

Initial Environmental Examination

June 2018

IND: Bihar State Highways III Project

Prepared by Bihar State Road Development Corporation Ltd., Government of Bihar for the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 10 May 2018)

Currency unit	–	Indian Rupee (₹)
₹1.00	=	\$0.01488
\$1.00	=	₹67.19

ABBREVIATIONS

AADT	–	Annual Average Daily Traffic
AEROMOD		Atmospheric Dispersion Modeling
ADB	–	Asian Development Bank
ASI	–	Archeological Survey of India
BIS	–	Bureau of Indian Standard
BOQ	–	Bill of Quantities
BSPCB	–	Bihar State Pollution Control Board
BSRDCI	–	Bihar State Road Development Corporation Limited
CAMPA	–	Compensatory Afforestation Fund Management Authority
CBD	–	Convention on Biological Diversity
CCF	–	Chief Conservator Forest
CD	–	Cross Drainage
CGM	–	Chief General Manager
CGWA	–	Central Ground Water Authority
CGWB	–	Central Ground Water Board
CPCB		Central Pollution Control Board
CTE	–	Consent to Establish
CTO	-	Consent to Establish
CFO	–	Certificate for Operation
CSC	–	Construction Supervision Consultant
dBA	–	Decibel
DEIAA	–	District Environment Impact Assessment Authority
DFO	–	Divisional Forest Officer
DGM	–	Deputy General Manager
DPR	–	Detailed Project Report
EA	–	Executing Agency
EAC	–	Expert Appraisal Committee
EARF	–	Environmental Assessment and Review Framework
EFP	–	Environment Focal Person
EIA	–	Environmental Impact Assessment
EMP	–	Environmental management plan
EMOP	–	Environmental monitoring plan
ERDAS	–	Earth Resources Data Analysis System
FGD	–	Focussed Group Discussion
FHWA	–	The Federal Highway Administration
GHG	–	Green House Gas
GIS	–	Geographic Information System
GM	–	General Manager
GOB	–	Government of Bihar
GOI	–	Government of India
GOR	–	Government of Rajasthan
GRC	–	Grievance Redress Committee
GRM	–	Grievance Redress Mechanism
GSDP	–	Gross State Domestic Product

IS	–	Indian Standard
IEE	–	Initial Environmental Examination
IMD	–	Indian Meteorological Department
IRC	–	Indian Road Congress
IUCN	–	International Union for Conservation of Nature
MDR	–	Major District Road
Leq	–	Equivalent Continuous Noise Level
MFF	–	Multitranche Financing Facility
MOEFCC	–	Ministry of Environment, Forests and Climate Change
MORTH	–	Ministry of Roads Transport and Highway
NAAQS	–	National Ambient Air Quality Standard
NSDP	–	Net State Domestic Product
NH	–	National Highway
ODR	–	Ordinary District Road
PCR	–	Physical Cultural Resources
PCU	–	Passenger Car Unit
PF	–	Protected Forest
PM	–	Particulate Matter
PD	–	Project Director
PIU	–	Project Implementation Unit
PMC	–	Project Management Consultant
PPP	–	Public-Private Partnership
REA	–	Rapid Environmental Assessment
RF	–	Reserved Forest
RCD	–	Road Construction Department
ROB	–	Road Over Bridge
ROW	–	right of way
RR	–	Rural Roads
SEIAA	–	State Environment Impact Assessment Authority
SH	–	state highway
SOE	–	Safeguard Officer – Environment
SPS	–	ADB Safeguard Policy Statement, 2009
TEEMP	–	Transport Emissions Evaluation Model for Projects
TNM	–	Traffic Noise Model
UNESCO	–	United Nations Educational, Scientific and Cultural Organization
UNFCC	–	United Nations Framework Convention on Climate Change
USEPA	–	United States Environment Protection Agency
WLS	–	Wildlife Sanctuary
WPA	–	Wildlife Protection Act

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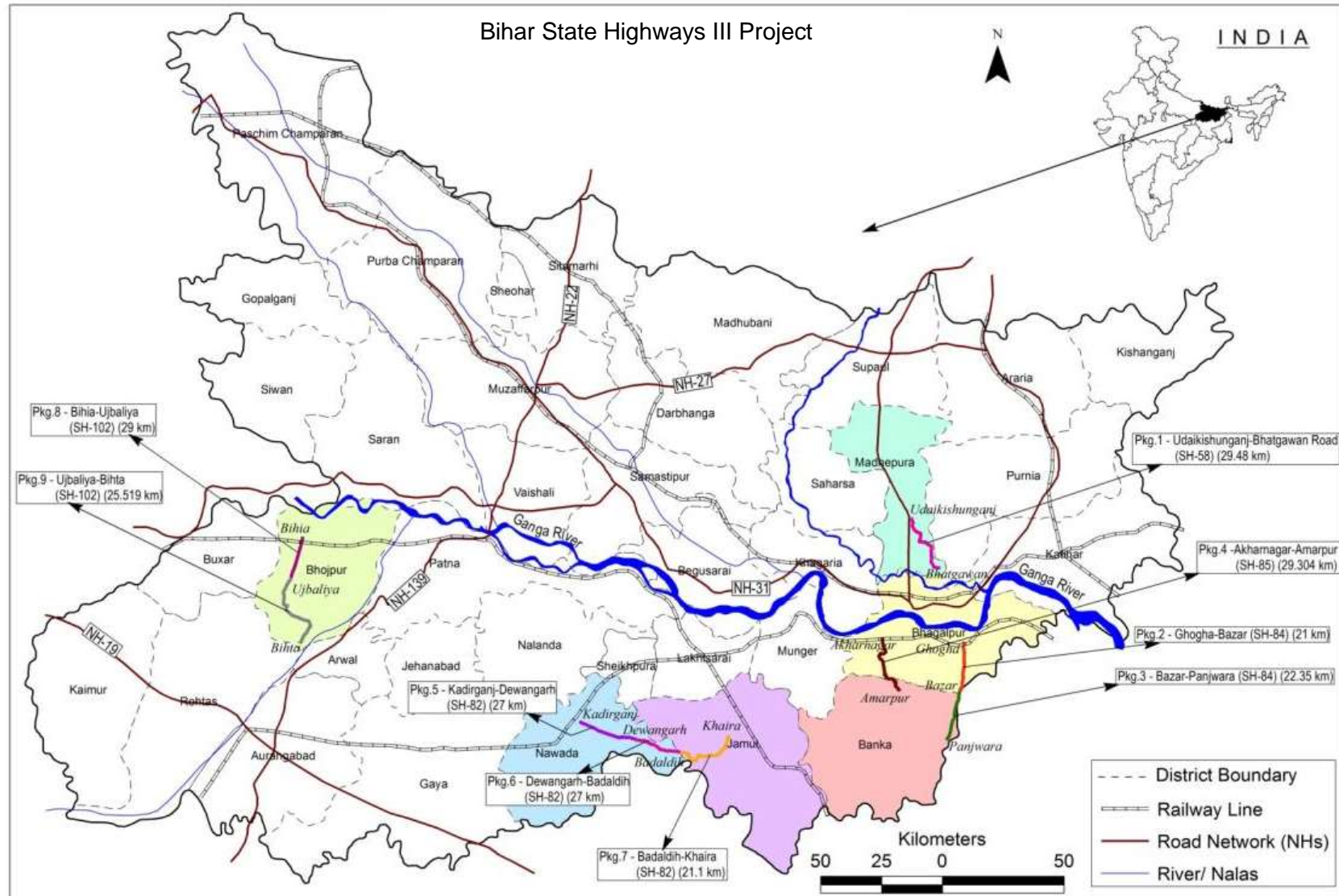
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Map 1: Key Map Showing Sub-projects and Construction Packages



Map 2: Showing Location of Proposed Bihar Road Research Institute



EXECUTIVE SUMMARY

1. **The Project:** Bihar State Highways III Project (BSHP-III) aims to up-graduate 5 state highways (SH-58, SH-82, SH-84, SH-85, & SH-102) totaling 231.75 kms from single/intermediate lane carriageway to 2- lanes with paved shoulder configuration. Distributed in 9 civil construction packages, the candidate roads are located in 6 districts namely: Madhepura, Bhagalpur, Banka, Nawada, Jamui & Bhojpur. Bihar State Road Development Corporation Limited (BSRDCL) on behalf of Road Construction Department (RCD), Govt. of Bihar (GOB) is the implementing agency. Key improvement components for the roads are (i) widening from the existing single/intermediate lane to 2-lane of 7.0m carriageway with of 1.5 m paved and 1.0 m earthen shoulders on either side (ii) improvement in pavement conditions and road geometry (iii) reconstruction/ widening and additional CD structures, (iv) provision of lined drains in built-up sections, (v) junctions/intersections improvement, (v) Construction of ROBs, and road furnitures like bus stops and installation of road safety measures etc. Project also addresses the climate change impacts and risks.

2. The project also includes creating infrastructure for proposed Bihar Road Research Institute (BRRI) to be located at Patna on a 2 Ha vacant land, already in possession of RCD. It is at conceptual stage and detailed design yet to be initiated. However, this IEE captures all potential impacts likely to be triggered and also includes a generic EMP which later on may be enhanced to more specific once design and layout plans are finalized.

3. **Environmental Sensitivity and Project Categorization** Project categorization has been done using Rapid Environment Assessment (REA) checklist of ADB for roads and highways after screening survey and initial consultations. Project scope is limited to expansion/improvement of existing roads with only 1 small bypass at Ghogha on SH-84 of 1.4 Km. Therefore, it is expected that stress on existing natural resource viz, land, water, soil and aggregates are not significant. Sub-project roads do not pass through or located nearby any wildlife sanctuary, national park, reserved forest¹ protected area network, archeological monument/heritage sites or any other similar eco-sensitive areas. Road side plantations along all the sub-projects have been declared as protected forest² (PF) by the state forest department except SH-58. A small portion of SH-82 intermittently (Ch. 42.7 near Mahodar to Km 54.1 near Chanarwar and 66.4 Km near Kurwad to Km. 68.8 near Baba Jhakhraj) passes through fringe area of natural forest. No loss of any rare, threatened or endangered floral species is envisaged due to clearance of vegetation for widening. Undefined movement of some wild animals mainly of Blue Bulls³ (*Boselaphus tragocamelus*; Schedule⁴ V) was reported by local people. Besides, occasional crossing of Spotted Deer (*Axis axis*; Schedule III), Sambhar (*Cervus unicolor*; Schedule II), and rare sighting of Sloth Bear (*Melursus ursinus*; Schedule) was also reported by local people. None of the animal species are under threatened or endangered categories as per IUCN classification. Sloth bear is under vulnerable category. All other impacts are mainly temporary and localized in nature which can be mitigated by effective implementation of Environmental Management Plan (EMP) included in IEE.

¹ **Reserved Forest:** an area notified under the provision of Indian Forest Act having full degree of protection. In Reserved Forests, all activities are prohibited unless permitted.

² **Protected Forest:** an area notified under the Indian Forest Act having limited degree of protection. In Protected Forests, all activities are permitted unless prohibited

³ Presently, this species is under Schedule III of Wildlife Act, 1972. Due to its large population causing heavy crop damage, MOEF has issued an advisory to include it in Vermin category of Schedule V so that killing/hunting of such animals are outside purview of law.

⁴ Wildlife Protection Act, 1972 has six schedules which give varying degrees of protection. [Schedule I](#) and part II of [Schedule II](#) provide absolute protection - offences under these are prescribed the highest penalties. Species listed in [Schedule III](#) and [Schedule IV](#) is also protected, but the penalties are much lower. [Schedule V](#) includes the animals which may be hunted.

The proposed site of BRRI is also outside any sensitive area/zone. Hence, the project has been categorized as **Category 'B'** as per SPS, 2009

4. **Existing Environment:** The state falls under the tropical to Sub-tropical climatic with on two climate zones; the Sub-Himalayan and the Ganga plain and characterized by three distinct seasons; winter, summer and monsoon. The temperature in Sub- Himalayan Zone varies from 40°C (mean maximum temperature) to 4°C (mean minimum temperature). Mean maximum and minimum temperature observed in Ganga Plain region are 43°C and 5°C respectively. South-West Monsoon accounts for most of the rainfall (85%) in the State. The average rainfall is around 1120 mm. The Sub-Himalayan zone receives high rainfall of over 1400 mm whereas in the Chotanagpur plateau it ranges from 600-800mm. The rainfall of project districts varies from 676.85 mm to 1323.90 mm. The highest humidity is observed during monsoon season (up to 79%) with lowest during summer season (30%).

5. The state portrays both plain and undulating topography. The land profile/topography along the project corridor is in general plain with some undulating/rolling terrain characterized by foothill/pedepain areas along SH-82 in its later sections. Major geologic formations of project districts are quaternary alluvium consisting unconsolidated sediments and granite gneissic complex of Chotanagpur plateau in Jamui and parts of Banka and Bhagalpur districts. Small part falls under Nawada mica belt. Soils of the region are alluvial and hilly. The alluvial soil derived partly from the older alluvium deposit and partly from the newer flood plain deposit characterized by light grey to dark grey colour and fine texture. The hilly soil derived from the weathered product is coarse grained, ferruginous, low in nitrogen, medium to high potash and acidic in nature.

6. Project districts are either not prone to or very less vulnerable to flooding. Overtopping of road after 1999 and 2000 floods is uncommon except at some isolated bridge locations. Water-logging in built-up sections was reported due to local drainage congestion. Out of six project districts, Bhojpur, Jamui, Banka and Nawada falls partially in Zone III (moderate risk zone) & IV (high risk zone), Bhagalpur in Zone IV and Madhepura falls in Zone IV & V (very high risk zone). Drought is recurring phenomena in the state. Two project districts (Bhagalpur & Madhepura) lies in drought free zone whereas Nawada and Jamui falls in severely affected zone and Banka & Bhojpur lies in intermediate affected zone. Predominant land use of the study area and along sub-project roads is dominantly agriculture and roadside plantation notified as protected forest. As mentioned above, natural forest is found only in small section of SH-82. Built-up sections constitute approximately 10-15% along most of the sub-projects. There are numerous community resource properties along sub-project roads including noise sensitive receptors, ponds etc. Rivers and other waterways intersecting the project roads are mostly non-perennial barring a few. Air quality parameters mostly confirm the prescribed limit except exceedance of Particulate matters (PM₁₀ and PM_{2.5}) at some locations. Noise level during night is within limits for all land use categories except at some locations along SH-84. Daytime noise exceeds in some market/builtup stretches. Groundwater mostly confirms the permissible limit but exceeds marginally the desirable limits at some monitored locations w.r.t Iron, Total Hardness, alkalinity and TDS. Surface water is not used for drinking or domestic purpose. It is however for outdoor bathing, irrigation and propagation of fishes and other aquatic life.

7. **Anticipated Environmental Impacts and Mitigation Measures:** Main pre-construction impacts are: (i) cutting of 11378 green and mature trees/loss of vegetation in forest area (ii) submergence of roads/CD structures and water logging in built-up areas due to inadequate waterways and absence/blockade of side drains (iii) disruption in wildlife movement (iv) accident risk due to poor horizontal and vertical profile and loss of (v) All CD structures have been designed for 50yr return period with anticipated risk of rarer flood of next higher frequency. Compensatory

afforestation on 1:2 basis and additional plantation proposed on 1:7 will improve the micro climate of the region in long term. Vent size of inadequate CD structures have been proposed for widening to avoid overtopping of road. A free board of 0.6 to 1m has been considered for all bridges. Lined side drains proposed in market areas/habitation to prevent water logging. To facilitate wildlife movement and avoid their collision with vehicles, several measures have been recommended viz: informatory and cautionary sign boards, speed limits in forest area, installing rumble strips/ speed breakers in specific areas where movement is more anticipated; widening, Since crossing of animals is mainly for water during summer, preferred water structure depending on local site condition on both sides of forest area in consultation with forest department has been proposed.

8. Significant impacts anticipated during construction phase are: (i) increase of local air pollution and noise level due to construction and site clearance activities, earthworks, borrowing and quarrying, operation of hot mix plants etc; (ii) deterioration of surface water quality due to silt run-off, spillage from vehicles and discharge from labour camps; (iii) health impacts from labour camps; (iv) disruption to through traffic; (v) occupational health and community safety. Mitigation measures includes: (i) utilizing least noisy equipment and regulating time of construction near settlements and sensitive receptors; (ii) sprinkling of water on earthworks, active construction sites, material storage locations and haulage roads; (iii) installation of silt and oil traps along waterbodies; (iv) slope stabilization to control erosion and protection work for ponds; (v) camp siting and management as per IRC guidelines and best practices (vi) traffic management to avoid congestion and maintain access of local residents; (vii) implementing compensatory plantation to off-set impacts from tree cutting and additional plantation at 1:7 to enhance to curb effects of green house gas emission and enhancement of micro-climate; (ix) no camp, materials storage, hot mix plant near forest areas/water bodies/residential areas; (x) no construction in the stretches of potential wild animal crossings during night time.

9. Operation stage impacts anticipated are road accidents, accidental spillage, submergence/overtopping of CD structures, water logging due to blockade of side drains, increased air pollution and noise level, survival of compensatory afforestation and additional plantation and animal-traffic collision etc. All these are mainly associated with maintenance and monitoring of effectiveness of mitigation measures taken during design and construction stage. Executing agency is mandated to undertake regular maintenance of the road conditions and its appurtenances.

10. No significant impact is expected due to construction of BRRI. Proposed site is within municipal limits and confirms city's Master Plan, key environmental services like stormwater drains, waste water discharge, drinking water, electricity etc. are already laid and also well accessible/connected by existing road. Localised and temporary construction related impacts like increase in dust and noise can be easily avoided/minimized by adopting good construction practices.

11. **Greenhouse Gas Emissions and Addressing Risk of Climate Change.** Total annual emission in business-as-usual scenario is 137,380 tons/yr and that with project is estimated to be 74,174 tons/year which is less than threshold⁵ limit of the 100,000 tons per year set by ADB. With-project scenario remains lower than without project due to improvement in vehicle speed after capacity augmentation and enhanced surface roughness.

12. With the projected variations in temperature and precipitation, the project region indicates vulnerability to, flooding, which can affect road, bridge and embankments. Key engineering

⁵ Page 38, Appendix I, footnote 10 of SPS 2009

measures taken to address these risks in the design are: i) construction of new side and lead away drains, iii) construction of new culverts or widening of existing ones and iv) increase in waterway including vertical clearance of bridges which amounts to USD 20.42 Million, approximately 10% of the total civil works costs.

13. **Public Consultations:** Meaning consultations in line with SPS, 2009 were conducted with local communities and government agencies like Forests and Wildlife, State Pollution Control Board, fisheries, etc. Emphasis made to include women and vulnerable groups in all interactions organized with local community. Focussed Group Discussions were organized at 20 locations. Project receives strong acceptability/support by potential beneficiaries. They disseminated many important informations and made several suggestions and demands. Main demands include provision of road safety measures, upgradation of CD structure and inclusion of side drains in built-up sections, employment in road construction and petty contracts during construction, avenue plantation. Most of their demands have been integrated in design.

14. **Environmental Management Plan:** Sub-project specific Environmental Management Plan (EMP) has been formulated with intent to set out action required to avoid or mitigate all impacts and the responsibility for taking each action. Responsibility is made legally binding when actions are subsequently specified in contracts. Environmental Monitoring Plan (EMoP) has been prepared to ensure that the intended environmental mitigations are realized and these results in desired benefits to the target population causing minimal deterioration to the environmental parameters. All costs for implementing the mitigation measures and monitoring plan will be included in the Bill of Quantities (BOQ) by the contractor as implementation of the EMP will be the responsibility of the contractor.

15. A generic EMP to avoid/minimize/mitigate potential impacts due to construction of BRRRI has been devised. This will be further enhanced by the design team based on type of facilities to be created and number of people using those facilities.

16. BSRDCL, through its Project Implementation Units (PIUs), will ensure the effective implementation of the environmental management plan. To provide regular monitoring information and technical advice to the PIUs a Construction Supervision Consultant will be engaged who will be responsible to examine environmental compliances and suggest corrective actions and guide them to enhance the environmental performance of the project. There is a need for the PIU to organize its environmental unit to ensure that contractors maintain environmental safeguard compliance.

17. **Conclusion:** This initial environmental examination (IEE) ascertains that upgrading is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed subproject, all of which are localized and temporary in nature and can be easily mitigated with minor to negligible residual impacts. Need of undertaking detailed EIA is not envisaged at this stage. The Executing Agency shall ensure that EMP and EMoP are included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract. The same shall be revised if necessary during project implementation or if there is any change in the design with prior approval of ADB.

I. INTRODUCTION

A. Background

1. Bihar is the 13th largest (94,163 Sq.km), the 3rd most populous (104 million), and the 6th most densely populated (1,102/km²) state of India. Nearly 34% of Bihar's population lives below the poverty line, compared with 22% nationally. The Per Capita Income in Bihar was about 35% of the national average in 2015-16, compared to about 33% a decade ago. The per-capita income at constant (2011-12) prices in 2015-16 was Rs 29,190 and at current prices in 2015-16, it was Rs. 36,964. The state has been growing at a faster rate than the country average: the medium-term growth rate for GSDP in Bihar was 7.6%, compared to 6.8% for the national economy. This is attributed to increased investment in infrastructure and improved governance.

2. Road network of the state comprised 226,895 kilometers. Out of which, the total length of National Highways (NH), State Highways (SH), Major District Roads (MDR) and Rural Roads (RR) is 4700 Kms, 4389 Kms, 10400 kms and 207406 kms respectively. All higher-class roads—national highways, state highways, and major district roads—are paved, but most rural roads are unpaved. Only 20% road network (SH and MDR) has pavement in fair condition and rest 80% is in poor condition. In terms of road length per 100 square kilometers, Bihar has overtaken the national average—193 km against 143 km. However, road density in Bihar, at 1,748 km per million inhabitants, is far below the national average of 3,875 km per million inhabitants.

3. The number of motorized vehicles registered in the state has increased from 1.96 million in 2009 to 4.78 million in 2015, representing an average annual increase of 16%. Of these, over 72% were two-wheelers and about 10% were cars and jeeps, the balance being other categories of vehicles including trucks and buses. Average annual vehicle growth observed during 2009—2015 was over 17% for two-wheelers and 15% for cars. Higher population and vehicular densities necessitates the need for capacity improvement.

4. Government of Bihar (GOB) has stepped up investments in the development of transport infrastructure using its own budgetary provisions, Public Private Partnership (PPP) and financial assistance from international funding agencies. Asian Development Bank (ADB) has been one of the key partners associated with state's growth story by road improvement. Since 2008, ADB has extended four loans, amounting to \$1.52 billion, to upgrade about 1,500 km of state highways and to construct a new bridge over the Ganga River near Patna⁶. In this series, GOB sought additional financial support for another set of prioritized SHs under Bihar State Roads Improvement III Project (BSRIP-III), hereafter referred as the 'Project'.

B. Bihar State Highways III Project (BSHP-III)

5. The project aims to up-gradate 5 state highways (SH-58, SH-82, SH-84, SH-85, & SH-102) totaling 231.75 kms to 2-lane with paved shoulder from its existing single/intermediate lane. For the ease of implementation and encourage participation of local contractors, 5 state highways have been distributed in 9 civil construction packages. Bihar State Road Development Corporation Limited⁷ (BSRDCL) has been entrusted for the implementation/execution of the project

⁶ The loans are: (i) IND-2443, Bihar State Highways Project (2008); (ii) IND-2663, Bihar State Highways II Project (2010); (iii) IND-2894, Bihar State Highways II Project (Additional Financing) (2012); and (iv) IND-3396, Bihar New Ganga Bridge Project (2016).

⁷ Road Construction Department (RCD) is the parent organisation responsible for construction and maintenance of roads on behalf of GOB. To streamline decision-making and provide more autonomy for project execution and delivery,

and hereafter referred as executing agency 'EA'. **Table 1** lists packagewise sub-projects details under BSHP-III.

Table 1: Road Sections under BSHP-III

SH. No	Road Sections	Package No.	Length (KM)	Districts
SH-58	Udakishunganj-Bhatgawan Road	BSHP-III/1/SH-58	29.48	Madhepura & Bhagalpur
SH-84	Ghogha Bazar Section of Ghogha Panjwara Road	BSHP-III/2/SH-84	21.00	Bhagalpur and Banka
SH-84	Bazar Panjwara Section of Ghogha Panjwara Road	BSHP-III/3/SH-84	22.35	
SH-85	(Akharnagar Amarpur Road)	BSHP-III/4/SH-85	29.304	
SH-82	Kadirganj Dewangarh section of Kadirganj Khaira Road	BSHP-III/5/SH-82	27.00	Nawada and Jamui
SH-82	Dewangarh Badaldih section of Kadirganj Khaira Road	BSHP-III/6/SH-82	27.00	
SH-82	Badaldih Khaira section of Kadirganj Khaira Road	BSHP-III/7/SH-82	21.10	
SH-102	Bihia Ujbaliya section of Bihia-Jagdishpur-Piro-Bihta Road	BSHP-III/8/SH-102	29.00	Bhojpur
SH-102	Ujbaliya Bihta section of Bihia-Jagdishpur-Piro-Bihta Road	BSHP-III/9/SH-102	25.519	

Source: BSRDCL (Executing Agency)

C. Project Objectives

6. Project aims to improve transport efficiency of the state road network, which will contribute to expansion of economic opportunities and poverty reduction. This will be realized by (i) improving the state highway network, (ii) facilitating safe and appropriate road usage, (iii) increasing efficiency of transport services and (iv) enhancing GoB capacity for road asset development and management and assist in creating an state of art road research institute. Project immediate outcome will be improved accessibility to social services and markets, increased fuel efficiency, reduced travel time, accidents, vehicle emissions and better employment opportunities outside agriculture, both through improved access to economic centers and increased industrial activities in the project area.

