etc. has been covered by trunk main and discharged into IPS 2. Further it has been carried to STP via Rising main

Layout of trunk sewers, sub-mains, branches and laterals shall be hydraulically configured with gravity flow concept. Sewers will be configured keeping the crowns continuous. Hydraulic Design of the Sewerage network for each district has been carried out separately in **Sewer-gems**. Summary details of the Sewerage districts including details of sewer lengths and depths are dealt below:

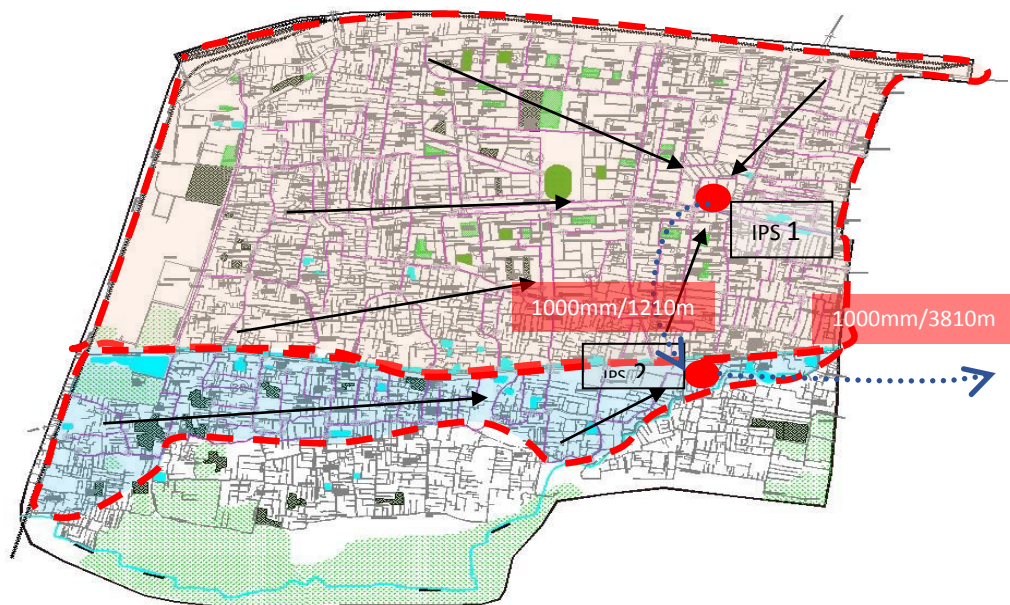


Figure 2.2: Network Kankarbagh Zones

**Minimum diameter for sewer network is proposed as:**

- 500 mm and above (RCC NP3 Pipes)
- 200 mm to 400mm (DwC PE Pipe)

Recommended velocity of flow through pipe: Maximum velocity (non-scouring) considered as 3.0 m/sec and self-cleansing of 0.6 m/sec for initial peak flow (2020) and 0.8 m/sec for ultimate peak flow as per clause 3.15.1 of CPHEEO manual. However, frequent flushing of Network has been proposed where minimum velocity has failed to achieve.

### Laying of Pipelines below sub-soil water Table

The ground water table in Patna varies from 6m -8m on an average below the ground level. The ground water table rises to around 4m during the monsoon. In the low-lying areas and the areas close to the Ganga, the ground water table is in the range of 3m - 4m below the ground level.

The maximum depth of the sewer line is limited to a maximum depth of 8.0m for Kankarbagh, to avoid / eliminate the need for additional pumping station and in effect, the additional expenditure in Operation and maintenance costs. The maximum depth considered seems logical in view of the higher sub-soil water table. However, the laying of pipe lines below sub-soil ground water shall be carried out with adequate measures to prevent caving of surrounding earth / soil. Provision for shoring has been contemplated (Timber shoring has been considered to be done for laying of sewers lines for depths upto 4.5m and Sheet piling for laying of sewer pipes below 4.5m in the estimates) and the technical requirement so that the sidewalls of earth are protected.

### Pumping Station

For the suggestive system, Sewage PS has been proposed to allow wastewater collected from one area to STP. Accordingly 2 Nos of Sewage PS for Kankarbagh Zone has been proposed.

Based on the Dry Weather flows for the intermediate Design year of 2035, the pump capacities have been arrived. Submersible sewage pumps have been proposed, considering the economy both in terms of capital cost and in terms of operation and maintenance costs. Summary details of pumps for the intermediate design year are presented below:

**Table 2.12: Capacity and Number of Pumps**

Description	Unit	IPS -1	IPS -2
Design Peak Flow (2035) =	LPS	1035.57	1269.22
	MLD	89.5	109.7
	m <sup>3</sup> /h	3728	4569
Average Flow (2035) =	m <sup>3</sup> /h	1657	2031
No. of working pumps for peak time =	nos.	2	2
No. of standby pumps for Peak Time (50% standby) =	nos.	1	1
No. of working pumps for lean time =	nos.	1	1
No. of standby pumps for lean Time (100% standby) =	nos.	1	1
Required Rating of each Pump for Peak flow	KW	127.00	366.00

Required Rating of each Pump for Lean flow	KW	56.00	162.00
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### Details of Land required and available for PS

An assessment of the Land requirements for the proposed Pumping Stations is presented below:

**Table 2.13: Land Required for PS**

ID of SPS	Land Requirements	Well Diameter	Location	Remarks
IPS 1	35m x 30m	14.0m	At Yogipur/Ganga Bhawan	Govt. Land Available
IPS 2	35m x 30m	16.0m	Near Khemini Chak & Ford Hospital (NH-98)	Govt. Land Available

### 2.4.9 Sewage Pumping Station (STP)

Lean, average, and peak flows are taken into consideration for optimum selection of pumping system. The symbiosis of pump characteristics of different pumps with various sizes of compatible force mains and corresponding power consumption, power efficiency zone, will be meticulously analysed to arrive for the most economical alternatives of pumping system and rising main under the perspective of designated pump operating points. Construction cost of pump house over collection pit is reduced making the same cost-effective. Provision of lifting/hoisting device with monorail arrangement at a requisite height above the sump shall be included for installation and necessary O&M of the pumping units.

Consideration of minimum velocity of 0.80 m/sec shall be the criteria for design of rising main. Hydraulic retention time (minimum) of the sump for the pumping station shall be taken as 3.75 minutes of peak flow.

### Capacity of STP

The projected wastewater flows pertaining to the various Design Years for the suggestive Sewerage Scheme for a per capita supply of 150 Lpcd is presented below:

**Table 2.14: Wastewater Generated and STP Capacity required in Design Years**

Sewerage Zone	Area (Sq. Km)	Ward Details	Design Population		
			2020	2035	2050
Kankarbagh		29,30(part), 31 to 35, 44 & 45	277227	428820	663310
Flow Generation taking 135 lpcd (MLD)			29.94	46.31	71.64
Floating Population @15% of designed population			41584	64323	99497
Flow Generation taking 45 lpcd for floating population (MLD)			1.50	2.32	3.58
Infiltration for 150km in MLD (taking 2500lit/Km/day)			0.38	0.38	0.38

Total (MLD)	31.82	49.01	75.60
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### Modular Approach for Construction of STP

The design of the proposed Sewerage system is for a period of 30 years (i.e. up-till 2050). However, the capacity of the Sewage Treatment Plant is proposed to be constructed for the design year 2035 (i.e. an initial fifteen year period as per CPHEEO Guideline) considering resource constraints and optimum utilization of assets.

- Initial Design Capacity for 2035 for sewerage : 50 MLD
- Ultimate Design Capacity for 2050 : 76 MLD
- Additional augmentation in 2035 : 26 MLD

Thus based on the derived capacities, the Treatment Plant capacity for intermediate phase is 50 mld & additional augmentation of 26 MLD for the Design year of 2050, so that ultimate capacity will be 76 MLD collectively for sewerage project only.

### Location and Availability of Land for STP

The BUIDCO has agreed to extend a land measuring approx. 6 Hectares at Pahari Village area at southern part of Patna situated in Pahari Sewerage Zone. In this location already a Lagoon type STP (25mld) exist which is planning to upgrade up to 97mld (SBR). So rest land will be utilised for Kankarbagh STP.

### Calculations of land required / to be acquired

The Sewage Treatment Plant is to be constructed for the year **2035**; however, it is proposed to acquire the land for the year **2050** for future expansion. The details of the land requirement for present as well as for the future expansion are shown below:

**Table 2.14: Present Land Required for STP**

Year	Capacity of STP (Mld)	Land Required (Ha.)	Land Available (Ha.)	Additional Land Required (Ha.)
2035	50	2.75	6	-
2050	76	4.18	6	-

Thus, no land is required for construction of the STP for the initial phase & Future augmentation.

#### 2.4.10 Justification for selection of technology (SBR)

The Life Cycle Cost analysis clearly illustrates that although a number of technologies can effectively work, the land requirement becomes the main guiding factor for the selection of the most suitable technology.

Accordingly it is observed that only SBR system can only accommodated within the available land demarcated for STP in the ULB. Further acquisition of land in the Municipal Corporation is almost impossible because of the following-

- Large piece of land is absolutely scarce
- Land cost is very high because of many reasons
- Some government lands are available but already allotted for some other purposes.

Hence, amongst the alternatives SBR is the most feasible alternative for sewage treatment, since availability of land for STP(s) is the single most deterring factor, ultimately guiding the final selection of the proposed technology. Also this technology ensures that the latest CPHEEO guidelines for effluent quality i.e. BOD < 10 mg/l are met adequately.

That the plant that can be optimally accommodated within the existing available land extended by the ULB for the purpose shall be adopted irrespective of the higher energy requirement perspective. Hence, from the above Techno-commercial evaluation and with special emphasis on socio-environmental aspects clearly suggests for the SBR Technology for final adoption.

#### **2.4.11 Characteristics of Raw sewage**

The existing drainage channels in Kankarbagh have medium levels of BOD and Suspended Solids. The average TSS from wastewater samples collected from drains is in the region of 170mg/ l and the BOD value is under 100 mg/ l.

However, based on the experience gained from similar projects under Ganga Action plan, it is noted that the normative values of parameters like BOD and SS taken from field investigations need to be carefully established in designing of the Treatment Plants.

In continuation, a more moderate value of 250 mg/l BOD has been considered in process design for the Treatment Plants. The value of Total Suspended Solids however has been considered at 300 mg/l.

#### **2.4.12 Characteristics of Treated Effluent**

The following effluent standards as prescribed by the CPCB have been adopted for evaluating treatment units and their sizes:

**Table 2.15: Effluent Standards prescribed by CPCB, Government of India**

<b>Parameters</b>	<b>Effluent Standards prescribed by CPCB</b>
pH	6.5 – 9.0
BOD (mg/l)	<= 20
SS (mg/l)	<= 50
Faecal	Desirable

Parameters	Effluent Standards prescribed by CPCB
Coliform (MPN/100 MI)	<1000

#### 2.4.13 Disposal of Treated Effluent

The effluent from the Sewage Treatment Plant will be discharged through an RCC channel up to nala located at southern part of Pahari Zone & discharged ultimately to Punpun River. The size of channel of the effluent line against ultimate flow (2050) of 92 MLD is given below.

**Table 2.16: Details of Effluent Channel (Tobe changed after Final Design)**

Description	In 2020	In 2050	Remarks
Flow	32 Mld	76Mld	
Slope	1 in 1200	1 in 1200	
Manning's "n"	0.013	0.013	
Velocity (m/s)	1.0m/s	0.90 m/s	
Required Depth (m)	1.15m	1.15m	
Width (m)	1.40m	1.40m	
Length (m)	1600m	1600m	
Proposed Size of Channel	1.40m(w)X0.70m(D)+0.45m(F.B)		

#### 2.4.14 Performance Evaluation for Sewage Treatment Plants

There has been significant improvement in process treatment options in recent years. Each treatment process comes with its own inherent advantages and disadvantages. The primary target of sewage treatment is to reduce pressure on oxygen demand.

In order to suitably identify the best treatment alternative, a comprehensive evaluation is primarily carried out to shortlist the more suitable process treatment options, which comply to the effluent standards. Thereafter a Life Cycle cost analysis of the process treatment options has been worked out based:

- Capital Costs including
- Cost for Land requirements and
- O&M Costs

## 2.5 Construction Methodology

As per MoUD, Gol, currently, most of the projects are bid out on Engineering procurement and construction (EPC) basis and have a limited role for EPC contractors in operation & maintenance of assets. In many instances, the assets are relatively of poor quality, and are inadequately maintained. In order to ensure optimum utilization of funds deployed and proper creation and maintenance of assets, it is desirable to explore the option of Build-Own-Operate-Transfer (BOOT) contracts wherein there is likelihood of long term commitment of Private sectors partner for the period of 5 years. The different PPP models for implementation of these technologies have also been suggested in various advisory note of MoUD.

## 2.6 Financing of Project Package wise

Sl. No	Description of Works	Total Cost (In Lakhs)
<b>Cost of Sewerage System</b>		
<b>A</b>	Estimated Cost for 150 km Sewer Network	22755.17
	Miscellaneous Works (Vehicles and Equipment for O&M)	154.00
	Sub Total	<b>22909.17</b>
<b>B</b>	Estimated Cost for 2nos Sewage Pumping Station	3742.79
	SCADA System for 2nos Pumping Stations	232.16
	Sub Total	3974.94
<b>C</b>	<b>Net Estimated Cost of Works</b>	<b>26884.11</b>
(i)	Estimated Cost for Utility Shifting	227.55
(ii)	Public Awareness	147.76
(iii)	Governance and Accountability Action Plan	41.09
(iv)	Environmental Mitigation and Monitoring Cost	145.78
<b>D</b>	<b>Gross Estimated Cost of Works</b>	<b>27446.29</b>
(i)	Cost of Project Preparation	682.39
(ii)	Cost for Supervision of Projects	1076.85
<b>E</b>	<b>Gross Estimated Cost of Works</b>	<b>29205.53</b>
(i)	Operation and Maintenance Cost (For 15 Years)	15063.34
<b>F</b>	<b>Total Estimated Cost of Project for Package A</b>	<b>44268.87</b>

Sl. No	Description of Works	Total Cost (In Lakhs)
<b>A</b>	Estimated Cost for Sewage Treatment Plant (50Mld)	7223.24



	<b>Net Estimated Cost of Works</b>	<b>7223.24</b>
	Public Awareness	98.51
	Governance and Accountability Action Plan	27.39
	Environmental Mitigation and Monitoring Cost	97.18
<b>B</b>	<b>Gross Estimated Cost of Works</b>	<b>7446.32</b>
(i)	Cost of Project Preparation	682.39
(ii)	Cost for Supervision of Projects	287.93
<b>C</b>	<b>Gross Estimated Cost of Works</b>	<b>8416.64</b>
(i)	Operation and Maintenance Cost (For 15 Years)	5158.61
<b>D</b>	<b>Total Estimated Cost of Project</b>	<b>13575.25</b>

**Overall cost of the project**

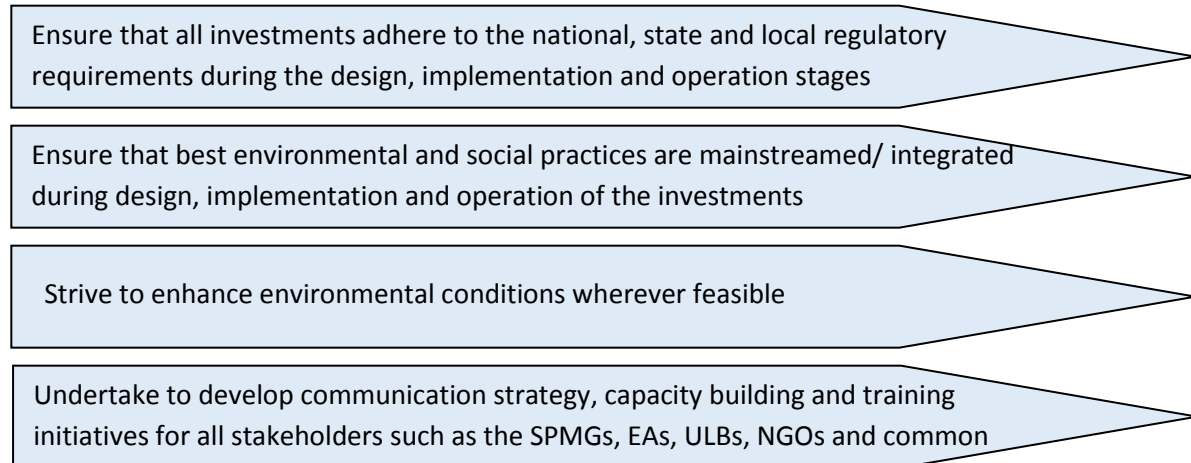
Sl. No	Description of Works	Package A Total Cost (In Lakhs)	Package B Total Cost (In Lakhs)	Overall Cost (A+B) (In Lakhs)
Cost of Sewerage System				
<b>A</b>	Estimated Cost for 150km Sewer Network	22755.17		22755.17
<b>B</b>	Estimated Cost for 2nos Sewage Pumping Station	3742.79		3742.79
<b>C</b>	Estimated Cost for Sewage Treatment Plant (50Mld)		7223.24	7223.24
<b>D</b>	Sub Total	<b>26497.96</b>	<b>7223.24</b>	<b>33721.20</b>
<b>i</b>	SCADA System for Pumping Stations	232.16	0.00	232.16
<b>ii</b>	Miscellaneous Works (Vehicles and Equipment for O&M)	154.00	0.00	154.00
<b>E</b>	<b>Net Estimated Cost of Works(D+i+ii)</b>	<b>26884.11</b>	<b>7223.24</b>	<b>34107.35</b>
(i)	Estimated Cost for Utility Shifting	227.55		227.55
(ii)	Public Awareness	147.76	98.51	246.27
(iii)	Governance and Accountability Action Plan	41.09	27.39	68.48
(iv)	Environmental Mitigation and Monitoring Cost	145.78	97.18	242.961
<b>F</b>	<b>Gross Estimated Cost of Works (E+i+ii+iii+iv)</b>	<b>27446.29</b>	<b>7446.32</b>	<b>34892.61</b>
(i)	Cost of Project Preparation	682.39	682.39	1364.78
(ii)	Cost for Supervision of Projects	1076.85	287.93	1364.78
<b>G</b>	<b>Gross Estimated Cost of Works (F+i+ii)</b>	<b>29205.53</b>	<b>8416.64</b>	<b>37622.17</b>
(i)	Operation and Maintenance Cost (For 15 Years)	15063.34	5158.61	20221.95
<b>H</b>	<b>Total Estimated Cost of Project</b>	<b>44268.87</b>	<b>13575.25</b>	<b>57844.12</b>



## CHAPTER 3: APPROACH AND METHODOLOGY

### 3.1 Introduction

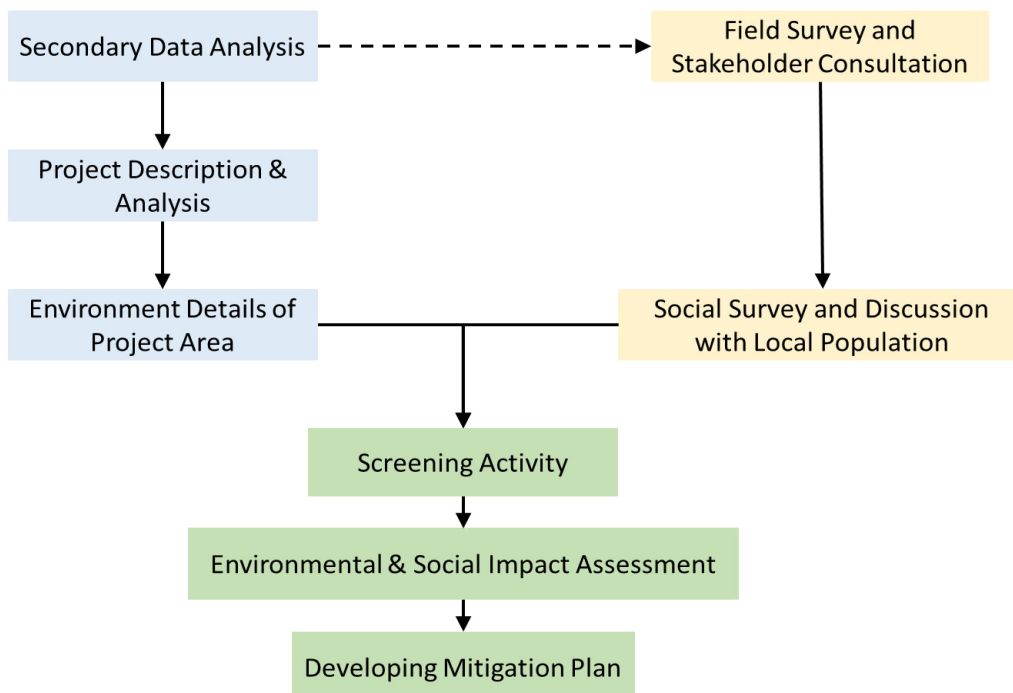
The Objective of Environment and Social Management Framework (ESMF) is to ensure environmentally sustainable development in NGRBA’s endeavour of Mission Clean Ganga by effective management of environmental and social issues in all the investments with a special focus on the following:



The approach to the development of ESMF has been a mix of technical as well as participatory exercise.