7. To achieve the above objectives, candidate roads will be improved to 2-lane with paved shoulders largely in consistent to Indian Road Congress (IRC) guidelines. Widening and improvement components will include (i) improvement in pavement conditions and road geometry (ii) reconstruction/ widening and provision of additional cross drainage (CD) structures, (iii) side drains in built-up sections, junction improvement, protection works, bus bays/truck lay byes and installation of safety measures etc.

D. IEE Objectives

8. The project is categorized as category 'B' in accordance with ADB's Safeguard Policy Statement (SPS), 2009 warranting an initial environmental examination (IEE). IEE identifies the environmental issues to be considered at project planning and design stage. The IEE report covers the general environmental profile of the study area and includes an overview of the

potential environmental impacts and their magnitude on physical, ecological, economic, and social and cultural resources within the project's influence area during design, construction, and operation stages. An Environmental Management Plan (EMP) forms part of this report which includes mitigation measures for significant environmental impacts during implementation of the project, environmental monitoring program, and the responsible entities for mitigation and monitoring. IEE has four basic objectives; (i) identify the environmental issues that should be taken into account due to project interventions, (ii) determine the magnitude of potential environmental concerns and to ensure that environmental considerations are given adequate weight at planning/design stage, (iii) identify need for further environmental studies or Environmental Impact Assessment (EIA), and (iv) suggest enhancement measures, if any.

E. Extent of IEE

9. IEE extent has been decided considering all likely Impacts and risks analyzed in the context of the project's area of influence. It encompasses (i) the primary project site(s) and related facilities (ii) associated facilities whose viability and existence depend exclusively on the project (iii) areas and communities potentially affected by cumulative impacts from further planned development of any existing project or condition, and other project-related developments that are realistically defined at the time of assessment; and (iv) areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The core zone of impact is taken as proposed right of way and its immediate vicinity. The assessment also considers the areas and activities related to associated facilities viz. quarry operation, borrow areas, construction camp, transportation/haulage routes etc. The study area is considered up to 10 km on either side of road for larger analysis of land use and other features. Assessment is carried out for all facets of environment i.e. physical, biological and socio-economic aspects.

F. Approach and Methodology

1. Preface

10. As stated above, 5 state highways have been splitted in 9 civil packages. This consolidated IEE report addresses all environmental impacts triggered by the entire project which inter-alia covers all 9 packages. Separate EMPs have been prepared for each civil package presenting the segregated technical details to define clear scope of activities under EMPs for the convenience of civil contractors.

2. Information Sources

11. The IEE report has been prepared on the basis of project interventions as described in Detailed Project Report (DPR), field investigations and stakeholder consultations to meet the requirements for environmental assessment process and documentation as per ADB's Safeguard Policy Statement (SPS), 2009. Key information sources include; DPR, executing agency, primary field survey, consultations with govt. agencies, Bihar govt IMD and other websites.

3. Steps Followed

12. IEE commenced with the review of legal requirements for the project. In next step, technical details were collected compiled by detailed design team. This was followed by a discussion with the implementing agency to reconfirm the technical details. Further steps followed for IEE have been concisely described in following paragraphs.

13. **Reconnaissance Survey and Initial Consultations:** Reconnaissance survey and initial consultations facilitated in designing the nature of the environmental survey and extent of consultations to be carried out along the road alignment. It helped to identify data gaps, decide valued environment components, key stakeholders and key informants who can further substantiate the collected information. Reconnaissance survey and initial consultations also recognized the need to conduct rapid bio-diversity assessment and wild-life movement study for the stretches where movement of wildlife was reported.

14. **Primary Data Collection:** Environmental resource inventory was prepared for all environmental features viz. terrain, land use, waterways/water bodies, road side vegetation, sensitive receptors, common property resources, utilities, drainage, flooding/water logging, accident prone areas etc. within the area of interest/core zone.

15. **Secondary Data Collection:** Secondary sources included environmental assessment done by feasibility team, published government reports, government websites, recognized institutions and relevant government departments (forests and wildlife, pollution control board, statistics, Indian Meteorological Department (IMD) etc. Recent Google images were captured to view environmental features at regional scale. References made to the secondary sources have been mentioned in the text and tables throughout the length of the report.

16. **Public Consultations:** Meaningful consultations were organized with the government agencies, local people/beneficiary population to know the level of project acceptability, understand their concerns, apprehensions, and overall opinion. These consultations enabled incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues. Efforts were made to make it gender inclusive and responsive. Information were gathered about existing baseline environmental condition viz. ambient levels and its effects on health, water resources, water logging/flooding, flora and fauna, wildlife movement, socio-economic standing of local people, impact due to loss of land other assets and common property resources, accident risk during construction and operation stage, perceived benefits and losses, etc. This will be continued throughout the project cycle.

17. **Other Tools, Additional Surveys and Studies:** The Transport Emissions Evaluation Model for Projects (TEEMP)⁸ developed by Clean Air Asia⁹ was utilized to assess the CO₂ gross emissions. Required input data-set viz. road length and configuration, traffic, road roughness, emission factors etc. were collected from different sources.

18. Assessment of land use/land cover map of larger area beyond the project site helps in better planning and decision-making before creating any physical infrastructure in the region. Remote sensing and Geographic Information System (GIS) based land use map of the study area (10 km buffer) has been prepared through recent satellite imagery. Unsupervised classification was done using Earth Resources Data Analysis System (ERDAS) Imagine software supported by ground verifications.

⁸ TEEMP is an excel-based, free-of-charge spreadsheet models to evaluate emissions impacts of transport projects.

⁹ A network of 250 organizations in 31 countries established by the Asian Development Bank, World Bank, and USAID to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

19. Climate risk screening identified increased temperature as major risk which has the potential to affect and reduce the life of asphalt road pavements through softening and traffic-related rutting. Extreme heat can also stress the steel in bridges through thermal expansion and movement of bridge joints and paved surfaces. Although the period of prediction is far longer than the design life of asphalt which will require maintenance overlay periodically, mitigation measures and feasible options to reduced impact on pavement have been included in the environmental management plan-operation phase.

20. **Assessment of Potential Impacts:** The assessment of the type, nature, direct, indirect, cumulative or induced impacts and their significance to the physical, biological, and socio-economic components of the environment has been done to ascertain whether the project is environmentally sustainable or not. Nature of impacts has been classified as significant, insignificant, short-term, long-term, reversible, irreversible etc. After identification of nature and extent of impacts, mitigation measures have been suggested.

21. **Environment Management Plan:** Packagewise EMP has been formulated with an aim to avoid, reduce, mitigate, or compensate for adverse environmental impacts/risks and propose enhancement measures. This includes: (i) mitigation of potentially adverse impacts, (ii) monitoring of impacts and mitigation measures during project implementation and operation, (iii) institutional capacity building and training (iii) compliance to statutory requirements, and (iv) integration of EMP with project planning, design, construction and operation.

G. Structure of the report

22. IEE has been structured in accordance with SPS, 2009. An executive summary describing critical facts, significant findings, and recommended actions has been presented in the beginning of the report. The report has been compiled and presented as follows.

Executive Summary

Chapter I -	Introduction
Chapter II-	Policy, Legal and Administrative Framework
Chapter III-	Description of Project
Chapter IV-	Description of the Environment
Chapter V-	Anticipated Impacts and Mitigation Measures
Chapter VI-	Information Disclosure, Consultation, and Participation
Chapter VII-	EMP and Grievance Redress Mechanism
Chapter VIII-	Conclusion and Recommendation

II. DESCRIPTION OF THE PROJECT

A. Location of the Project

23. The 5 sub-project roads distributed in 9 construction packages are located in 6 districts of Bihar state namely: Madhepura, Bhagalpur, Banka, Nawada, Jamui & Bhojpur. The State can be divided into two major divisions structurally as North Bihar & South Bihar. All the project roads fall in the South Bihar except SH-58 which lies in the North Bihar. Project location map for sub-project roads and proposed BRRI building are enclosed in beginning of this report as **Map 1** and **Map 2** respectively.

B. Importance of Sub-Projects and Need for the Project

24. All sub-projects are strategically linked either with national highways or important state highways forming parts of state's core network. They directly or indirectly connect district headquarters or serve as arterial road joining two or more district centres and some roads provide inter-state connectivity to adjoining state of Jharkhand and West Bengal. Traffic load on these roads has already outstripped the present single/intermediate lane configuration causing increased travel time, decreased fuel efficiency adversely affecting vehicle operating cost. There are many undrilled gaps along some of the sub-projects. High projected traffic load combined with deficient road geometry, inadequate cross and side drainage facilities, lack of safety provisions and road furnitures, idling at level crossings and poor conditions of other road ailments necessitates the capacity augmentation and improvement of sub-project roads.

25. Enhancement of sub-projects roads will ensure (i) better riding quality, congestion free and improved level of service resulting in reduced travel time and fuel consumption (ii) decrease in accidents (iii) reduced recurrent costs over the medium and long term due to more efficient road asset management and high quality construction and maintenance (v) acceleration in social and economic development through increased employment opportunities and better accessibility to socio-economic services.

C. Project Category

26. Project categorization has been done using Rapid Environment Assessment (REA) checklist (**Appendix-1**) of ADB for roads and highways after screening survey and initial consultations. Project scope is limited to improvement and widening of existing single/majority intermediate roads to 2-lane with 1.5 m paved and 1 m earthen shoulder. Hence, it is expected that stress on existing natural resource viz, land, water, soil and aggregates are not significant. Sub-project roads do not pass through or located nearby any wildlife sanctuary, national park, reserved forest¹⁰ protected area network, archeological monument/heritage sites or any other similar eco-sensitive areas. However, road side plantations along the sub-projects have been declared as protected forest¹¹ (PF) by the state forest department except SH-58. Area details for diversions and number of affected trees have been described in baseline chapter. A small portion of SH-82 intermittently (Ch. 42.7 near Mahodar to Km 54.1 near Chanarwar and 66.4 Km near Kurwatad to Km. 68.8 near Baba Jhakhraj) passes through fringe area of natural forest. No loss of any rare, threatened or endangered floral species is envisaged due to clearance of vegetation for widening.

¹⁰ **Reserved Forest:** an area notified under the provision of Indian Forest Act having full degree of protection. In Reserved Forests, all activities are prohibited unless permitted.

¹¹ **Protected Forest:** an area notified under the Indian Forest Act having limited degree of protection. In Protected Forests, all activities are permitted unless prohibited

Undefined movement of some wild animals mainly of Blue Bulls¹² (*Boselaphus tragocamelus*; Schedule¹³ V) was reported by local people. Besides, occasional crossing of Spotted Deer (*Axis-axis*; *Schedule III*), Sambhar (*Cervus unicolor*; *Schedule II*), and rare sighting of Sloth Bear (*Melursus ursinus*; *Schedule I*) was also reported by local people. None of the animal species are under threatened or endangered categories as per IUCN classification. Sloth bear is under vulnerable category. While granting Stage-I approval, forest department has confirmed that areas along road strip is devoid of endangered floral or faunal species. All other impacts are mainly temporary and localized in nature which can be mitigated by effective implementation of Environmental Management Plan (EMP) included in IEE. Hence, the project has been categorized as 'B' as per SPS, 2009.

27. One of important constituent of the project is the construction of a state of art road research centre for research, development and capacity building in the area of highway engineering and other civil structures. The project is at conceptual stage. Screening of potential impacts concludes that construction of proposed BRRI will not cause any significant adverse impacts. All likely impacts are short-term, localized and hence the project categorization is not affected. As per GOI's EIA Notification 2006 and its amendments, the project inclusive of proposed BRRI is not under purview of environmental clearance.

D. Characteristics of Existing Roads

28. Sub-project roads on an average are having sufficient width/ROW¹⁴ to accommodate the proposed widening except at few isolated built-up sections and curves where land acquisition is inevitable. No additional land is required for SH-58 and SH-82. In remaining sub-projects also, land requirement is minimal and limited to 1.4 acre for SH-85, 7.83 acre for SH-102 and 11.90 acre for SH-84 where a short bypass is proposed. Riding condition is mostly fair to good after recent maintenance and overlays in major portions of all sub-projects by RCD except SH-58 which is in very bad conditions in absence of any recent maintenance activities. Some culverts and bridges have also been improved recently which may not be reflected in detailed design report undertaken prior to improvement activities. IEE team has made all efforts to capture these recent improvement activities. Roadside drains are present in some built-up stretches but mostly choked and non-functional. There are total 3 level crossings; one each on SH-84, SH-85 and SH-102. Bus shelters are present in some built-up areas. Most of the roads are largely devoid of safety provisions except signages at few locations. Horizontal profile is incoherent to applicable codal provisions at some locations in all sub-projects. Vertical profile largely meets the guidelines except few locations. Abutting land use is mainly agricultural along all the project roads with intermittent built-up stretches varying from 10-15% of the total alignment along most of the sub-projects. There is large number of common resource properties including sensitive receptors close to the alignments.

¹² Presently, this species is under Schedule III of Wildlife Act, 1972. Due to its large population causing heavy crop damage, MOEF has issued an advisory to include it in Vermin category of Schedule V so that killing/hunting of such animals are outside purview of law.

¹³ Wildlife Protection Act, 1972 has six schedules which give varying degrees of protection. [Schedule I](#) and part II of [Schedule II](#) provide absolute protection - offences under these are prescribed the highest penalties. Species listed in [Schedule III](#) and [Schedule IV](#) is also protected, but the penalties are much lower. [Schedule V](#) includes the animals which may be hunted.

¹⁴ ROW along sub-projects :

- SH-58: 22 m in entire stretch.
- SH-84: Max- 40m, Min 08 m and 18 m on an average
- SH-82: Max- 40m Min-12m and 16 m on an average
- SH-85: Max-30m, Min-12m and 15 m on an average
- SH-102: Max-24, Min-14 m and 18 m on an average

E. Existing and Projected Traffic

29. The appreciation of traffic characteristics is one of most important activity to evaluate the potential of the existing network and identify the major issues to develop various components of road. Traffic survey begins with identification of homogeneous sections with similar traffic volume and composition. Traffic survey for each homogenous section was conducted to determine the existing traffic volumes in a number of vehicular categories. The peak and seasonal correction factors were worked out and applied on the Average Daily Traffic to obtain the Annual Average Daily Traffic (AADT) on the project roads. Various vehicle types having different size and characteristics were converted into Passenger Car Equivalents using Passenger Car Units (PCU) as suggested in IRC-64-1990; Guidelines for Capacity of Roads in Rural Areas to determine the relative effect of different types of vehicle on the traffic flow as compared to car as a standard vehicle. Traffic composition of sub-project roads road varies from each other. Some roads have higher percentage of heavy commercial vehicle whereas some is dominated by cars/jeep and 2 wheelers.

30. The traffic projection on the road normally consists of normal traffic¹⁵, diverted traffic¹⁶, and induced/generated¹⁷ traffic. Annual growth rates adopted range between 5.5% to 8% for cars and 2-wheelers, 5% for buses, and 5% to 7% for trucks. The traffic growth rates have been estimated based on the latest socio-economic and vehicle registration data. **Table 2** presents the existing and projected traffic volume converted in PCU since design service volume for different category of roads are assessed based on PCU. Traffic projection establishes that most of the road will reach its capacity within 10 yrs of its wideing to 2-lane and require 4 laning within the study horizon. SH-102, SH-84 and SH-85 require immediate four laning.

Table 2: Exiting and Projected Traffic on Sub-Project Roads

Road	Homogenous Sections	PCUs/day			
		2018	2024	2032	2041
SH-58	km 0+0 to km 23+00	2,573	3,906	6,802	12,842
	km 23+00 to km 29+480	6,432	8,905	13,488	22,179
SH-82	km 0+000 to km 51+000)	6,477	9,211	13,713	21,436
	51+000 to km 75+100	8,027	10,819	15,375	23,287
SH-84	km 0+000 to km 14+000	14,328	18,992	26,037	37,870
	(km 14+000 to End point)	15,432	21,317	30,462	45,734
SH-85	km 0+000 to km 10+000	7,848	10,883	15,853	24,374
	(km 10+000 to km 29+304)	12,763	17,485	25,322	38,880
SH-102	(km 0+000 to km 12.175)	13,770	21,431	37,609	70,187
	(km 12.175 to km 32+924)	6,231	9,710	17,161	32,234
	km 32+924 km 54+519)	4,080	6,350	11,182	20,946

Note: Diverted traffic for SH-58 has been added to homogenous setion 2 only. This will not affect the total projected figure for entire length since all the diverted traffic will travel the whole road length i.e both homogenous sections.

F. Design Parameters

31. Project road improvement will broadly follow special codal provisions relevant to state highways prescribed by Indian Road Congress (IRC: SP: 73-2007 updated in 2015) and Ministry of Road Transport and Highways (MoRTH) Guidelines. In case of any compromise with these guidelines, has been specifically mentioned with reasons. All efforts have been made to maintain

¹⁵ Tthe existing traffic which would in any event continue to use the road even if no improvement is made for the road.

¹⁶ The traffic attracted to the improved road in absence of alternative routes when the improvements are completed.

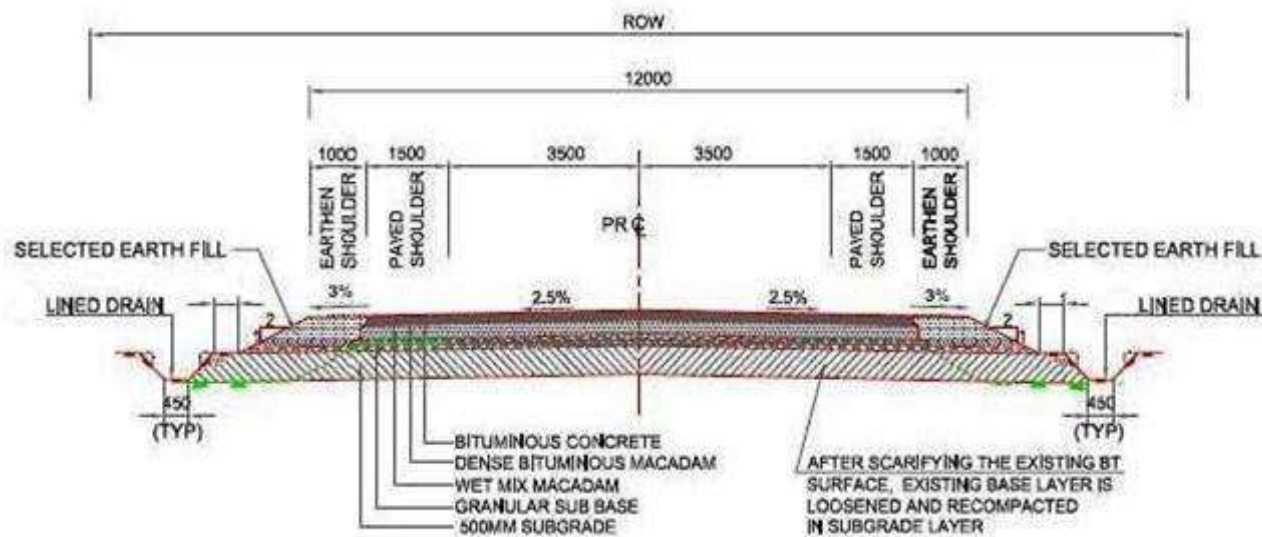
¹⁷ Tthe increase in traffic, that may arise from improvements and development of adjacent area due to added mobility

the consistency of design criteria for all sub-projects barring few exceptional cases due to limiting factors for the reason that of ground conditions. Design criteria adopted for the project is summarised in **Table 3**. Typical cross-section for proposed configuration is given in **Fig 1**.

Table 3: Design Parameters

S. No	Parameters	Details
1	Geometric design standards	IRC 73-1980 relevant to plain/rolling terrain
2	Design Speed (Km/hr)	Ruling -100 Km/Hr, Minimum 80. 50-65 kmph near bridge approaches settlements, intersections, , horizontal curves etc.
3	Roadway Elements	Carriageway: 1x7.0m Paved shoulder- 2x1.5m Unpaved Shoulder: 2x1.0m
4	Service Road Width	5.5 m applicable only for SH-102 for small portion
5	Embankment Slope	In filling- 1V: 2 H In cutting- 1V:1H
6	Ditch Slopes (H:V)	1:1 (Fore slope or back slope)
7	Camber	Carriageway/Paved Shoulder- 2.5%, Unpaved Shoulder- 3.5%
8	Super-elevation	Maximum 7% except RD 02 where it is limited to 5.5%
9	Min Radii for Horizontal Curves	400 m for 100 km/hr, 260 m for speed of 80 km/hr, 170 m for speed of 65 km/hr, 100 m for speed of 50 km/hr
10	Gradient(rolling/mountainous)	Ruling: 3.3/6.0%, Limiting:5.0/7.0%, Exceptional 6.7/8.0%
11	Design Flood Frequency	Bridges: 50 years, with anticipated risk of rarer flood of next higher frequency i.e. 100 yr return period flood on the structure
12	Free board	0.6m to 1.0 m depending on discharge

Figure 1: Typical Cross-section of proposed 2-lane configuration



G. Improvement/Strengthening Proposal

32. Improvement components include (i) widening of road from the existing intermediate/2-lane to 2-lane of 7.0m carriageway with 1.5 m paved and 1.0 m earthen shoulder on either side. (ii) improvement in pavement conditions and geometrics (iii) reconstruction and widening of CD structures (iv) provision of roadside drains (iv) junctions/intersection improvement, safety provisions for road users and provision of road facilities like bus bays/bus shelters. Environmental

enhancement measures such as additional plantation also proposed to curb green house gas emission. Salient features of the improvement proposals are discussed in brief in following paragraphs.

33. The horizontal curves have been eased to the extent feasible considering the ground constraints. Horizontal geometry will be based on IRC: 38-1988 “Guidelines for Design of Horizontal Curves for Highways (First Revision)” and vertical geometry will be based on IRC: SP 23-1993 “.

34. Two major bridges have been proposed under the project at SH-82 & SH-85. All low level bridges have been upgraded to Highlevel Bridge and culverts with inadequate vents have been either converted to box or slab culverts. Vented causeways in some roads have been proposed for minor bridge or culverts depending on discharge of waterways.

35. Existing roads are largely devoid of side drains. In some urban stretches where drains were observed, are blocked and choked. Covered lined drain with foot-paths has been proposed in all built-up sections. Open unlined earthen drains have been provided to capture surface run off from the main highway in some stretches of the sub-projects.

36. All major junctions are proposed for improvement as per IRC guidelines mostly at grade. At some intersecting NH, flyovers are either under construction one like at Jagdishpur where NH-30 is intersecting with sub-project road SH-102. Bus shelters have been provided at all important habitations with an additional paved area in order to enable a bus to stop without obstructing the flow of traffic.

37. Safe crossing facilities for pedestrians are proposed at major intersections. These facilities are planned in accordance with the relevant provisions contained in IRC-11¹⁸, IRC-67¹⁹ and IRC-103²⁰. At intersections, controlled form of crossing is achieved through provision of 3 m wide zebra crossing, accompanied by STOP line.

38. The project roads have been provided with all safety features as per IRC: 8²¹, IRC:25²², IRC:26²³, IRC:35²⁴, IRC:67²⁵, IRC:103²⁶ and Section 800²⁷ of MORTH. Key features includes provisions of crash barriers in high embankment areas, speed breakers, zebra crossings near built-up areas & schools, speed restrictions in built-up sections, delineators, road studs, cat's eye, chevrons, object markers etc. have been included in the design.

39. There are 3 existing level crossing along the sub-project roads; Ghogha (SH-84), Akbar Nagar (SH-85) and Piro (SH-102). Rail over Bridges (ROB) have been proposed for all level crossings except at Akbarnagar since it is only at a distance of 150m from the junction point of SH-85 & NH-80. Gradient from junction to ROB location will be only 7%, which is very steep and may cause major safety hazard.

¹⁸Recommended Practice for the Design and Layout of Cycle Tracks

¹⁹Code of Practice for Road Signs

²⁰Guidelines for Pedestrian Facilities

²¹Type Design for Highway Kilometer Stones

²²Type Design for Boundary Stones

²³Type Design for 200-meter Stones

²⁴Code of Practice for Road Markings

²⁵Code of Practice for Road Signs

²⁶Guidelines for Pedestrian Facilities

²⁷ Specifications for Traffic Signs and other Safety-Related Works

40. For construction stage safety, a proper traffic diversion plan shall be prepared as per IRC: SP: 55-2014²⁸. Separate traffic diversion plan shall be prepared for structures and CD works.

41. . The execution of the project road should be planned such that inconvenience to road users is minimal. The width of temporary diversion should be equal to the width of existing carriageway. Embankment heights are proposed for raising for grade improvement and locations where overtopping was reported either due to local drainage problem or ponding due to over flow of rivers during monsoons.

42. Existing sub-project road's characteristics/salient features and proposal for improvement has been summarized in **Table 4**.