### 3.2 Methodology

The following methodology shall be adopted to maximize outputs:



### 3.3 Screening and Categorization

The project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. The extent of assessment required to identify and mitigate the impacts largely depends upon the complexities of project activities.

The scrutiny and screening has been based on a detailed Environment and Social Screening exercise, summarized in table 3.1.

**Table 3.1: Screening Format**

Environmental and Social Information Format for Screening			
Project Title:			
Implementing Agency:			
Project Cost:			
Project Components:			
Project Location:			

Sl. No.	Screening Criteria	Assessment of Category (High/ low)	Remarks /Explanatory note for categorisation
1	Is the project in an eco-sensitive area or adjoining an eco-sensitive area? (Yes/No) If Yes, which is the area? Elaborate impact accordingly.	No impact	Patna is not located near any eco-sensitive area and there is no such area within 100 kms.
2	Will the project create significant/ limited/ no social impacts?	No Impact	There will be no land acquisition required for the project. New STP will be developed in the premise of existing STP land.
	Land acquisition resulting in loss of income from agricultural land, plantation or other existing land-use.	No Impact	STP at Kankarbagh will be constructed on present STP site, therefore no land acquisition or tree cutting is required.
	Land acquisition resulting in relocation of households.	No Impact	Not Applicable
	Any reduction of access to traditional and river dependent communities (to river and areas where they earn for their primary or substantial livelihood).	No Impact	Not Applicable
	Any displacement or adverse impact on tribal settlement(s).	No Impact	No land acquisition or relocation of settlement is required.

	Any specific gender issues.	No Impact	No gender issues observed/raised in the public consultation. .
3	Will the project create significant / limited / no environmental impacts during the construction stage? (significant/limited/ no impacts)	Low and short term impact	The STP is going to be constructed on present STP site. Therefore, there is only limited environmental impact.
			The proposed lifting stations will be constructed in the open areas which will minimise the impact
			The proposed sewer line will be under the road with minimum 3m or more road width.
	Clearance of vegetation/ tree-cover	Low Impact	No major tree cutting is required.
	Direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials adversely affecting water quality and flow regimes.	Low and short term impact	No such major construction. The STP will be SBR type prefabricated units with minimal civil works. The laying of sewer lines will not produce any significant amount of waste. Laying will cause some traffic disruption of temporary nature. Sensitive locations like schools, hospitals will have special problems which will be taken care of during construction.
	Flooding of adjacent areas	Low Impact	Dewatering for construction will not generate significant amount of water to flood adjacent areas Back-up power system has been proposed in the pumping stations so that it will not create flooding in case of power failure.
	Improper storage and handling of substances leading to contamination of soil and water	Low and short term impact	No such material will be used which may contaminate or create pollution.
	Elevated noise and dust emission	Low and short term impact	Proper measure will be taken during sewer lying to minimise the noise and dust emissions. The contractor has to submit the method statement to comply with Air Act, 1981 & Noise Rules as per EP Act, 1986 before construction.
	Disruption to traffic movements	Low and short term impact	Proper diversion of traffic will ensure less disruption during construction.
	Damage to existing infrastructure,	Low and short term	Utility mapping of the existing

	public utilities, amenities etc.	Impact	infrastructure and relocation of the same if required will minimise the damage on existing infrastructure.
	Failure to restore temporary construction sites	Low and short term Impact	The roads will be reinstated to its original conditions after lying of sewer line.
	Possible conflicts with and/or disruption to local community	No impact	The local community will be made aware of the temporary nature of disruption.
	Health risks due to unhygienic conditions at workers" camps	Low Impact	Adequate sanitation facilities and safety arrangement will be provided to the workers to tackle on-site hazards.
	Safety hazards during construction	Low and short term Impact	Proper health and safety statement will be submitted by the contractor and approved by The Engineer prior to the construction.
<b>4</b>	Will the project create significant / limited / no environmental impacts during the operational stage? (Significant / limited / no impacts)	Limited	STP will have minimal odour and noise pollution.
	Flooding of adjacent areas	Low Impact	Back-up power for the pumping stations will ensure minimum flooding and odour nuisance in case of power failure. Properly designed sewer line will minimise the impact on environment.
	Impacts to water quality due to effluent discharge	Low Impact	The characteristics of the treated waste water from FAB reactor will be within limit set by CPCB/MoEF.
	Gas emissions	Low Impact	SBR is a compact system and the possibility of the Gas emission is very less.
	Safety hazards	Low Impact	Mechanised system and trained people will be used to run the Pumping stations and STPs will reduce the risk of safety hazards
<b>5</b>	Do projects of this nature / type require prior environmental clearance either from the MOEF or from a relevant state Government department? (MOEF/ relevant State Government department/ No	No clearance required	The project is not an environmental sensitive project and does not require clearance as Environmental Impact Assessment Notification 14th Sep-2006

	clearance at all)		
<b>6</b>	Does the project involve any prior clearance from the MOEF or State Forest department for either the conversion of forest land or for tree-cutting? (Yes/ No). If yes, which?	No clearance required	No
Overall Assessment		Low	

### **3.4 Screening Conclusion**

Kankarbagh zone of Patna are not located near any eco-sensitive area. Further the proposed project will not involve any land acquisition or displacement of any category of people including tribals. The proposed STP will be constructed in the existing STP ground resulting marginal environmental impact on the adjoining settlement in terms of dust and noise during construction. However compliance with Air Act 1981 and Noise Rules, EP Act 1986 will be mandatory for contractors. Two new pumping stations will being constructed on Govt. land which will also have minimal environmental impact. The laying of sewer lines will not produce any significant amount of waste particularly since it will be laid under minimum 3 m width roads. The roads will be reinstated to its original conditions after lying of sewer line. Traffic disruptions will be avoided through appropriate diversions. There will be no significant adverse impacts in terms of flooding, gas emission, waste discharge, health risks etc. Hence Environmental Clearances and abidance to Social laws and Regulations are not relevant in the context of the Proposed Sewerage project in Patna. Based on the assessment of overall social and environmental impacts, the project can be categorised as a “Low” impact project.

## **CHAPTER 4: REGULATIONS AND LEGAL FRAMEWORK**

### **4.1 Regulations and Legal Framework**

The national, state and local environmental and social regulatory requirements that are applicable to the investments proposed are given in this section. As the applicability of these legal requirements would depend on the nature of the specific investments, the exact applicability cannot be determined at this stage. SPMGs and the State level executing agencies (EA) would ensure compliance of these requirements by all concerned.

PMG would verify whether the investments are in compliance with these regulatory requirements prior to granting approval to the investments and disbursement of funds. During implementation, PMG would ensure that SPMGs monitor the ESAMP compliance in all investments on an on-going basis.

The following laws and regulations are applicable to the environmental and social aspects of the investments implemented under the programme:

- Applicable Environmental Laws and Regulations
- Applicable Social Laws and Regulations
- Legislations applicable to construction activities
- World Bank's Operational Policies

### **4.2 Applicable Laws and Regulations - Environmental**

The following laws and regulations are applicable to the environmental and social aspects of the investments implemented under the programme:

- Policy and Regulatory Framework of Government of India (GoI)
- Environmental Policy and Regulations of the respective State Governments
- Legislations applicable to construction activities

#### **4.2.1 Legal Framework of Government of India**

The Government of India has laid out various policy guidelines, acts and regulations pertaining to environment. The Environment (Protection) Act, 1986 is umbrella legislation for the protection of environment. As per this Act, the responsibility to administer the legislation has been jointly entrusted to the Ministry of Environment and Forests (MoEF), Government of India and the Central Pollution Control Board (CPCB)/ State Pollution Control Boards (SPCBs).

#### **Regulations and Legal Framework**

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The following laws and regulations are applicable to the environmental and social aspects of the investments implemented under the programme:

- Applicable Environmental Laws and Regulations
- Applicable Social Laws and Regulations
- Legislations applicable to construction activities
- World Bank's Operational Policies

#### **4.3 Applicable Laws and Regulations - Environmental**

The following laws and regulations are applicable to the environmental and social aspects of the investments implemented under the programme:

- Legal Framework of Government of India (GoI)
- Key Environmental Laws and other related regulations
- Legislations applicable to construction activities

##### **Legal Framework of Government of India**

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

Categories A projects require Environmental Clearance from Ministry of Environment and Forests (MoEF) Gov. of India. The proponent is required to provide preliminary details of the project in the Form-1 of a EIA Notification, after which an Expert Appraisal Committee (EAC) of the MoEF prepares comprehensive Terms of Reference (ToR) for the EIA study, which are finalized within 60 days. On completion of the study and review of the report by the EAC, MoEF considers the recommendation of the EAC and provides the EC if appropriate.

Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the EC based on the EAC recommendation. The

Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

***Environment Clearance requirement is not applicable for this subproject under EIA Notification 2006 as amended till date since the proposed project does not listed in schedule of said notification.***

#### **4.3.1 Key Environmental Laws and Other Related Regulations**

The key environmental laws and regulations as relevant to the investments under the NGRBP are given in the table 4.1 below. The key environmental regulations can also be accessed at [www.moef.nic.in/rules-and-regulations](http://www.moef.nic.in/rules-and-regulations).

S. No	Act / Rules	Purpose	Applicable to	Reason for Applicability	Authority
			Yes/ No		
1	Environment Protection Act-1986	To protect and improve overall environment	Yes	As all environmental Notifications, rules and schedules are issued under this	MoEF, Gol, DoE, State Gov. CPCB, SPCB
3	Environmental Impact Assessment Notification 14th Sep-2006	To provide environmental clearance to new	NO	As per schedule of EIA Notification Sewerage and sanitation project does not attract Environmental Clearance.	---
4	Municipal Solid Wastes(Management and Handling) Rules, 2000	To manage the collection, transportation, segregation, treatment, and disposal of	NO	This notification is applicable only for Municipal Solid waste Treatment facility investments	-
5	Coastal Regulation Zone(CRZ) Notification	Protection of fragile coastal belt	No	If Project location is located along coastal belt	--
6	The Land Acquisition Act 1894 (As amended in 1985 and 2013)	Set out rule for Acquisition. of land by government	No	This act will be not applicable as land acquisition of STP and its associated facilities are not required.	Revenue Department State Government



S. No	Act / Rules	Purpose	Applicable to	Reason for Applicability	Authority
			Yes/ No		
7	The Forest (Conservation) Act. 1980	To check deforestation by restricting conversion of forested areas into non-forested areas	No	Applicable if there is Diversion of forest land for non-forest activities i.e. forest land if required for any of the investments. In this case the project entirely in urban/semi urban area does not attract it.	Forest Department, State, Ministry of Environment and Forests, Government of India
8	Wild Life Protection Act 1972	To protect wildlife through certain of National Parks and Sanctuaries	No	This act is will be applicable, if there are any points of wildlife crossing s in proximity to project locations	Chief Conservator Wildlife, Ministry of Environment and
9	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by controlling emission of air pollutants as per the prescribed standards.	Yes	This act will be applicable during construction. As well as setting of STP, Consent to establish and consent to operate.	SPCBs
10	Water Prevention and Control of Pollution) Act1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Yes	This act will be applicable during construction. As well as setting of STP, Consent to establish and consent to operate construction.	SPCBs
11	The Noise Pollution (Regulation and Control) Rules, 2000	The standards for noise for day and night have been	Yes	This act will be applicable for all construction equipment deployed at worksite.	SPCBs
12	Ancient Monuments and Archaeological Sites and Remains Act1958	Conservation of cultural and historical remains found in India	Yes	This act will be applicable, only if any investment is in proximity to any Ancient Monument, declared protected under the act.	Archaeological Department Gol, India Heritage Society and Indian National Trust for

S. No	Act / Rules	Purpose	Applicable to	Reason for Applicability	Authority
			Yes/ No		
13	Public Liability and Insurance Act 1991	Protection of harmful hazardous material	Yes	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions	SPCBs
14	Explosive Act 1984	Safe transportation, storage and use of explosive material	NO	For transporting And storing diesel, Oil and lubricants etc. In this project it is not applicable as no blasting work is required.	Chief Controller of Explosives
15	Minor Mineral and concession Rules	For opening new quarry.	No	Regulate use of minor minerals like stone, soil, river sand etc. As the work is mainly of excavation and laying of Sewer line, no minor mineral listed in this	District Collector
16	Central Motor Vehicle Act 1988	To check vehicular air and noise Pollution.	Yes	This rule will be applicable to vehicles deployed for construction activities and construction Machinery	Motor Vehicle Department
17	National Forest Policy, 1988	To maintain ecological stability through Preservation and restoration of biological diversity.	No	This policy will be applicable if any eco sensitive feature exists in and around the investments	Forest Department, State Government and Ministry of Environment and
18	The Mining Act	The mining act has been notified for safe and sound mining activity.	Yes	The construction activities for investments will require aggregates. These will be procured through mining from approved quarries	Department of mining, State Government

#### **4.4 Legislations Applicable To Construction Activities**

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

1. **Workmen's Compensation Act 1923** (the Act provides for compensation in case of injury by accident arising out of and during the course of employment);
2. **Payment of Gratuity Act, 1972** (gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years);
3. **Employees PF and Miscellaneous Provision Act 1952** (the Act provides for monthly contributions by the employer plus workers);
4. **Maternity Benefit Act, 1951** (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.);
5. **Contract Labor (Regulation and Abolition) Act, 1970** (the Act provides for certain welfare measures to be provided by the contractor to contract labour);
6. **Minimum Wages Act, 1948** (the employer is supposed to pay not less than the Minimum Wages fixed by the Government as per provisions of the Act);
7. **Payment of Wages Act, 1936** (it lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers);
8. **Equal Remuneration Act, 1979** (the Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees);
9. **Payment of Bonus Act, 1965** (the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages);
10. **Industrial Disputes Act, 1947** (the Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment);
11. **Industrial Employment (Standing Orders) Act; 1946** (the Act provides for laying down rules governing the conditions of employment);
12. **Trade Unions Act, 1926** (the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities);
13. **Child Labour (Prohibition and Regulation) Act, 1986** (the Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry);
14. **Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979** (the inter-state migrant workers, in an establishment to which this Act becomes applicable, are

required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.);

15. **The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996** and the **Cess Act of 1996** (all the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.);
16. **The Factories Act, 1948** (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities);
17. **Hazardous Wastes (Management and Handling) Rules, 1989** (the Rules govern handling, movement and disposal of hazardous waste); r. Manufacture, Storage and Import of Hazardous Chemicals Rules 1989.

#### The key Legislations applicable to construction projects

S. No	Act / Rules	Purpose	Applicable	Reason for
1	Workmen's Compensation Act 1923	Provides for compensation in case of injury by accident arising out of and during the course of	Yes	This act will be applicable for all construction workers deployed at worksite.
2	Payment of Gratuity Act, 1972	Under certain conditions Gratuity is payable to an employee on separation if an employee has completed	Yes	This act will be applicable for all construction workers deployed at worksite if he /she completes 5 years of service.
3	Employees PF and Miscellaneous Provision Act 1952	Monthly contribution by the employer and workers to the fund	Yes	Contractor need to contribute and deduct specific proportion of salary towards contribution to the fund.
4	Maternity Benefit Act, 1951	Provides for leave and some other benefits to women employees in case of confinement or	Yes	For all women employees under confinement or suffering miscarriage
5	Contract Labour (Regulation and Abolition) Act, 1970	Provides for certain welfare measures to be provided by the	Yes	For all contract workers engaged in construction work.

S. No	Act / Rules	Purpose	Applicable	Reason for
	Minimum Wages Act, 1948	Provides for payment of fixed minimum wages fixed by the Government as per	Yes	For all workers engaged in construction activity.
7	Payment of wages act 1979	Provides for by what date the wages are to be paid, when it will be paid and what deductions can be	Yes	Applicable to all workers.
8	Equal Remuneration Act, 1979	Provides for payment of equal wages for work of equal nature to Male and Female workers.	Yes	Prevents discrimination against women employees in wage payments.
9	Payment of bonus act 1965	Provides for payment of annual bonus subject to a minimum of 8.33% of wages and maximum of	Yes	Applies to all workers in regular employment for more than a year.

#### 4.5 Applicable Laws and Regulations - Social

All strategic interventions on human development, spread across all social issues, need directives of policies and legal support to operationalize the appropriate actions. These policies and legislations help to overcome the constraints and support administrator, implementer, community and individual in delivery of justice. The social management framework comprise of the following acts and laws.

- National Resettlement and Rehabilitation Policy for Project Affected Families -2007
- Land Acquisition Act, 1894 (As Modified Until 1st September,1984)
- Right to Fair Compensation and Transparency in LA RR Bill,2013,
- Scheduled Caste and Scheduled Tribes Orders (Amendment) Act, 2002

##### **National Resettlement and Rehabilitation Policy for Project Affected Families -2007**

The National Resettlement and Rehabilitation Policy, 2007 (NRRP) provides guidelines and execution instructions applicable to all projects. It provides that the basic minimum requirements of projects

leading to involuntary displacement of people must address the rehabilitation and resettlement issues comprehensively. The objectives of the NRRP are as follows:

- To minimise displacement and to promote, as far as possible, non-displacing or least-displacing alternatives;
- To ensure adequate rehabilitation package and expeditious implementation of the rehabilitation process with the active participation of the affected families;
- To ensure that special care is taken for protecting the rights of the weaker sections of society, especially members of the Scheduled Castes and Scheduled Tribes, and to create obligations on the State for their treatment with concern and sensitivity;
- To provide a better standard of living, making concerted efforts for providing sustainable income to the affected families; and
- To integrate rehabilitation concerns into the development planning and implementation process; and where, displacement is on account of land acquisition, to facilitate harmonious relationship between the requiring body and affected families through mutual cooperation.

NRRP 2007 distinguishes between projects requiring large extent of land and those involving linear acquisitions where the loss to an individual will be minimal. In projects relating to railway lines, highways, transmission lines, laying of pipelines and other such projects wherein only a narrow stretch of land is acquired for the purpose of the project or is utilised for right of way, the NRRP provides for an ex-gratia payment of not less than Rs.25, 000/- in addition to the compensation or any other benefits due under the project. However, if as a result of such land acquisition, the land-holder becomes landless or is reduced to the status of a "small" or "marginal" farmer, other rehabilitation and resettlement benefits available under NRRP shall also be extended to such affected families. Further, the affected families will have the option to take a lump-sum amount in lieu of one or more of the benefits specified under NRRP.

#### **Land Acquisition Act, 1894 (As Modified Until 1st September,1984)**

The act is applicable to whole India except the state of Jammu and Kashmir. The policy provides a broad guideline of procedure of land acquisition. The Land Acquisition (LA) Act of 1894 is commonly used for acquisition of land for any public purpose. It is used at the State level with State amendments made to suit local requirements. Expropriation of and compensation for land, houses and other immovable assets are carried out under the Land Acquisition (Amendment) Act, 1984. The Act deals with compulsory

acquisition of private land for public purpose. The LA Act does not contain any provision specifically dealing with resettlement including income restoration aspects.

### **Right to Fair Compensation and Transparency in LA RR Bill, 2013**

The salient features of the bill include:

1. The Bill seeks to amend the Land Acquisition Act, 1894. The bill suggests that the 1894 Act be repealed and a new comprehensive legislation be brought in Parliament. It states that the legislation should be enacted expeditiously.
2. The bill notes that the use of the word 'may' dilutes specific provisions and provides undue discretion to the implementing agency. It recommends that 'may' should be replaced by 'shall' in all clauses except ones where the intent is to provide flexibility.
3. In order to protect agricultural land from getting acquired, it states that the Bill should include a provision that makes it mandatory for the Collector to submit a report stating that wasteland or barren land was not available for a particular project. Also, the government should make a list of unutilised land.
4. The Committee also makes several suggestions for development of wasteland. It also recommends that the government should do long term planning regarding the total area of agricultural land required to meet food grain requirements. Also, a strong law is required to protect prime agricultural land in similar manner as forest land. There should also be measures to guard against excessive acquisition of land which is at time more than the land required for the project.
5. The Committee recommends that in cases where award of compensation is pending, solatium and the rehabilitation and resettlement package should be provided retrospectively.
6. The Committee recommends that all the benefits provided under the Land Acquisition and Rehabilitation and Resettlement legislation should be doubled at every stage in case of second and subsequent displacement of a family/person.
7. The Bill would apply to Nagaland only when decided by a resolution of the Nagaland Legislative Assembly. This should be provided for in the Bill.
8. Legislative Assembly. This should be provided for in the Bill.

9. As per the Act, 30 days' time period from the date of publication of the notification has been provided for the affected person to object to the acquisition of land. The Committee feels that the period is not sufficient and recommends that it be increased to 60 days.
10. The Committee is of the opinion that fixing some percentage of the land to be acquired by the appropriate government and private body for a particular project of public purpose is very contradictory and impractical. Also, the definition of "public purpose" as per the 1894 Act should be retained.
11. There should be discretion in deciding whether a Social Impact Study is necessary if the number of families is below the threshold level.
12. The Committee recommends that the highest price of sale deed as indicated in the sale deeds of the last three years plus 50 per cent of the highest price should be the criteria for assessing and determining the market value of the land. For tribal areas, the Committee recommends that the highest price of a sale deed of the adjoining non-tribal blocks/village for the last three years plus 50 per cent should be the criteria.
13. The Committee is against the provision that allows the Collector, before determining the market value of the land, to ascertain the intended land use category.
14. The Committee states that issue of shares and debentures as part of the compensation is not practical. Therefore, issue of shares and debentures should be over and above the admissible compensation. Further, it should be left to the acquiring body to issue shares and debentures over and above the admissible compensation to the affected person/family whose land is acquired.
15. The Committee pointed out certain contradictions in the Land Acquisition Bill and the Rehabilitation and Resettlement Bill with regard to compensation with shares and debentures.
16. The Committee recommends that emergency powers of the government may be restricted to acquisition of minimum area of land for the purpose of defence or national security or in case of natural calamities.



17. The Committee suggests that the Acquisition Compensation Disputes Settlement Authority should consist of at least three members, including the Chairperson. Also, the retirement age should be reduced to 65 years from 67 years.
18. The Committee proposes that the rate of interest should be increased from nine per cent to 15 per cent per annum and compound interest should be paid wherever applicable.

This Act is not going to have any impact on the project as no land acquisition is envisaged. Neither any loss of livelihood or relocation or resettlement is envisaged.

#### **Scheduled Caste and Scheduled Tribes Orders (Amendment) Act, 2002**

The Act provides for the inclusion in the lists of Scheduled Tribes (ST), of certain tribes or tribal communities or parts of or groups within tribes or tribal communities, equivalent names or synonyms of such tribes or communities, removal of area restrictions and bifurcation and clubbing of entries; imposition of area restriction in respect of certain castes in the lists of Scheduled Castes (SC) and the exclusion of certain castes and tribes from the lists of SCs and STs.

#### **4.6 Environment, Health, Safety Policies of World Bank**

The General EHS guideline of World Bank is applicable to the project which discharges process wastewater, wastewater from utility operations or storm water to the environment directly or indirectly. It is also applicable to industrial discharges to sanitary sewers that discharge to the environment without any treatment. e. It provides information on common techniques for wastewater management, water conservation, and reuse that can be applied to a wide range of industry sectors. This guideline is meant to be complemented by the industry-specific effluent guidelines presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines.

In the context of overall ESHS management system, facilities should:

- Understand the quality, quantity, frequency and sources of liquid effluents in its installations. This includes knowledge about the locations, routes and integrity of internal drainage systems and discharge points
- Plan and implement the segregation of liquid effluents principally along industrial, utility, sanitary, and storm water categories, in order to limit the volume of water requiring specialized treatment. Characteristics of individual streams may also be used for source segregation.
- Identify opportunities to prevent or reduce wastewater pollution through such measures as recycle/reuse within their facility, input substitution, or process modification (e.g. change of technology or operating conditions/modes).

- Assess compliance of their wastewater discharges with the applicable: (i) discharge standard (if the wastewater is discharged to a surface water or sewer), and (ii) water quality standard for a specific reuse (e.g. if the wastewater is reused for irrigation).

When wastewater treatment is required prior to discharge, the level of treatment should be based on:

- Whether wastewater is being discharged to a sanitary sewer system, or to surface waters
- National and local standards as reflected in permit requirements and sewer system capacity to convey and treat wastewater if discharge is to sanitary sewer
- Assimilative capacity of the receiving water for the load of contaminant being discharged wastewater if discharge is to surface water
- Intended use of the receiving water body (e.g. as a source of drinking water, recreation, irrigation, navigation, or other)
- Presence of sensitive receptors (e.g., endangered species) or habitats
- Good International Industry Practice (GIIP) for the relevant industry sector

## **CHAPTER 5: BASELINE STATUS**

### **Introduction**

The baseline environmental and social status is important to understand the region's existing physical and biological characteristics along with cultural and social status of the residing community. Information and data presented in this section is based on field surveys, stake-holder interaction/consultation and secondary data collection which majorly include the draft Detailed Project Report (DPR) of proposed sewerage work, City Development Plan (CDP) report by Nagar Nigam, Water/ Air/ Noise quality monitoring report of CPCB and Bihar State Pollution Control Board, City census data and others. The information on the baseline environmental conditions forms the basis to analyse the probable impacts of the proposed project vis-à-vis the present background environmental quality of the core study area.

### **5.1 Baseline Environment**

#### **5.1.1 Topography**

Patna is located on the southern bank of river Ganga. The town is situated at an altitude of 53 m above mean sea level. Patna is unique in having four large rivers in its vicinity - Ghaghara, Gandak, Punpun and Sone. This urban area is entirely flat, except the 8km width narrow strip of somewhat high land along the southern bank of the river Ganga. Patna does not contain any hilly region.

#### **5.1.2 Geology**

Patna city is a part of the Indo Gangetic alluvium. The district forming a part of the flood plains of the Ganga has a monotonously flat relief. The region is underlain by alluvial sediments of quaternary age. The quaternary sediments are deposited unconformable on the Archaean basement.

#### **5.1.3 Soil**

Patna district is a part of the Indo Gangetic alluvium. The district forming a part of the flood plains of the Ganga has a monotonously flat relief. Patna region is underlain by alluvial sediments of quaternary age. The quaternary sediments are deposited unconformable on the Archaean basement. The district has mainly four types of soils ranging from moderately well drained to poorly drained, acidic to slightly alkaline and medium to heavy textured. The land in the district is too fertile to be left for wild growth. The district is devoid of any forest wealth of consequences. The alluvial text of land yields rice, sugarcane and other food grains. The area under cultivation is studded with mango orchards and bamboo clumps. In the fields adjoining the Ganges weeds such as Ammannia, Citriculari, Hygrophile and Sesbania grow. But palmyra and date palm and mango orchards are found near habitations. Dry shrub jungles are

sometimes seen in the villages away from the rivers. Trees commonly met with are bel, siris, jack fruits and the red cotton tree.

In this report the soil quality data has been taken for reference from EIA report of River front development, patna submitted to NGRBA (RFD-I), which was monitored in September 2012 by approved lab.

**Table 5.1: Soil Quality data around project area of Patna**

Sr. No	Parameter	Unit	Gulvi ghat	Collectorate ghat	T N Banerjee ghat
1	pH	-	8.56(1:5)2 <sup>0</sup> <sub>6</sub> C	8.85(1:5)2 <sup>0</sup> <sub>6</sub> C	7.8(1:5) 2 <sup>0</sup> <sub>6</sub> C
2	Texture	-	Loamy sand	Silt loam	Loam
3	Sand	%	84.2	26.1	38.3
4	Silt	%	10.2	52.4	34.1
5	Clay	%	5.6	21.50	27.6
6	Bulk density	g/cc	1.43	1.29	1.25
7	WHC	%	30.26	42.67	44.17
8	OM	%	0.15	0.64	1.59
9	N	mg/k	92.23	184.46	338.18
10	P	mg/k	16.25	<4	292.49
11	Na	mg/k	20	500	400
12	Na	mg/k	60	60	40
13	Ca	Mg/k	13584	11808	4224
14	Mg	Mg/k	2678.4	2966.4	2476.8
15	EC	µm/cm	68.8(1:5) 25°C	199(1:5) 25°C	112(1:5) 25°C

Source: EIA Report of River front Development, Patna submitted to NGRBA

The soil quality as observed shows alkaline content which supports the presence of Calcareous alluvium (as referred from secondary literature as well).

#### 5.1.4 Seismicity

The town as most part of Bihar falls under Seismic Zone-IV, as per State of Environment Report, Bihar, and Published by BPCB which is categorized as High damage Risk Zone. In consideration, special measures are to be incorporated in designing of water / waste-water retaining structures. (Viz., Sewage lifting Station or Wastewater Treatment Plants, as per provision of the Code).

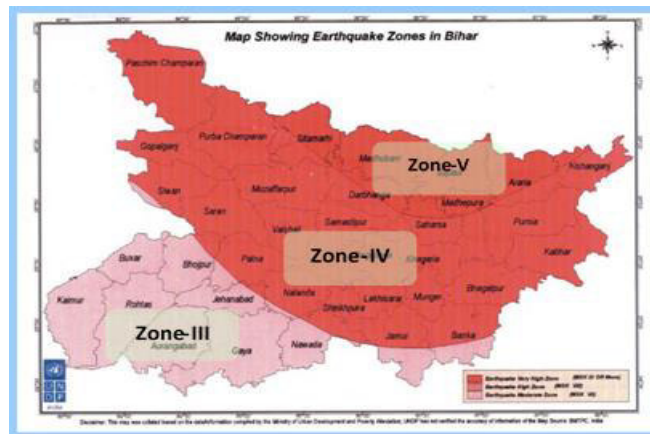


Figure 5.1: Map showing seismic Zones in Bihar

### 5.1.5 Climate

The climate is moderate to extreme type. The hot weather begins about the middle of March, when hot westerly winds begin to blow during the day. The months of April and May are extremely hot touching temperature up to 30-43°C. The cold weather begins from the month of November and lasts till February with average temperature of 5-21°C. January is the coldest month when temperature comes down to as low as 5°C. The monsoon starts mostly from the mid of June when moisture laden north-west monsoon wind hits the region. The rains last through August & September and continue into early October. The average annual rainfall data for the past 70 years indicates an average 1200mm/year. Approximately 85% of the annual rainfall is received during monsoon period.

### 5.1.6 Air Pollution

The fast industrialization, higher traffic and higher levels of energy consumption has resulted in increase in pollution load in the urban environment. Urban ambient air quality have acquired new dimension due to increase in Hazardous Air Pollutants namely, Ozone, Volatile Organic Compounds (VOCs), Ketones and aldehydes. Air pollution generally occurs in most of the towns due to heavy movement of vehicular traffic. In this report the air quality data has been taken for reference from similar report submitted to NGBRA, which was monitored in September 2012.

**Table 5.21: Ambient air quality data in project influence area of Patna**

Location	Monitoring	PM10	PM2.5 (2.5)	SO2	NO2	Co (µg/m3)
	period	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	
Collector Ghat	Sept 2012	88	47	5.4	26.7	363
Dr. T.N Banerjee Ghat	Sept 2012	54	29	4.3	21.4	275
Gulvi Ghat Area	Sept 2012	69	36	4.0	19.0	175
Limit as per CPCB.		100	60	80	80	2000
Sampling and analysis methodology		IS:5182 (part-23)-2006	USEPA, CFR-40, Part-50, Appendix L	IS: 5182 (part-2)-2001	IS:5182 (Part-6)-2006	IS:5182: Part 10, 1999

Source: EIA report of River Front Development Patna submitted to NGRBA

The PM10 and PM2.5 level near the Collectorate Ghat is found in the higher range may be due to the market activities and associated dust generation. However, all the parameters of ambient air quality are found well within prescribed limit.

### 5.1.7 Noise Pollution

The baseline environmental monitoring for noise quality was conducted through primary survey to at strategic locations considering various project components like construction of STP, SPS, laying of sewer line etc. The baseline noise levels helps in understanding the existing noise level so that necessary monitoring mechanism and safeguard measures can be formulated for the possible impacts from the project on noise quality during the construction and operation stages of the project. The existing baseline noise level is presented in table 5.3.

**Table 5.3: Noise Quality at Kankarbagh, Patna**

Locations Name	Equivalent Noise Level Leq (dB(A)) 6.0 am to 10.0 pm	Equivalent Noise Level Leq (dB(A)) 10.0 pm to 6.0 am
Pahari STP site	63.96	54.01
Jalan High School	45.10	37.40
Gauri Das Ki Mandi	63.68	52.71
Malaipakdi Chowk	61.20	50.41

### 5.1.8 Water Quality

#### Surface water

In this report the water quality data has been taken for reference from EIA report of River front development, Patna submitted to NGRBA, which was monitored in September 2012. Since the measurements were made during the monsoon/post monsoon having high discharge, the BOD load has been reduced to a great extent due to the concept “dilution is the best solution to pollution”. But, it also warrants that the serious measures are required to take as part of the city sanitation plan to minimize the disposal of direct discharge of raw sewage in Ganga. The analysis result has been given in below mentioned table

**Table 5.4: Surface water quality of river Ganga**

Sl	Parameter	Unit	Sample Location					
			Kali ghat	Krishna ghat	Collectorate ghat	Gandhi ghat	Ananta ghat	Gulvi ghat
1	pH		7.52 at 28°C	7.36 at 28°C	7.31at 28°C	7.65 at 28°C	7.49 at 28°C	7.45 at 28°C
2	TDS	mg/l	127.4	257	141.5	130.5	128.4	136.4
3	TSS	mg/l	680	599	165	837	157	170
4	TH	mg/l	103.68	172.8	107.52	119.04	88.32	111.36
5	Fe	mg/l	1.93	3.27	3.88	3.47	1.69	3.35
6	Cl	mg/l	17.81	31.67	15.83	15.83	17.81	17.81
7	F	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
8	Ca	mg/l	27.65	44.54	26.11	41.47	23.04	27.65
9	Mg	mg/l	8.29	14.75	10.13	3.68	7.37	10.14
10	SO4	mg/l	<1.0	25.89	1.71	28.75	7.19	3.05
11	NO3	mg/l	3.2	<0.4	5.7	3.1	2.7	11.2
12	As	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
13	Zn	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
14	DO	mg/l	7.7	7.3	7.9	7.7	7.2	7.2
15	BOD	mg/l	3.3	3.21	3.11	<2.0	3.21	2.1
16	COD	mg/l	19.48	15.58	19.48	7.79	19.48	7.79
17	Total Alkalinity	mg/l	105.08	184.6	99.4	110.76	110.76	107.92
18	Total Coliform	cfu/10 Oml	30	110	170	280	280	23
19	Faecal Coliform	cfu/10 Oml	13	21	13	17	22	13

Source: EIA report of River Front development, Patna submitted to NGRBA

**Table 5.5: Ganga River Water Quality at Patna by Bihar state pollution Control Board**

Parameter	Digha near Railway Bridge (U/S)	Gaighat (D/S)	General standard for discharge on inland surface water as per CPCB
BOD(mg/l)	2.6	2.8	30
COD (mg/l)	16	20	250
TSS (mg/l)	28	30	100
DO	8.0	7.8	
T. Coli (MPN/100 ml)	3000	9000	500
F. Coli(MPN/100 ml)	1300	3000	

Source: Bihar State Pollution Control Board, Patna

**Table 5.6: Punpun River Water Quality as conducted by Bihar State Pollution Control Board**

Parameter	Railway Bridge (U/S)	Fatua (D/S)	General standard for discharge on inland surface water as per
BOD(mg/l)	2.0	2.5	30
COD (mg/l)	16	20	250
TSS (mg/l)	26	34	100
DO	7.5	7.0	
T. Coli (MPN/100 ml)	1400	1700	500
F. Coli(MPN/100 ml)	500	700	

Source: Bihar State Pollution Control Board, Patna

### Ground Water

According to the observation of State Ground Water Investigation Department, Govt. of Bihar, CGWB, the observed minimum, and maximum water levels were 3.00 and 8.57 m bgl respectively during the pre-monsoon season. The water level lies in the range of 2-5 m bgl for 25 % of the observation wells and of 5 – 10 m bgl for the remaining 75%. Groundwater is the major source of water supply in Patna town and its urban agglomerations. The average discharge of 450mm\* 300mm\* 200m deep tube well varies from 50,000 to 1,00,000 gallons per hour.