Table 4: Road's Salient Features and Improvement Proposals

Table 1. Road's Salient Features and Improvement Proposal								
Road	Existing Road's Salient Features		Improvement Proposal					
Udakishanganj- Chousa- Bhatgawan (SH-58)	<ul style="list-style-type: none">Length=29.48Location: Starts from a T-junction of SH-91 at Udakishanganj in Madhepura district and terminates at the T- Junction (km. 374.220 of NH-31) near Bhatgawan under Chousa tehsil of Madhepura district.Habitations are JamnuiaTola, Karchokka, Nayatola, Puraini, Dhulia Kalasan, Ghosai, Chausa, Lawalagam, BhatgawanROW: 80 feet (24.4m) as per government records.Configuration: Carriageway of 3m width & road width of 4.8m on an average.Junction/Intersections: 2 major junctions at Udakishanganj (starting point) &Bhatgawan (end point) & 21 minor intersections.Cross Drains: 9 minor bridges. 12 slab culverts, 9 pipe culvertsTerrain and Land use: Plain terrain. Land use predominantly is agricultural.No level crossing		<ul style="list-style-type: none">Project Road Length : 29.48 KmConfiguration: 2 lane with carriageway width of 7m, paved shoulders 1.5m & earthen shoulders of 1m each side.Bypass- NilNo toll plazaCross Drainage Structures					
			Cross Drains	New	Re-construction	Widening & Retain with Minor repair	Total	
			Pipe culvert	15	6	3	-	24
			RCC Slab culvert	-	11	0	1	12
			Minor Bridge	-	7	2	-	9

²⁸ Guidelines on Traffic Management in Work Zones

Road	Existing Road's Salient Features	Improvement Proposal																								
Ghogha- Panjwara(SH-84)	<ul style="list-style-type: none">Length=43.350 KmLocation: starts at Ghogha (at km 150 of NH-80) T-point& Endsends at Panjwara (NH-333A) T-point. Project road falls in Bhagalpur & Banka districts.Major settlements are Ghogha, Olpura, Sanhaula, Bhuria, KurmaHaat, Ghoriya, Batsar, Saadpur, Panjwara,ROW: 12-30mConfiguration: Intermediate lane with width 5.5m.Poor bituminous pavement condition upto first 24km and then fair earthen shoulder of 1.5m width upto end point. Reasonably fair alignment.Junction/Intersections: 4 major and 46 minorCross Drains: 10 minor bridge. 78culvertsLanduse: Mainly flat with few stretches rolling/hilly. Landuse mainly agriculturalSide drains: existing in few built-up sections but mostly choked and non-functional. No lined/unlined drain in remaining open sections1 level crossing at Ghogha	<ul style="list-style-type: none">Project Road Length: 43.350 KmConfiguration: 2 lane paved shoulders of 7m carriageway with earthen shoulder of 2.5 m on either sideBypass: 2 (Ghogha Bypass &KumriyaHaat Bypass)16 Bus stoppage.No toll plazaCross Drainage Structures: <table><tr><th>Cross Drains</th><th>New</th><th>Re- construction</th><th>Widening & Repair</th><th>Retain with Minor repair</th><th>Total</th></tr><tr><td>Pipe Culverts</td><td></td><td>35</td><td>15</td><td>-</td><td>50</td></tr><tr><td>RCC Slab Culverts</td><td></td><td>20</td><td>8</td><td></td><td>28</td></tr><tr><td>Minor Bridge</td><td>-</td><td>6</td><td>3</td><td>-</td><td>9</td></tr></table> <ul style="list-style-type: none">ROB:One ROB combined with Ghogha Bypass (CH-0.360-1.410km).	Cross Drains	New	Re- construction	Widening & Repair	Retain with Minor repair	Total	Pipe Culverts		35	15	-	50	RCC Slab Culverts		20	8		28	Minor Bridge	-	6	3	-	9
Cross Drains	New	Re- construction	Widening & Repair	Retain with Minor repair	Total																					
Pipe Culverts		35	15	-	50																					
RCC Slab Culverts		20	8		28																					
Minor Bridge	-	6	3	-	9																					
Akbar Nagar- Amarpur (SH-85)	<ul style="list-style-type: none">Length=29.506 KmLocation: Starts from Akbar Nagar on NH-80 (at Km 113) and ends at Amarpur Market. Road passes through Bhagalpur & Banka districts.Villages enroute are Srirampur, Pachrukhi, Sahkund, Kusmaha, Pawai, Bikrampur, MahadevpurROW: 12-25mConfiguration: Mostly Intermediate lane with carriageway width varies from 6m to 4.5m with latest improvement of the road.Earthen pavement throughout the road varies from 0.5m to 2m width.Junction/Intersections: 5 major and 41 minorCross Drains: Major Bridge- 1, Minor Bridge- 4, Culvert- 72Landuse: Road passes through flat Gangatic plain areas. Landuse mainly agricultural followed by built-up/settlements areas.Side drains: existing in few built-up sections namely at Pancharukhi, Bajar&Pawai.1 level crossing at KM 0+150.	<ul style="list-style-type: none">Project Road Length: 29.304 KmConfiguration: 2 lane of 7m carriageway with 1.5m pavedshoulders, 1m earthen shoulders throughout the project road.Bypass: Nil12 bus laysNo Toll PlazaCross Drainage Structures: <table><tr><th>Cross Drains</th><th>New</th><th>Re- construction</th><th>Widening & Repair</th><th>Retain with Minor repair</th><th>Total</th></tr><tr><td>Culverts</td><td>9</td><td>53</td><td>6</td><td>13</td><td>81</td></tr><tr><td>Minor Bridge</td><td>-</td><td>4</td><td></td><td>-</td><td>4</td></tr><tr><td>Major Bridge</td><td>-</td><td>1</td><td>-</td><td>-</td><td>1</td></tr></table> <ul style="list-style-type: none">Side Drains: throughout the project road.ROB: Not proposed due to very steep gradient of 7% from junction (Starting point) to the existing level crossing location.	Cross Drains	New	Re- construction	Widening & Repair	Retain with Minor repair	Total	Culverts	9	53	6	13	81	Minor Bridge	-	4		-	4	Major Bridge	-	1	-	-	1
Cross Drains	New	Re- construction	Widening & Repair	Retain with Minor repair	Total																					
Culverts	9	53	6	13	81																					
Minor Bridge	-	4		-	4																					
Major Bridge	-	1	-	-	1																					

Road	Existing Road's Salient Features	Improvement Proposal																								
Kadirganj-Khaira (SH-82)	<ul style="list-style-type: none">Length=75.100 KmLocation: Starts at Kadirganj on SH-8 (at KM 10) and ends at Khaira on NH-333. Road passes through Nawada&Jamui districts.Road passes through Kadirganj (RupohMor, Roh, Rupoh, Baghela, Jorawali, Kawakol, Rani Bazar, Ropawel, Badaldih, Garhi, Laldaia, Gopalpur, Khaira,ROW:12-18mConfiguration: 35-50 km- Single Lane of 3m bituminous surface width 7m formation width with average 1.5m average embankment height. Rest of the road- Intermediate lane of 5.5m width bituminous carriageway with average 1.5m earthen shoulders.Junction/Intersections: 65 intersections throughout the project road.Cross Drains: 3 major bridges, 7 minor bridges/ Vented Causeway&213 culvertsTerrain and Landuse: Plain & rolling terrain and abutting land use is agricultural followed by forest and built-up/settlements areas.No railway level crossing	<ul style="list-style-type: none">Project Road Length=75.100 kmConfiguration: 2 lane of 7m carriageway with 2.5m earthen shoulder in rural sections and 7.5m earthen shoulder in built-up sections.No bypass proposed12 Bus Stoppages.No toll plazaCross Drainage Structures: <table><thead><tr><th>Cross Drains</th><th>New</th><th>Re-construction</th><th>Widening & Repair</th><th>Retain with Minor repair</th><th>Total</th></tr></thead><tbody><tr><td>Culverts</td><td>-</td><td>75</td><td></td><td>138</td><td>213</td></tr><tr><td>Minor Bridge</td><td>-</td><td>7</td><td></td><td>-</td><td>7</td></tr><tr><td>Major Bridge</td><td>-</td><td>1</td><td>-</td><td>-</td><td>1</td></tr></tbody></table> <p>(Two bridges are under construction by BRPNN which is not under the scope of this project)</p> <ul style="list-style-type: none">Side Drains: 13.33 km covered drains in built-up sections on both side of the road.	Cross Drains	New	Re-construction	Widening & Repair	Retain with Minor repair	Total	Culverts	-	75		138	213	Minor Bridge	-	7		-	7	Major Bridge	-	1	-	-	1
Cross Drains	New	Re-construction	Widening & Repair	Retain with Minor repair	Total																					
Culverts	-	75		138	213																					
Minor Bridge	-	7		-	7																					
Major Bridge	-	1	-	-	1																					
Bihea-Jagdishpur-Piro-Bihita (SH-102)	<ul style="list-style-type: none">Length= 54.519 kmLocation: Starts from Bihiya on NH-84 (km 22.6) and ends at Bihita (on SH-81). The project road lies totally in Bhojpur district.Road passes through Bihiya, Trimurti, Jagdishpur, Ramdastala,Tenduni, Keshwa, Jitora Bazar, Dhobi Ghatwa, Piro, Ibrahimpur, Tiwaridih, Bhulukuwa,Sikroul, Fathepur, Nanidih, Sikrahata, Muptibazar, Bishunpura, Bihta,ROW:12-18mConfiguration: Intermediate lane width 5.5m carriageway widthJunction/Intersections: 6 major junctions and 115 minor junctions.Cross Drains: 8 minor bridges &159 culvertsTerrain and Landuse: Plain terrain and abutting land use is agricultural followed by built-up/settlements areas.Two railway level crossings at Bihiya&Piro. ROB at Bihiya is under construction.	<ul style="list-style-type: none">Project Road Length=54.519 kmConfiguration: 2 lane of 7m carriageway with paved shoulderNo bypass proposed but realignment at two stretches (Ch.- 27.5-28.05km & Ch. 47.8-48.05km) of total length of 800m.20 Bus Bays & 2 truck bays.No toll plazaCross Drainage Structures: <table><thead><tr><th>Cross Drains</th><th>New</th><th>Re-construction</th><th>Widening & Repair</th><th>Retain with Minor repair</th><th>To tal</th></tr></thead><tbody><tr><td>Culverts</td><td>7</td><td>156</td><td></td><td>1</td><td>164</td></tr><tr><td>Minor Bridge</td><td>-</td><td>5</td><td>3</td><td>-</td><td>8</td></tr></tbody></table> <ul style="list-style-type: none">Service Road- Piro ROB (length-1.332km)Side Drains: 18.5 km open drains and 4.558 km covered drains on both side of the road.	Cross Drains	New	Re-construction	Widening & Repair	Retain with Minor repair	To tal	Culverts	7	156		1	164	Minor Bridge	-	5	3	-	8						
Cross Drains	New	Re-construction	Widening & Repair	Retain with Minor repair	To tal																					
Culverts	7	156		1	164																					
Minor Bridge	-	5	3	-	8																					

H. Existing Site Conditions and Proposed Facilities at BRRI

43. Proposed BRR I site is situated in Patna (capital of Bihar) at Gaighat, nearly at a distance of 8.8 km from Patna railway station and 14 km from Patna Airport. It is well connected with a 12 m wide paved road abutting Gaighat main road. The site is vacant plot surrounded by:

- East- Bihar Judicial Academy
- West – Residential Area mainly hutments
- North- Residential Area mainly Hutments
- South- Female Remand Home

44. The site erstwhile being used for hot mix plant is under possession of Road Construction department (RCD), the parent department of executing agency (BSRDCL). Being located within municipal limit, all environmental services like storm water drains, sewage system, electricity, water supply etc facilities are already laid. Presently site is almost vacant with one guard room and some abandoned structures. No major demolition is involved. Plot is fenced with concrete wall. Trees within the site are mostly along the periphery. Remaining few will be adjusted with layout plan to avoid its cutting. Topography of the site is flat with isolated humps of soil. Terrain is naturally sloping towards Ganga river in north direction. The area is not susceptible to flooding but it lies in Seismic Zone IV indicating high damage risk zone.

45. Key facilities to be created at BRR I include laboratories for testing of construction material, seminar/conference halls, auditoriums, canteen, library, hostel for trainees and accommodation for staffs and related infrastructure. The total builtup area is supposed to be less than 20000 sq. m and hence not triggering environmental clearance. However, there are several permissions need to be secured prior to construction. All legal/legislative requirement have been listed in next chapter.

I. Construction Material

46. Good earth/soil for embankment is available locally within 0-10 km lead distance for all the sub-project roads. Aggregates for the project are available in close vicinity for SH-84 & SH-85. For the other roads it is available within 100-138km. Sand is also available in plenty in beds of rivers being crossed by the project roads for SH-84 & SH-85 and for remaining roads within a lead distance of 30-108km.

47. Construction material sources have been assessed by DPR team in terms of its capacity, material quality and accessibility to the project site and found be adequate and suitable. Water requirement for construction will be met through combination of ground water and surface water. Some of the project road lies within 100 km distance from operational thermal power plants and hence fly-ash utilization is mandatory as per Fly-Ash Notification 2003²⁹. Sources & quantity of construction materials are summarized in **Table 5**.

Table 5: Source of Construction Material and its Lead

Construction Material	SH-58	SH-84	SH-85	SH-82	SH-102
	Source and Its Lead in (Km)				
Soil	Locally Available				
Sand	River Chanan (108)	Gherwa R (intersecting)	Gherwa R (50) Getarnath R (10) Sukanya R (37)	Kiul River (30)	Sone River (28)

²⁹As per IRC SP 58 2001, a cushion of 0.5 m between fly-ash and granular material is required. Additionally, 1 to 3 m thick cushion of selected earth cover on embankment slopes is required where fly-ash is to be used. Embankment height of the proposed sub-projects are in general less than desired height for fly-ash utilization.

Construction Material	SH-58	SH-84	SH-85	SH-82	SH-102
	Source and Its Lead in (Km)				
		Sukanya R (3.4)			
Stone Metals	Mirza Chowki (138)	Mirza Chowki Bhalijor (10.5)	Banama Quarry (2) Shivsankarpur (1.5)	Sheikhpura (100)	Gaya (133)
Cement/Steel	District Head Quarters				
Bitumen	Barauni (134)	Barauni (150) Haldia (450)	Barauni (133) Haldia (478)	Barauni (140)	Haldia 622
Emulsion	Ulberia (638)	Ulberia (405)	Ulberia (405)	Ulberia (840)	
Fly Ash	Kahalgaoon (57)	Kahalgaoon (10)	Kahalgaoon (49)	Beyond 100 Km	
Water	Combination of ground and surface water sources after prior permission from Central Ground Water Authority (CGWA) in case of groundwater abstraction and state irrigation department in case of surface water use.				

Source: Detailed Design Report, R: River

Note: the above sources are tentative. Contractor is free to select the sources after securing permissions from competent authority like DEIAA, SPCB, CGWA, Mining department etc and consent from panchayat and concurrence of land owners.

J. Cost and Implementation Schedule

48. Project construction period will be 30 months for all the sub-project roads with one year defect liability period. Estimated project cost for all the project roads have been tabulated below **(Table-6)**. This represents only civil works cost. Cost towards pre-construction permits like tree cutting and forest diversions will be borne by executing agency.

Table 6: Estimated Cost of Construction Packages

S. No	Roads Sections	Package No.	Length (km)	Cost (Million INR)
1	SH-58 (Udakishunganj-Bhatgawan Road)	BSHP-III/1/SH-58	29.48	1533.48
2	SH-84 (Ghogha Bazar Section of Ghogha Panjwara Road)	BSHP-III/2/SH-84	21.00	1420.65
3	SH-84 (Bazar Panjwara Section of Ghogha Panjwara Road)	BSHP-III/3/SH-84	22.35	1184.16
4	SH-85 (Akharnagar Amarpur Road)	BSHP-III/4/SH-85	29.304	1562.52
5	SH-82 (Kadirganj Dewangarh section of Kadirganj Khaira Road)	BSHP-III/5/SH-82	27.00	1216.17
6	SH-82 (Dewangarh Badaldih section of Kadirganj Khaira Road)	BSHP-III/6/SH-82	27.00	1434.77
7	SH-82 (Badaldih Khaira section of Kadirganj Khaira Road)	BSHP-III/7/SH-82	21.10	1111.84
8	(SH-102 Bihia Ujbaliya section of Bihia-Jagdishpur-Piro-Bihta Road)	BSHP-III/8/SH-102	29.00	1750.11
9	(SH-102 (Ujbaliya Bihta section of Bihia-Jagdishpur-Piro-Bihta Road)	BSHP-III/9/SH-102	25.519	1953.81
Total			231.75	13167.51

Source: BSRDCL

III. POLICY AND LEGAL FRAMEWORK

49. This chapter presents a review of the international agreements and commitments, existing institutions and legislations relevant to the project at the National and State level. The environmental assessment process needs to adopt environmental regulations and guidelines of Government of India (GoI) and ADB's safeguard requirements.

A. International Agreements and Commitments

50. India is party to various international agreements/conventions/treaties for conservation of environment at global level. Important among them have briefly described and analysed vis-à-vis the project development.

51. **Ramsar Convention on Wetlands, 1971:** The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an inter-governmental treaty, which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Out of 19 designated wetlands of International Importance in India, none of them is located in project influence area.

52. **Convention on Protection of the World Cultural and Natural Heritage, 1972:** The United Nations Educational, Scientific and Cultural Organization (UNESCO), which seeks to encourage the identification, protection and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity has embodied these objectives in an international treaty called the Convention concerning the Protection of the World Cultural and Natural Heritage in 1972. There are Twenty-six world cultural heritage and natural sites in India. None of them is located in project influence area.

53. **Vienna Convention for Protection of the Ozone layer, 1985 and Montreal Protocol on Substances Depleting the Ozone layer, 1987:** The Vienna Convention outlines states responsibilities for protecting human health and the environment against the adverse effects of ozone depletion, and established the framework under which the Montreal Protocol was negotiated. The Montreal Protocol stipulates that the production and consumption of compounds that deplete ozone in the stratosphere chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform) are to be phased out by 2010. The project does not envisage production and consumption of ODS.

54. **United Nations Framework Convention on Climate Change (UNFCCC), 1994:** As per the convention the reduction/limitation requirements of Green House Gases (GHG) apply only to developed countries. The only reporting obligation for developing countries relates to the construction of a GHG inventory (GHG sources and sinks, potential vulnerability to climate change, adaptation measures and other steps being taken to address climate change). India acceded to the Kyoto Protocol but has not ratified it and hence the carbon emission limits are not binding upon India.

55. **Convention on Biological Diversity (CBD) 1992:** The Convention on Biological Diversity (CBD) is dedicated to promoting sustainable development and came into force in 1992 Rio Earth Summit. India signed the CBD in 1994. Member Parties have committed themselves to achieve by 2010, a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth.

B. Country's Legal Framework and Regulatory Requirements

56. The implementation of the BSHP-III will comply with the environmental acts, policies, rules, and regulations of the Government of India which has a comprehensive coverage of environmental issues and requirements. This environmental legal framework imposes command and controls on certain activities deemed detrimental to the environmental integrity and encompass the conservation of various components of the biological and physical environment and environmental assessment procedures and requirements for public consultation. The policies and requirements which are most relevant in the context of this project including construction of BRRI building are provided in **Table 7** below.

Table 7: Summary of Environmental Legislations Applicable to the Project

S. No	Act / Rules	Purpose	Applicable	Reason for Applicability	Authority
1	Environment Protection Act-1986	To protect and improve overall environment	Yes	It is umbrella legislation and notifications, rules and schedules are promulgated under this act.	MOEFCC. GoI; BIHAR State Gov. SPCB
2	Environmental Impact Assessment Notification, 14th Sep-2006 ³⁰	To accord environmental clearance to new development activities listed in schedule of EIA notification.	No	None of the sub-projects are located either in eco-sensitive areas or 1000m above mean sea level. The total built-up area of BRRI building proposed to be less than 20000 sq. m Hence does not attract EC	MoEF. SEIAA
3	Fly Ash Notification, 1999 as amended upto 17th August 2003:	Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal	Yes	3 sub-projects (SH-58, SH-84 and SH-85) are located within 100 km from Thermal Power Plants. However, due to technical constraints ³¹ flyash utilization has not been proposed.	MoEF
4	Office memorandum dated 18.05.12, by MoEF in view of Apex Court order dated 27.2.2012	Conserve top soil, aquatic biodiversity, hydrological regime etc. by haphazard and unscientific mining of minor minerals	Yes	In case of renewal of quarries and opening of new borrow areas	SEIAA

³⁰**Category A-i)** New National High ways; and ii) Expansion of National High ways greater than 100 KM, involving additional right of way greater than 40m in existing alignment and 60 m in bypass and realignment section.

Category B-i) All new state High ways; and ii) Expansion projects in hilly terrain (above 1000 m above mean sea level and/or ecologically sensitive areas.

Note: A general condition applies to both of the above category: "Any project or activity specified in Category 'B' will be treated as Category A, if located in whole or in part within 10 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas, (iv) inter-State boundaries and international boundaries".

³¹ ³¹As per IRC SP 58 2001, a cushion of 0.5 m between fly-ash and granular material is required. Additionally, 1 to 3 m thick cushion of selected earth cover on embankment slopes is required where fly-ash is to be used. Embankment height of the proposed sub-projects are generally less than desired height for fly-ash utilization

S. No	Act / Rules	Purpose	Applicable	Reason for Applicability	Authority
5	National Environment Appellate Authority Act (NEAA) 1997	Address Grievances regarding the process of environmental clearance.	Yes	Grievances if any will be dealt with, within this act.	NEAA
6	The Forest (Conservation) Act 1980 (Amended 1988) and Rules 1981 (Amended 2003)	To check deforestation by restricting conversion of forested areas into non- forested areas	Yes	Diversion of forest land is required in all all packages except SH-58	State Forest Dept. and MOEFCC regional Office.
7	Felling of Trees	To restore tree cover equal to or more for trees likely to be cut	Yes	Significant Tree utting is involved in all sub-projects.	DFOs
8	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by controlling emission of air Pollutants as per the prescribed standards.	Yes	For construction; for obtaining NOC for establishment of hot mix plant, workers' camp, construction camp, etc.	SPCB
9	Water (Prevention and Control of Pollution) Act 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Yes	This act will be applicable during construction for (establishments of hot mix plant, construction camp, workers' camp, etc.	SPCB
10	Permission of Abstraction of Groundwater	To conserve and augument the groundwater resources	Yes	All infrastructure projects abstracting ground water in bulk requires prior permission	CGWA
11	Noise Pollution (Regulation and Control Act) 1990	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	Yes	Vehicular noise on project routes required to assess for future years and necessary protection measure need to be considered in design.	SPCB
12	Explosive Act 1984	Safe transportation, storage and use of explosive material	Yes	In case of opening new Quarries	Chief Controller of Explosives
13	Mines & Minerals Development Act, 1957 Bihar Minor Mineral Rules, 2017, Bihar Minor Mineral Concession (Amendment) Rules, 2014, Bihar Minerals (Prevention of	To regulate excavation, production, storage, collection, distribution, transportation, manufacturing, possession, purchase and sell of any minor mineral including soil	Yes	Project requires sand, aggregates, soil and other minor minerals in large quantity.	District Collector and State Mines Dept.