**Table 5.7: Water Quality Report (Norms as Per IS 10500-1991& CSP report) (Patna Municipal Corporation)**

Sl. No.	Parameters	Requirement (desirable Limits)	Permissible limit in absence of alternate source
1	Colour, Hazen Units	5	25
2	Turbidity, NTU	10	10
3	pH	6.5-8.5	No relaxation
4	Total Hardness (as CaCO <sub>3</sub> ), mg/ L	300	600
5	Iron (as Fe), mg/ L	0.3	1
6	Chloride (as Cl), mg/ L	250	100
7	Residual free Chlorine, mg/ L	0.2 min	-
8	Fluoride (as F), mg/ L	0.6 to 1.2	
9	Calcium (as Ca), mg/ L	75	200
10	Magnesium (as Mg), mg/ L	30	
11	Copper (as Cu), mg/ L	0.05	1.5
12	Manganese (as Mn), mg/ L	0.1	0.3
13	Sulphate (as SO <sub>4</sub> ), mg/ L	150	
14	Nitrate (as NO <sub>3</sub> ), mg/ L	45	100
15	Phenolic Compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/ L	0.001	0.002
16	Mercury (as Hg), mg/ L	0.001	No relaxation
17	Selenium (as Se), mg/ L	0.01	No relaxation
18	Cadmium (as Cd), mg/ L	0.01	No relaxation
19	Arsenic (as As), mg/ L	0.05	No relaxation
20	Cyanide (as CN), mg/ L	0.05	No relaxation
21	Lead (as Pb), mg/ L	0.05	No relaxation
22	Zinc (as Zn), mg/ L	5	15
23	Chromium (as Cr <sub>16</sub> ), mg/ L	0.01	0.05
24	Poly nuclear aromatic Hydrocarbon	--	-
25	Pesticides, mg/ L	Absent	0.001
26	Anionic Detergents (as MBAS), mg/ L	0.2	1
27	Mineral Oil, mg/ L	0.01	0.03
28	Radio active	--	

#### Other water sources

River Ganga and Sone are surface water sources, which have not been utilized for drinking purposes due to high investment costs and high reliance on ground water. The Patna water supply augmentation and improvement project, which is under execution, has taken Ganga water as source of water supply for northern part of Patna town. However, the southern part will have ground water as source of water supply. At present, there are 93 tube wells with water production of 325 million litres per day (MLD) against total requirement of 261.50 MLD (2011).

### 5.1.9 Drainage

The state of water quality is the result of complex natural and man-made conditions and the consequent interactions between in both time and space. Consequently, abstracting the essence of water quality conditions is often very difficult. Monitoring and assessment of the environmental state of surface and ground water defines a network of the water bodies of various nature, e.g. rivers, springs, brooks, streams, river systems, ponds, lakes, reservoirs, estuaries, coastal area, or open marine water and the geographical area it covers.

Total length of pucca covered drains is about 460 km, which is coming to about 16.18% coverage of storm water drainage network. The drainage system of Patna town was laid about 200 years back and drains are in bad condition. The system comprises hierarchy of natural and man-made drains that ultimately discharge surface run off and sewage to River Ganga and Punpun. Natural nalas are the main carriers of the storm water. The existing Patna drainage system has 9 major, 6 medium and many minor drains. The details of major, medium drains are shown below :

**Table 5.8: Details of Major Drains**

Sl.No	Name of Drain	Length (In Kms)
1	Serpentine	7.00
2	Rajapur – Anandpuri Drain	1.58
3	Patel Nagar Drain	1.00
4	Mandiri Drain	1.68
5	Bakarganj	15.00
6	Kurjee	6.90
7	Saidpur	6.58
8	Srikrishnapuri Drain	4.60
9	Yogipur Drain	4.39

Patna has saucer type topography and has many depressions and low-lying pockets such as Kankarbagh, Rajendra Nagar etc. having ground levels below the HFL. In order to drain out the surface runoff during monsoon and drain out the dry water flow from low lying pockets, 35 nos. of drainage pumping station once operated. Out of 35 drainage pumping station, 24 pumping station are operated by BRJP, 10 pumping station are operated by PMC and 1 pumping station is operated by Housing board.

### **Drainage and Sludge Disposal**

- Drainage outfalls at the river bank side causes flow back of water when river level rises.
- Water logging is a common problem. This problem has increased gradually along with progress of rapid urbanization. The Catchment areas of water bodies have been gradually filled up, modifying the natural slope of the land and thus disturbing the existing drainage system heavily.
- Natural drains are highly silted up and are suffering from being inhabited by squatter settlements.
- Surface Drains are being choked by wastes particularly by plastic materials

### **Wastewater characteristics of different drains**

As per guidelines of NRCD, 4 samples of waste water of each point to be conducted for one month where three samples were to be taken on week-days and one sample on an off day i.e. holiday to assess pollution load quantitatively and qualitatively. Sampling was done during the month of April-May 2015.

**TABLE 5.9: POLLUTION STATUS OF DRAINS AT DIFFERENT LOCATIONS OF PATNA**

Parameter	Unit	Anandapuri		S.K. Purinala		AshiyanaNala		YogipurNala		MandiriNala		RajapuraNala		NandapuriNala		PahariNala	
		Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down
		stream	Stream	stream	Stream	stream	Stream	stream	Stream	stream	Stream	stream	Stream	stream	Stream	stream	Stream
pH	--	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
TSS	mg/L	70	70	137	137	53	53	149	149	109	109	48	48	66	66	80	80
TDS	mg/L	629	629	486	486	671	671	680	680	610	610	457	457	711	711	659	659
VSS	mg/L	47	47	84	84	33	33	95	95	71	71	30	30	41	41	49	49
COD	mg/L	129	129	61	61	81	81	115	115	108	108	117	117	163	163	79	79
BOD	mg/L	55	55	21	21	36	36	48	48	41	41	49	49	80	80	28	28
Chloride	mg/L	53	53	29	29	64	64	62	62	58	58	43	43	58	58	60	60
TKN	mg/L	20	20	12	12	13	13	17	17	17	17	16	16	20	20	15	15
PO <sub>4</sub>	mg/L	2	2	1	1	2	2	2	2	2	2	3	3	2	2	2	2
SO <sub>4</sub> <sup>-2</sup>	mg/L	20	20	18	18	23	23	20	20	16	16	16	16	18	18	19	19
S <sup>-2</sup>	mg/L	2	2	1	1	3	3	2	2	2	2	2	2	3	3	3	3
Total Coliform	MPN/100ml	4630	4630	411	411	1308	1308	7897	7897	6864	6864	243	243	7821	7821	4173	4173
Faecal Coliform	MPN/100ml	1527	1527	91	91	391	391	1871	1871	1370	1370	36	36	1587	1587	823	823
Flow(Avg)	m <sup>3</sup> /hr	--	2705	--	538	--	3248	--	2562	--	2502	--	95	--	689	--	9427

## **5.2 Ecology and Biodiversity**

Forest Resources: Bihar is situated in the eastern part of India bordering Nepal and has a geographical area of 94,163 km<sup>2</sup>. It is part of gangetic plains and is drained by two major rivers, the Ganga and the Gandhak. Annual rainfall in the state varies from 1000mm to 2000 mm. The recorded forest area of the state is 6473 km<sup>2</sup> which is 6.87% of the geographical area. Reserve forest constitutes 10.70%, Protected Forest 89.28% and unclassified Forest, which is about 0.02% of the total forest area. Patna district has deciduous type of forest. The district has 3202 km<sup>2</sup> of Geographical area comprising 13 km<sup>2</sup> of Moderately Dense forest, 3 km<sup>2</sup> open forest and absence of Very Dense forest. Thus the forest cover of the district is 0.50% of total Geographic Area. (Source: State Forest Report – 2009).

### **Wildlife Protected area and Wildlife Sanctuary**

One Wildlife National Park (Valmiki National Park) and twelve Wildlife Sanctuaries are located in Bihar. However, no National Park and Wildlife Sanctuary is reported within 10 km from project boundary. During primary survey Schedule – I mammals as per WPA – 1972, like fresh water Dolphin (*Platanista gangetica gangetica*) was seen in river Ganga stretch in Patna city.

### **Wetland**

No wetland notified under “The Ramsar Convention – 1971” or listed under “the National wetland Conservation Programme – 2009” is reported within 10 km from project boundary.

### **Flora**

The phytosociological study of the core zone (terrestrial habitat) beyond the riparian habitat comprises of manmade ecosystem. Trees plantation in form of landscaping was noticed due to nearby residential area, government offices, hospitals, university, parks and market places. The species of trees reported are mainly planted, except few species which are naturally growing. These trees are fruit, flower and seed bearing and attract avifauna, small mammals and reptiles. Nesting was commonly reported. Species of trees reported during survey are following:

1. Peepal <i>Ficus religiosa</i>	10. Jackfruit <i>Artocarpus heterophyllus</i>
2. Bat <i>Ficus benghalensis</i>	11. Kadamb <i>Anthocephalus cadamba</i>
3. Sissoo <i>Dalbergia sissoo</i>	12. Siris <i>Albizia procera</i>
4. Jamun <i>Syzygium cumini</i>	13. Amla <i>Phyllanthus emblica</i>
5. Neem <i>Azadirachta indica</i>	14. Coconut <i>Coco nucifera</i>
6. Sal <i>Shorea robusta</i>	15. Mango <i>Mangifera Sp</i>
7. Bahera <i>Terminalia arjuna</i>	16. Gular <i>Ficus Glomerata</i>

8. Mango <i>Mangifera indica</i>	17. Palash <i>Butea monosperma</i>
9. Golden shower <i>Crassia fistula</i>	18. Gulmohar <i>Delonix regia</i>

## Fauna

To study the diversity of fauna, various survey methods were adopted. The survey was mainly carried out at dawn and at dusk to study animal behavior and habitat. This study period is mainly selected as animals are most active. Secondary data was collected from the forest department and interaction with the local was also conducted to establish baseline study for distribution of wild animals in the study area. No wild mammals are reported in the study area, due to anthropogenic activity and urbanized habitat. Domestic mammals are reported in the study area.

## Avifauna

The fauna reported in the inner buffer zone are mainly avifauna (highest diversity) followed by mammals and reptiles. The commonly reported avifauna in the study area during primary survey, with higher diversity are Common crow, Myna, Eagle, Sparrow, Babbler, Pigeon, Cattle Egrets, Red Vented bulbul, Drongo, Sparrow, Indian Roller etc. During site visit higher frequency of birds recorded in the project affected. This is mainly due to availability of nesting habitat, discarded foods from rituals ceremony and fruits bearing trees. Table 4.3 gives the list of avifauna reported in the core zone and inner buffer zone.

1. Red Wattled Lapwing <i>Vanellus indicus</i>	9. Green Bee eater <i>Merops orientalis</i>
2. Rock Pigeon <i>Columba livia</i>	10. House sparrow <i>Passer domesticus</i>
3. Cattle Egrets <i>Bubulcus ibis</i>	11. Drongo <i>Dicrurus bracteatus</i>
4. Cuckoo <i>Cuculus micropterus</i>	12. Egret <i>Casmerodius albus</i>
5. Red Vented Bulbul <i>Pycnonotus cafer</i>	13. Cattle Egret <i>Bubulcus ibis</i>
6. Common Crow <i>Corvus splendens</i>	14. Rose ringed parakeet <i>Psittacula krameri</i>
7. Common Myna <i>Acridotheres tristis</i>	15. Spotted dove <i>Spilopelia chinensis</i>
8. Common Babbler <i>Turdoides caudata</i>	16. Bank Myna <i>Acridotheres ginginianus</i>

## Mammals

During primary survey no wild mammals are reported in the study area. Based on secondary information like interaction with the local, wild mammals like Indian mongoose and five striped squirrel are reported. Domesticated mammals like goat, sheep, dog, cow, ox, donkey etc. are reported. These animals are domesticated for milk and other commercial purposes.

## Reptiles

Based on forest working Plan and interaction with people dwelling nearby ghat areas, it has been confirmed that the study area witness poor reptilian distributions. Reptiles like Rat Snakes (*Ptyas mucosus*), Common Kraits (*Bungarus caeruleus*), Indian cobra (*Naja Naja*) etc. has been reported. House Gecko and Garden Lizard are directly sighted during primary visit.

### **5.3 Baseline Socio- Economic Status**

#### **5.3.1 Demographic Data**

From Bihar's total area 96163 km<sup>2</sup> Patna district occupies an area of 3,202 km<sup>2</sup>. Total Urban Population of Bihar is 1, 17, 58, 016.00 in which males population are 62, 04,307 and females are 55, 53,709. Out of the total Patna population for 2011 census, 43.07 percent lives in urban regions of district. As per 2011 census, total population of Patna urban is 25, 14,590 of which 1,683,200 lives within the municipality boundary. Total male population in Patna is 13, 32,487 which is approximately 53 % of total urban population. Sex ratio in Patna district as per Census 2011 is 887 whereas child sex ratio is 883. Child populations (0-6) in urban region were 3, 29,592 of which males and females were 1, 75,005 and 1, 54,587. This child population figure of Patna district is 13.11 % of total urban population.

#### **5.3.2 Literacy Rate**

Average literacy rate in Bihar is 76.86% which males and females are 82.56% and 61.95%. In Patna district as per census 2011 literacy rate is 80.98 % of which males and females are 85.75 % and

75.59 % literates respectively. In actual number 1769307 people are literate in urban region of which males and females are 992574 and 776733 respectively.

Average literacy rate in Patna district as per census 2011 is 82.40 % of which males and females are

87.71 % and 81.33 % literates respectively. In actual number 1,810,338 people are literate in urban region of which males and females are 1,008,475 and 801,863 respectively.

#### **5.3.3 Employment Trend**

The total workers population of PUA was 25.2% of its total population in 2001. The male worker population was 3.8 lakhs (41.4%) and that of females it was 0.45 lakhs (5.8%). This is less than the percentage of workers population in the Bihar state which was 33% in 2001. This indicates that 74.8% of the population is dependent. It also indicates a high percentage of part time and supplemental jobs, common among those below the poverty line.

Among workers, 77% are in the other workers category which includes offices/institutional workers and business.

#### **5.3.4 Social Infrastructure**

Patna being headquarter of Patna District caters to the education and health need of the entire district. PMC does not run any school or education institution. The Education Department of the State Government does so with control over administrative and financial aspects.

#### **Town Management**

The urban local bodies in the state of Bihar are governed by the Bihar Municipality Act 2007. The act specifies the governance framework, spatial jurisdiction and the functional domain of the urban local bodies. The functional domain was expanded in 2007 as per the 12th schedule of the 74th CAA. They include:

- Water-supply for domestic, industrial, and commercial purposes
- Drainage and Sewerage
- Solid waste management
- Preparation of plans for development and social justice
- Communication systems, construction and maintenance of roads, footpaths, pedestrian pathways, transportation terminals, both for passengers and goods, bridges, over-bridges, subways, ferries, and inland water transport system
- Transport system accessories including traffic engineering schemes, street furniture, street lighting, parking areas, and bus stops
- Community health and protection of environment including planting and caring of trees on road sides and elsewhere
- Markets and slaughterhouses
- Promotion of educational, sports and cultural activities, and aesthetic environment, and
- Perform such other statutory or regulatory functions as may be provided by or under this Act or under any other law for the time being in force.

These Local Bodies play a critical role in the delivery of social, economic and infrastructure services like public-health, sanitation, primary education, solid waste management, and maintenance of road networks.

#### **Institutional Responsibilities**

Inter-departmental coordination is one of the prominent issues and conflict that are becoming difficult to address or resolve even at the level of heads of the service delivery agencies. It is observed that the citizen is often concerned with the quality of service rather than who is delivering the service. The service delivery



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often suffers because more than one agency is involved and there is no mechanism for ensuring inter-agency coordination.

## **CHAPTER 6: ENVIRONMENTAL AND SOCIAL IMPACTS**

Pollution abatement projects may prove beneficial for the environment and society or they may have some adverse impacts as well. Planners and decision makers have realized the importance of understanding the consequences of any such projects on both environmental and social sectors, and have started taking steps to avoid any adverse impacts. Based on the major findings obtained from the field visits and secondary data analysis, the possible environmental and social issues with reference to the proposed sewerage project is been discussed in these sections.

### **6.1 Potential Environmental and Social Impacts**

The following environmental parameters have been evaluated to assess/ analyse the impact of the Project:

- air quality;
- noise;
- water quality;
- waste management and;
- Occupational health and safety
- Traffic flow

#### **6.1.1 Air Quality**

During the construction of new sewer line, pumping station and STP; there will be temporary increase in the level of suspended solid particles and other minute particles from the construction activity and the construction material. The Residual impact will not be significant and also a short term impact and will not have an adverse impact on the residents.

During the operational phase, when the project households are connected to the new sewer line, pumping station and STP is in operation, there is a less possibility of sewer odour spreading into the air. However, it may arise only when there is a fault or malfunctioning of pumping station and STP which can easily be avoided with proper mitigation measures.

#### **6.1.2 Noise**

Noise will generate during construction which will be above the acceptable criteria. During construction proper use of technology can considerably control the noise levels from the construction sites.

During the operational phase, noise level will not create any adverse effect as proper technology will be adopted. The noise level generated during this phase will be based on the sound power level of the pump, but it would be within the criteria due to the large attenuation afforded by the pumping station building. Thus, it is concluded that the operational noise levels would not create any adverse impacts to local residents.

### **6.1.3 Water Quality**

Water quality will be impacted during the construction phase due to suspended solids runoff from excavation sites and spoil heaps and from dewatering of trenches and foundations, when water containing high concentrations of suspended solids may be discharged to water courses. However, with the implementation of suitable mitigation measures, it is concluded that there will be no adverse impacts. No residual construction impacts are predicted.

Once operational, the overall system of sewage discharge will be upgraded as no untreated or chronically discharged water will affect the water courses. Thus, the scheme offers a significant environmental benefit to the area in terms of improvements in the quality of the River Ganga.

The only potential water quality issue during the operational stage will arise from the emergency overflow of sewage into the local receiving waters. To protect against this, all pumping stations have been designed to include a stand-by pump and emergency power supply. Based upon these mitigation measures, it is extremely unlikely that a failure will occur. However, in case a failure does occur, it would be repaired promptly and the discharge would be short-term.

### **6.1.4 Waste Management**

A large proportion of the soil material that will be excavated during the construction phase can be used for several other purposes like backfill material for the sewer alignment. The remaining earth and the broken surface material will require off-site disposal on the basis that it will be surplus to requirements or unsuitable for backfilling respectively.

The waste material generated during the operational phase will be limited to screening materials removed during the maintenance of the pumping station and materials removed from manholes after removal of blockages. Assuming proper handling and disposal methods are adopted, no adverse impacts are predicted.

Care must also be taken so that the solid waste generated from the screening of waste at the sewage pumping stations and Sewage Treatment Plant is adequately disposed to an identified location and not just outside of the premise boundary.

In similar manner separate arrangement to be made for the disposal of sewage sludge in a suitable site.

#### **6.1.5 Occupational Health and Safety**

Workers need to be mindful of the occupational hazards which can arise from working in trenches and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures.

#### **6.1.6 Traffic Flow**

Traffic congestion will be caused by pipeline construction and increased construction traffic in urban areas. Roads may be fully or partially closed during construction, causing temporary inconvenience to residents, commercial operations and institutions. However since traffic flow analysis indicates that there is a domination of cycles, rickshaws and two wheelers de-routing can be a possibility without major disruptions.

#### **6.1.7 Impact on Livelihood**

The excavation work will not lead to any road blockage and normal life will not be hampered.

#### **6.1.8 Impact on Land Use**

New STP will be constructed at the existing STP campus that belongs to Municipal Corporation as such, there will be no requirement of additional land (refer Annexure VI). For LS, the lands are available with the Municipal Corporation / I & WD.

#### **6.1.9 Impacts of migrant labour on host community**

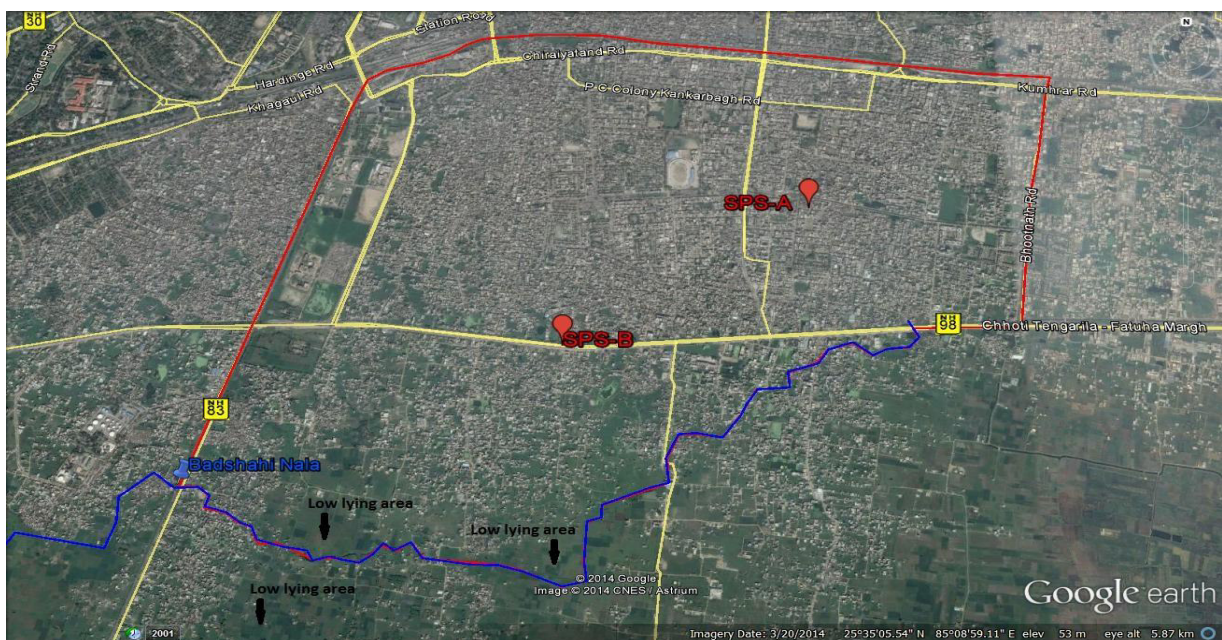
There will be no impacts of migrant labour on host community at the project site. If any such impacts will be anticipated that will be taken care of by the borrower.

### **6.2 Analysis of Alternatives**

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

The Kankarbagh zone is sloping from north to south and crowded with residential complexes in the northern zone. Therefore, the best option available to redesign its sewage system is to collect and divert the sewage flow from the northern populated area to the low-lying barren regions in the south. The sewage can then be treated at the STP, built in this low lying area near the Badshahi canal in the southern boundary of the zone (Figure 6.1). The STP discharge can be released into the Badshahi canal without much difficulty.

So, the suggestive Sewer trunk can be laid along Malahi Pakdi Road, P C colony Kankarbagh Road, Kankarbagh Road and Chiraiyatand Main Road to collect sewage from the crowded residential complex area situated in the northern part of Zone IV. Then, the sewer trunk will cross Fatuha Margh (NH-98) road to enter the southern part of Zone IV. In the southern portion below the Fatuha Margh, the sewer trunk along the roads as marked in Figure 17 will be laid to reach the waste water treatment plant. The width and condition of these roads needs to be surveyed to perceive the feasibility of construction of sewer trunk along these roads. The final design of sewer network depends on the availability of land for STP, which will be decided by the PMC.



### **6.2.1 Concept plan for Kankarbagh zone**

The availability of land for STP construction is the main difficulty in Kankarbagh zone. Most of the area is congested and the lands available are owned privately. So, the client has suggested combining the STP of Digha and Kankarbagh zone together and setting it up on the bank of the river Ganga in the northern portion of Digha zone (Figure 16). But after field visit and investigating the roads, it is perceived that the suggestion is highly unrealistic and cannot be carried out for the following reasons:

- i. It will require crossing the Eastern Railway main line to reach the Digha zone from Kankarbagh zone. No suitable crossing is observed for this purpose.
- ii. A considerable number of pumping stations will be required to collect and pump the sewage from the Kankarbagh zone to Digha zone. The land required for these pumping stations will not be possible to acquire in this region.

- iii. The initial capital cost as well as life cycle cost will be very high. The main sewer trunk has to be laid for a distance of about 9 Km to reach the proposed STP site from Kankarbagh zone. The increased number of pumping stations will add cost to O&M.

The second proposal for setting up STP for Kankarbagh zone is to construct it in the area where present STP of Beur zone (Figure 17) is situated. After observing the obstacles provided by the Patna-Gaya railway line, it can be concluded that the option for building up STP of Kankarbagh zone along with Beur zone is also not feasible.

So, after investigating the area, the two possible options that be applied to achieve a sensible and practical design is listed below.

- i. To build a STP in the southern low-lying vacant area near Badshahi canal of the Kankarbagh area as shown. This will allow economic design as the sewer line will be laid along the slope of the region from the north to the south.
- ii. To collect the sewage from the Kankarbagh zone and carry it along NH-98 to treat it at a STP constructed in the area where the present Pahari STP is located. The distance of existing Pahari STP from Kankarbagh zone is about 4.2 Km and the natural slope is in the direction of the proposed sewage flow (Figure 19). Moreover, no obstruction like Railway crossing is present in the path of the sewage flow. Thus, this option may be considered for STP design of Kankarbagh zone.

### **6.2.2 Treatment Technology**

One of the most challenging aspects of a sustainable sewage treatment system design is the analysis and selection of the treatment processes and technologies capable of meeting the requirements. The process is to be selected based on required quality of treated water. While treatment costs are important, other factors should also be given due consideration. For instance, effluent quality, process complexity, process reliability, environmental issues and land requirements should be evaluated and weighted against cost considerations. The proposed sewage treatment plant is based on SBR technology which is the most suitable technology with respect to the available land. Further acquisition of land in the Municipal Corporation is almost impossible because of the following-

- Large piece of land is absolutely scarce
- Land cost is very high because of many reasons
- Some government lands are available but already allotted for some other purposes.

Hence, amongst the alternatives SBR is the most feasible alternative for sewage treatment, since availability of land for STP(s) is the single most deterring factor, ultimately guiding the final selection of the proposed

technology. A comparative assessment of different natural waste water treatment technology has been given in approved DPR.

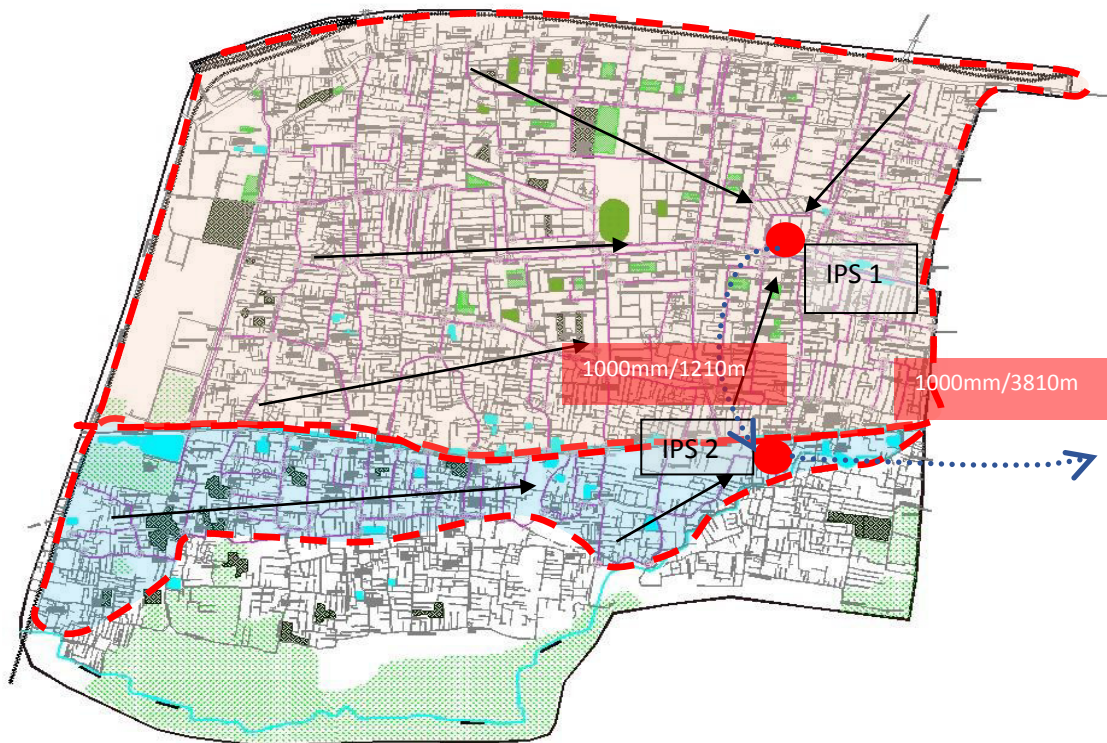
The Sequential Batch Reactor (SBR) technology is a type of activated sludge process for treatment of wastewater. While there are several configurations of SBRs, the basic process is similar. The installation consists of at least two identically equipped tanks with a common inlet, which can be switched between them. The tanks have a “flow through” system, with raw wastewater (influent) coming in at one end and treated water (effluent) flowing out the other. While one tank is in settle/decant mode the other is aerating and filling. At the inlet is a section of the tank known as the bio-selector. This consists of a series of walls or baffles which direct the flow either from side to side of the tank or under and over consecutive baffles. This helps to mix the incoming Influent and the returned activated sludge (RAS), beginning the biological digestion process before the liquor enters the main part of the tank. The effluent will be disinfected by chlorine with a contact time of 30 minutes before discharging into nearby waterbodies. A contact tank has also been proposed at the STP site.

The process has limited environmental impacts expected during construction. Little air, water and noise pollution is expected from the proposed construction activities; however these are localized impacts and can be minimized with proper construction schedule and precautionary approach.

### **6.2.3 Pumping Stations and Lifting Stations**

For the suggestive Sewerage system, Sewage PS have been proposed to allow wastewater collected from one area to STP. Accordingly 2 Nos Sewage PS for Kankarbagh Zone has been proposed.





### 6.3 Project Impacts

The project component specific impacts at different phases of project execution have been elaborated below:

**TABLE 6.1: PROJECT COMPONENT SPECIFIC IMPACT ASSESSMENT**

Activity	Details	Impact
<b>PRE CONSTRUCTION PHASE</b>		
<b>Pre-construction base work</b>	Land acquisition, if any	Following the governmental procedures of land transfer
	Transportation of machines and material	Noise and Sound Pollution and overall disruption
<b>CONSTRUCTION PHASE</b>		
<b>Construction of STP ,Lifting Stations</b>	Percolation of leachate into groundwater by from the solid waste disposal sites, which may contain high concentrations of organics and heavy	The leachate may contaminate ground and surface water unless it is contained by an impermeable layer which allows it to be collected for subsequent treatment.



Activity	Details	Impact
	metals.	
	Cutting and excavation of roads	Longer Travel time Inconvenience in traffic movement
	Accidental and emergency overflow of sewage into the local receiving waters.	Increased toxic materials in drains and water bodies
	During construction air and noise and odour during operation phase	Bad Odour, Air and Noise pollution will be nuisance as the STP is located in Residential area.
<b>Construction of Sewer Line</b>	Excavation, cutting and filling operations	There will be disruption to the movement of vehicles.
	Digging of roads, pavements Removal of soil and pipe. Storing removed materials beside the trench. Generation of solid waste Heavy machinery will be on the road blocking free flow of vehicles safe disposal of silt.	There will be disruption to the movement of vehicles and reduced access to residences and business.
	All lanes and by lanes with 4 mt to 6 mt width will cause traffic congestions.	
	Machines will operate , day and Night	Generates heavy noise during night times
	Suspended solids runoff from excavation sites and spoil heaps	Water containing high concentration of suspended solids may be discharged to water courses
	Digging of earth will generate debris	Dust Generation
<b>Renovation of Pumping Station</b>	Installation of mechanized screenings equipment Installation of grit removal equipment Replacement of pumps	Construction materials on site will generate Dust from construction materials
<b>Any construction activity</b>	Occupational Hazards	Health impacts due to absence of housing and sanitation facilities in labour camps. Engagement of child labour
<b>OPERATIONAL PHASE</b>		
<b>STP Location At Kankarbagh</b>	Treatment	Percolation of leachate into groundwater by from the solid waste disposal sites, which may contain high concentrations of organics and heavy metals. The leachate may contaminate ground and surface water unless it is contained by an impermeable layer which allows it to be collected for subsequent treatment.
	Indiscriminate disposal of Sludge	Bad odour , air pollution by dust , Noise pollution Contamination of soil and water

Activity	Details	Impact
	Disposal by-passing of sewers	As the drain receives both sewage and sullage, the drain sludge will be high in pathogens.

#### **6.4 Stakeholder Feedback on Perceived Impact**

Environmental and social impact was assessed through physical observation and verification and through Focus group discussion. The purpose of the assessment was to understand the environmental situation in the Municipal Corporation and also understand the probable environmental impacts due to the projects as conceived by stakeholders.

Since there is no land acquisition there is no significant social impact related to displacement of population and related rehabilitation and resettlement. However social impact is likely to occur in respect to temporary disruptions in daily life and commuting of people specially school children etc. Health impacts, disruption of daily life and livelihood are the various aspects which were discussed during consultation with stakeholders.

Social impact assessment was done through a two stage process of

- Identification of sensitive wards and locations through consultation with Ward Councillors
- Assessment of social and environmental conditions in the context of the project through Focus group discussion with inhabitants or beneficiaries.

##### **6.4.1 Identification of sensitive locations**

It is one of the crowded residential colony of Patna municipal corporation. The area is marked by residential houses and high raise apartments. There are several schools, colleges, hospitals etc. Some Focus Group Discussion (FGD) has been organized in some prominent areas in the zone . Key issues raised during the survey has been given in the table below followed by location photograph.

Sl. No.	Place of consultation	No of Participants	Nature of Participants	Key issues (Positive and negative feedbacks)
1	RKD College, Lohia Nagar	10	Mixed Group of college students,	Affirmative and co-operative. Traffic inconvenience and congestion due to

Sl. No.	Place of consultation	No of Participants	Nature of Participants	Key issues (Positive and negative feedbacks)
			teachers, staffs	construction activities admitted. Need for speedy action during construction activities. Restoration should be done with priority.
2	Commercial shop, Ashok Nagar	8	Mixed group of shop owners and local residents	Inconvenience in commuting. Worried about reduced access to businesses places. Speedy action during construction activities. Restoration should be done with priority. Affirmative and co-operative.
3	Household survey, Hanuman Nagar	10	Local residents	Affirmative and co-operative towards project. Willing to the project. Traffic inconvenience, congestion of road. Increase travel time, reduced access to station, shops, market, schools etc. Restoration should be done with priority.
4	Kali temple, Ramjanaki Path	8	Local residents, devotee, priest.	Affirmative and co-operative towards project. Willing to the project. Restoration should be done with priority.
5	Slum survey at Ganga Nagar	10	Slum dwellers	Willing to the project. Need awareness generation, motivation campaign.
6	Road side survey, Khemini Chowk	8	Mixed group of shop owners and travellers	Inconvenience in commuting. Worried about reduced access to businesses places. Speedy action during construction activities. Restoration should be done with priority. Alternate traffic diversion arrangement may be arranged.

## **CHAPTER 7: ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN**

### **7.1 Environmental Mitigation and Management Plan**

The Mitigation and Management Plan (EMP) covers all phases of the Project from preparation and construction to commissioning and operation, and aims to monitor environmental impacts and their mitigation. The EMP has been incorporated into the design stage, and will be incorporated into the construction and operation management plans.

Plans for public involvement during the design, construction and operation phases have been developed during the project preparation stage. These plans include public participation in:

- a. monitoring impacts and mitigation measures during the construction and operation phases,
- b. evaluating environmental and economic benefits and social impacts, and
- c. Interviews after the Project have been completed. There will be several types of public involvement, e.g., site visits, workshops, investigation of specific issues, interviews, and public hearings.

Costs of all mitigation measures during the construction phase will be included in the tender and contract documents and will be borne by contractors. Costs related to mitigation measures for the operation phase will be borne by IAs. Costs of environmental management consultants and of training will be borne by the project as a whole.

During the construction and operation phases, the implementing agencies (IAs) will be responsible for monitoring the performance of the facilities and the environmental impact of the project. Each IA will make appropriate arrangements for monitoring in consultation.

Besides compliance monitoring, detailed internal environmental monitoring programs during the construction and operation phases with higher monitoring frequency will be prepared at the beginning of project implementation. These monitoring programs and budgets will be included in the construction and operation contracts and programs.

Summarizes the generic environmental management plan for low category investment that identifies the potential issues of various activities that are anticipated in the design and development, construction, and operation phases of the proposed sewer work and STP in Patna. The environmental management plan

ensures to suggest appropriate mitigation measure against the issues/ concerns identified during the environmental and social assessment study.

### **7.1.1 Specific activities by BUIDCO**

In general, the BUIDCO (with assistance from DBO Operator and Independent Engineer/Supervision Consultant) is the responsible entity for ensuring that the mitigation measures as suggested in the ESMP. The roles and responsibilities of the involved institutes are described below.

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

- EIA clearance from NMCG and World Bank;
- CTO Certificate from Bihar State Pollution Control Board for STP.
- Disclosure of EIA document as well as in the info shop of World Bank and
- Permission from line department for laying of networking, renovation of STP & completion of construction work of sewerage system.
- Permission for tree felling (if any) ;
- Advising contractor for necessary environmental monitoring of Air, Water, Noise and Soil Quality during the construction Operation phase.

### **7.1.2 Specific activities by Contractor/DBO Operator**

The activities to be performed by the contractor/DBO Operator shall implement the EMP.

### **7.1.3 Implementation of EMP**

The DBO Operator shall have prime responsibility to implement the EMP. “The DBO engineer” shall monitor the compliance of the EMP. DBO engineer and BUIDCo will have secondary responsibility for implementation of EMP.

#### **The Operator shall ensure that:**

- Ensure that sewer laying process does not create hazardous movement situation. Also ensure that public is pre-warned about the activities, construction area is barricaded, all debris is well managed causing minimum inconvenience to public and other measures are implemented as indicated under EMP.
- Specific area shall be earmarked for intermittent storage of biodegradable and non-biodegradable waste at SPS site.
- Tree plantation (minimum two rows) shall be made on the periphery of SPS to prevent spread of

bad odour and undertake landscaping to enhance aesthetic at SPS locations.