S. No	Act / Rules	Purpose	Applicable	Reason for Applicability	Authority
	Illegal-Mining, Transportation and Storage) (Amendment) Rules, 2014				
14	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989	To check vehicular air and noise pollution.	Yes	These rules will be applicable to road users and construction Machinery.	Motor Vehicle Department
15	National Forest Policy 1952 National Forest Policy (Revised) 1988	To maintain ecological stability through conservation and restoration of biological diversity.	Yes	This policy will be applicable as project intervention requires forest land to be acquired.	Forest Dept. Gol and GoB
	Construction and Demolition Waste Management Rules, 2016	To ensure all such waste are disposed in environmentally acceptable manner and prevent from land and water pollution		Project involves demolition of few structures at BRR I site. There will variety of construction waste likely to be generated	Municipal Corporation and SPCB
	Solid Waste Management Rules, 2016 and Plastic Waste Management Rules 2016	Mandated the source segregation of waste in order to channelise the waste to wealth by recovery, reuse and recycle.		Domestic wastes food leftovers, vegetable peels, plastic, house sweepings, clothes, ash, paper, cardboard, plastic, wastes like batteries, bulbs, tube lights etc	SPCB
	Hazardous and other Wastes (Management and Trans Boundary Movement) Rules, 2016.	To ensure that transport storage, use, and disposal of such waster do not pollute land and water environment and do not causes danger to health		Hazardous wastes from construction and demolition like tar and tar products (bitumen, felt, waterproofing compounds, etc.), wood dust from treated wood, lead containing products, chemical admixtures, sealants, adhesive solvents, paints etc	SPCB
	Batteries (Management and Handling) Rules, 2001 as amended 2010.	Notified with an objective of channelizing the used lead acid batteries for environmentally sound recycling.		Applicable to all the projects when disposal of used lead-acid battery is involved.	
	E-waste (Management and Handling) Rules, 2011	to channelize the E-waste for environmentally sound recycling which is largely controlled by the un-organized sector who are adopting crude practices that results		Due to use and disposal of electrical and electronic wastes generated in the building, like PC, printers, cartridges, CDs, Xerox machine etc collectors	SPCB

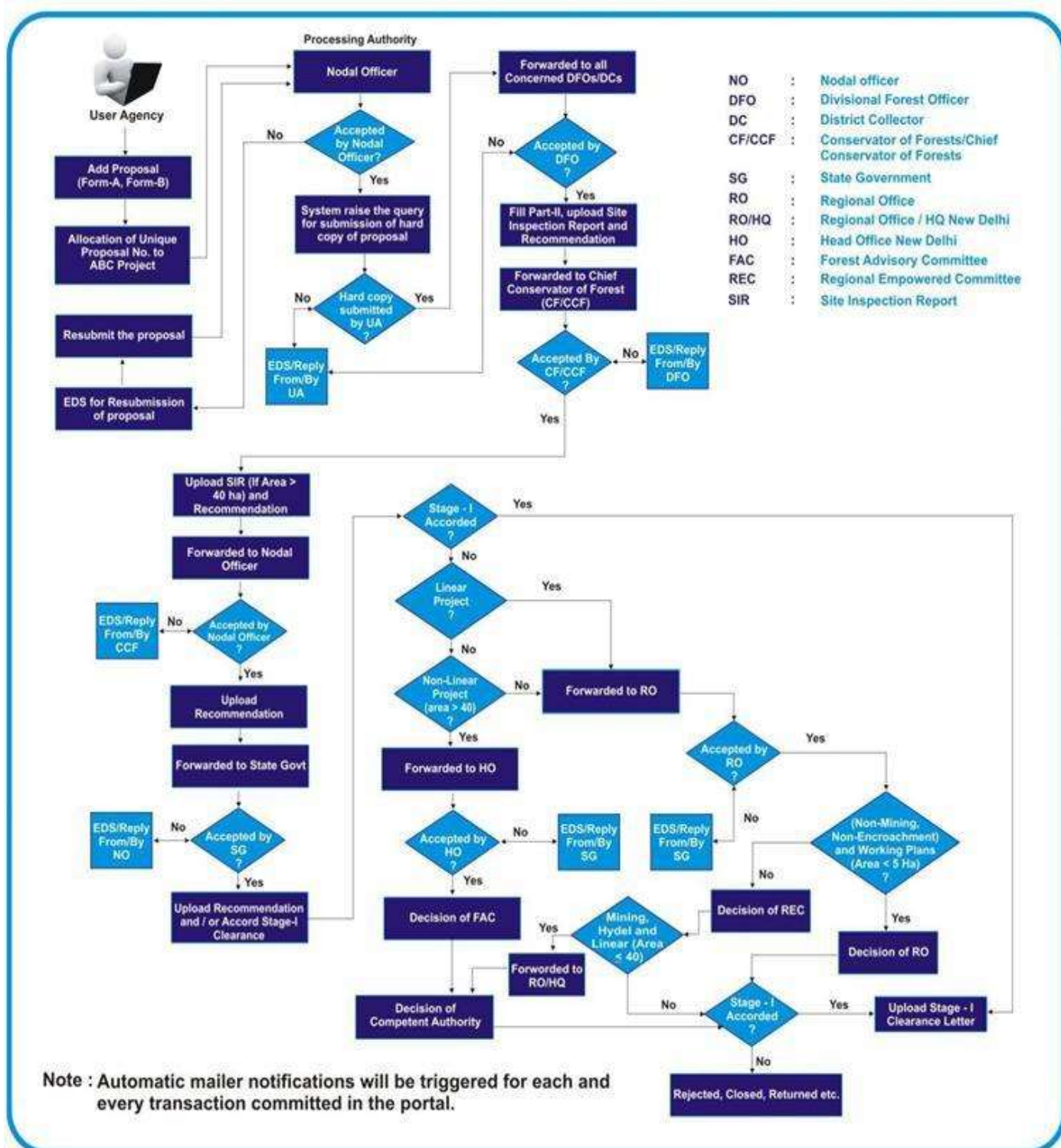
S. No	Act / Rules	Purpose	Applicable	Reason for Applicability	Authority
		into higher pollution and less recovery,			
16.	The Building and Other Construction Workers (regulation of employment and conditions of service) Act, 1996	To regulate the employment and conditions of construction workers and to provide for their safety, health and welfare measure and for other matter incidental thereto	Yes	A large number of construction workers skilled, semiskilled or unskilled will be employed temporarily during Construction Phase of the project	Ministry of Labor and Employment Government of India
17	Bonded Labour (Abolition) Act, 1976 and Rules, 1976	Abolition of bonded labor.	Yes	- Do-	- Do-
18	Contract Labour (Regulation and Abolition) Act 1970 and rules, 1971	Prevent exploitation of contract labor and also to introduce better conditions of work.	Yes	- Do-	- Do-
19	Employees Provident Funds and Miscellaneous Provisions Act 1952	Promote and secure the well-being of the employees where contractors employ more than 20 persons during Construction	Yes	- Do-	- Do-
20	Minimum Wages Act 1948 along with Central Rules 1950	Ensure that workers get at least minimum wages as fixed by the state/central Govt. whichever is higher	Yes	- Do-	- Do-
21	Public Liability and Insurance Act 1991	Protection from hazardous materials and accidents.	Yes	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions	- Do-

DEIAA: District Environment Impact Assessment Authority, DFO: Divisional Forest Officer, MOEFCC: Ministry of Environment, Forests and Climate Change, SEIAA: State Environmental Impact Assessment Authority SPCB: State Pollution Control Board, CGWA: Central Ground Water Authority

C. Procedure for Obtaining Forest Clearance

57. MOEFCC has initiated online submission and disposal of forest clearance cases. The detail procedure is available on ministry website <http://forestsclearance.nic.in/> . However, the work-flow is unchanged which has been illustrated in the succeeding **Figure 2**.

Figure 2: Procedure and Work Flow for Forest Clearance



Note: In a recent initiative, MOEFCC has decided to dispose of all proposals of linear projects by its Regional Office irrespective of diversion area. Specific time limit for processing and disposal of fresh/new proposal at state level and central level is 90 days and 60 days (total 150 days) respectively. Time limit is reckoned from date of acceptance by Nodal Officer subject to completeness of application.

D. Procedure for Obtaining Borrow Area Permit

58. In pursuance to the order of Hon'ble Supreme Court dated the 27th February, 2012 in I.A. No.12- 13 of 2011 in Special Leave Petition (C) No.19628-19629 of 2009, in the matter of Deepak Kumar etc. Vs. State of Haryana and Others etc., prior environmental clearance has now become mandatory for mining of minor minerals irrespective of the area of mining lease. Steps to obtain environmental clearance for borrow areas is given in **Table 8**.

Table 8: Steps to be followed for obtaining Environmental Clearance for Borrow Areas

Steps	Activities
1	Contractor identifies the Borrow Area (BA) quantity based on prospective BA identified in F/S/DPR
2	Contractor identifies the Borrow pits with quantity and raise Request for Inspection (RFI) to IE/CSC.
3	IE/CSC inspects borrow pit in the presence of Environmental Engineer of contractor and land owner with his lease document.
4	Contractor takes the sampling of soil in identified pit and test in lab. IE/CSC approves the pit based on the test report (Moisture contents, particle size etc.)
5	Contractor makes the agreement with land owner and get NOC from Gram Panchayat if necessary
6	If BA is more than 5Ha (B1 category), contractor submit application for clearance to State Environment Impact Assessment Authority (SEIAA) the project is treated as B1 EIA and Public Hearing needs to be carried out.
7	If BA is < 5Ha (B2 category), contractor submit application in Form 1M, Prefeasibility report and approved mine plan to District Environment Impact Assessment Authority (DEIAA). DEIAA accords clearance on the recommendation of District Environment Appraisal Committee (DEAC).
8	Contractor pays Royalty amount to state government at the prescribed rate.
9	Contractor submit Borrow Area Redevelopment plan to IE/CSC.
10	Contractor raise RFI to IE/CSC for Borrow pit excavation
11	Contractor fulfils the compliance of EC agency observations if any.
12	Contractor will maintain haul road and ensure for fugitive dust suppression
13	Contractor does sampling of each pit at the time of excavation test and gets approval of IE/CSC.
14	Contractor raises RFI to IE/CSC before closing the pit.
15	Contractor reclaims borrow pit as per owner agreement and gets clearance from him.
Key Considerations prior to selection of Borrow Areas: <ul style="list-style-type: none"> Cluster shall be formed if the distance between peripheries of one lease to the other and is less than 500m in homogenous mineral area. Minimum distance between two clusters is 500 meters. Maximum depth of excavation 2000mm from existing ground level. In case of fertile land; 15 cm top soil is stock piled, further up to max.30 cm depth. Maintain 5m distance from the toe of the final section of the road/Embankment. BA should not be dug within 1500 m of town/village. If unavoidable should not exceed 30 cm in depth. Ridges not less than 8m width shall be left an interval of not exceeding 300m. 	

E. Specific Permissions/NOC required for the Construction of BRRI

59. Apart from above regulatory and statutory clearances, building projects require following permission/NOC from local authorities

- **Building Plan Approval:** Building plans approval Patna Regional Development Authority/Municipal Corporation
- **Fire NOC:** NOC from Fire Department

- **NOC from AAI** (Airport Authority of India): NOC from AAI for height clearance shall be obtained since project site is within 20 km radius
- **Sewage Discharge Connection:** NOC for discharge of sewage in municipal drain shall be taken, if any discharge of sewage is proposed.
- Contract with registered vendor/recycler shall be done for collection of construction waste and municipal solid waste

F. Relevant Indian Road Congress (IRC) Codes

60. Key IRC guidelines have been summarized in **Table 9** that have a direct/indirect bearing on the environmental management during design and construction stages.

Table 9: Relevant Indian Road Congress (IRC) Codes

Sr. N.	IRC code Theme	IRC code
1.	Recommended practice for borrow pits for Rural road embankments constructed by manual operations	IRC: 10 1961
2.	Guidelines for Pedestrian Facilities	IRC: 103 -1988
3.	Guidelines for EIA of Highway projects	IRC:104-1988
4.	Ribbon developments on highways and its prevention	IRC: SP: 1996
5.	Manual on Landscaping of road	IRC: SP: 21-2009
6.	Report on recommendations of Regional workshops on highway safety	IRC: SP: 27-1984
7.	Road safety for Children (5-12 years old)	IRC: SP: 32-1988
8.	Guidelines on road drainage	IRC: SP: 42-1994
9.	Highway safety code	IRC: SP: 44-1994
10.	Guidelines for safety in construction zones	IRC: SP: 55-2001

G. Relevant Codes/Bylaws/Guidance Manual for Construction of BRR

- National Building Code, 2016; Bureau of Indian Standards:
- Model Building Bye-laws, 2016; Town and Country Planning Organisation Urban Development, Government of India
- Bihar Building Byelaws 2014;
- Energy Conservation Building Code, 2017; Bureau of Energy Efficiency, Ministry of Power Government of India:
- Manual on norms and standards for environment clearance of large construction projects published by Ministry of Environment, Forests and Climate Change available
- Environmental Impact Assessment Guidance Manual for Building, Construction, Township and Area Development project

H. ADB's Safeguard Requirement

61. The Asian Development Bank has defined its environmental safeguard requirements under its "Safeguard Policy Statement, 2009" (SPS 2009). The SPS 2009 key requirements include screening for significant impacts and categorization, consultation, and disclosure. Proposed projects are screened according to type, location, scale, and sensitivity and the magnitude of their potential environmental impacts, including direct, indirect, induced, and cumulative impacts. Projects are classified into the following categories:

- **Category A.** The proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented; impacts may affect an area larger than the sites or facilities subject to physical works. A

full-scale environmental impact assessment (EIA) including an environmental management plan (EMP), is required.

- **Category B.** The proposed project's potential environmental impacts are less adverse and fewer in number than those of category A projects; impacts are site-specific, few if any of them are irreversible, and impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE), including an EMP, is required.
- **Category C.** The proposed project is likely to have minimal or no adverse environmental impacts. No EIA or IEE is required although environmental implications need to be reviewed.
- **Category FI.** The proposed project involves the investment of ADB funds to, or through, a financial intermediary.

62. Project categorization has been done using REA checklist following the guidance provided above and the project is categorized as B. As per SPS 2009, **Category B** projects warrants preparation of an IEE. The SPS includes 11 policy principles on environment safeguards on screening, conduct of environmental assessment, alternative analysis, mitigation hierarchy, need for meaning consultation, public disclosure, environmental management planning, biodiversity protection and conservation, pollution prevention, occupational health and safety, and conservation of physical cultural resources.

IV. DESCRIPTION OF EXISTING ENVIRONMENT

63. To get familiar with existing phenomena before project implementation and the phenomena which could get impacted due to proposed project activity it is imperative to assess baseline conditions before projects take off. The entrant roads are sited within Banka, Bhagalpur, Bhojpur, Jamui, Madhepura and Nawada district of Bihar state. This chapter presents primary and secondary data covering all facets of environment viz Physical, Biological, social and land environment in the project influence area with respect to the State, corresponding project districts and project corridor.

A. Physical Environment:

1. Climate:

64. The state lies in the Sub Tropical region of temperate zone, with tropical monsoon climate characterized by three distinct seasons; winters, summer and rainy. The state can be divided into two climate zones; the Sub-Himalayan and the Ganga plain. The winter season exists from December to February, January being the coldest when temperature falls below 10°C. The winter season is characterized by fog, cold wave and western disturbances. The summer season covers the period from April to June, May is the hottest month and the maximum temperature reaches above 45°C causing heat waves in the state. The monsoon season normally starts in the third week of June and lasts up to end of September and downpour accumulated seasonal rainfall of 120-150 cm throughout the state.

65. **Temperature:** The region has extreme variation in temperature i.e. relatively high in summer (April-June) and quite low in winter (December to February). The temperature in Sub-Himalayan Zone varies from is 40°C (mean maximum temperature) to 4°C (mean minimum temperature). Whereas Mean maximum and minimum temperature observed in Ganga Plain region are 43°C and 5°C respectively. Temperature profile of project district is given in **Figure 3**.

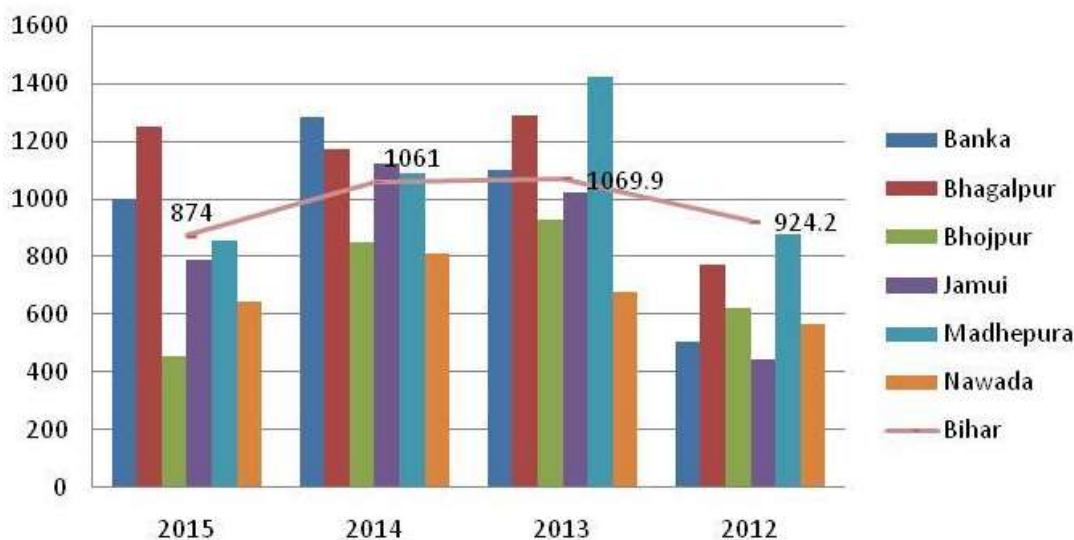
Figure 3: Temperature Profile of Bihar



66. **Rainfall:** South-West Monsoon accounts for most of the rainfall (85%) in the State. The average rainfall is around 1120 mm. Remaining 15 percent rainfall is from winter rain, hot weather rain and north-west monsoon. The state receives maximum rainfall during monsoon region and

monsoon region lasts from Jun end to September. Rainfall varies in different climatic Zones of the state. The Sub-Himalayan zone receives high rainfall of over 1400 mm whereas in the Chotanagpur plateau it ranges from 600-800mm. The rainfall of project districts varies from 676.85 mm to 1323.90 mm. Annual average rainfall of project districts for last 4 years is summarized in following **Figure 4**.

Figure 4: Annual Average Rainfall of Project Districts



Source: Rainfall Statistic of India, 2012-2015; Indian Meteorology Department

67. **Relative Humidity and Wind:** On an average relative humidity of state reaches 73%. The highest humidity is observed during monsoon season (up to 79%) with lowest during summer season (30%). Information related to wind has been discussed in later part of this chapter under Natural hazard section.

2. Topography/Physiography and Landforms

68. Based on broad geomorphic parameters, Bihar may be divided into three geomorphic domains. They are the: (i) uplifted block of hilly southern highlands (SH-82 partially lies in this unit) (ii) Ganga foredeep of the north Bihar Plains bounded by the rising Himalaya in the north (SH-58 lies in this zone) and the Ganga River in the south (SH-102 lies in this unit), and (iii) Transition zone between the southern highlands the Great Ganga Plains, constituting the central Bihar Plains (SH-84 and SH-85 largely lies in this part). The state portrays both plain and undulating topography giving rise to short-range variations in terrain and soil and water conditions. The elevation in the state ranges from 150 m in the plains to about 600 m in the hilly areas of the Chotanagpur plateau towards the south. The land in Northern Bihar slopes from North West to south east whereas southern Bihar slopes from south to North. The land profile/topography along the project corridor is in general plain with some undulating/rolling terrain characterized by foothill/pedepain areas along SH-82. District specific topography with its physiographic units of the project area is summarised below in **Table 10**.

Table 10: Physiography/Topography of Project Districts

District	Physiographic Units
Banka	Alluvial Plain, Hills & Pediments
Bhagalpur	Flat Indo-Gangetic alluvium tract and marginal alluvium tract

District	Physiographic Units
Bhojpur	Younger alluvium with newer flood plains and older alluvium with older flood plains
Jamui	Rocky upland, plateau / pediplain and alluvial plain
Madhepura	Younger Alluvium with Newer Flood Plains,
Nawada	Plain land in North and the hilly/pediments in the south.

Source: State of the Environment, 2007 and Central Ground Water Board District Profiles

3. Geology

69. **Geology:** Geologically, Bihar represents the extreme northern front of Indian sub-continent. Bihar exhibits diverse geological formations ranging in age from Archean to Holocene. Geologically, Bihar represents the extreme northern front of Indian sub-continent. These include (i) the belt of Himalayan foothills in the northern fringe of Paschim Champaran (ii) the vast Ganga Plains, (iii) the Vindhyan (Kaimur) Plateau extending into Rohtas region, (iv) the sporadic and small Gondwana basin outliers in Banka district, (v) the Satpura Range extending into large part of the area north of Chotanagpur Plateau, (vi) the parts of Bihar Mica belt in Nawada, Jamui and Banka districts and (vii) the Granite Gneissic complex of Chotanagpur plateau. Nearly two third of Bihar, including the subproject districts are under cover of Ganga basin composed of alluvium comprising quaternary unconsolidated sediments. The alluvium can be subdivided into older and newer alluvium consisting of polycyclic sequence of sand, silt and clay with kankar nodules in the former and sand, silt and clay in later and present day deposit. Major Geological Formations of project districts are summarized in **Table 11**.

Table 11: Major Geological Formations of Project Districts

District	Geological Formations
Banka	Quaternary Alluvium, Granite Gneiss
Bhagalpur	Quaternary Formations and Basement Pre-cambrian Granitic Gneiss
Bhojpur	Alluvium (younger & older), Vindhyan hard rocks
Jamui	Alluvium, Granite gneisses, Quartzite Partially plain and foothills in later section
Madhepura	Quaternary Alluvium representing flat topography
Nawada	Quaternary Alluvium

4. Soil

70. **Soil:** There are three major types of soil in Bihar: a) Piedmont Swamp Soil - found in northwestern part of west Champaran district b) Terai Soil – found in northern part of the state along the border of Nepal c) The Gangetic Alluvium – the plain of Bihar is covered by gangetic alluvium (both new as well as old). The soil of the project districts (**Table 12**) varies as per geographic locations, geologic formations and climatic conditions of the area.

Table 12: Soil of the Project Districts

District	Soil Types and its Physical Characteristics
Banka	Alluvial and hilly soil. The alluvial soil derived partly from the older alluvium deposit and partly forms the newer flood plain deposit characterized by light grey to dark grey colour and fine texture. The hilly soil derived from the weathered product is coarse grained, ferruginous, low in nitrogen, medium to high potash and acidic in nature.
Bhagalpur	Older and newer alluvium soil. Newer alluviums are light grey to dark grey and texturally fine pH is neutral to acidic. The hilly soils are acidic with low nitrogen and high potash. Older alluvium is mainly loamy with moderate to heavy texture and well drained. In low lands these are poorly drained. Black soil also found in some areas..

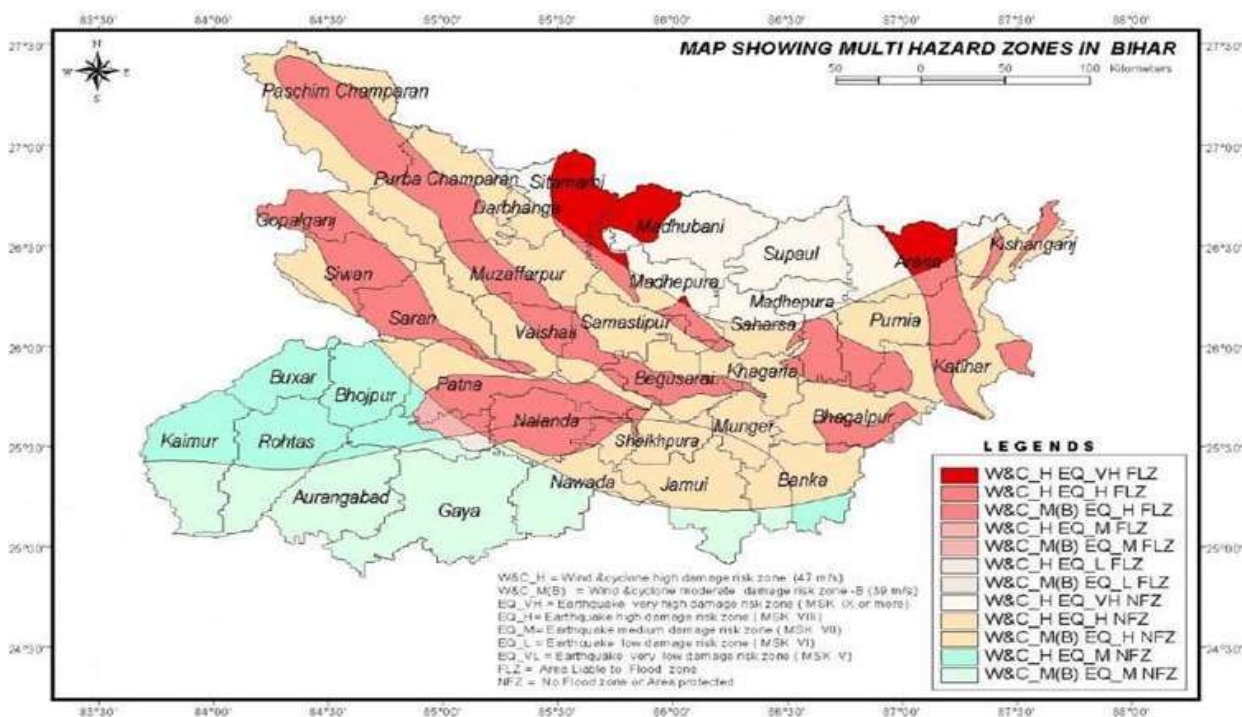
District	Soil Types and its Physical Characteristics
Nawada	Five types of soils; (i) Loam, (ii) Sandy, (iii) Clay, (iv) Sandy loam and (v) Clay loam. Color is reddish brown to pale yellow and light to medium texture. Acidic to neutral, low to medium in organic carbon, low to high in phosphorous and high in potassium
Bhojpur	Soils near river/rivulets are sandy loam, Loamy and sandy and texturally coarse. The areas away from the rivers are silty sand to sandy silt with fine texture. The soils of coarse textured got mixed with silt and fine sand due to the mixing of canal water
Jamui	Alfisols and ultisols. The alfisols are in the northern fringe of hard rock terrain. The ultisols have low base status. Red and yellow soils occur in southern and eastern parts
Madhepura	Soil types are sandy loam, Loam, silty loam deposited by Kosi River. The soils association types-Recent alluvium, non-calcareous, non-saline mostly high to medium textured, acidic to neutral and generally yellowish to white to light grey in colour.

71. **Soil Quality along Project Corridors:** The soils of the region are moderately acidic to lightly alkaline with low free CaCO_3 and P_2O_5 content, low soluble salts and low to occasionally high organic carbon. Sub-soil investigations carried out along project road indicates that soils are having adequate CBR values conforming to MORTH specifications and suitable for embankment formation.

5. Natural Hazard:

72. Major part of the state is prone to one or multiple natural hazards like earthquake, floods, cyclone, drought etc. as shown in multi hazard zone map of Bihar (**Map 3**). Sometimes two of the major hazards visit different parts of the state during the same period. Following paragraphs describes the extent and magnitude of different natural hazards of the state, project districts and project area.

Map 3: Multi Hazard Map of Bihar

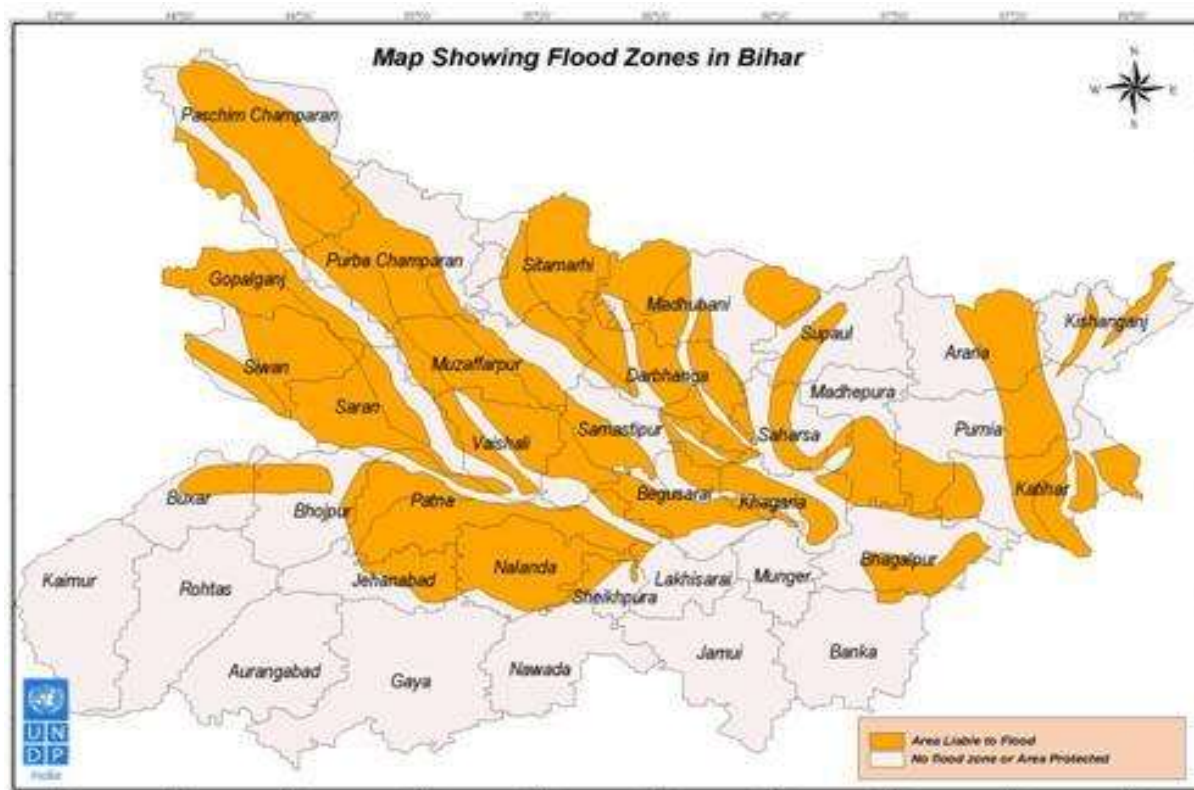


Source: State Disaster Management Plan, Bihar

73. **Flood:** Bihar has always been a worst victim of flood, particularly the areas north of Ganga (**Map 4**). This is mainly due to rainwater overflow in upper cathment of Himalayan rivers especially originating from Nepal and sloping down to Bihar. Out of 36 districts, 28 districts are susceptible to flooding. Nearly 73% of the total geographical area of the State is flood prone. This constitutes nearly 17% of the total flood affected area in the country affecting 22% of the country's total population. The districtwise flood hazard map³² prepared by Flood Management Information System (FMIS), Water Resources Department, Bihar establishes that the most parts of the project districts are either not prone to or very less vulnerable to flooding.