Feedback from the local residents can also be taken from time to time to cross check the contractor’s report. Project management consultants should make inspection visits at construction site to check the implementation of Environment Management Plan as per the contract. Broad Institutional arrangement for implementation of EMP is shown in figure 8.1 below:

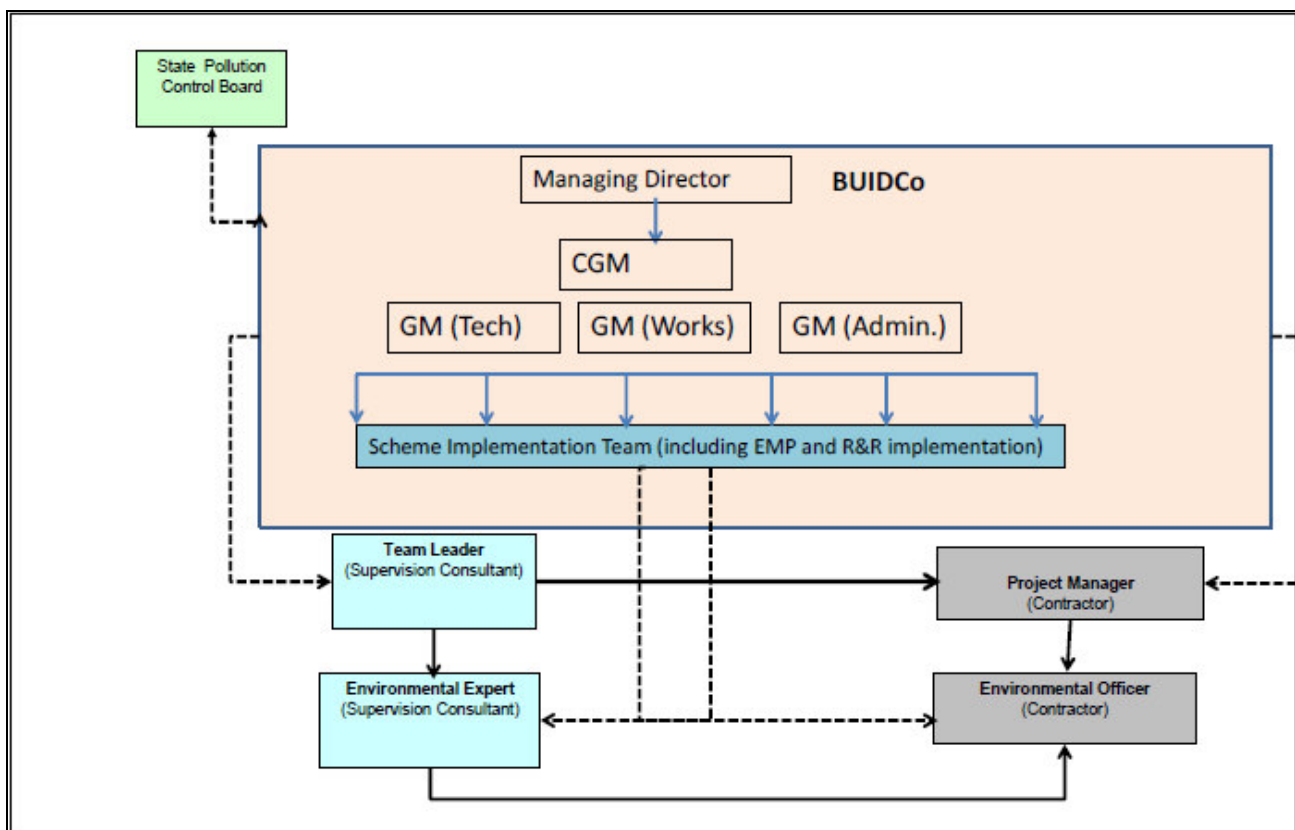


Figure 7.1 : Organisation Structure for Implementation of EMP

Role and responsibilities of various stakeholders as given below:

Table 7.1: Responsibilities of Different Stakeholders

Stakeholder Category	Role in project implementation	Role in mitigation
NMCG	Over all coordination	Coordinating so that the mitigation plan is implemented well Ensuring funds for mitigation plan execution.
Executing agencies	Implementation of the project by awarding the project to the suitable contractor and regional	Ensuring that the relevant departments are available for mitigation plan Enough safety provisions are available for the project

Stakeholder Category	Role in project implementation	Role in mitigation
(BUIDCo.)	coordination Informing the relevant departments about the progress of the project	implementation
Patna Municipal Corporation	While execution of projects related to sewerage line, Patna Municipal Corporation is responsible for the damage caused to the public utility functions like drinking water pipe lines. Ensuring better access to households.	Should ensure that the basic amenities are in order during the construction and operational phase of the project Should ensure all the households envisaged at project planning phase gets access to the services. Weaker section of the society should get equitable share.
State, local Government	Coordination Monitoring and evaluation	Ensure all the safeguarding plans are in line and acted upon.
NGOs, CSOs, Research Institutes	Awareness creation about the project activities community participation for better project implementation	Public participation and coordination

#### **7.1.4 Reporting and Monitoring**

Responsible person from implementing agency should monitor and report the progress once in a week, whereas that from SPMG will do it once in a month and from NMCG once in three month.

#### **7.2 Environment Management Plan (EMP)**

Activity		Potential Impact/Concern	Negative	Duration of impact	Mitigation Measures	Responsible agency
<b>A. Design and Development Phase: STP</b>						
Sewage Treatment plant	Treated water disposal into nearby stream	Pollution of received water body ( river) or land due to inefficient treatment or non-operation of STP		Temporary	<ul style="list-style-type: none"> <li>The treated water quality shall comply with the prescribed standards of the bid document and other applicable conditions of consent to establish issued by the state pollution control board.</li> <li>Selection of best available sewage treatment technology with High BOD removal efficiency.</li> <li>Ensuring development and compliance to standard operation and maintenance practices.</li> <li>Provision of effective screening at inlet of STP for removal of grit, fine plastics and other suspended solids</li> <li>Provision of effective separation and controlled disposal of digested sludge</li> <li>Provision effective disinfection before discharge of treated water for irrigation or to river</li> </ul>	Concessionaire



Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
	STP Breakdown	Discharge of untreated sewage leading river pollution.	Temporary	<ul style="list-style-type: none"> <li>Provision of adequate holding capacity adequate for storage of sewage to prevent flow of untreated sewage to river.</li> </ul>	DBO Operator
	Flooding due to rain water run off	Rain water may flood the STP area in absence of adequate provision of diverting rain water flow towards STP from periphery area.	Temporary	<ul style="list-style-type: none"> <li>Suitable drainage provision shall be made to divert the rain water likely to be accumulated from peripheral catchment area of STP, to natural drainage stream or area.</li> </ul>	DBO Operator
	Sludge disposal	Disposal of sludge leading to contamination of land and water.	Permanent	<ul style="list-style-type: none"> <li>Efficient Sludge dewatering with minimum land involvement shall be adopted.</li> <li>Provision shall be made for intermittent storage of digested sludge at STP site.</li> <li>The digested sludge shall be utilised as manure or disposed to suitable site as approved by DBO engineer.</li> </ul> <p>If disposal is made for land fill, the site shall be located away from habitation and water bodies and shall be pre-approved by concerned authorities like Municipal corporation, Pollution Control Board or</p>	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
	Provision for safety of workers and safe operation of STPs	Accidents leading to injury or death of workers (Fall of workers from Height, Fall into deep water tanks, Short Circuiting), accidental slip, trip and fall in walk ways or work areas, Fire, exposure to toxic gas such as chlorine etc.	Permanent	<ul style="list-style-type: none"> <li>• Ensure adequate provision of Handrails on both sides of walkways close to deeper tanks and STPs need to be ensured;</li> <li>• All electric switches ( including unit specific on-off switches installed at respective units ) and panels should have adequate protection from rain water to prevent short circuiting</li> <li>• Proper earthing with installation of earth circuit breakers shall be made</li> <li>• Walk ways designs shall be made with proper slope to avoid accumulation of rain water. Material handling and storage shall be so designed that walk way surface remains free from wet or oil surface situation to prevent slips, trip or fall accidents.</li> <li>• Provision of interlock system to either stop STP or divert untreated effluent to holding tanks in case of short circuiting, or mall functioning of STP</li> <li>• Prepare emergency preparedness plan including identification of assembly area in case of fire</li> </ul>	DBO Operator

Activity		Potential Impact/Concern	Negative	Duration of impact	Mitigation Measures	Responsible agency
	Location of STP	Noise/Odour/fly hazards to neighbouring areas. Cutting of Trees	nuisance	Permanent	<ul style="list-style-type: none"> <li>• Ensure minimum noise generation; at pump station in STP</li> <li>• Minimize Tree cutting if involved.</li> <li>• Tree plantation of at least two rows around the periphery of STP site and landscaping to prevent spread of bad odour with large canopy/ broad leaves trees like Sesum, Neem, Bargad, Teak, Sal, etc.</li> <li>• Accumulated sludge and solid waste to be cleared within 24 hours and spraying of suitable herbicides on accumulated sludge/solid waste to reduce odour.</li> </ul>	DBO Operator
<b>B. Construction phase</b>						
Sewage Treatment plant	Excavation of earth	Loss of topsoil due to excavation activities.		Temporary	<ul style="list-style-type: none"> <li>• The existing STP shall not be demolished till alternate arrangement for treatment of existing sewage is made to ensure that untreated sewage is not discharged to river.</li> <li>• Excavation shall be planned in such a manner that such that no damage occurs to existing structures.</li> <li>• Top soil should be separately stockpiled and utilized for green belt development or landscaping after completion of work</li> </ul>	DBO Operator

Activity	Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
	Construction waste	Temporary	<ul style="list-style-type: none"> <li>All the associated construction waste should be properly managed by storing and disposing off at suitable refusal sites approved by DBO engineer.</li> </ul>	DBO Operator
	Nuisance due to domestic solid waste disposal	Temporary	<ul style="list-style-type: none"> <li>Provide two bins for recyclable and non-recyclable wastes.</li> <li>Ensure that recyclable and non-recyclable wastes are collected in Segregated manner in these bins before disposal. Recyclable material should be sold. Non-recyclable material should be disposed to designated land fill area of the city.</li> <li>Provide adequate sanitation facility for workers at construction sites.</li> </ul>	DBO Operator
	Dust Generation due to construction activities	Temporary	<ul style="list-style-type: none"> <li>Excavated material transported by trucks will be covered and/or wetted to prevent dust nuisance.</li> </ul>	<ul style="list-style-type: none"> <li>DBO Operator</li> </ul>

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
				<ul style="list-style-type: none"> <li>• Suppressing dust generation by spraying water on stockpiles and unpaved movement areas</li> <li>• Water sprinkling over excavated areas, unpaved movement areas and stockpiles.</li> <li>• Transportation of loose construction material through covered trucks.</li> <li>• Use dust curtains (polysheets/ sheets) around the construction area for containing dust spread.</li> <li>• Construction equipment must comply with pollution norms and carry Pollution Under Control certificate.</li> </ul>	
		Temporary flooding due to uneven dumping of construction waste	Temporary	<ul style="list-style-type: none"> <li>• The construction waste material should be stored on the higher areas of the site and or areas where water may accumulate creating flooding like situation</li> </ul>	DBO Operator
		Spillage of fuel and oil	Temporary	<ul style="list-style-type: none"> <li>• Care to be taken to store fuel and oil (if required) at a place away from any drainage channel/nalla preferably to be stored in drums mounted on a concrete paved platform with slop draining to small spills collection pit.</li> </ul>	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
		Noise and vibration disturbances to residents and businesses	Temporary	<ul style="list-style-type: none"> <li>• Construction activities to be carried out in day time with prior intimation to local residents and shop keepers.</li> <li>• Use of low noise and vibrating equipment (such as enclosed generators with mufflers, instruments with built in vibration dampening and improved exhaust), to meet standards as prescribed by CPCB</li> <li>• Provision of protective equipment (PPE) like ear muffs and plugs for construction workers.</li> <li>• Provision of noise barriers as feasible in inhabited areas, particularly near sensitive zones like hospitals, schools etc.</li> <li>• DG set to be fitted acoustic enclosure.</li> </ul>	DBO Operator
Construction camps	Sanitation	Nuisance due to absence of facility of sanitation and solid waste management	Temporary	<ul style="list-style-type: none"> <li>• Labour camp if provided, must have adequate provision of shelter, water supply, sanitation and solid waste management</li> </ul>	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
General safety during construction	Safety and Health Hazard	Safety hazards to labours and public. Workers are seen to working without any PPE even at height.	Temporary	<ul style="list-style-type: none"> <li>● Comply with the Occupational health and Safety act of India</li> <li>● Ensure that the contact details of the police or security company and ambulance services nearby to the site.</li> <li>● Ensure that the handling of equipment and materials is supervised and adequately instructed.</li> <li>● Follow safe practices for working at height or confined area or underground working for safety of workers</li> <li>● Erect warning signs/ tapes and temporary barriers and/or danger tape, marking flags, lights and flagmen around the exposed construction works warn the public and traffic flow of the inherent dangers.</li> <li>● Provide adequate PPE to workers such as helmets, safety shoes, gloves, dust masks, gumboots, etc. to workers</li> <li>● Provide handrails on both sides of walkways close to deeper tanks and STPs need to be ensured;</li> </ul>	DBO Operator

Activity		Potential Impact/Concern	Negative	Duration of impact	Mitigation Measures	Responsible agency
					<ul style="list-style-type: none"> <li>• Smaller on and off switches at STP units to be installed with protection from rain water to minimize electrical short circuit;</li> <li>• Monthly reporting of all accidents and immediate reporting to DBO engineer and owner.</li> </ul>	
<b>C. Operation phase</b>						
Sewage treatment plant	Treatment and Disposal of Treated Water and Sludge	River, land or ground water pollution due to discharge of untreated or partially treated sewage due to inadequate or inefficient STP operations.		Temporary	<ul style="list-style-type: none"> <li>• Monitor the treated sewage quality and ensure compliance with PCB standards for effluent disposal into surface water bodies, on land or for the agricultural use.</li> <li>• Follow standard operating procedures for operation and maintenance.</li> <li>• Undertake periodic audit as per these procedures.</li> <li>• Comply with all applicable condition of consent to operate</li> <li>• Quarterly monitoring of influent sewage, treated sewage, upstream and downstream point of treated sewage disposal point to river</li> </ul>	DBO Operator



Activity	Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
	Problems arising due to bad odour, insects, polluted air,	Temporary	<ul style="list-style-type: none"> <li>● Maintain the green belt as per provision of design to prevent spread of bad odour with large canopy/ broad leaves trees like Sesum, Neem, Bargad, Teak, Sal, etc.</li> <li>● Accumulated sludge and solid waste to be cleared within 24 hours and spraying of suitable herbicides on accumulated sludge/solid waste to reduce odour.</li> <li>● Quarterly monitoring of Ambient Air Quality with respect to PM10, PM2.5, Sox and NOx, CO and Odour at three locations ( at STP site, minimum 500 m away from STP site in up-wind and down-wind direction of STP area.</li> </ul>	DBO Operator
	Increase in Ambient Noise Level and discomfort to neighbouring people	Temporary	<ul style="list-style-type: none"> <li>● Proper handling and regular maintenance of operating machines including pumps, generators, air diffusers, etc.</li> <li>● Quarterly Monitoring of Ambient Noise level to check compliance to standards.</li> <li>● Quarterly monitoring of ambient noise levels ( day and night) at same locations as of ambient air monitoring</li> </ul>	DBO Operator

Activity	Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
	Indiscriminate disposal of sludge leading to contamination of land and soil.	Temporary	<ul style="list-style-type: none"> <li>● Prepares sludge disposal plan as per desire stage provisions and guidelines and adhere to the same.</li> <li>● Ensure proper functioning of STP for digestion of sludge and ensure adequate functioning of dewatering units for efficient functioning of system</li> </ul>	DBO Operator
	River, land or ground water pollution due to discharge of untreated or partially treated sewage due to inadequate or inefficient STP operations.	Temporary	<ul style="list-style-type: none"> <li>● Ensure compliance with PCB standards for effluent disposal into surface water bodies, on land or for the agricultural use.</li> <li>● Follow standard operating procedures for operation and maintenance.</li> <li>● Undertake periodic audit as per these procedures.</li> <li>● Comply with all applicable condition of consent to operate</li> </ul>	DBO Operator

Activity		Potential Impact/Concern	Negative	Duration of impact	Mitigation Measures	Responsible agency
General Safety	<b>Workers exposure to hazardous materials/situations</b>	<ul style="list-style-type: none"> <li>• Serious/health/safety hazards</li> </ul>		Temporary	<ul style="list-style-type: none"> <li>• Ensure availability of PPE for maintenance workers.</li> <li>• Follow safety measures and Emergency preparedness plan evolved at design stage</li> </ul>	DBO Operator
<b>SEWER NETWORK</b>						
<b>Sewerage and Sanitation Investments</b>						
<b>A. Design and Development Phase</b>						
Sewerage Network	Accidental leakages/bursts	<ul style="list-style-type: none"> <li>• Due to accidental burst or leakage of sewers, flooding of the nearby areas</li> <li>• Backlogging due to unexpected heavy flow rates</li> </ul>		Temporary	<ul style="list-style-type: none"> <li>• Designing sewers with adequate capacity and flow velocity</li> <li>• Provision for Regular inspection and maintenance of the sewers</li> <li>Preparation of safety and Emergency Preparedness plan</li> </ul>	DBO Operator
<b>B. Construction phase</b>						

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
Sewerage (laying of sewers)	Excavation, cutting, back filling, compaction and construction operations	Damage to underground utilities like water, gas line, electricity and telephone conduits, etc. due to construction activities.	Temporary	<ul style="list-style-type: none"> <li>Identify existing underground other utility structures, lines through available records and in consultation with concerned authorities and plan construction activities accordingly to minimize damage to such utilities. These underground utilities encountered in excavating trenches carefully shall be supported, maintained and protected from damage or interruption of service until backfill is complete and settlement has taken place.</li> </ul>	DBO Operator
		Accidents/ damages due to erosion/ sliding of vertical sides of excavated trenches while places the pipes	Temporary	<ul style="list-style-type: none"> <li>Maintaining the excavation by Shoring trench sides by placing sheeting, timber shores, trench jacks, bracing, piles, or other materials</li> <li>Exposed surface shall be resurfaced and stabilized. Exposed surface will be resurfaced and stabilized by making the sloping sides of trench to the angle of repose at which the soil will remain safely at rest.</li> </ul>	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
		Generation of substantial debris, top soil and muck during construction	Temporary	<ul style="list-style-type: none"> <li>• Top soil shall be preserved and may be used for agricultural purpose or development of city parks.</li> <li>• Soil and debris may be managed for planned land filling and landscaping;</li> <li>• Debris may be suitably stored to filling back the excavated areas after placing the trunk sewer lines.</li> </ul>	DBO Operator
		Dust Generation (Air Pollution) due to excavation, cutting, back filling and compaction operations	Temporary	<ul style="list-style-type: none"> <li>• Water sprinkling over excavated areas, unpaved movement areas and stockpiles.</li> <li>• Transportation of loose construction material through covered trucks.</li> <li>• Use dust curtains (polysheets/ sheets) around the construction area for containing dust spread at SPS building construction site.</li> <li>• Construction equipment must comply with pollution norms and carry Pollution Under Control certificate.</li> </ul>	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
		Noise and vibration Disturbances to residents and businesses	Temporary	<ul style="list-style-type: none"> <li>• Construction activities to be carried out in day time with prior intimation to local residents and shop keepers.</li> <li>• Construction work near schools and colleges to be carried out during vacations and work near hospitals to be completed on priority basis (in shorter time period with alternate provision of traffic, accessibility of exit/entry gates etc.).</li> </ul>	DBO Operator
				<ul style="list-style-type: none"> <li>• Use of low noise and vibrating equipment meeting prescribed noise standards.</li> <li>• Provision of protective equipment (PPE) like ear muffs and plugs for construction workers. .</li> <li>• Provision of noise barriers in inhabited areas, particularly near sensitive zones like hospitals, schools etc.</li> <li>• DG set to be fitted acoustic enclosure.</li> </ul>	
		Temporary flooding due to excavation during monsoons or blockage of surface drains	Temporary	<ul style="list-style-type: none"> <li>• Stockpiled areas to be bordered by berms;</li> <li>• Stockpiles to be done in high areas to avoid flow in storm water run-off channels and erosion;</li> </ul>	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
		Increased traffic inconvenience (emissions, congestions, longer travel times, blockage of access)	Temporary	<ul style="list-style-type: none"> <li>• Alternate traffic routing must be adopted in consultation with concerned traffic police authorities. Proper traffic planning be made for narrow lane areas.</li> <li>• Work should to be completed on priority near business and market place to minimize business loss.</li> <li>• Care should be taken to minimize congestion and negative impacts at schools and hospitals. Safe access shall be maintained to these places during construction.</li> <li>• Provide temporary crossing/ bridges as may be required to facilitate normal life and business</li> </ul>	DBO Operator
		Settlement of backfilled area after construction	Temporary	<ul style="list-style-type: none"> <li>• The backfilling material shall be free from petroleum products, slag, cinders, ash or other material.</li> <li>• Backfilling activity shall be completed within five days of laying of sewer.</li> <li>• Proper compaction as per the soil condition and retain the original level of alignment and grade.</li> </ul>	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
		Spillage of fuel and oil	Temporary	Care to be taken to store fuel and oil (if required) at a place away from any drainage channel/nalla preferably to be stored in drums mounted on a concrete paved platform with slop draining to small spills	DBO Operator
		Nuisance due to solid waste disposal	Temporary	<ul style="list-style-type: none"> <li>• Provide two bins for recyclable and non-recyclable wastes.</li> <li>• Ensure that recyclable and non-recyclable waste are collected in segregated manner in these bins before disposal. Recyclable material should be sold. Non-recyclable material should be disposed for designated land fill area of the city.</li> <li>• Provide adequate sanitation facility for workers at construction sites.</li> </ul>	DBO Operator



Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
General safety during construction	Accidents	Safety hazards to labours and public	Temporary	<ul style="list-style-type: none"> <li>• Comply with the Occupational health and Safety act of India</li> <li>• Ensure that the contact details of the police or security company and ambulance services nearby to the site.</li> <li>• Ensure that the handling of equipment and materials is supervised and adequately instructed.</li> <li>• Erect warning signs/ tapes and temporary barriers and/or danger tape, marking flags, lights and flagmen around the exposed construction works warn the public and traffic flow of the inherent dangers.</li> <li>• Provide adequate safety precautions such as helmets, safety shoes, gloves, dust masks, gumboots, etc. to workers</li> </ul> <p>Monthly reporting of all accidents and immediate reporting to DBO engineer and owner.</p>	DBO Operator

Activity		Potential Impact/Concern	Negative	Duration of impact	Mitigation Measures	Responsible agency
<b>C. Operation phase</b>						
Sewer line	Leakage/ overflows	Water pollution and possibility of mixing with water supply line		Temporary	<ul style="list-style-type: none"> <li>Regular monitoring of sewer line and manholes for visible leakages/ overflows. Immediate repair shall be carried out to plug the leakages. Restore the sewer and other utility services if damaged due to leakages.</li> </ul>	DBO Operator
Sewage Pumping Station	Waste Handling	Bad odour, Health hazard and public nuisance		Temporary	<ul style="list-style-type: none"> <li>Provision for regular clearance of sludge and solid waste to minimize odor nuisance</li> <li>Ensure maintenance of Green belt as planned</li> </ul> Periodic disposal of accumulated sludge/solid waste to disposal site as approved by DBO engineer.	DBO Operator

Activity		Potential Impact/Concern	Negative	Duration of impact	Mitigation Measures	Responsible agency
General Safety	Workers exposure to toxic gases in sewers and hazardous materials during sewer maintenance work	<ul style="list-style-type: none"> <li>• Serious/health/ hazards</li> <li>• The toxic gases are likely to contract communicable diseases from exposure to pathogens present in the sewage.</li> </ul>	safety	Temporary	<ul style="list-style-type: none"> <li>• During cleaning/ maintenance operation, the sewer line will be adequately vented to ensure that no toxic or hazardous gases are present in the line.</li> <li>• Ensure availability of PPE for maintenance workers.</li> <li>• Follow safety and Emergency Preparedness plan prepared at design stage</li> </ul> <p>Monthly reporting of all accidents and immediate reporting to DBO engineer and owner.</p>	DBO Operator

### **7.3 Environmental Monitoring Plan**

The Environmental Monitoring Programme has been detailed out in annexure-I. Successful implementation of the Environmental Monitoring Program is contingent on the following:

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

## **7.4 Guidelines for Siting of Construction Camp**

### **7.4.1 Site**

The contractor based on the following guidelines shall identify the location of the construction site. The construction site shall be located:

- The construction camps will be located at least 200 m away from Ganga Ghats at identified sites. The living accommodation and ancillary facilities for labour shall be erected and maintained to standards and scales approved by the resident engineer.
- On non-agricultural lands, as far as possible
- Not within 1000m of either side of locations of Forest areas.
- All sites used for camps must be adequately drained. They must not be subject to periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections of water unless such water surface can be subjected to mosquito control measures.
- The camps must be located such that the drainage from and through the camps will not endanger any domestic or public water supply.
- All sites must be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance.

### **7.4.2 Layout**

The Contractor during the progress of work will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labour to standards and scales approved by the engineer. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. Safe drinking water should be provided to the dwellers of the construction camps. Adequate washing and bathing places shall be provided, and kept in clean and drained condition. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force.

### **7.4.3 Sanitation Facilities**

Construction camps shall be provided sanitary latrines and urinals. Sewerage drains should be provided for the flow of used water outside the camp. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and regularly emptied and the garbage disposed off in a hygienic manner

#### **7.4.4 Shelter at Workplace**

At every workplace, there shall be provided free of cost, four suitable shelters, two for meals and two others for rest, separately for use of men and women labourers. The height of shelter shall not be less than 3m from floor level to lowest part of the roof. Sheds shall be kept clean and the space provided shall be on the basis of at least 0.5m<sup>2</sup> per head.

#### **7.4.5 Canteen Facilities**

A cooked food canteen on a moderate scale shall be provided for the benefit of workers wherever it is considered necessary. The contractor shall conform generally to sanitary requirements of local medical, health and municipal authorities and at all times adopt such precautions as may be necessary to prevent soil pollution of the site.

#### **7.4.6 First aid facilities**

At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances will be provided as per the Factory Rules. Workplaces remote and far away from regular hospitals will have indoor health units with one bed for every 250 workers. Suitable transport will be provided to facilitate taking injured and ill persons to the nearest hospital. At every workplace an ambulance room containing the prescribed equipment and nursing staff will be provided.

#### **7.4.7 Health Care Facilities**

Health problems of the workers should be taken care of by providing basic health care facilities through health centres temporarily set up for the construction camp. The health centre should have at least a doctor, nurses, duty staff, medicines and minimum medical facilities to tackle first-aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses or critical cases.

The health centre should have MCW (Mother and Child Welfare) units for treating mothers and children in the camp. Apart from this, the health centre should provide with regular vaccinations required for children.

### **7.5 Guidelines for Debris Disposal Site and Management**

#### **7.5.1 Location**

The location of Disposal sites have to be selected such that:

- Productive land to be avoided and available wasteland to be given preference.

- Disposal sites to be located at least 1000m away from sensitive locations like Settlements, Water body, notified forest areas, Sanctuaries or any other sensitive locations.
- Should be located in the downwind side of nearest settlement locations.
- Disposal sites do not contaminate any water sources, rivers etc. for this, site should be located away from water body, and disposal site should be lined properly to prevent infiltration of water.
- Public perception about the location of debris disposal site has to be obtained before finalizing the location.
- Permission from the Villager/local community is to be obtained in writing by contractor for finalizing the disposal site identified.
- The Plan must be approved by DBO Engineer, Executing Agency and SPMG.

### **7.5.2 Precautions to be adopted during disposal of debris & Waste Material**

The DBO Operator will take the following precautions while disposing off the waste material:

- During the site clearance and disposal of debris, the contractor will take full care to ensure that public or private properties are not damaged/ affected, there is no dwellings below the dumpsite and that the traffic is not interrupted.
- DBO Operator will dispose off debris only to the identified places or at other places only with prior permission of Engineer/EO.
- In the event of any spoil or debris from the sites being deposited on any adjacent land, the DBO Operator will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Engineer/EO.
- The DBO Operator will at all times ensure that the entire existing drains within and adjacent to the site are kept safe and free from any debris.
- The DBO Operator will utilize effective water sprays during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.
- Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a tarpaulin in good condition.
- Care will always be taken to maintain the hydrological flow in the area.

### **7.5.3 Rehabilitation of Disposal Sites**

The dumpsites filled only up to the ground level could be rehabilitated as per guidelines below and to be decided by the DBO engineer and EA:

- The dumpsites have to be suitably rehabilitated by planting local species of shrubs and other plants. Local species of trees has also to be planted so that the landscape is coherent and is in harmony with its various components.

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- In cases where a dumpsite is near to the local village community settlements, it could be converted into a play field by spreading the dump material evenly on the ground, if possible. Such playground could be made coherent with the landscape by planting trees all along the periphery of the playground.
  - Care should always be taken to maintain the hydrological flow in the area.



## 7.6 Cost of EMP

Phase	Component of EMP	Mitigation measure	Cost included in the DPR (Yes/no/not clear)	Cost in Rupees (or Details if provided in DPR)	Remarks
Design and Development	Provision for accidental leakages / bursts in SPS,STP	Proper drainage arrangements to prevent water stagnation/ flooding in SPS site area& STP	Yes (not specific but included as a part of associated construction activity)	Details provided in DPR	The proposed DPR includes these activities
	Location of SPS,STP	Appropriate siting, and enclosing within building to reduce noise and odour nuisance to surrounding area	Yes	Details provided in DPR	The proposed SPS,STP will prevent noise and enclosed nature and appropriate cleaning and maintenance will prevent odour nuisance
Construction	Excavation, Cutting and filling operations	Review of existing infrastructure, shoring trenches, reinstatement/ resurfacing	Yes	Details provided in DPR	The proposed DPR includes these activities
	Damage public utilities	Proper reviewing of existing drawings of utilities, informing concern authorities and reinstatement of public utilities	Yes	Details provided in DPR	The proposed DPR includes these activities
	Dust generation	Water sprinkling on excavated	No	Rs. 5,61,60,00/-	The entire stretch of the sewer

Phase	Component of EMP	Mitigation measure	Cost included in the DPR (Yes/no/not clear)	Cost in Rupees (or Details if provided in DPR)	Remarks
		material to suppress dust and provision of top cover when transported through vehicles			network (150 km) will be covered in 36 months. This means approximately 138.89 m will be covered per day. Assumed Labour Cost: Rs900/- per day Tanker cost: Rs1700/-per day Cost per metre (Rs.)=2600/138.89= Rs 18.72/- Cost for 150 KM = Rs 2808000/- Cost for two times a day = Rs. 5616000/-
		Top cover for dumper truck	No	Rs. 1,01,250/- (S.network:IPS: STP= 40:30:30)	30 sq. mtr cost of covering 30* Rs.75= Rs.2250/- for 5 no. dumper = 5*2250 = Rs 11,250 cover to be changed atleast 9 times during construction. Cost = 9*11250=Rs 101250/-
	Noise and vibrations	Usage of sound barriers or sheets.	No	Rs. 19,61,900/- (S.network:IPS: STP= 40:30:30)	One side barricading: No. of sheet required (338.89 mtr/3 mtr) = 112.96, say 113 nos. So total number required 226. Cost of sheeting 226*1075=Rs

Phase	Component of EMP	Mitigation measure	Cost included in the DPR (Yes/no/not clear)	Cost in Rupees (or Details if provided in DPR)	Remarks
					242950/- (plain GI sheet cost Rs 1075 per sheet). Two sets barricading require 2*242950/- =Rs 485900/-. Labour required for this work 6 nos @ 300/- = Rs 1800/- per day. Cost of labour = 1800*820= Rs 1476000/-. Total Cost = Rs 1961900/-
	Temporary flooding or, water logging	Alternate traffic re-routing, Ensuring storage of excavated soil material on the higher lying areas	Yes		
	Increased traffic inconvenience	Traffic re-routing	Yes	Specific plan	
	Safety hazards to workers and residents	Putting fences or other barricades to demarcate the area	No	Rs 45,70,000/- (S.network:IPS: STP= 40:30:30)	Cost of Fence /wire 50 kgs @Rs 600 per Kg = Rs 30,000/- Labour required for this work 8 nos @ 300/- for 100 days = Rs 240000/- Total cost = Rs 270000 Safety signage and light = Rs. 43,00,000

Phase	Component of EMP	Mitigation measure	Cost included in the DPR (Yes/no/not clear)	Cost in Rupees (or Details if provided in DPR)	Remarks
	Health hazards and nuisance due to absence of facility for sanitation or solid waste management	Sanitation	No	Rs 10,21,950/- (S.network:IPS: STP= 30:30:40)	Cost of Septic Tank for 200 users= Rs1,50,000 Cost of twin soak pit for 2 years = Rs 15000/- *2=Rs 30,000/- Cost of 5 seater water closet = Rs 1,60,650/- (Ref: Establishment and Management of Community Sanitary Complexes in Rural Areas- A handbook. Cost enhanced as it has considered the cost in May 2011) No. of labour engaged nearly 700-800 nos Therefore, Cost of sanitation = 3*3,40,650=Rs 1021950/-
		Creation of Water Supply	No	Rs 5,25,000/- (S.network:IPS: STP= 40:30:30)	Provision of tube wells @Rs1,75,000 in approx.. 3 locations where water supply is not available.  Approval for tube wells will be acquired from the concerned authority
		Dust bins	No	Rs. 7,00,000/-	

Phase	Component of EMP	Mitigation measure	Cost included in the DPR (Yes/no/not clear)	Cost in Rupees (or Details if provided in DPR)	Remarks
				(S.network:IPS: STP= 40:30:30)	
Construction	Fly Nuisance at STP	Application of insecticides	No	Rs.5,00,000/- (S.network:IPS: STP= 30:30:40)	Lump sum Cost
	Treatment of Disposal of Sludge	Ensure proper functioning of STP for digestion of sludge	No	Rs. 7,00,000/- (S.network:IPS: STP= 30:30:40)	Lump sum Cost
	Sludge Monitoring and heavy duty steel frame for DG Set, air intake and air exhaust silencers, operable doors for every part of DG sets (In BOQ Ref. Page No. 106,113,129 etc.)	Analysis of sludge and its neutralization	No	Rs. 7,00,000/- (S.network:IPS: STP= 30:30:40)	Lump sum Cost
	Tree Plantation & Landscaping		No	Rs. 5,00,000/- (S.network:IPS: STP= 30:30:40)	Lump sum Cost
	Training and Awareness generation	Among the workers of construction camp and operators of STP and Monitoring and Evaluation	No	Rs. 3,00,000/- (S.network:IPS: STP= 30:30:40)	Lump sum Cost

Phase	Component of EMP	Mitigation measure	Cost included in the DPR (Yes/no/not clear)	Cost in Rupees (or Details if provided in DPR)	Remarks
		expert			
Monitoring	Cost of Monitoring during Construction Phase (3 years)			Rs 18,00,000.00	@ Rs 600,000 per year
	Cost of Monitoring during Operation Phase (15 years)			Rs 60,00,000.00	@ Rs 4,00,000 per year
			<b>Total Cost of Environment Management</b>	Rs. 2,42,96,100.00 or 2.43 crore	

**COST OF ENVIRONMENTAL MONITORING: CONSTRUCTION PHASE (3 YEARS)**

S. No.	Monitoring	Parameter	No. of Stations / Samplers	Frequency	Cost (INR)
1.	Ambient Air Quality Monitoring	As per NAAQS, 2009	3 Locations	Half yearly	15000x2x3= Rs 90,000.00
2.	Ambient Noise Level Monitoring	Noise level monitoring (During Day & Night Time) As per CPCB standards	3 Locations	Half yearly	10000x2x3= Rs 60,000.00
3.	Noise Monitoring (D.G sets)	As per CPCB standards	Depending on number of DG sets used	Half yearly	5000x1x2= Rs 10,000.00
4.	Drinking / Ground Water Quality	As per IS: 10500	5 locations	Quarterly	10000x4x5= Rs200,000.00
6.	Surface water Monitoring	Ground water Level Monitoring	5 Locations	Quarterly	10000x4x5= Rs200,000.00
7.	Soil Monitoring	Essential parameters	1 Location	Half yearly	20000x2= 40,000.00
<b>Total</b>					<b>Rs. 600,000.00</b>

Annual environment monitoring cost during construction phase is **Rs. 600,000.00**. Therefore for three years of construction period, the environment monitoring cost is **Rs.18,00,000.00** (Rupees Eighteen Lacs only).

**Cost of Environmental Monitoring: Operational Phase (15 Years)**

S. No.	Monitoring	Parameter	No. of Stations/Samplers	Frequency	Cost (INR)
1	Drinking/Ground Water Quality	As per IS: 10500	5 locations	Quarterly	10,000x4x5 Rs. 2,00,000.00
2	Surface water Monitoring	Ground water Level Monitoring	5 Locations	Quarterly	10,000x4x5 Rs. 2,00,000.00
<b>Total</b>					<b>Rs.4,00,000.00</b>

Annual environment monitoring cost during operational phase is **Rs. 4,00,000.00**. Therefore for Fifteen (15) years of operation period, the environment monitoring cost is **Rs. 60,00,000.00** (Rupees Sixty Lacs only).

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## **CHAPTER 8: Social Management Plan**

### **8.1 Social Management plans during construction phase**

Based on the identified social issues, appropriate mitigation plans are proposed. Some of these measures are already listed in the DPRs, and some of them are additionally recommended for social development of the project and the concerned stakeholders.

#### **i. Impact on human health**

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

Mitigation plan involves the erection of temporary enclosures around construction sites. These barriers will help entrap some of the dust that is brought up in digging. They will also provide safety benefits, to be detailed below. According to the interaction/consultation with the key stakeholders, it was said that contractors are doing water sprinkling in the construction area.