74. Sub-projects roads are not susceptible to submergence/overtopping in general because most of the sub-projects are located south of Ganga river. However, few isolated incidences of overtopping were reported during local enquiries. Some sections (Km 0.7-Km. 1.3 near JamuniaTola, Km 5.3 – Km.6.1 near Karchokka and Km 20.3 near Ghosai) of SH-58 are liable to submergence. In SH-84, the causeway over river Mirchaini experiences frequent overtopping. Out of 11 bridges, 5 bridges at Km 19.080, Km 23.540, Km 31.420, Km 31.990, and Km 42.300 were overtopped during the flood of 1999. During 2000 floods, some stretches of SH-85 near village Milki (Km 4), Km 19.6-22.8 (Sangrampur-Pawai Chowk) and existing bridge over River Chanan was overtopped marginally. whereas in SH 85 overtopping at Ch. 3.6, 21.5, 21.63 & 22.19 km was reported.

Map 4: Flood Zones in Bihar



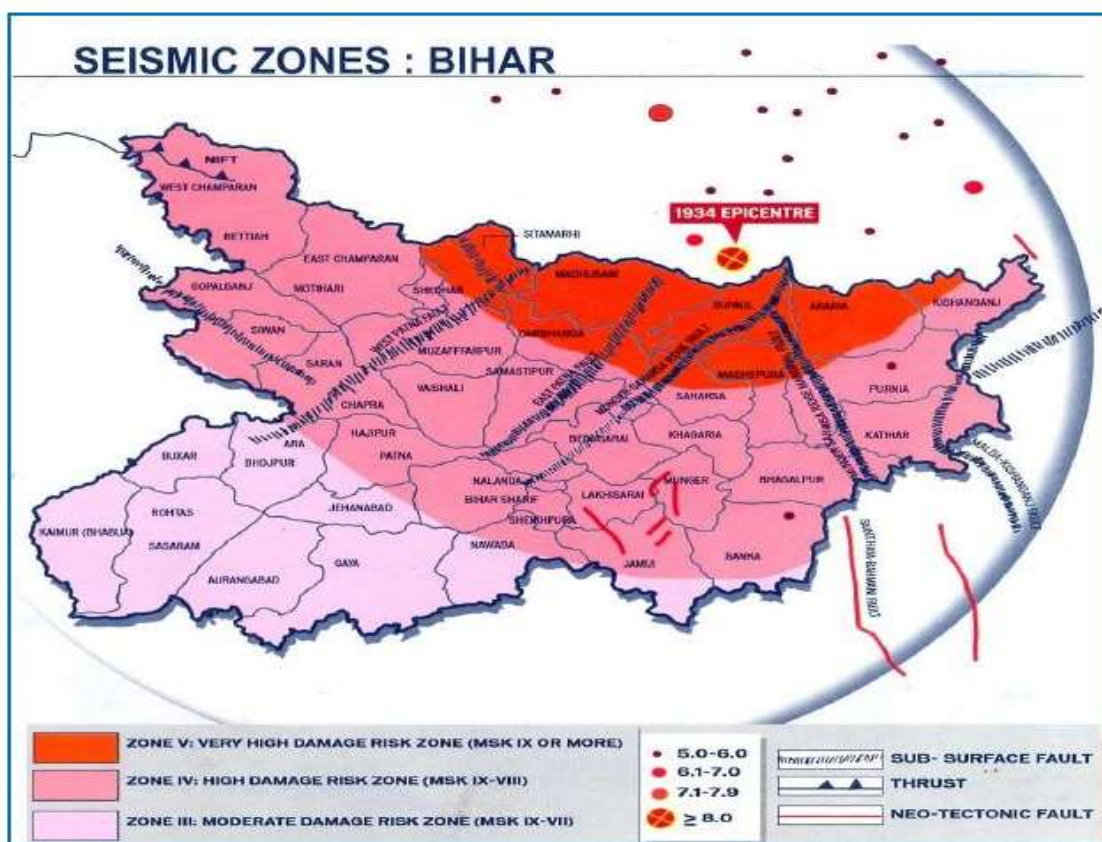
Source: National Disaster Risk Reduction Portal, Bihar

³² 128 Satellite datasets were acquired during floods from 1998-2010 to extract flood inundated layers.. These layers were integrated to generate flood hazard layer, which provides the details on how frequently a given area is subjected to flood.

75. **Earthquake:** Bihar is located in high seismic zone perched on the boundary of the tectonic plate joining the Himalayan tectonic plate near the Bihar-Nepal Border and having six sub-surface fault lines penetrating through its Gangetic planes in four directions. State has experienced 10 earthquakes in a span of 247 years ranging from 5.5 to 8.3 on the Richter scale. The latest earthquake was on 18th Sept. 2011 on 6.8 Richter scale with epicenter being in Sikkim – Nepal region. As shown in **Map 5**, out of seven project districts Bhojpur, Jamui, Banka and Nawada falls partly in Zone III (moderate risk zone) & IV (High Risk Zone), Bhagalpur in Zone IV and Madhepur falls in Zone IV & V (very high risk zone).

76. **Drought:** Even after being rich in the water bodies the state of Bihar faces severe droughts situation of different scales/levels that intrinsically lead to famine situations. Recurrent rainfall variability and sustained departure from the normal rainfall vis-a-vis low reliability, fluctuating both surface and underground water resources and extremely poor water holding capacity of the major soil group appear to have clubbed together to cause frequent droughts in Bihar. Apart from this decreasing forest cover is also an important factor which is liable for increasing rainfall variability. Two subproject districts (Bhagalpur & Madhepura) lies in drought free zone whereas Nawada and Jamui falls in severely affected zone and Banka & Bhojpur lies in intermittently affected zone.

Map 5: Seismic Zones of Bihar



Source: State Disaster Management Authority, Bihar

77. **Winds and Cyclone:** The state of Bihar also experiences surface cyclones (High Speed Winds). Cyclones are by far the most devastating both by causing loss of life as well as loss in terms of socio-economic development. As detailed in the Vulnerability Atlas of India, 27 districts

in Bihar are fully affected by high-speed winds of 47 m/s intensity. The area of districts—**Banka**, Jahanabad, Arwal, and Nalanda is nearly 90 percent affected. Other districts of South Bihar except Nawada are partly affected by high-speed winds of 44 m/s. **Nawada** In all 86 percent of the total area of Bihar is prone to high-speed winds of 47 m/s intensity and only 14 percent of the area prone to high-speed winds of lesser intensity.

6. Land Use Land Cover:

78. **State:** The total area of the state is 94,163.00 Sq.km. out of which 92,251.49 Sq.km. (97.97%) are rural areas and 01,911.51 Sq.km. (2.03%) are urban areas. Out of the total geographical area of 94.163 lakh ha the land use is as given below in **Table 13**.

Table 13: Land Use of Bihar

Category	Area (Ha)	%age
Forest Land	676400	7.18
Land under misc trees, groves	211709	2.25
Current fallow	256783	2.73
other fallow	687570	7.30
cultivable waste	79319	0.84
Net area under cultivation	5605798	59.53
Barren Land & permanent pasture	503381	5.35
Area under non agricultural use	1395340	14.82
Total	9416300	100.00

Source: Directorate of Statistics & Evaluation, GoB.

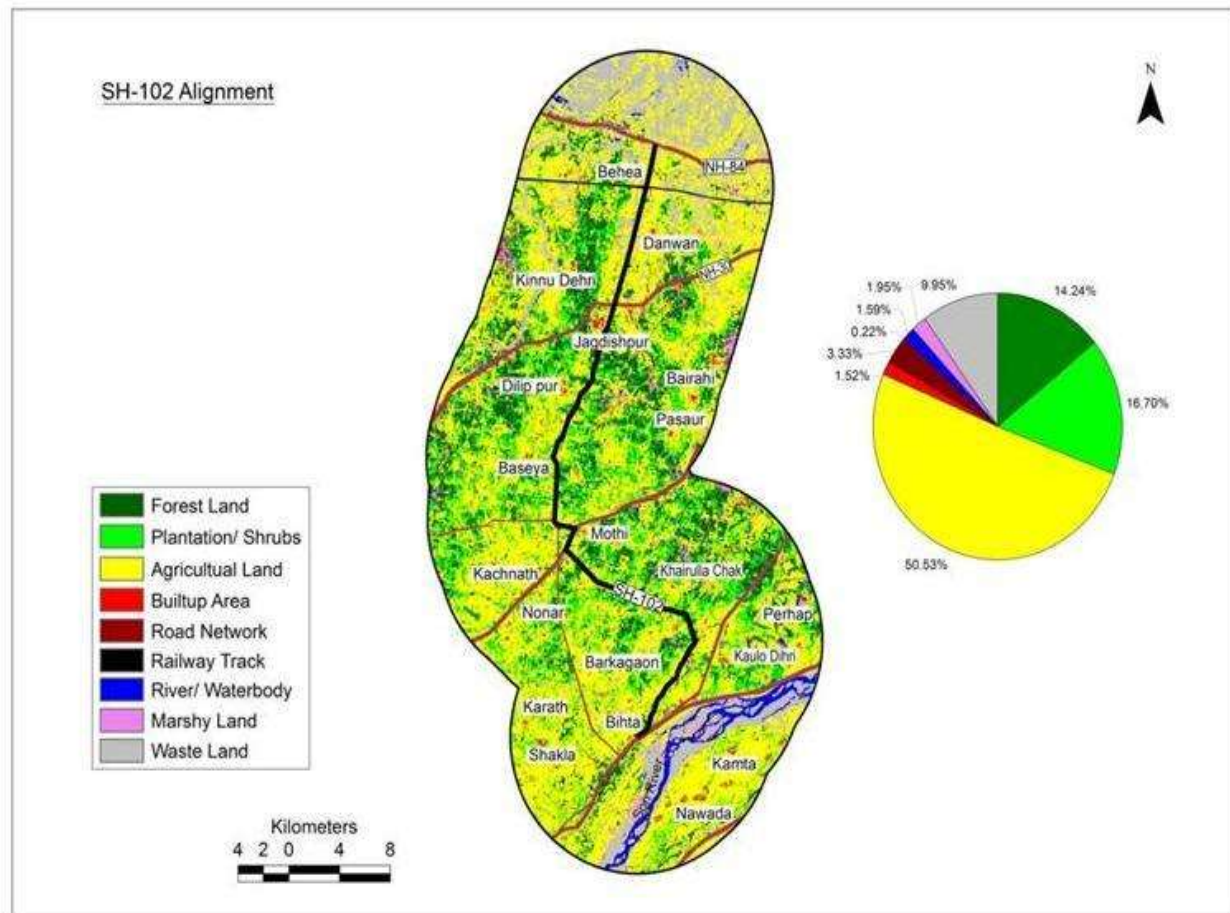
79. **Landuse/Land Cover of/ Study Area:** Satellite imagery based landuse mapping was done for 10 km buffer area of each sub-project. Land use pattern along the sub project roads is predominantly agricultural (75.89-38.68%), rest comprises of settlement/built-up area; water bodies other utilities and cultivation etc. Land use Land cover details of project roads are summarized in Table 14 and depicted in **Map 6-10**.

Table 14: Land Use Land Cover Break-up of Study Area (10 km)

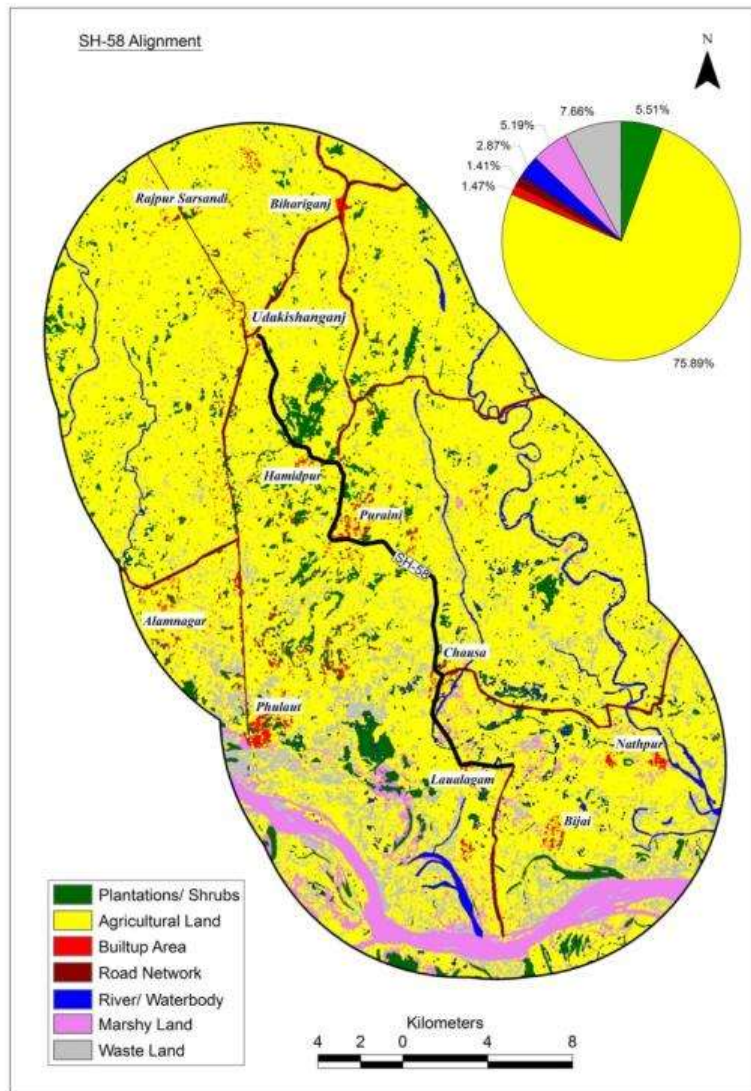
Particulars	SH 58	SH 84	SH 85	SH 82	SH 102
Plantation/ shrubs	5.51 %	6.06 %	11.15%	15.47%	16.7%
Agricultural land	75.89%	71.33%	67.72%	38.68%	50.53%
Built-up area	1.47 %	2.94%	1.18%	2.04%	1.52%
Road network	1.41 %	1.42%	6.09%	2.26%	3.33%
River/ waterbody	2.87 %	3.35%	0.22%	3.06%	1.59%
Marshy land	5.19 %	5.09%	0.96%	8.39%	1.95%
Waste/fallow land	7.66 %	9.82%	8.16%	9.73%	9.95%
Forest Area	--	--	4.53%	18.49%	14.24%

80. **Landuse of Corridor:** Immediate vicinity/Row is dominated by road side plantations which are declared as protected forests in most of the roads. Intermittent built-up sections aggregates to 10-15% of the total length. There are many common resource properties along the project road very close to the alignment including ponds, govt establishments and noise sensitive receptors like school, college etc.

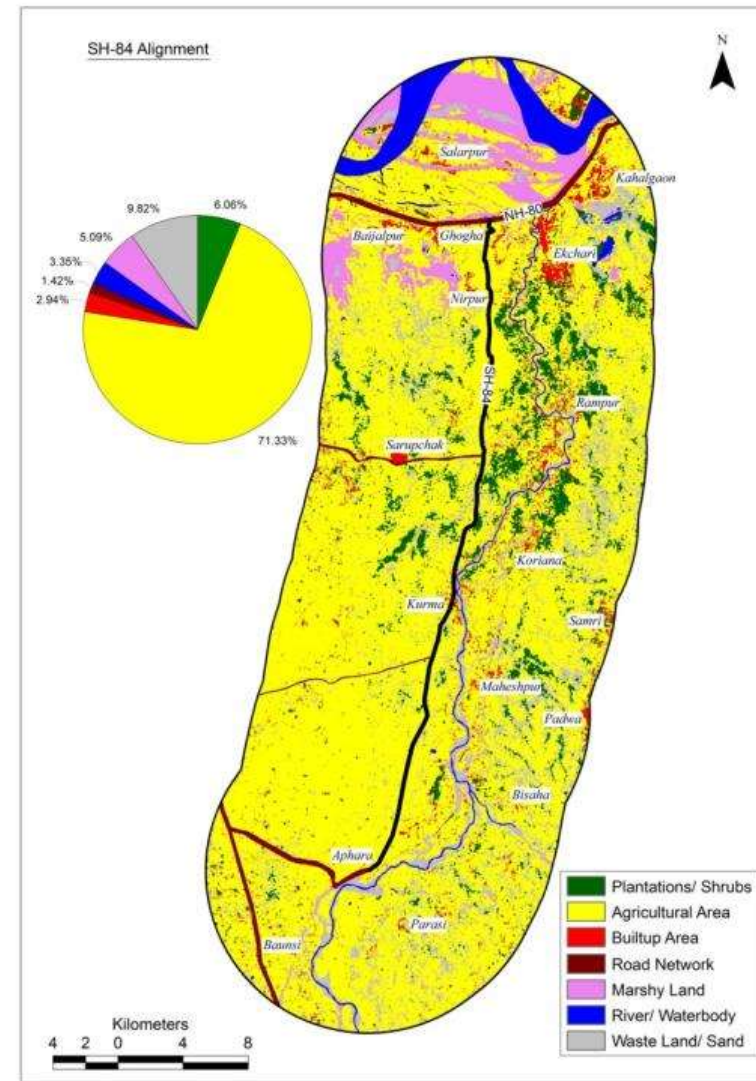
Map 6: Land Use Land Cover Map of SH-102



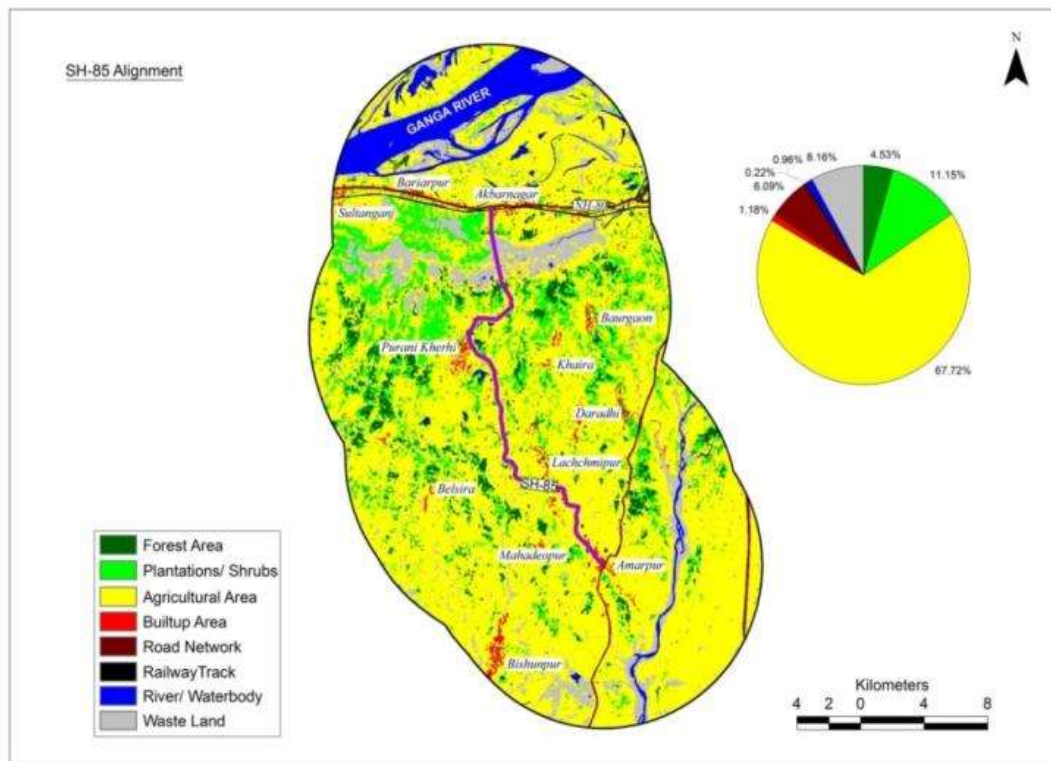
Map 7: Land Use Land Cover Map of SH-58



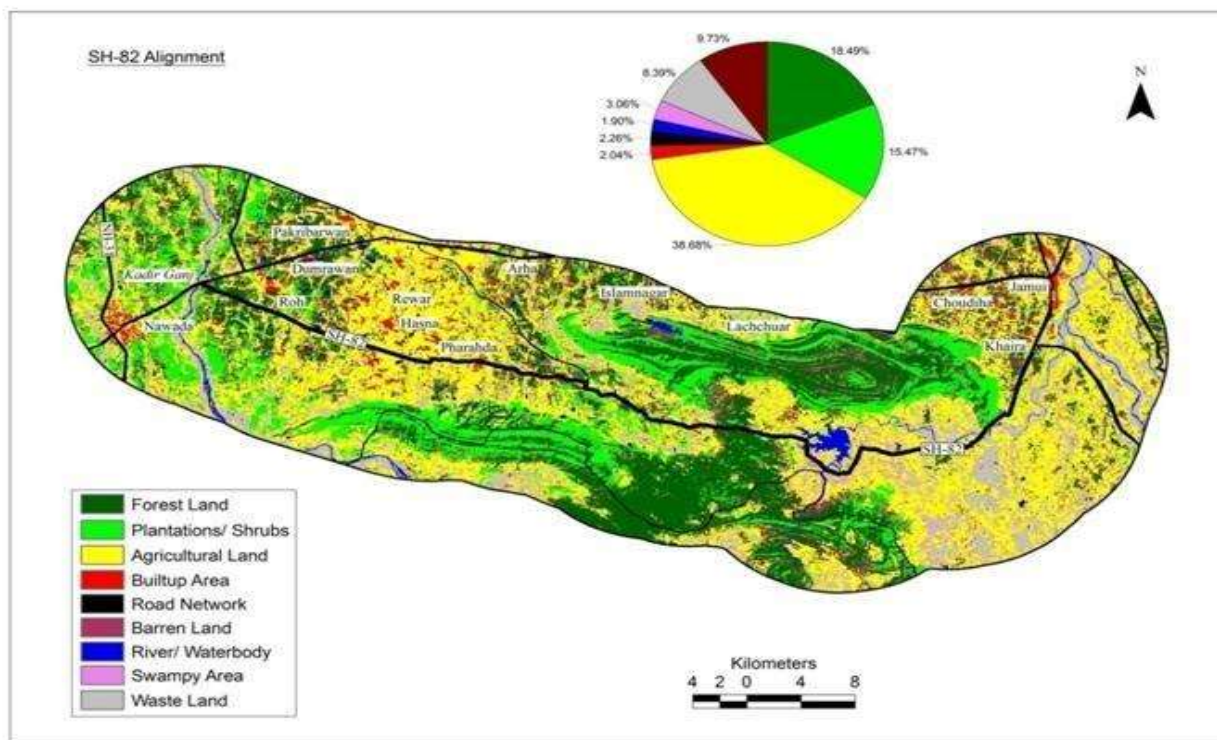
Map 8: Land Use Land Cover Map of SH-84



Map 9: Land Use Land Cover Map of SH-85



Map 10: Land Use Land Cover Map of SH-82



7. Air Quality

81. Project area is characterized mainly by rural/open areas and intermittently traversed by few settlements/built-up areas. Sources of air pollution in the project area are mainly vehicular emission, dust emanation due to use of unpaved shoulders/deteriorated roads by vehicles and domestic fuel burning. All such emissions will be very well dissipated. Reference made from previous studies in the project district, establishes that the ambient air quality levels with respect to particulate matter (PM), Sulphur die Oxide and nitrogen oxides (NO_x) are within the National Ambient Air Quality Standards (NAAQS) as appended in **Appendix-2**.

82. Monitored parameters of ambient air quality largely meet the prescribed limit (Appendix 5) of National Ambient Air Quality Standard (NAAQS) and Central Pollution Control Board (CPCB) and World Bank interim target except particulate matter PM₁₀ & PM_{2.5} at SH-84 &85. All data are 24hourly. Increased level can be attributed to heavy traffic combined with poor road conditions and it narrow width. Baseline air quality compliance summary w.r.t GOI/CPCB limits and World Bank EHS is presented in **Table 15** and results are enclosed as **Appendix 6**.

Table 15: Ambient Air Quality in the Project Area

Roads	WB EHS (in µg/m ³)	GOI NAAQS (in µg/m ³)	Remarks
SH 58	✓	✓	All parameter are meeting WB interim Target/guideline and GOI limit.
SH 82	✓	✓	
SH 84	X	X	SO _x and NO _x are meeting both WB interim target and GOI limits. PM ₁₀ & PM _{2.5} are exceeding both limits. SO _x and NO _x are meeting both WB interim target and GOI limits. PM ₁₀ & PM _{2.5} are exceeding both limits.
SH 85	X	X	
SH 102	✓	✓	All parameter are meeting WB interim Target and GOI limit.