#### **ii. Traffic Congestion**

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

Traffic must be re-routed to facilitate ease of movement. Proper signage should provide detailed information on the dates and duration of road closures and which detours will be available, ideally well in advance of actual construction so residents can plan accordingly. Strategic placement of traffic police at critical intersections will also facilitate better flow of traffic. Plans and budget for these measures are already included in the DPR.

#### **iii. Impact on livelihood**

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



customers from accessing businesses or other disruptions.

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

#### **iv. Impact on existing utility services**

Mitigation Measure:

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

#### **v. Public Notice:**

According to the suggestion given by local community during the interview, Government and contractor should give a prior notice to each and every locality with the details of project, street wise start date of construction and street wise end date of construction, contact person during emergency. This information would help them better adjust to the situation and make necessary adjustments and provisions.

Additionally, the interviewees said that they understood the inconveniences were of a temporary measure and are providing a social good. Thus, they have created local adaptation measures as quick and efficient ways to mitigate the temporary inconveniences. However the proposed project has grievance redress mechanism which will be adopted as mentioned in the Environment and Social Management Framework.

<b>Activity</b>	<b>Potential Negative Impacts/ Concern</b>	<b>Mitigation Measures</b>	<b>Cost Issues</b>
Land acquisition for STP and SPS	NA	The land is already owned by the Govt. and confirmed by revenue department.	NA
Laying of sewer network	Safety hazards to labours and residents	Provide workers with adequate safety equipment such as helmets, safety shoes, gloves, etc.  Fences/temporary enclosures should be put around construction sites (even inactive ones, if hazards, like open pits, remain); enclosures should be properly marked with caution signs	Cost included in DPR
	Dust generation, with resulting implications for human health	Water sprinkling, removal of excess materials, cleaning of sites upon completion of activities.  Construction of temporary enclosures to entrap dust.	Cost included in DPR
	Reduced pedestrian and vehicle access to residences and businesses, with inverse effects on livelihoods.	Work should proceed on schedule so as to minimize road closures  Upon project completion, quick clearance of debris, etc. will facilitate access by customers to local business and residents to their households.	Cost included in DPR
	Temporary water, electricity, supply interruptions	Circulation of layout plan for all underground infrastructure to ensure that contractor is aware of water/electricity lines in construction zones  Local authorities should be made aware of timing/location of all construction, enabling them to respond swiftly to supply interruption, especially in the event of flooding, etc.	Provision for temporary shifting of water/power lines, etc. already in DPR.
	Increased traffic inconvenience (emissions, congestions, longer travel times)	Use of alternate traffic routes; signage should clearly indicate dates of road closures and new routes so residents can plan accordingly  Placement of traffic officers at busy intersections to facilitate easy of movement	Provisions for traffic diversion, with signage already in DPR

Activity	Potential Negative Impacts/ Concern	Mitigation Measures	Cost Issues
Construction of new STP	Safety hazards to workers	Provide workers with adequate safety equipment such as helmets, safety shoes, gloves, etc.	Cost included in DPR
	Dust generation, with resulting implications for human health	Water sprinkling, removal of excess materials, cleaning of sites upon completion of activities.  Construction of temporary enclosures to entrap dust.	Water sprinkling  Cost included in DPR

## **8.2 Consultation Framework for Participatory Planning and Implementation of Mitigation Plan**

Relevant stakeholders, especially community members (residents, shop owners, etc.) may be informed about the details of the proposed mitigation plan. A public consultation may be conducted where the mitigation plan is presented, and feedback solicited from the community. Individual meetings with other key stakeholders – government officials, relevant NGOs, etc. – could be scheduled to solicit their feedback as well. Once construction begins and the mitigation plan is put into effect, third party audits should be taken up so as to evaluate the efficacy of the mitigation plan, as well as to speculate local sentiments related to the construction and identify/address new issues that may have arisen during construction.

Stakeholders that should be involved in planning and implementation of the mitigation plan include;

- All affected persons (APs), program beneficiaries, including representatives of vulnerable households;
- Decision makers, policy makers, elected representatives of people, community and citizens, NGOs etc;
- Staff of executing agency, implementing agencies, etc
- Officials of the revenue departments, social welfare department etc and
- Representatives of the various state government departments, as required.

### **8.2.1 Assess the Capacity of Institutions and Mechanisms**

To implement the social development aspects and social safeguard plans; recommend capacity building measures should be taken by the respective authorities.

Roles and functions of the institutions are pre-defined, but they can enhance their capacity for better implementation and operation of the project. There should be synergies and continual interaction amongst the departments for better coordination. The officers of the relevant departments can be trained in social sciences, social management plan, etc.

Institutional reform and capacity building of local body is in process under JNNURM, it will be required to ensure that operating authorities have the ability and equipment to properly manage and finance the operation and maintenance of sewerage schemes. Otherwise continued development will not be sustainable.

**Table 8.1: Role of stakeholder in implementation and mitigation**

Stakeholder Category	Role in project implementation	Role in mitigation
NMCG	Over all coordination	Coordinating so that the mitigation plan is implemented well  Ensuring funds for mitigation plan execution
Executing agencies (BUDICO)	Implementation of the project by awarding the project to the suitable contractor and regional coordination Informing the relevant departments about the progress of the project	Ensuring that the relevant departments are available for mitigation plan  Enough safety provisions are available for the project implementation.
Patna Municipal Corporation	While execution of projects related to sewerage line, Patna Municipal Corporation is responsible for the	Should ensure that the basic amenities are in order during the construction and
	damage caused to the public utility functions like drinking	operational phase of the project
Municipality	Ensuring better access to households	Should ensure all the households envisaged at project planning phase gets access to the services. Weaker section of the society should get equitable share.
State, local Government	Coordination Monitoring and evaluation	Coordination  Monitoring and evaluation Ensure all the safeguarding plans are in line and acted upon.

Stakeholder Category	Role in project implementation	Role in mitigation
NGOs, CSOs, Research Institutes ( Patna University)	Awareness creation about the project activities Community participation for better project implementation	Public participation and coordination

### **8.2.2 Develop Monitoring and Evaluation Mechanisms to Assess Social**

#### **Development Outcomes**

Regular monitoring and evaluation of the project activities should be carried out to judge its success or any gaps. Certain key parameters can be taken as the benchmark for monitoring and evaluation of the project based on the identified development outcomes. Some of the indicators are listed below;

- Increase in sewer access (number of households linked to the sewer network)
- Decrease in effluent discharge into the Ganga (water quality assessment of the river)
- Proper sites for industries, building etc.
- Accessibility of the service to backward and weaker sections of the society
- Increase in public toilet
- Increase in the land rate (property appreciation value)
- Decrease in water borne disease incidence in the area

## CHAPTER 9: Institutional Arrangements

### 9.1 Institutional Arrangement for Monitoring and Evaluation

The project authority will be responsible for carrying out M&E. Internal monitoring will be carried out by the Social Officer of BUIDCO with assistance from Social Officer and NGO. This will help monitor project activities closely. Regular monitoring by undertaking site visits will help identify potential difficulties and problems faced in the project implementation and subsequently help take timely corrective measures including deviations, if needed.

### 9.2 Internal Monitoring

The project is responsible for internal monitoring on regular basis with the help of Social Officer of BUIDCO and Social Specialist of supervision consultant. A quarterly report of internal monitoring will be prepared by Social Officer. The internal monitoring will also provide feedback on community concerns, grievances and requests. Internal monitoring will focus and ensure the followings:

Information campaign

Effective operation of the Grievance Redress Committees detailing out number of complaints received and those resolved; reasons for not being able to resolve the grievance and status of unresolved grievances

**Table 22: Internal Monitoring Framework**

Type	Indicators	Issue	Procedure	Timing	Responsibility
P		Employment of local labor including women	Site observation, attendance record, interaction with laborers and contractors	Monthly	BUIDCO /NGO

Type	Indicators	Issue	Procedure	Timing	Responsibility
	Project Implementation	Campsite management including lodging arrangement and campsite facilities	Site observation, interaction with laborers, contractors	Monthly	BUIDCO /NGO
		Use of health and safety measures	Site observation, interaction with laborers, contractors	Quarterly	BUIDCO / NGO
		Temporary	Site observation, contractors, check contract agreement	Monthly	BUIDCO / NGO
		leasing of private land and house			
		Discrimination of wage rate between male and female workers	Interaction with laborers, labor survey, record of wage payment	Monthly	BUIDCO / NGO / SPMG
		Development of new settlements /slum along the river	Observation, recording of sites, photograph	Quarterly	BUIDCO / NGO /SPMG
		Incidence of communicable diseases like respiratory, STD, HIV/AIDS etc.	Discuss with local people, health workers/ health post/ center records	Annually	BUIDCO / NGO /SPMG

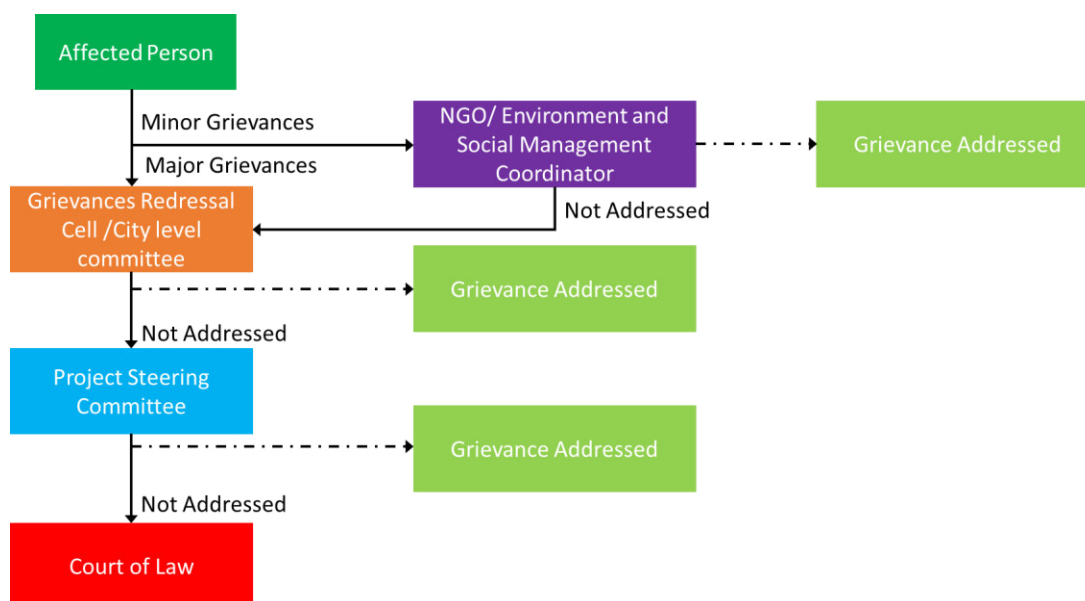
<b>Type</b>	<b>Indicators</b>	<b>Issue</b>	<b>Procedure</b>	<b>Timing</b>	<b>Responsibility</b>
Impact level	Change in household level income and economic	Changes in occupation	Consultation with relocated PAPs	Annually	BUIDCO / NGO
	Social safety	State of social harmony and social security	Police records, consultation with relocated PAPs, NGO's progress report, report submitted by M&E Consultants	Annually	BUIDCO / NGO
	Housing condition at new relocation site	Completed house with basic amenities	Visit the area, discuss with people, observation and photographs	Annually	BUIDCO / NGO



### 9.3 Subproject specific grievance redressal mechanism

Redressal of grievances contributes to a great extent to the positive perception of the public regarding the project implementation. Therefore it is essential that any query or a complaint vis a vis any aspect of the project implementation is promptly, effectively & positively addressed. The Grievances will be submitted through various mediums, in person, through phone calls, online or through letters. A single system for redressal of grievances shall be adopted at the project level to ensure that its purpose is met. The integrated grievance system will include the following.

1. Establishing Grievances Redressal Cell (GRC) with dedicated project officer and System at the local EA & ULB .At project level the proposed GRC includes designated Officer, Patna Municipal Corporation. Project Engineer, BuIDCo will be Grievance redressal officer at EA level including representative of DBO. Name and contact information of GRO will be displayed at project site/Notice Board and also disclosed on website of ULB, EA and SPMG.
- 2.
3. The public also can submit their unresolved grievances at Tehsil Divas on every Second and fourth Tuesday of every month between 10:00 to 14:00, to District Magistrate/Sub District Magistrate and all district level officials for quick redressal.
- 4.
5. The SPMG & EA will prepare a half yearly report on grievance redressal under GAAP and will be reviewed during meeting of CMCs and Social Audit.
- 6.
7. The above arrangement will be in addition to the PIO official appointed under RTI Act



**Figure 9.1: Grievance Redressal Mechanism Matrix**

### **9.3.1 Members of GRC**

The GRC will be constituted by the DM of Patna. The GRC will have representatives of PAPs, NGO and other opinion leaders who will look into the grievance of the people. It will be chaired by a retired officer, who served as principal/judges/ DM/Additional DM, etc. The suitability of the Chairperson will be decided by the DM in consultation with BUIDCO. Apart from the nominated persons, the cell will have representative from BUIDCO as convener.

### **9.3.2 Functions of the Cell**

All the grievances received shall be discussed by the Chairperson of the cell with DM for the necessary action.

The compliance to all the petitions shall be reviewed in each of the meeting by the chairman and the DM. In case of the grievances not addressed by the GRC, it will be escalated to the office of District Magistrate by the Chairperson / BUIDCO.

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## **CHAPTER 10: Conclusion**

The project report of the proposed sub-project for sewerage Kankarbagh Zone after environment analysis concludes that the project falls in 'low impact' category and have overall positive benefits on the life and environment of the people. There has been no reported land acquisition or livelihood losses to be caused under this project. As per environmental and social management framework guidelines of NGRBA, Environmental and Social Assessment, with a Generic Safeguard Management Plan was conducted for addressing possible issues/ concerns arising from proposed project. Impacts of activities identified during the assessment fell under two separate categories of Construction and Operation. Although no such permanently negative or adverse environmental or social impacts were identified, there were certain temporary impacts, for which appropriate mitigation plans have also been suggested. The environmental management plan ensures to suggest appropriate mitigation measure against the issues/ concerns identified during the environmental and social analysis study. All the social and environmental issues were appropriately studied and have been substantiated using appropriate evidences, to ascertain the magnitude of their impacts. Even the issues of public grievances and public notice have been taken care in the report to confirm transparency during the project implementation. Report also ensures that well defined institutional mechanism is in place to monitor and evaluate the progress of the project during construction, implementation and operation phases.

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**Annexure-I: NOC/ Allotment Letter of Land**

**Annexure-II: Households Questionnaire**

1. Name:
2. Sex: 1. Male 2. Female
3. Ward:
4. What is the source of drinking water? 1 Piped Water 2 Tubewell 3. Well 4. River 5. Others
5. Do you think that the quality of water is good? 1. Yes 2. No
6. Do you have pucca toilet at home? 1. Yes 2. No
7. If no, do you want to construct pucca toilet at home? 1 Yes 2 No
8. Do you think river Ganga is polluted? 1. Yes 2. No
9. What is the source of pollution? 1. Household waste through drains 2. Garbage dump 3 Industrial waste 4 Others
10. Are you aware of the project that aims to clean Ganga? 1. Yes 2. No
11. What would be the direct benefits of the project? 1 Clean Ganga 2 Health Improvement 3 Improvement of service 4 Low pollution and Clean Environment 5 Other
12. Do you want to connect it to the sewerage line? 1. Yes 2. No
13. Are you willing to pay user charges to cover O and M costs? 1. Yes 2. No
14. What problems would you face during the construction and post construction phases?

Sl no	CONSEQUENCES (Pre)	MITIGATION ( Pre)	CONSEQUENCES (Post)	Mitigation( Post)
1	Traffic blockage		Traffic blockage	
2	Parking disruption		Parking disruption	
3	Dust		Dust	
4	Loss of tree cover/rare species of tree		Loss of tree cover/rare species of tree	
5	Noise		Noise	

6	Pollution of water body		Pollution of water body	
7	Temporary disruption of water body		Temporary disruption of water body	
8	Soil and water contamination due to indiscriminate disposal of construction and demolition waste		Soil and water contamination due to indiscriminate disposal of construction and demolition waste	
9	Health		Health	
10	Livelihood		Livelihood	

15. From where did you come to know about it?

- Leaflet
- Poster
- Cable TV
- Radio
- Local news paper
- Ward Councillors or other representatives
- Govt. dept staff
- Municipal staff
- Meetings
- 

16. How could awareness on the project be generated?

- Leaflet
- Poster
- Cable TV
- Radio
- Local news paper
- Ward Councillors or other representatives
- Govt. dept staff
- Municipal staff
- Meetings

**Annexure-III: FGD Query Sheet**

**Focus Group Discussion**

Date:

1. Location:-
2. Ward no:-
3. Mix of Group:-
4. What are the sources of Drinking water? Give opinion on The Quality of Water.
5. What are the sources of Ganga River Pollution in your Town?
6. Which are the key points of pollution of the River Ganga?
7. Is there any practice of open defecation in river in your town?
8. Why is such practice still prevalent?
9. Do you think that the Ganga River Should Be Cleaned?
10. If Yes, how? (probable Steps)
11. Are You Aware That Project Has Been Taken to Mitigate River Pollution In Your Town?
12. Do you know the components of this project ?
13. How did you get to know about it?
14. Do you know how would you be benefitted from this Project?
15. Do you want to establish sewerage connections even for houses with septic tanks?
16. Are you willing to pay the user charge to cover O&M cost?
17. Do you Think That You Have Some Responsibility Regarding This Project?
18. Please indicate ( ) The Probable Consequences of the Construction Involved In This Project?  
(Temporary)

Sl no	CONSEQUENCES	MITIGATION
1	Traffic blockage	
2	Parking disruption	
3	Dust	

4	Loss of tree cover/rare species of tree	
5	Noise	
6	Pollution of water body	
7	Temporary disruption of water body	
8	Soil and water contamination due to indiscriminate disposal of construction and demolition waste	
9	Health	
10	Livelihood	

19. Which areas will be most affected by Temporary Disruption?

20. Please indicate ( ) the Probable consequences of the Project post Completion? And what could be the solution?

Sl no	ONSEQUENCES	MITIGATION
1	Traffic blockage	
2	Parking disruption	
3	Dust generation	
4	Reduced pedestrian and vehicle access to residences and businesses	
5	Loss of tree cover/rare species of tree	
6	Noise	
7	Odour	
8	Pollution of water body	
9	Soil contamination	

21. Are you aware of any Community Based Awareness program/Social Movement organized for or against this Project

22. How can awareness about the program be raised? Give opinions



- 
- Leaflet
  - Poster
  - Cable TV
  - Radio
  - Local news paper
  - Ward Councillors or other representatives
  - Govt. dept staff
  - Municipal staff
  - Meetings

**Annexure – IV: Glimpses of the FGD and Household Survey conducted in different locations of Kankarbagh Zone**

**Few Snapshot of Focus Group Discussion**



Survey at RKD College, Lohia Nagar



Commercial shop, Ashok Nagar



Household survey, Hanuman Nagar



Market survey at Vijay Nagar



Canara Bank, Indranagar



Survey at Kali temple, Ramjanaki Path



Road side survey, Khemini Chowk



Slum survey at Ganga Nagar