Source: Detailed Project Report, Primary Monitoring and EIA studies

8. Noise Level

83. Traffic is the principal source of noise in the project area. The area mostly includes rural open areas with intermittent built-up locations. There is no continuous sound frequency of impulsive nature. Noise level during night is within limits (**Appendix 3**) for all landuse categories except at some locations along SH-84. Daytime noise exceeds in some market/builtup stretches. It is anticipated that noise level will decrease significantly after road expansion and improvement work enabling decongestion at existing built up areas. Noise level in the project area has been summarized in **Table 16** and monitored results are enclosed as **Appendix 7**.

Table 16: Noise Level in the Project Area

Road	WB EHS				GOI /CPCB					
	Resi/ Inst/ Educational		Ind/ Com		Resi		Com		Silence	
	D	N	D	N	D	N	D	N	D	N
SH 58	✓	✓	✓	✓	✓	✓	✓	✓	--	--
SH 82	--	--	✓	✓	--	--	✓	✓	--	--
SH 84	X	✓	✓	✓	X	✓	X	X	X	X
SH 85	X	✓	✓	✓	X	✓	X	✓	X	✓
SH 102	X	✓	X	✓	X	✓	X	✓	--	--

Source: Primary Monitoring and DPR

D: Day Time, N: Night Time, Resi: Residential, Ind: Industrial, Com: ommercial

9. Ground water

84. **Availability, Occurrence and Yield:** Hydrogeologically, the various litho-units of the State can be grouped as i) unconsolidated / Alluvial formation, ii) semi-consolidated formations and iii) consolidated/fissured formations. The main alluvial tract covers entire north Bihar and a sizeable area south of the Ganga River. These alluvial formations constitute prolific aquifers where the tubewell can yield between 120-247 m³/hr whereas in the hard rock areas of South Bihar, borewells located near lineaments/fractures can yield between 10-50 m³/hr. The state has 589 no of ground water blocks defined by Central Ground Water Authority (CGWA). All Blocks falls under safe category.

85. Ground water is the principal source for drinking purposes in the sub project districts. Due to the presence of the Ganga river and abundant ground water resources overall there are no problems of water shortage for communities in the project area. District wise details about water bearing formations and water tables are summarized in in **Table 17**.

Table 17: District wise Groundwater Details

District	Water Bearing Formations	Water Table (mbgl)	
		Pre Monsoon	Post Monsoon
Banka	Quaternary Alluvium, Granite Gneiss	2.85- 8.76	1.62-5.55
Bhagalpur	Alluvium	2.5 -10.69	1.53- 8.04
Bhojpur	Alluvium	5.35 – 8.2	1.6 – 8.2
Jamui	Unconsolidated sand and weathered and fracture zones in hard rocks	5.87 – 14.2	2.84 -11.25
Madhepura	Sand zones in Quaternary Alluvium	3.30 – 4.80	2.58 – 3.65
Nawada	Quaternary Alluvium	6.46 - 10	1.0 – 6.0

Source: District wise brochure, CGWA.

86. **Groundwater Quality:** As per the study done by Central Ground Water Board (CGWB) in the sub project districts, ground water is largely fit for drinking. In some pockets, concentration of Fluoride, Arsenic and Iron are higher but not in project area. Ground water sampling collected and analysed establishes that some parameters like Iron, TDS, Ca Alkanity, Hardness is exceeding the desirable limit but well within permissible limit of drinking water standard prescribed in IS: 10500:1991 (**Appendix 4**). Summary of analysed results of samples is given in **Table 17** and it can results of Sampling is appended as **Appendix-8**.

Table 18: Groundwater Quality along Project Roads

Roads	GOI Limits		Remarks
	Desirable	Permissible	
SH 58	X	✓	TDS marginally exceeds desirable limit at Chosa location.
SH 82	X	✓	TDS and Ca marginally exceeds desirable limit at all 3 locations and Hotal Hardness at 2 locations
SH 84	X	X	Total Hardness, Total alkalinity, Magnesium are exceeding desirable limits whereas Iron exceeding permissible limit too.
SH 85	X	✓	Total alkalinity and Maganese are exceeding desirable limits at both locations whereas total hardness is exceeding desirable limit at Pawai.
SH 102	X	✓	Total alkalinity is exceeding desirable limits

Source: Onsite Monitoring

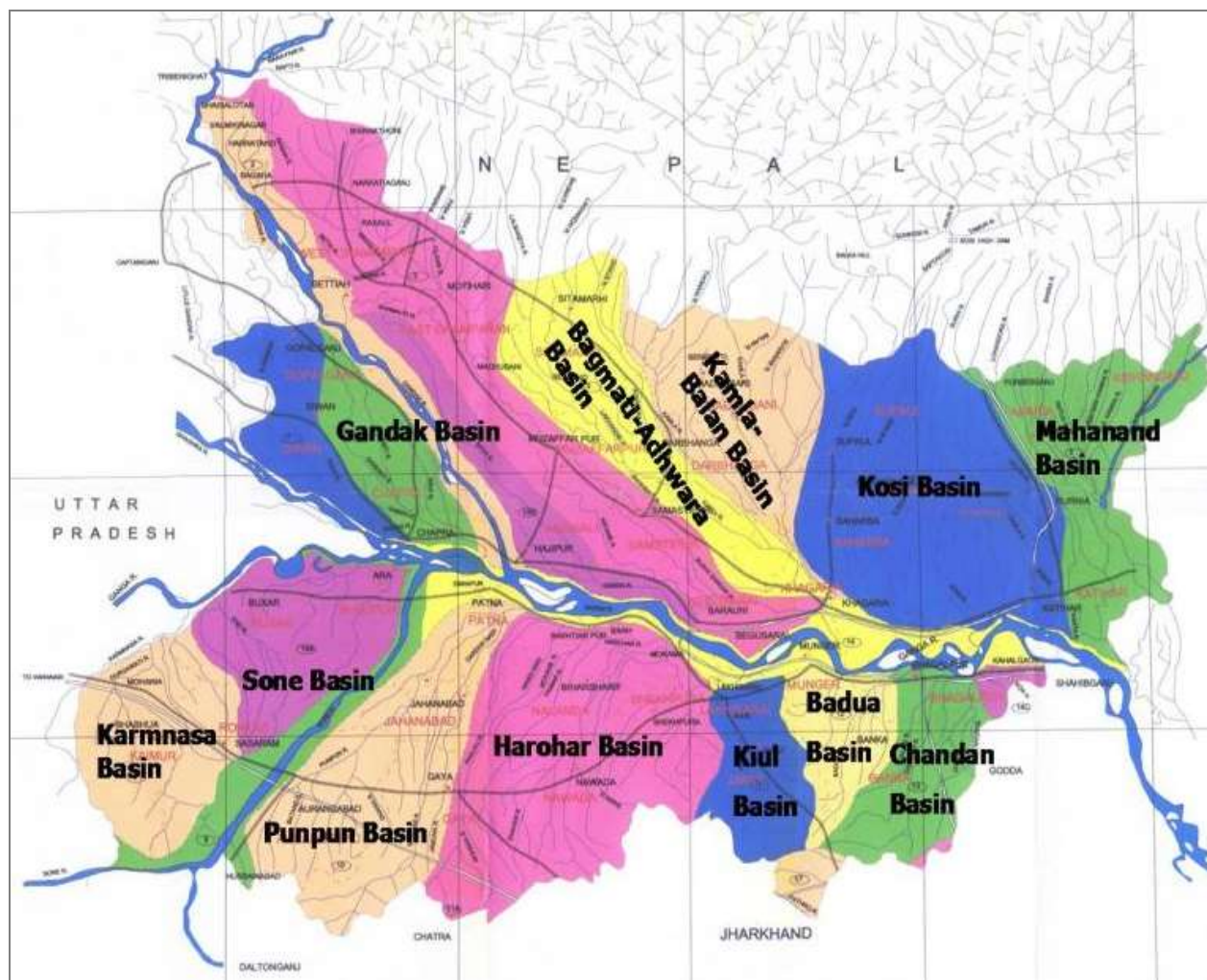
10. Surface water

87. **River System and Drainage:** Bihar is a landlocked state, yet it is endowed with many natural water resources. There are 19 river basins controlling the drainage of entire state. The

most important river Ganga, flowing from west to east, divides the state into north and south Bihar. The state is further divided into regional blocks by rivers flowing down from the Himalayas and the Chhotanagpur Plateau to find repose in the Ganges. The Northern Gangetic plain of Bihar is the courtyard of rivers flowing from the Himalayas, like the Ghaghara, the Gandak the Burhi Gandak, the Bagmati, the Kamla, the Kosi and the Mahananda and the Southern Gangetic plain is the backyard to the rivers that descend down the Chhotanagpur Plateau like the Karmansa, the Sone, the Punpun, the Phalgu, the Kiul and the Sakri.

88. Rivers of the project districts are part of Kosi (SH-58), Kiul and Harohar (SH-82), Badua, Ganga-Stem, Chandan (SH-84 and SH-85) and Sone-stem (SH-102) river Basin. Worthmentioning Rivers which are mainly influencing the drainage of areas surrounding to the sub-projects and intersecting them are River Kiul and River Sakri (SH-82), River Gerwa and Mirchaini in SH-84 and Chanan River in SH-85. No major rivers are being crossed by SH-58 and SH102. List of rivers intersecting the sub-project road is given in **Table 19**. There are many other seasonal streams, nallah and ponds along/across the project road. List of ponds nearby the alignments is given in “Location” column of all EMPs.

Map 11: River Basin Map of Bihar



Source: Water Resource Department, Bihar

Table 19: Rivers Crossing the Sub-project Roads

Road	Rivers/Stream	
	Name	Intersecting Chainage
SH-58	No River being crossed. Only seasonal channels, nallahs and canals	
SH-82	Bhagree River	26+100
	Sakri River	29+550
	Harkha River	48+800
	Killt Quel	51+600
	Kuel River	62+200
SH-84	Gerwa River.	15+605
	Mirchaini	27+710
SH-85	Chanan River	3+800
SH-102	No River being Crossed. Only seasonal streams, nallahs.and canals	

Source: DPR and Site Observations

89. **Surface Water Quality:** Surface water is not used for drinking or domestic purpose in the project area. Main usage of surface water in the project area is for outdoor bathing, irrigation and fishery activity in some water bodies. Therefore, surface water samples from rivers and ponds have been analysed to confirm its suitability for different classes prescribed for freshwater classification by CPCB (**Appendix 5**). Analysed samples confirm the prescribed limits.as summarised in **Table 20**. Results of sampling is given in **Appendix 9**.

Table 20: Surface Water Quality in the Project Area

Roads	GOI (CPCB)			
	Drinking Water Source without treatment	Outdoor Bathing	Fish and other aquatic Life Propagation	Irrigation
SH 58	X	✓	✓	✓
SH 82	X	✓	✓	✓
SH 84	X	✓	✓	✓
SH 85	X	✓	✓	✓
SH 102	No waterbodies found in the vicinity of the Sub-project road hence sampling not done			

Source: Onsite samplings, BDL- Below Detection Limit

B. Ecological Resources:

1. State Profile

90. **Forest Resources:** As per the Indian State of Forest Report, 2017 by Forest survey of the India, Bihar has forest cover of 7299 sq. km., which is 7.75% (figure 11) of its total geographical area. In terms of forest canopy density classes, the state has 332 sq.km under very dense, 33260 sq.km under moderately dense forest, and 3707 sq.km under open forest.

91. There are three forest types in the state: (i) Dry Deciduous; found in the north-eastern of Kishanganj district and particularly in area with annual rainfall more than 120 cm. Density of vegetation is very high with dominant vegetation type is Sal and associated vegetation are Assam, Semal, Ghaura, Caham, Kend, Mango, and Jamun; (ii) Wet Deciduous found in hills of Kanpur and Chotanagpur plateau and in few parts of Raxual, Purnia and Araria districts where the annual rainfall is less than 120 cm., with open forest and major vegetation types are Sal, Bamboo, Khair, Pal, Shesham, Mahua and Kend; (iii) Sub Himalayan and Tarai Forest found in northern part of Bihar and boarder of Nepal, major forest areas are found are western Champaran (Showmeshwar), Purnia and Araria and major vegetation type is Sal, Tun, Oak, and Pinl.

92. **Flora and Fauna:** Owing to its geographical location in the foothills of the Himalayas, Bihar has a wide variety of flora. The natural vegetation since Haines' publication has been continuously and increasingly under pressure owing to developmental projects including mining activities and non-judicious exploitation of plant resources. The jungles of Bihar are abundant in wildlife, some of the notable game animals and birds like tiger, deer, buffalo, duck etc., are fast disappearing. Thirteen wildlife sanctuaries have been set up by the government for protection.

93. **Protected area Network:** Bihar has one national park and twelve wildlife sanctuaries covering an area of 0.32 million hectares, which constitutes 3.38% of the total geographical area of the state. The lone tiger reserve of the state i.e. Valmiki Tiger Reserve covers an area of 84,000 hectares. Kabar, situated in Begusarai district with an area of 6,738 hectares, is a wetland of national importance. Details of these protected areas are given in **table 9** and **figure 13** show the protected area map of the Bihar.

2. Protected area in Project Districts

94. The nearest eco sensitive area is Vikramshila Gangetic Dolphin Sanctuary (VGDS). The sanctuary lies between Latitudes 25°10' and 25°25' N and Longitude 86°30' and 87°15' E in the Bhagalpur District of Bihar and extends over a length of about 60 kilometre of portion of River Ganges from Sultanganj to three hillocks in the middle of River Ganges at Kahalgaon. A draft Notification Declaring Eco Sensitive zone around VGDS was published by Ministry of Environment and Forest and Climate Change (MoEF&CC) vide S.O. 3030 dated 09.11.2015. <http://www.moef.gov.in/sites/default/files/S.O.%203030%20%5B09.11.2015%5D%20Vikramshila%20Gangetic%20Dolphin%20WLS%2C%20Bihar.pdf> The Final Notification is still awaited. In its 18th meeting held on 31.05.2016, expert committee sought geographical co-ordinates of revised area along with colour maps of protected area and eco-sensitive zone. As soon as it is submitted by state wildlife authority, final notification will be issued by MOEFCC. Minutes of meeting available at <http://www.moef.gov.in/sites/default/files/31.05.2016%20Minutes%20of%20ESZ%20Meeting%20on%2031st%20May%202016.pdf>. The VGDS is at an approximate aerial distance of 2.75 km from the end point of SH 84 and at 2.6 km from the end point of SH 85, Dolphin population is not recorded in the rivers being crossed by SH 84 and SH-85.

3. Forest in the Project Districts

95. Forest cover in sub project districts varies from 1.5% to 20.69% of their geographical area. Proportion of moderately dense is highest followed by and open forest and very dense forest. Forest cover in different canopy classes of the project districts is given in Table 20.

Table 21: Forest Cover in Project Districts

Project District	Geographical Area (sq. km)	Very Dense Forest	Moderately Dense Forest	Open Forest	Total Forest Area (sq. Km)	% to Total Area
Banka	3020	0	104	136	240	7.95
Bhagalpur	2569	0	49	19	68	2.65
Bhojpur	2395	0	21	15	36	1.5
Jamui	3098	29	351	261	641	20.69
Madhepura	1788	0	1	50	51	2.85
Nawada	2494	0	189	323	512	20.53

Source: State of Forest Report 2017, Forest Survey of India

4. Forest along the Project Corridors:

96. Areas along the sub-projects are mostly devoid of natural forest except intermittent patches along SH-82 (Km 42.7 to km. 54.1 and 66.4 to 68.8). Roadside plantations along all sub-project roads except SH-58 have been notified as Protected Forest. Hence, permission for diversion of forest land is required prior to civil works. **Table 22** summarizes the status of forest diversion in all sub-projects.

Table 22: Status of Tree Cutting and Forest Diversion proposals and Indicative Timeline

Road no.	Status	Action to be taken	Timeline
SH-58 Only tree cutting permit is required for 1017 trees	Application for joint verification submitted to DFO	1) Joint Verification and correction if any 2) Forest Dept to provide estimates for tree cutting/compensatory plantation 3) BSRDCL to deposit money in CAMPA Fund 4) Forest Department to issue permission	June 2018 July 2018 August 2018 September 2018
SH-82	Earlier road length was 94 km, now it is reduced to 75km; Road falls in two forest divisions (0 – 48 km in Nawada and 49 – 75km in Jamui) Stage 1 clearance for 27.695 ha of forest land has been received for first road section in May 2015; Fulfilling conditions of stage 1 is pending. Application for 2 nd section moved by RCD Jamui. PIU needs to check with RCD on progress	5) Complete conditions of stage 1 clearance for first section and get full clearance 6) Check with RCD on status of application for second section 7) Proceed with next steps for second section depending on RCD's progress 8) Final Approval	September 2018 Within May 2018 June 2018 October 2018
SH-84	Stage 1 clearance received for 96.18 ha of forest land in 2013 for 54km of road. However, the road length is reduced to 43km and remaining 11km is declared as NH. Also the clearance could have lapsed as the clearance validity is 5 years. PIU needs to confirm with nodal officer and initiate renewal	1) PIU to meet with Forestry nodal officer to discuss next steps 2) Initiate next steps as agreed with Forestry nodal officer 3) Need to clarify with Forestry nodal officer or District Magistrate (DM)	First week of June 2018 Last week of June 2018 Within June 2018
SH-85	Stage 1 clearance required for 57.09 ha of forest land full length of road in May 2013. The clearance may have lapsed as clearance validity is 5 years. PIU needs to initiate process for renewal and submit compliances to Stage-I	1) PIU to meet with Forestry nodal officer to discuss next steps 2) Completion of remaining steps to get full clearance 3) Final Approval	First week of June 2018 September 2018 October 2018
SH-102	Application for stage 1 clearance for 55.46 ha of forest land has been submitted; Forestry department is working on their internal procedures currently; Stage 1 clearance to be processed;	1) Follow up with Forestry Department and get stage 1 clearance 2) Get complete forestry clearance	Within July 2018 October 2018

5. Trees Within Right of Way

97. **The road side plantation is mixed type and natural regeneration is seen.** The number of tree to be cut varies greatly from 1017 to 4246 in numbers (**Table 23**). SH 58 involves felling of 1017 no of trees, SH 82-4246 nos, SH 84-2222 nos, SH 85-1390 nos and SH102- 2503 nos. Details of predominant specie along with girth size are appended with the report. All efforts will be made to restrict the tree cutting to toe line of the formation width considering the safety issue.

Table 23: Details of Tree Felling in Project Roads

Road Name	Girth Size (in cm)						Total
	0-30	31-60	61-90	91-120	121-180	>180	
SH 58	0	280	322	199	153	63	1017
SH 82	265	428	460	1135	1958	0	4246
SH 84	218	258	307	421	968	50	2222
SH 85	40	391	217	324	418	0	1390
SH 102	1	210	463	409	486	934	2503
Total							11378

Source: Tree Inventory Conducted By DPR Team

6. Floral Elements in the Forest Area along SH-82:

98. Rapid floral assessment was carried along the naturally grown forest patch of SH-82. There are about 150 floral species including some medicinal plants/shrubs/herbs found in the forest area adjoining the sub-project road. Mahua and Palas are the dominant species of the region. The road side plantation is mixed type i.e. natural regeneration supported by artificial regeneration. The tree species mainly consist of Gulmohar (*Delonix regia*), Sal (*Shorea robusta*), Awla (*Ebmlica officinalis*), Palas (*Butea monosperma*), Mahua (*Madhuca indica*) etc. The shrubs mainly consists of some climbers kendu (*Diospyrous melanoxylon*), chameli, harshingar (*Nyctanthes arbortristis*) and bans (*Dandrocalthamas strictus*) etc. No big plantation is visible near the road in the forest area. Some natural regeneration has however been supported by manmade plantation programs. As forest is dry deciduous less edible herbs is seen in area for animals. The major one is Mahua which is very frequent which attracts the herbivore during summer. Species like Eucalyptus, Kala Siris (*Albizia lebbek*), Chakundi (*Cassia siamea*), Gulmohar (*Delonix regia*) have been planted by the road side. The summary of the quadrant for estimation of floral density is summarised in the table 24 below-

Table 24: Summary of Quadrant Analysis (10m X 10m)

Quadrant No.	GPS Co-ordinate	Chainage (Km.)	No. of plants	Important Floral
1	24.8124483N 85.9707117E	Mahodor, 42.7	11	Charota, Palas, Putus, Palas
2	24.8122801N 85.9715683E	Mahodor 45.2	7	Kend, Mahua, Jhau, Tulsi, Arandi
3	24.8105802N 85.9869829E	Pratapur 49.2	13	Khajur, Putus, Palas, Galphul,
4	24.8106800N 85.9878017E	Maholia Tad 53.7	12	Putus, Ber, Dhela, Ratti, Sabai
5	24.8093413N 86.0180566E	Chanarwar 54.1	5	Tulsi, Mahua, Ber
6	24.7996818N 86.1591199E	Laldaia 66.5	6	Ber, Chirchiri, Putus

7. Fauna and Wildlife Movement along/across SH-82

99. The vegetation is not rich in diversity due to dry weather condition and heavy grazing. Moreover, it is fringe area of the forest. No large carnivore is found in the area. It is connected with Rajauli and Koderma forest ranges partitioned by a chain of low mountains. The forest area forms the habitats for some mammals, amphibians and reptiles as listed in **Table 25**.

Table 25: List of Animals in Forest Areas Along SH-82

S. No.	Common Name	Scientific Name	WPA, 1972	IUCN Status
List of Mammals				
1	Wild Boar	<i>Sus scrofa</i>	III	Not Assessed
2	Blue Bull	<i>Boselaphus tragocamelus</i>	III	
3	Spotted Deer	<i>Axis-axis</i>	III	
4	Sambhar	<i>Cervus unicolour</i>	III	
5	Jackal	<i>Canis aureus</i>	II	
6	Indian Hare	<i>Lepus nigricollis</i>	IV	
7	Common Mongoose	<i>Herpestes edwardsi</i>	IV	
8	Indian Mongoose	<i>Herpestes auropunctatus</i>	II	
9	Monkey	<i>Macaca mulatta</i>	III	
10	Common langur	<i>Presbytis entellus</i>	III	
11	Indian Porcupine	<i>Hystrix indica</i>	IV	
12	Indian Fox	<i>Vulpes beagalensis</i>	II	
13	Jungli billi	<i>Felis chaus</i>	II	
14	Barking Deer	<i>Muntiacus muntjak</i>	III	
15	Hyena	<i>Hyena hyena</i>	III	
16	Sloth Bear	<i>Melursus Ursinus</i>	I	Vulnerable
Amphibians and Reptiles				
1	Frog	<i>Rana tigrina</i>	C IV	Not Assessed
2	Indian bull frog	<i>Hoplobatrachus tigerinus</i>	C IV	
3	Common Krait	<i>Bungarus coeruleus</i>	C IV	
4	Binocellate cobra	<i>Naja naja</i>	C II	
5	Russell's Viper	<i>Vipera russellis</i>	C II	
6	Rat snake	<i>Ptyas mucosus Dhaman</i>	C II	
7	Indian Lizard	<i>Calotes versicolor</i>	C II	
8	Indian chameleon	<i>Chamaeleo zeylanicus</i>	C IV	

100. Movement of some wild animals was reported by local people and also confirmed by respective forest ranger offices along/across the sub-project road of SH-82 in the vegetated portion lying between Mahodar (Ch. 42.7 Km) to Chanarwar (Ch. 54.1 Km) and Kurwatad (Ch. 66.4 Km) to Baba Jhakhraj (Ch. 68.8 Km). Enroute villages in first sections are Lijhaad, Farkipathar and Pratappur. Villages in second section are kurwatad, Laldiha and Baba Jakhraj. Movement across the highway is mainly in search of water and food. The road crosses just middle to the parallel chain of mountains. This often attracts animal movements in both directions. Movement is erratic/not defined and mostly during night away from built-up areas.

101. Most frequent movement is that of Blue Bulls¹ (*Boselaphus tragocamelus*; Schedule² V) followed by occasional crossing of Spotted Deer (*Axis-axis*; *Schedule III*), Sambhar (*Cervus*

¹ Presently, this species is under Schedule III of Wildlife Act, 1972. Due to its large population causing heavy crop damage, MOEF has issued an advisory to include it in Vermin category of Schedule V so that killing/hunting of such animals are outside purview of law.

² Wildlife Protection Act, 1972 has six schedules which give varying degrees of protection. [Schedule I](#) and part II of [Schedule II](#) provide absolute protection - offences under these are prescribed the highest penalties. Species listed

unicolor; Schedule II), and rare siting of Sloath Bear (*Melursus ursinus*; Schedule 1) None of the animal species are under threatened or endangered categories as Per IUCN classification. Sloath bear is under vulnerable category. This may be attributed to absence of traffic during night time. However, there have been several occasions of animal sufferings due to non availability of water during summer.

102. Although the movement of wild animals can be anticipated anywhere between the two intermittent patches mentioned above, biodiversity team identified 5 potential accident/collision locations (**Map 11** and **Map 12**) due to comparatively dense vegetation combined with curves which may hamper adequate sight distance to driver. Point 1 and 2 is between Village Gua Ghogra and Mahodar.

103. Potential accident/collision location 3, 4 and 5 lies between Mahodar (Km. 45.4) and Mohalia Tad (Km. 53.6). Vegetation in this stretch is very close to alignment and hence gives the driver a very little time to respond if an animal is seen near the road or crossing it. At location 4, there is a perennial stream causing more concentration of animals including other side of the project road. It is only water source in the area. But in absence of check dam the animals have to travel upto Garhi dam which is far away. Movement along this section is mainly towards the Garhi Dam. As the road is in east-west direction and the water body is in north east direction the crossing of animal is fairly high in the point area 5 from south to north crossing the road.

Map 12: Potential Location (1 and 2) for Vehicle-Animal Collision



in [Schedule III](#) and [Schedule IV](#) is also protected, but the penalties are much lower. [Schedule V](#) includes the animals which may be hunted.

Map 13: Potential Location (3, 4 and 5) for Vehicle-Animal Collision

C. Economic Development

104. Bihar faces complex economic development challenges. With an estimated population of 103.8 million in 2011, Bihar is a densely populated region, with no less than 1102 persons living per sq. km. of its area. As per the Planning Commission figures, in 2004-05, 41.4 percent of the population lived below poverty line in Bihar. As nine out of ten people on the average live in the villages, poverty is more visible in rural areas.

105. The growth rate of Bihar's economy has not been uniform over the last decade. During the first five years since 1999-00, the economy had grown at an annual rate of only 4.42 per cent. The economy then witnessed a turnaround and it grew at an annual rate of 11.36 percent during the period 2004-05 to 2010-11. It can be noted that the growth rate achieved during 2004-05 to 2010-11 has been one of the highest among all the Indian states.

106. In 2009-10, the Net State Domestic Product (NSDP) of Bihar was US\$ 32.5 billion. The average NSDP growth rate between 2004-05 and 2009-10 was about 16.2 percent. Bihar's per capita NSDP increased from US\$ 172.6 in 2004-05 to US\$ 340 in 2009-10. A robust secondary and tertiary sector has helped Bihar to increase its average per capita NSDP by around 14.5 percent between 2004-05 and 2009-10.

107. The Per Capita Income in Bihar was about 35 percent of the national average in 2015-16, compared to about 33 percent a decade ago. The GSDP of Bihar at constant (2011-12) prices in 2015-16 was Rs. 3.27 lakh crore, yielding a Per Capita Income of Rs. 29,190. The estimated GSDP at current prices in 2015-16 is Rs. 4.14 lakh crore, implying a Per Capita Income of Rs. 36,964. The economy of Bihar ranked 12th out of all Indian states. Various facets of socioeconomic environment of the state and the project district have been described in following paragraphs.

1. Agriculture and allied sector

108. Bihar state is located in the Indo-Gangetic plains in central-north India, and its naturally fertile soil is one of the key assets of the State, and conducive to agriculture. However, agriculture and its allied sectors in Bihar are beset by many challenges, and climate change and its impacts are only likely to deepen these challenges.

109. About half the area of the state is under cultivation, but pressure of population has pushed cultivation to the furthest limits, and little remains to be developed. In 2009-10, net area sown was 57.0 percent and it has increased marginally to 57.7 percent in 2012-13. In 2013-14, it has again decreased to 56.1 percent. During this period, there has been an increase in gross sown area between 2009-10 (7295.81 thousand hectares) and 2013-14 (7580.14 thousand hectares). The cropping intensity has increased marginally from 1.37 in 2009-10 to 1.44 in 2013-14. The annual rainfall is reasonably adequate for the state's agricultural operations. However, only worrisome feature is the year-to-year variation in rainfall which tends to create flood or draught-like situations in the state.

110. The Animal husbandry, along with agriculture, is one of key sectors which provide massive employment and income opportunities for the rural people of Bihar. The production of milk has increased 25.1 percent from 66.25 lakh tonnes in 2011-12 to 82.88 lakh tonnes in 2015-16. The production of egg has also increased from 75.43 crores in 2011-12 to 100.21 crores in 2015-16, implying an increase of 32.9 percent. In 2004-05, the production of fish in Bihar was 2.67 lakh tonnes. The production grew continuously thereafter and reached the peak level of 5.07 lakh tonnes in 2015-16.

2. Industries and Mineral Resources

111. The level of industrialization in Bihar is still very low and the contribution of this sector to the state's GSDP stands at below 20 percent, compared to the national average of above 30 percent. The industrial sector in Bihar, as elsewhere in India, is very heterogeneous with industrial units ranging from tiny/small to large. Since a large number of these industrial units are not registered, it is nearly impossible to know the number of industrial units operating in a state and any of their characteristics. The share of Bihar in the total number of industries in India is only 1.52 percent, while its share in national population is more than 8 percent. There were 17.07 lakh economic enterprises in the state in 2013, after recording an increase of 39.4 percent over the number in 2005 (12.25 lakh). Key industries in the state include food processing/beverages, fibres/textile, jute, leather, mines and minerals, tobacco, dairy, tea, petroleum products and cement.

112. The mineral resources in Bihar are extremely limited, thus the importance of agro-based industries are relatively more in Bihar. The most of mineral belt i.e. about 90% of the important minerals was taken away by Jharkhand from Bihar after its separation. Still some more important minerals are located in the state which are not only useful for the state but also has become important source of revenue for the state. There are reserves of important deposits of Limestone, Purite, Magnetite, Mica, Chinaclay, Soapstone, Gold, Slate, Felspar, Galena, Sandstone, Saltpetre, etc.

3. Infrastructure Facility

113. Infrastructure is one of the key movers of socio-economic development. Physical infrastructure drives the economic growth and social infrastructure impacts human resource

development. Physical infrastructure consists of power, **telecommunication**, aviation and road connectivity.

114. **Roads:** Bihar has been at the lowest rung of development in respect to roads and bridge development. It has, for every one lakh populations, road density of only 126.13 kms. as against 322.77 kms. at all India level. Similarly, for every 100 sq kms. of area there were 129 kms. of roads for the country, whereas it was only 111.17 kms. for Bihar. The road network is seriously deficient both in the quantum network connectivity as well as in riding quality of the roads, mainly the state highways, district roads and village roads

115. **Railway:** Bihar's railway network is fairly well developed, with the railway route density (route kilometers per 1000 sq km) in the state being 30.15, compared to 19.09 for All-India. Total rail length in the state is 5,400 km. The East Central Region, one of the biggest railway zones in the country with five divisions of Danapur, Mughal Sarai, Dhanbad, Sonapur, and Samastipur, has its headquarters at Hajipur. Important railway junctions include Patna, Gaya, Mughalsarai, Muzaffarpur, Bhagalpur, Samastipur, Katihar, and Barauni.

116. **Aviation:** Patna's airport emerged as number one among 46 airports in the country in terms of growth of domestic passengers as well as domestic aircraft movement for the second consecutive year in 2010-11. There is virtually no international aircraft movement in the state, since the state does not have an international airport. Although Gaya airport is declared as an International airport, it is only nominal, because the big aircrafts do not operate on regular basis from here. There are 39 district Headquarters that have air strips/aerodromes.

117. **Waterways and Inland Navigation:** There is virtually no organised inland navigation in the waterways of the state, and there is ample scope for development in this sector in Bihar. With promotion of waterways and navigation in the state, the rural economy can be substantially transformed.

118. **Power:** The bifurcation of Bihar in year 2000 resulted in leaving only dilapidated thermal power generating units to Bihar, other major power generating units went to Jharkhand. The total installed capacity including hydel is about 600 mw against the peak demand of 3000 mw. The deficit which was around 15 percent in 2006-2007 has increased to around 45% in 2010-11 not because the availability has gone down but because the peak demand has increased two and a half time.

119. **Communication:** The telecommunication in Bihar has taken giant step forward from the year 2005-2006 during which it registered around 10 fold increase (from 42 lakh in 2005-06 to 415 lakh in 2010-11) in respect of verbal connectivity. In spite of this Bihar is still far behind in tele density (Number of telephone per 100 persons) of other states in the country. The tele density as per Economic Survey, 2010-11 was 139 in urban area and 16 in rural area.

D. Social Development

120. **Demography:** According to 2011 census the total population of the state is about 104.1 million. The population density of the state is 1106 per sq. km. (compared to the country's average of 436 sq. Km). The decadal growth rate recorded during the previous decade at 25.42% is higher than the national level of 21.5 %. Approx 88.71% of the population resides in rural areas and rest 11.29% in urban areas. The number of females per 1000 males (sex ratio) in Bihar was 918 in 2011 and had shown a negligible decrease as compared to that in 2001 at 919. Facts and figures about demography of the project district is Summarized below in **Table 26**.

Table 26: Demography of the Project Districts

Indicators	Banka	Bhagalpur	Bhojpur	Jamui	Madhepura	Nawada
Area Sq. Km	3020	2569	2395	3098	1788	2494
Actual Population	2034763	3037766	2728407	1760405	2001762	2219146
Male	1067140	1615663	1430380	916064	1047559	1144668
Female	967623	1422103	1298027	844341	954203	1074478
Population Growth (%)	26.48	25.36	21.63	25.85	31.12	22.63
Density/km ²	674	1182	1139	568	1120	890
Sex Ratio (Per 1000)	907	880	907	922	911	939
Child Sex Ratio (0-6 Age)	943	938	918	956	930	945
Average Literacy	58.17	63.14	70.47	59.79	52.25	59.76
Male Literacy	67.62	70.30	81.74	71.24	61.77	69.98
Female Literacy	47.66	54.89	58.03	47.28	41.74	48.86
Child proportion (0-6 Age) (%)	18.44	17.99	16.83	18.43	20.21	17.73
Boys proportion (0-6 Age) (%)	18.10	17.45	16.73	18.12	20.01	17.67
Girls Proportion (0-6 Age) (%)	18.82	18.60	16.94	18.78	20.44	17.80

Source: Census Survey, 2011

121. **Educational Facility:** There has been a high leap in the literacy rate in the last ten years. The literacy rate has grown from 47.00%% (male- 71.20%; female 51.50%) in 2001 to over 61.80% (male- 59.68%; female 33.12%) in 2011. But the literature disparity (19.7%) between gender is still higher and lags behind all India average of 74.04 % (Male 82.14%- Female 65.46%) by over 13% The total coverage of primary and upper primary schools together for every ten thousand of population in Bihar has increased from 6.05 to 6.98.

122. The number of senior secondary schools has also increased. But overall coverage of secondary education remained unchanged at 0.41 for every ten thousand of population between 2002 and 2009. The national average for each of these categories in 2002 were 6.33 (Primary), 2.38 (Upper Primary), 0.88 (secondary) and 0.42 (Senior secondary). In the realm of higher education Bihar did not have sufficient institutional and sufficient human resource base to hold the aspiring and intellectually brighter students within its fold. In the past few years the scope for quality higher education has increased with institutions like NIT, BIT centre, Medical, Law, Management, Hospitality and Fashion opening in the state capital and nearby districts. As against 11 universities in 2001, Bihar now has 13 universities. The enrolment of students has increased by 35% in technical institutions.

123. **Health Infrastructure:** Bihar has experienced substantial improvements in health facility in recent years but the available facilities are still inadequate. One of the key indicators of health in a state is infant mortality Rate (IMR) which was 48 per thousand live birth in 2010, nearly equal to national average of 47 per thousand live birth. The number of primary health centre has been increased from 1648 in 2005 to 1883 in year 2015. Whereas Community health centre has been decreased from 101 to 70 and sub centre has also experienced a decrease to 9729 from 10337 no in 2005.

124. **Tourism:** Bihar is a land of monasteries and several antique ruins of Mugal Empire and other dynasties. Several Hindu, Buddhist, Jain, Muslim, and Sikh shrines abound in this ancient land. Important places of tourist interest are Rajgir (pilgrim place for the Buddhists), Bodh Gaya (most sacred place for Buddhists), Gaya, (centre of pilgrimage for Hindus), Nalanda (ruins of the world's earliest Buddhist university) and Vaishali (the seat of the first republic of the world in the sixth century BC). Other places of tourist interest in Bihar Bhimbandh, famous for hot springs; Maner, a sacred Muslim shrine of Sufi Saint Hazrat Makhdoom Shah; Vikramshila, the ruins of a Buddhist university; Deoghar, famous for a Hindu shrine and Sasaram, the site of the tomb of

Afghan emperor Sher Shah Suri. Vaishali is famous religious tourist destination on world tourism map. There is no protected monument in subproject area. However, there are few temples along the subproject road.

125. Archaeological and Historical Monument, Sensitive Receptors and other Community Structures: There are no archeological or historical monuments along the project roads. However, there are a number of religious structures and other community property resources (CPR)¹ including sensitive receptors like schools and health centres. Complete List of sensitive receptors and community structures is attached as a supplementary Table to the EMP. Most of the religious structures are notional/symbolic as small shrines and hence not considered for solid noise barrier. Summary of all type of Sensitive and Community Structures is given In **Table 27**.

Table 27: Summary of Noise Sensitive and Religious Structures

No.	Road Sections	Educational Institutes	Health Centres	Religious	Total
1	SH-58 (Udakishunganj-Bhatgawan)	14	1	24	37
2	SH-84 (Ghogha – Bazar)	18	1	18	34
3	SH-84 (Bazar- Panjwara)	16	2	18	36
4	SH-85 (Akharnagar- Amarpur)	17	7	32	56
5	SH-82 (Kadirganj - Dewangarh)	16	3	10	26
6	SH-82 (Dewangarh - Badaldih)	11	0	18	28
7	SH-82 (Badaldih - Khaira)	10	1	15	24
8	SH-102 (Bihia - Ujbaliya)	23	02	27	52
9	SH-102 (Ujbaliya - Bihta)	14	1	21	36
Total		139	18	183	329

¹ In India CPRs are structures or facilities that belong to a community such as hand pumps, wells, schools, health centers, temples, grave yards etc. Some Physical Cultural Resources (PCR) such as temples can also be a CPR if it belongs to the community

V. IMPACT ASSESSMENT AND MITIGATION MEASURES

126. Road improvement projects are likely to bring several changes in the local environment both beneficial and adverse. This section of IEE identifies nature, extent and magnitude of all such likely changes vis-a-vis project activities for all stage of project cycle i.e. pre-construction, construction and operation. Beneficial impacts are mostly long-term and permanent whereas adverse impacts are localized and temporary in nature and are likely to occur mostly during construction stage.

A. Potential Beneficial Impacts

127. The immediate benefits of road construction and improvement will come in the form of direct employment opportunities during construction for the roadside communities engaged as wage labourers, petty contractors and suppliers of raw materials. During operation stage, roadside economic activities supporting transport like gasoline stations, automotive repair shops, lodging, and restaurants will increase due to increased number of vehicles. Increase in agro-industrial activities are also expected to take advantage of improved access to urban centers where there are higher demands and better prices for agricultural products. Project will accelerate the economic opportunities resulting in reduced migration. Other benefits of project improvement are: (i) reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care, educational and other infrastructural facilities (iv) improved quality of life of rural population (v) reduced accident events and (vi) better investment climate for industries creating more employment opportunities to local people.

B. Potential Adverse Impacts

128. Major anticipated impacts arising from the sub-project roads improvement are: (i) economic displacement of sizeable number of households mainly non title holders including vulnerable populations impacting their livelihood, (ii) cutting of 11378 green and mature trees and disruption in wildlife movement in forest area of SH-82, (iv) adverse impacts due to borrowing and quarrying, (v) increased risk of accident due to faster vehicular movement (iv) increase in air pollution and noise pollution due to increased traffic. Most of the impacts are reversible, temporary, localized in nature, and can be easily mitigated/minimized/avoided by effective implementation of EMP.

C. Pre-construction phase Impacts

1. Land and Assets

129. Extent of land acquisition is insignificant i.e 21.6 acres (8.74 ha). However, the number of affected structure and displaced persons within the ROW is significant. There are 4265 private structures (mainly squatters and encroachers) causing 4011 households to be displaced (economically+physically). Total number of common property resources that will be affected (schools, temples, graveyards, hand pumps, well, govt. buildings, health facility etc.) is 553. Roadwise summary is given in **Table 28**.

Table 28: Summary of impacts on land and assets

Impacts	SH-58	SH-85	SH-82	SH-84	SH-102
Total Land required (in Acres)	Nil	1.41	Nil	12.64	7.54
Private land to be acquired (in Acres)	Nil	1.36	Nil	11.41	6.72
Private structures affected	1056	552	736	1025	896

Impacts	SH-58	SH-85	SH-82	SH-84	SH-102
No. of displaced households	863	531	677	1044	904
Total number of CPR affected	62	88	70	113	220
Source: Resettlement Plan, 2018					

130. Adequate compensation and rehabilitation assistance has been proposed for affected households in consistent to ADB and GOI policies. Income restoration measures/livelihood options for vulnerable group/resource poor sections and other affected persons as recommended RP shall be implemented. All impacted CPRs will be relocated and reconstructed in consultation with the respective local communities under the project.

2. Diversion of Forest Land and Tree Cutting

131. There is no forest along SH-58. Roadside plantations along remaining sub-projects have been notified as protected forest. Hence, permission for diversion of forest land aggregating 236.425 Ha (SH-82=27.695 Ha, SH 84=96.18 Ha, SH 85=57.09 Ha and SH 102 =55.46 Ha) is required from regional office of MOEFCC¹. Stage-1 (in principle) permission already accorded for SH-84, SH-85 and SH-82 (Nawada Forest Division; Km 0+000 to Km 48+000). Diversion proposal for later section of SH-82 has been applied by RCD Jamui division. Application for SH-102 is also under process and presently pending with Department of Environment (DoE), State Government for its further recommendations to regional Office. Letters of Stage-I clearance for SH-82, SH-84 & SH-85 have been appended as **Appendix 10** and status of forest application for SH-102 is attached as **Appendix-11**. No loss of rare endangered or threatened species of flora is envisaged due to road side tree clearance. However, in forest stretch SH-82, removal of road side naturally occurring plants/vegetation may deprive the birds, animals, reptiles, orchids, mosses, lizards and insects of their habitat. Cutting of hill slopes for road making without proper protection may lead to soil erosion and affect moisture retention, thus creating arid condition and loss of food.

132. A total of 11378 trees have been enumerated in proposed ROW. However, the tree cutting will be restricted to toe line of the formation width. The mandatory compensatory plantation will be done on 1: 3 basis by the Forestry Department. Additional plantation on 1:7 basis will be done as a strategy to minimize GHG emissions from increase in traffic due to road upgrading. BSRDC will implement the additional plantation through contractors of forest department with an access to monitor to ensure at least 80% survival of trees after 3 years. Annual reports pertaining to the accomplishment and survival will form part of the annual environmental monitoring report to be submitted to the ADB.

3. Wildlife Movement

133. . Sub-project road (SH-82) in its forest stretch beyond Pratappur is already intermediate lane and expansion of addition 1.5 m carriageway is not expected to cause either habitat fragmentation, or increased chance of hitting any animals as additional time to cross the width of 7 m to its present width of 5.5 m is negligible. There is already existing trenches in most parts on both sides to restrict the animal crossing. Further, the road is fairly on high embankment along forest stretch so existing CD structures (6 existing Slab culverts with more than 3 m vertical clearance) easily facilitating the crossings. Despite, animals like Deers, Hyena and wolf some times cross the road during extreme summer in search of water. Most frequent crossing was reported that of Blue bulls which attacks the agricultural fields. This may be due to negligible traffic during night and animal cross the roads mainly during this time. However, in improved conditions

¹ In a recent initiatives by MOEFCC, final disposal of all forest diversion proposal will be done by its regional office.

when the projected traffic is more during whole day, collision of wild animals may be frequent in absence of any mitigation measures. Following set of mitigation measures are recommended to avoid any vehicle-animal collision. These measures will be taken in coordination with forest department during implementation of the project.

- Installation of rumble strips: rumble strips shall be installed at 50 m before the locations identified as accident prone. Locations are Km 44.5, Km. 44.9, Km. 45.4, Km.45.9 and Km. 53.6
- Informatory sign boards, cautionary sign boards for speed limits up to 30 Kmph on both sides. Details on the numbers and locations of these measures are provided in Tables 27
- Habitat enhancement through plantation but not immediately beside the roads as part of the additional and compensatory plantation. The plantation will make a protective zone. Most viable and effective alternative is to go for planting of edible plant species which will provide fruits, leaf litter, flowers for the wildlife to consume and provide some intensive protection of the habitat. The trees are indigenous, utility oriented and yield edible fruits such as Kusum, Mahula, Kendu, Jamun, Mango, Bel, Kathal, Ficus etc. near the dam side, Edible grasses should be planted up in sheltered blanks free from grazing by live stock.
- Bigger plants should not be planted along the road side so as to have a view of vehicular movement by the animals. Non grazing species to be preferred to avoid collection of animal near highway. Eucalyptus plantation is to be avoided. This will make less concentration of animals near the highway thus avoiding accidents.
- No dipper should be used in forest areas since such a sudden change in illumination saturates their retinas rendering the animals like deers instantly blind for a while causing their abrupt movement.
- Creation of check dam or creation of water bodies on both sides of road in forest area.
- Existing slab culverts not catering to the perennial flow of water could also serve as animal crossings/pass.

Table 29: Location for Sign Boards

Sl. No.	List of Villages	Ch. (in km)	Nos.	Remarks
1	Gua Ghoghra	41.1	2	1 warning cum informatory sign board to be installed at 100 m before and after each village illustrating speed limit, wild life details, no use of dippers, horns etc.
2	Mahodor	42.7	2	
3	Pratappur	49.4	2	
4	Ropawel	51.2	2	
5	Maholia Tad	53.6	2	
6	Chanarwar	54.1	2	
7	Kurwatad	66.4	2	
8	Laldaia	66.5	2	
9	Baba Jhakhraj	68.8	2	

4. Natural Hazards

134. Project roads in general are not liable to flooding. However, overtopping was reported at isolated bridge locations due to inadequate waterways during historical flood of 1999 and 2000 as detailed in project description chapter. Absence of side drains are also causing water logging in some built-up stretches during monsoon. Out of six project districts Bhojpur, Jamui, Banka and Nawada falls partly in Zone III (moderate risk zone) & IV (High Risk Zone), Bhagalpur in Zone IV and Madhepura falls in Zone IV & V (very high risk zone). All CD structures have been designed for 50yr return period with anticipated risk of rarer flood of next higher frequency. Waterway and

elevation of most of the bridges are increased. Free board of 0.6m to 1m from deck level has been considered for all bridges. Embankment height of embankment in general not required as flood protection measure. Lined side drains have been included in the design to avoid water-logging in built-up sections. Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone III to V.

D. Construction phase

1. Topography and Geology

135. Since project scope is limited to expansion of existing roads with only a short bypass in SH-84, there is no substantial cut-and-fill operations required. The surplus soil from cut operations, which is unsuitable for selected sub grade, will be used to reinstate the borrow areas. Topography along the road will change a little on account of cutting, filling, and construction of project related structures. The overall impact on the physiography of the area will be limited along the RoW and therefore the impacts are categorized as low. Likely impact on the geological resources will occur from the extraction of materials (borrow of earth, granular sub base and aggregates for base courses and bridges). Boulders will be procured from the authorized suppliers and prevalent rules will be followed for borrowing of soil, sand and aggregates.

136. Mitigation Measures

- Sources/sites of construction material sites have been identified within the immediate vicinity of the road. No new quarry has been proposed for the project. Only licensed quarries will be used as sources of coarse and fine aggregates.
- The CSC will ensure that the quarries have environmental clearance from DEIAA, all appropriate licenses and being operated as per conditions of mine lease and pollutional control board norms.
- Cut slopes should be re-vegetated immediately after widening activities
- Borrow areas should be rehabilitated and brought back as far as possible to their previous appearance. Some borrow areas will be converted into ponds to compensate loss of water bodies. This will also enhance the local aesthetics
- Cut off material should be used to widen the road or disposed of at proper sites

2. Air Quality

137. The specific locations affected by the air pollutant during construction are working areas, construction plant sites, quarries, and construction machinery and construction vehicles. Activities which generate air pollutants are: (i) dust generation from the construction zone during different stages of the construction such as clearing and grubbing, materials dumping, drying of materials, brushing of the surface; (ii) dust generation from the access roads to the soil borrow areas, aggregate quarries construction plants and construction camp sites; (iv) operation of the construction plants such as hot mix plants, Crushers, WMM plants and concrete batching plants; and (iv) material storage, transportation and handling (loading/unloading) of different construction materials such as sand, earth from borrow pits and aggregates. Some of the pollution control measures have been incorporated in the design stage by relieving congestion in built-up stretches at critical sections, improving road geometry, widening of road to smooth the traffic flow. The specific measures to control air pollution during construction are:

138. Mitigation Measures

- Vehicles delivering loose and fine materials are covered.

- Loading and unloading of construction materials in covered area or provisions of water fogging around these locations.
- Storage areas are located downwind of the habitation area.
- Water will be sprayed on earthworks periodically
- Regular maintenance of machinery and equipment. Vehicular pollution check will be made mandatory.
- Hot mix plants to be located at least 1.5 km from the nearest habitation, school, hospital, forest, rivers, 500 m from ponds, and national highway, 250 m from state highway, unless otherwise required by statutory requirements after securing a No-Objection Certificate (NOC) from the SPCB. Hot mix plant will be fitted with stack of adequate height as prescribed by SPCB to ensure dispersion of exit gases.
- Bitumen emulsion and bitumen heaters should be used to extent feasible.
- Only crushers licensed by PCB will be used.
- LPG should be used as fuel source in construction camps instead of wood.
- Regular water sprinkling of unpaved haulage roads.
- Mask and other PPE will be provided to the construction workers
- DG sets will be fitted with adequate height as per CPCB/MoEF guidelines.
- Contractor should submit a dust suppression and control programme to the RCD prior to construction.
- Additional plantation proposed on 1: 7 basis will improve the micro-climate

3. Noise

139. Increases in noise due to construction activities (land clearing, site preparation, material/equipments/machinery movement, establishment of camps/site offices) are expected. The impacts of noise exposure on the community residing near the work zones will be significant and intensity of the exposure to different receptors will also vary widely. These impacts are temporary in nature as the construction site moves along different road stretches. For these operations the noise levels will increase during the construction period. The machinery involved in the construction operation are; dozer, roller, grader, paver, tractors, brooms/ rotary brushing, tippers, generators, excavators etc. produce noise levels in the range of 80 – 95 dB(A) (at a distance of about 5 m from the source). Although this level of noise is higher than permissible limit, it will occur intermittently and temporary. This noise level will attenuate fast with increase in distance from noise source. There is a number of noise sensitive receptors especially schools close to the alignment. Adequate mitigations have been proposed for the remaining structures near the road.

140. Mitigation Measures

- All equipment will be timely serviced and properly maintained to minimize its operational noise. Noise level will be one of the considerations in equipment selection which will favour lower sound power levels. Construction equipment and machinery will be fitted with silencers and maintained properly.
- Stationary noise making equipment will be placed along un-inhabited stretches.
- Timing of noisy construction activities will be regulated near residential areas and sensitive receptors. Maximum construction activities will be undertaken during night time and weekends when sensitive receptors such as schools are not functioning. Alternatively, construction work will be executed during day time near residential areas. The health centres along the project roads are of primary level with first aid outdoor treatment facility and hence is anticipated not to require any permanent noise barrier.

- Noisy operations will be separated to reduce the total noise generated, and where feasible traffic will be re-routed during construction to avoid the accumulation of noise beyond standards.
- If the above mentioned schemes prove to be inadequate, the provision of temporary noise barrier will be made near identified sensitive locations or near the noise source during construction.
- Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines.
- Noise monitoring will be carried out to ensure the effectiveness of mitigation
- Complaints on noise from local community will be received and addressed through the grievance redress mechanism system discussed in chapter VI.

4. Impact on Land and Soil

141. Loss of Productive Soil and Change in Land use: Acquisition of agricultural land is bare minimum. Top soil from borrow areas are not used for embankment formation as it is specific condition by SEIAA/DEIAA while granting environmental clearance for borrow areas. Loss of topsoil is envisaged during construction stage, if construction plant, offices, workers camps, stockyards, and borrow areas are located on fertile areas and if haul roads and traffic detours during construction are routed through agricultural land. Change in land use is insignificant since widening and improvement is mostly within available right of way. Hence no specific mitigation proposed.

142. Mitigation Measures

- The topsoil will be stripped to a maximum of 1.5m depth and stored in stockpiles. At least 10% of the temporarily acquired area will be earmarked for storing topsoil.
- The stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile will be restricted to 2m.
- Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum and stock pile will be covered with gunny bags or tarpaulin.
- It will be ensured that the topsoil will not be trafficked either before stripping or when in stockpiles.
- To prevent any compaction of soil in the adjoining productive lands, the movement of construction vehicles, machinery and equipment will be restricted to project corridor as far as possible.
- The stored topsoil will be utilized for; covering all disturbed areas including for the redevelopment of borrow areas after filling and dressing of the slopes of road embankment.

143. Soil Erosion/Silt Runoff: Slopes of the project roads are relatively stable as the embankments of the roads are not high compared to the adjacent lands. Soil erosion may take place near cutting areas, at steep and un-compacted embankment slope, bridge locations and wherever vegetation is cleared. Soil erosion may have cumulative effect like siltation, embankment damage, drainage problem etc. Loss of soil due to run off from earth stock-piles may also lead to siltation.

144. Mitigation Measures

- Bank protection measures will be taken at erosion prone areas.
- Provision of side drain to guide the water to natural outfalls.
- Retaining walls and breast walls have been included in the design to check erosion.

- Covering the slope surface with grass and bushes, by simple planting of grass roots and saplings;
- In conditions where simple planting and seeding is not effective, the slopes are covered with open mesh of natural fibres such as coir or jute, or of geo-synthetics, followed by planting of grass and bushes. This is often termed slope reinforcement method of vegetation; and,
- Where slopes are of highly erodible materials or other adverse conditions prevail, the vulnerable slope surface is covered with protective surfacing. Stone or brick pitching are most commonly used in India for this purpose.
- Side slopes of the embankment will not be steeper than 2H: 1V. Turfing of embankment slopes will be done along the stretch.
- IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control will be taken into consideration.

145. **Borrow Areas and Quarries:** Extraction of the soil from borrow area and boulders/ aggregates/ granular sub base from the river beds can result in some direct and indirect impacts on the local and regional environment. Impacts may be positive or negative and vary from case to case. Borrow areas may cause some adverse impacts if left un-rehabilitated. It may pose risk to people, particularly children and animals of accidentally falling into it as well as become potential breeding ground for mosquitoes and vector born disease. Illegal quarrying may lead to unstable soil condition; destroy the landscape of the terrain, air and noise pollution.

146. **Mitigation Measures**

- Borrow areas will not be located near habitation and forest areas. The edges of borrow sites will be no closer than 3 metres from any fence line or boundary.
- Adequate clearance will be provided for the construction of catch drains. Borrow sites will have adequate drainage outlets unless the relevant landowner has agreed that the borrow area is to create a permanent tank or dam. Written clearance from the land owner/village head will be obtained before leaving a site
- Obtain environmental clearance from SEIAA/DEIAA for opening of any new borrow area and renewal of quarries.
- Borrow pits will be selected from barren land/wasteland to the extent possible. The top soil will be preserved and depth will be restricted to 1.5 m to comply IRC guidelines.
- Borrow areas should be excavated as per the intended end use by the owner. The Indian Road Congress (IRC):10-1961 guideline should be used for selection of borrow pits and amount that can be borrowed.
- The depths in borrow pits to be regulated as per IRC guidelines. Borrow areas will be levelled with salvaged material or other filling materials which do not pose contamination of soil.
- Transportation of fine aggregates and earth material by covered trucks.
- Sprinkling of water near loading/downloading and stockpile locations.
- The contractor will evolve site-specific redevelopment plans for each borrow area, which will be implemented after the approval of the CSC.
- Opening of new quarries only after environmental clearance from SEIAA/DEIAA, NOC from SPCB and permission from state mines department.

147. **Compaction and Contamination of Soil:** Soil of the haulage roads and construction camp area may be compacted due to movement of construction vehicles, machineries and equipment, and due to siting of construction camps and workshops. Soil may get contaminated due to inappropriate disposal of liquid waste, (lubricating oil and fuel spills, waste oil and lubricant

and vehicle/equipment washing effluent) and solid waste (fuel filters, oily rags) likely to be generated from repair and maintenance of transport vehicles, construction equipment and machinery. Soil may also get contaminated due to inappropriate disposal of domestic solid waste and sewage from construction camps. Sub-soil contamination may also be attributed to: scarified bitumen wastes, operation of the emulsion sprayer and laying of hot mix, storage and stock yards of bitumen and emulsion, excess production of hot mix and rejected materials.

148. Mitigation Measures

- Fuel and lubricants will be stored at the predefined storage location. The storage area will be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils.
- Unavoidable waste will be stored at the designated place prior to disposal. To avoid soil contamination at the wash-down and re-fuelling areas, "oil interceptors" will be provided. Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers and sold off to SPCB/ MoEF authorized re-refiners.
- Movement of construction vehicles, machinery and equipment will be restricted to the designated haulage route.
- Approach roads will be designed along the barren and hard soil area to reduce the compaction induced impact on soil.
- The productive land will be reclaimed after construction activity.
- Septic tank/mobile toilets fitted with anaerobic treatment will be provided at camp.
- Domestic waste at construction camp will be segregated into biodegradable and non-biodegradable waste. Non-biodegradable waste will be given or sold to relevant agents for recycling or buried in nearby waste land following environmentally friendly practices.

5. Impact on Groundwater and Loss of Water Sources

149. There are numerous water bodies along the sub-project roads. Most of them are seasonal and few hold water year long. Encroachment or filling of any pond is not envisaged. Large number of hand pumps and few wells are likely to be affected due to the proposed widening. This may hamper water need of community along road. Suitable arrangement for drinking in the campsite will be managed by contractor without affecting availability to local community. Due to favorable geologic formations, Bihar is endowed with abundant groundwater resources. Impact due to groundwater abstraction for construction purpose is insignificant since none of the project area is notified for regulation of groundwater and falls under safe category as per Central Ground Water Authority.

150. Mitigation Measures

- All efforts have been taken in while finalising the alignment to minimise the impact on ponds/other water sources.
- Some of the borrow area are proposed to be converted in ponds. These measures will significantly augment the ground water/surface water availability in the area.
- All hand pumps and wells are proposed for relocation at suitable locations in consultation with local community.
- In view of the recent order by Green Tribunal, It is pre-condition to recharge groundwater while granting permission for abstraction of groundwater by CGWA for any infrastructure project. This can be through roof top rain water harvesting and/or collecting surface runoff and allowing it to aquifers through pipes.

Additionally, creating a pond/water body within site is also a good option subject to availability of space.

- The contractor will make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected.
- No change in groundwater regime is envisaged hence no mitigation is proposed.

6. Siltation and Deterioration in Surface Water Quality

151. Construction activities may increase turbidity level increasing the sediment load. Sometimes contamination of surface water may take place due to accidental spills of construction materials, oil, grease, fuel, and paint. Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of workers camps and from spillages from vehicle parking and/or fuel and lubricant storage areas. During construction phase, care would be exercised to control silt so that the water available in the ponds and wells especially those located very near to the ROW may not be contaminated.

152. Extraction of sand from the river bed will increase turbidity and affect propagation of fishes and other aquatic life mainly benthic organisms. The macro-benthic life which remains attached to the river bed material may get dislodged and carried away downstream by turbulent flow. Mining and dredging activities, poorly planned stockpiling and uncontrolled dumping of overburden, and chemical/fuel spills from equipments and machinery involved in dredging may cause deterioration of water quality for downstream users, and poisoning of aquatic life. However, the river bed sand quarries identified for the project have no density and diversity of benthic fauna. No fishing was observed or reported. This is mainly because all river beds are dry for most part of the year. Moreover, any extraction of river bed material is regulated by different authorities like State Environmental Impact Assessment Authority, State Pollution Control Board and State Mining Department with an objective of to conserve top soil, avoid impact on aquatic biodiversity, hydrological regime etc. by haphazard and unscientific mining of minor minerals. The project will utilize river bed materials from existing licensed quarries with all stipulated conditions of above mentioned authorities.

153. Mitigation Measures

- Construction works near waterways/water bodies will not be undertaken during the monsoon season
- Retaining walls and breast walls have been proposed to prevent erosion
- Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- No construction camp within 500m of any water body
- Locate all parking, repair and fuel and hazardous material storage area away from any water body. Vehicle parking and maintenance areas will have waterproof floors from which drainage is collected and treated to legal standards.
- Refuel vehicles only in dedicated areas with waterproof floors from which drainage flows to an oil/water separator before discharge
- Collect all waste oil, store in sealed damage-proof containers and dispose it to recyclers.
- All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual cleanup.
- temporary retention ponds, interception drains, and silt traps are installed to prevent silt laden water from entering adjacent water bodies/waterways;

- The slopes of embankments leading to water bodies should be modified and rechannelised to prevent entry of contaminants.
- Comply with requirements of the clearance issued by the relevant state authority for mining in rivers

7. Hydrology and Drainage

154. Large number of river/streams/nallahs drains the project area. Although most of them are seasonal in nature water logging/flood situation may arise due to construction of road embankment which may act as impediment to flow of water to its outfall in absence of adequate cross drainage/side drain. Water logging along the road will also have ill effects on the stability of embankment especially in the area of shallow water table. Diversion of water channels during construction of cross drainage structures or otherwise is not envisaged. Substructure construction should be limited to the dry season and cofferdams may be constructed and utilized to lift the spoil directly out of it and carried to the river bank for land disposal.

155. Mitigation Measures

- Adequate cross drainage structures have been provided to avoid impediment to natural flow of water. Additional balancing culverts have been provided. The embankment height has been designed in consistent with the existing topography of the region.
- Effective drainage system will be provided to drain the storm water from the roadway and embankment and to ensure minimum disturbance to natural drainage of surface and subsurface water of the area.
- The design of drainage system such as surface and sub-surface drainage will be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes and the service roads will be discharged through longitudinal drains, designed for adequate cross section, bed slopes, invert levels and the outfalls. If necessary, the walls of the drains will be designed to retain the adjoining earth.
- The design discharge will be evaluated for flood of 50-year return period for calculation of waterway and design of foundations. Proposed water way will not be reduced from existing one.

8. Impact due to Construction Debris/Waste

156. Debris can be generated by dismantling of pavement, though involved for few kilometres. Quarry dust and unused iron bars or damaged support structures constitute significant wastes. Mitigation for solid waste from construction camp has been given in construction camp section.

157. Mitigation Measures

- The existing bitumen surface can be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, haulage routes etc.
- All excavated materials from roadway, shoulders, verges, drains, cross drainage and the like will be the property of the EA and will be used for backfilling embankments, filling pits, and landscaping.
- Unusable debris material should be suitably disposed at pre-designated disposal locations to the satisfaction of CSC. The bituminous wastes will be disposed in secure landfill sites only in environmentally accepted manner.

- Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.
- Following consideration will be made during selection of dumping sites.
- 1.5 km from habitation and forest areas and 500 m from ponds.
- Dumping sites do not contaminate any water sources, rivers etc, and
- Consent from the village council has to be obtained before finalizing the location.
- Form works will be re-used to the extent possible. All stripped formworks will be examined for any damage and rectified in the workshop for re-use.

9. Ecological Resources

158. **Terrestrial:** There are no national parks, wildlife sanctuaries or any other similar eco-sensitive areas in the project area. Project road, passes through some forest patches. The cutting of 11378 trees will impact the local environment but will be compensated through planting of large number of trees along the road that will improve the local climate in long term. No loss of any rare/endangered species is envisaged. Risk of forest fire cannot be ruled out due to uncontrolled burning of grasses/shrubs for clearance of ROW, fuel accumulation due to accidental spillage.

159. Mitigation Measures

- Requisite permission from Forest Department will be secured for cutting of roadside trees.
- Mandatory compensatory plantation will be done by forest department after depositing requisite money by BSRDCL to the Compensatory Afforestation Fund Management Authority (CAMPA).
- Additional compensatory afforestation on 1:7 basis will be carried out the mode of implementation already discussed above in the chapter
- For safe traffic operation, vertical clearance between the crown of the carriageway and lowest part of overhang of the tree available across the roadway will conform to IRC: SP: 21-2009. The pit size, fencing, watering, and manuring requirements will also conform to the above standard. Use of pesticides will be restricted.
- Immediate removal of fuel accumulations near forest areas;
- Clearance of vegetation will not be done by burning along forested/vegetated areas.
- Planting and management of fire-resistant species adjacent to and within ROW.
- Provision of fire lines to avoid further spread over of fire.

160. **Establishment of invasive species:** Soil brought into the project area from outside may contain seeds of alien invasive species. Also, the construction machinery and vehicles can accidentally introduce seeds of such plants if used without proper cleaning. Temporary facilities such as labour camps, dumping sites, soil storage sites are potential locations where invasive plant species can get established in quick succession. This will negatively affect both the natural and manmade habitats. Securing soil from locations close to the project area will reduce the chances of transporting any seeds of alien invasive species to the project area. Land area of labour camps, dumping sites and soil storage sites should be frequently checked for any growth of invasive plant species. If found they should be burned and destroyed within the premises which they were found.

161. **Aquatic Ecology:** Temporary sedimentation and water quality deterioration is expected during the construction stage. Increase in turbidity due to erosion will lead to reduction of light penetration and make it an undesirable place for aquatic fauna and flora. Further due to the reduced light penetration to the water body, the primary productivity of the biota in the water body

will be reduced resulting in increased mortality. In addition, when these particles settle on the bottom it will affect the breeding ground of aquatic animals. Improvement of existing embankments particularly along the waterways may increase silt while accidental spill of materials, chemicals, and fuels will deteriorate receiving water quality. The impact is insignificant since most of the waterways are non-perennial and construction of bridges will be mostly during summer. Siltation will be avoided by measures suggested above in impact on surface water resource section.

10. Impacts due to Construction Camp and Immigration of Workers

162. Poor sitting and improper management of construction camp may lead to several adverse impacts on environment like: (i) loss of vegetation due to use of wood as fuel source for cooking, (ii) deterioration in nearby surface water bodies' quality, (iii) compaction and contamination of soil due to uncontrolled disposal of solid waste, and (iv) poor sanitation may result to transmission of communicable diseases among the workers and the host communities. This include the possible spread of sexually transmitted disease, diseases from improper handling and supply of foodstuffs, poor water supply, insect-borne diseases, and alcoholic and drug.

163. Mitigation Measures

- No productive land will be utilised for camp. All sites must be graded and rendered free from depressions to avoid water stagnation. Accommodation and ancillary facilities will be erected and maintained to standards and scales approved by the resident engineer. All camps will be sited at 500 m from habitation and water bodies.
- All construction camps will be provided sanitary toilet with provision of septic tanks attached with soak pits. Storm water drains will be provided for the flow of used water outside the camp. Drains and ditches will be treated with bleaching powder on a regular basis. Garbage bins must be provided in the camp and regularly emptied and disposed in a hygienic manner. LPG cylinders will be provided as fuel source for cooking to avoid any tree cutting.
- At every workplace, the Contractor will ensure that a readily available first-aid unit. Workplaces away from regular hospitals will have indoor health units. Suitable transport will be provided to approach the nearest hospital. At every workplace an ambulance containing the prescribed equipment and nursing staff will be provided.
- The Contractor will ensure the good health and hygiene of all workers to prevent sickness and epidemics. These include the HIV/AIDS prevention program to reduce the risk and transfer of HIV virus. Activities under the program include monthly information, education, and communication campaigns to workers, drivers, delivery crew, and communities on the risk.
- The Contractor will provide adequate and safe water supply for workers. No alcoholic liquor or prohibited drugs will be imported to, sell, give, and barter to the workers of host community.
- Migrant workers may be the potential carriers of various diseases. Regular health check-up and immunization camps will also be organized for the workers and nearby population.

11. Safety of Construction Workers and Accident Risk to Local Community

164. The following safety aspects will be observed: (i) safety of construction workers, (ii) safety of road users including pedestrians, (iii) safety to cattle, (iv) safety of local community, (iv) unsafe/hazardous traffic conditions due to construction vehicle movement need to be considered during

design and construction stage, and (v) conduct of safety audit. Impact and mitigations due to blasting operation as already been detailed in Noise and Vibration section.

165. Mitigation Measures

- During the construction phase, contractors will be required to adopt and maintain safe working practices. Internationally accepted and widely used safety procedures should be followed during: (i) road works (ii) handling of large construction equipment and machineries, (iii) handling of chemicals and hazardous materials and inflammable substances, (iii) welding, and (iv) electrical works etc.
- Contractor will arrange all PPEs for workers, first aid and fire fighting equipment at construction sites. An emergency plan will be prepared duly approved by engineer in charge to respond to any instance of safety hazard.
- To avoid disruption of the existing traffic due to construction activities, comprehensive traffic management plan will be drawn up by the concessionaire. Traffic in construction zones will be managed as per the provisions of IRC SP 55.
- After construction is completed in a particular zone, it will be opened for normal operation. All diversions should be closed before start of normal operation.
- Use of retro-reflectorized traffic signs, and cantilever/gantry type's overhead signs, thermoplastic road marking paints, delineators, traffic cones, empty bitumen drums, barricades, and flagmen will be used to ensure traffic management and safety. Conduct of regular safety audit on safety measures adopted during construction.

12. Obstruction and Disruption of Traffic

166. Disruption of access to infrastructure or social resource due to construction activity will cause nuisance and to a certain extent additional cost to the public in terms of longer travel period due to diversion or heavier traffic. It will also pose risk of accident to motorist at night if these blockages and disruption are not clearly demarcated.

167. Mitigation Measures

- The contractor will submit a traffic plan to the Project Engineer before the construction. This Plan will recommend for approval, the safe and convenient temporary diversion of traffic during construction, design of barricades, delineators, signs, markings, lights, and flagmen, among others.
- For widening of existing carriageway and part of it will be used for passage of traffic, paved shoulder will be provided on one side of the existing road by the contractor
- At least one 3.5 m lane to remain to traffic at all times
- The surface used by the through traffic will be firm bituminous compacted surface free of defect
- The maximum continuous length over which construction under traffic may take place is limited to 750 meters.
- Construction activity will be restricted to only one side of the existing road.
- On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed.

168. Transportation of quarry material to the construction sites through heavy vehicles will be done through existing major roads to the extent possible. This will restrict wear and tear to the

village/minor roads. Small vehicles/un-motorised vehicle can also be used for its further transportation to the construction sites from temporary storage areas.

13. Transports and Storage of Materials

169. The construction material primarily will consist of aggregate, sand, cement, bitumen, and lubricating oil and fuel for vehicle and construction equipment. These will be primarily stored temporarily at construction camps. The oils, fuels and chemicals will be stored on concreted platform with spills collection pits. The cement will be stored under cover. All these temporary storage areas will be located at least 150 M away from the habitat. The likely impacts due to transportation and storage including fugitive emission have already been covered under different sections above.

14. Chance find of Cultural or Archaeological significance

170. During construction activities sites, structures or artifacts of archaeological, cultural or religious importance may be found. In such instances all construction work must immediately be stopped in the respective construction area and the contractor and CSC environmental specialist must immediately inform the PIU. The PIU will then coordinate with the concerned local agency on procedures for recovering the artifacts or restoring and maintaining the site.

E. Operational Phase

171. Road aesthetics will be improved after tree plantation, landscaping of embankment slopes, improving the road cross sections providing more bus bays, side drains installation of safety signages, crash barriers, and road markings. The aesthetics will further be improved due to the enhancements/creation of new ponds as a rehabilitation measures for borrow areas. However, due to lack of proper maintenance may deteriorate the road condition over the years resulting into numerous problems such as rise in accidents, disruption of transportation services, tree survival, and functioning of side drains. BSRDCL will allocate adequate resources to ensure that the road and its furnitures is being maintained and intended benefits are generated thereof.

1. Soil Erosion and its Cumulative Impacts:

172. The consequences of soil erosions are far wider than repair and maintenance of the road. Along the project road, the inflow of water into ponds during rains causes erosion of the embankment besides seepage of water into embankment and sub-grade resulting in softening of the sub grade. This may also increase siltation in water bodies. Project design includes provisions of retaining walls for the protection. Regular checks will be made to check its effectiveness.

2. Impacts on water resources

173. Improvements to the road drainage will result in improved storm water flows, and reduce the tendency of blockages to occur in roadside drains. Risks to the public health caused by such stagnant water bodies by acting as disease vector breeding places will be reduced. By designing the drains to withstand appropriate storm events and regular maintenance will further reduce the chances of drainage system failure. Accidental oil spillage, washing of vehicles, used engine oils, paints used in maintenance can contaminate the water bodies. Proper handling of such chemicals under strict supervision will help to minimize the water pollution during the maintenance period. Rejuvenation of the drainage system by removing encroachments/ congestions will be regularly conducted

3. Pedestrian and commuter safety

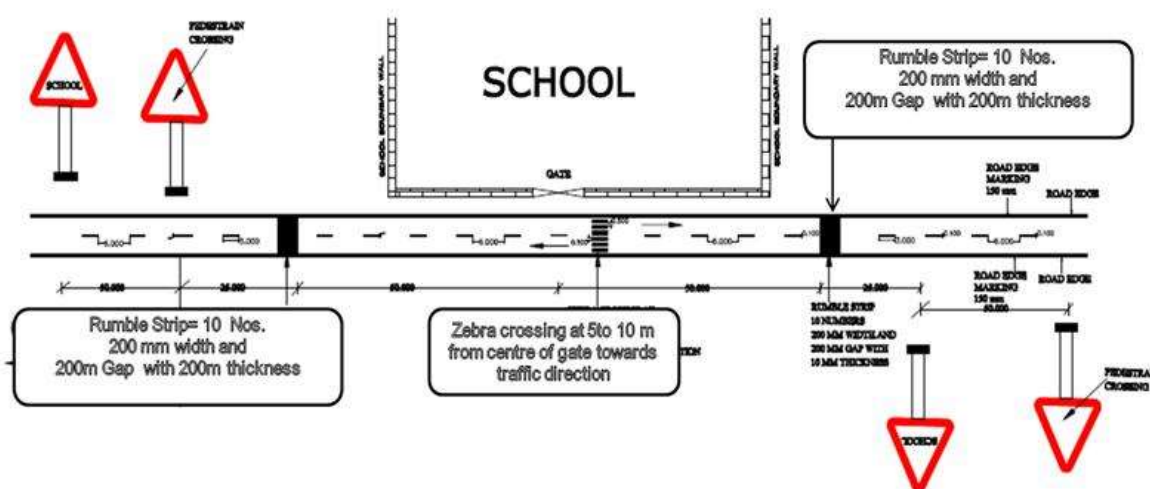
174. Improvements to the road surface will be conducive to safe vehicle travel at higher speeds. Such speeds may increase the incidences of accidents. Incorporating the following measures could offset this negative impact;

- Mandatory provision of centreline road marking, edge delineation in design
- Provision of sign boards near builtup areas, sensitive locations such as potential wildlife crossings one like in SH-82, schools, temples etc.
- Enforcement of speed limits by reminding driver through sign boards and installing rumble strips, especially near potential wildlife crossings and built-up sections.
- Safety of road users could be ensured during repair of carriageway and CD structures by placing sign boards and barricading of the repairing sites

4. Specific Measures for Safety at Schools

175. With intent to provide easier accessibility to education and health services, most of the schools and primary health centres were constructed close to roads. In absence of any safety measures, incidences of futile accidents at these locations are increasing. Govt of Bihar in its special drive for road safety have launced various programs. Most importantly is the decision to install road safety measures at all schools and other institutions in phased manner. Govt is making budgetary provisions for the same. Typical (**Figure 5**) design for safety measures comprising, rumble strip, signage, zebra crossings etc have been worked out and under approval process.

Figure 5: Typical Design for Safety Installations at Schools



5. Air Quality Predictions during Operation Phase

176. Air emissions due to vehicular movement are one of the prime sources of air pollution in the study area. The project roads are currently having 1 or 1.5-lanes. The widening and upgradation of the road will result into ease of traffic movement and reduction of traffic congestion. In order to assess the impact of current traffic volume on the surrounding areas as well as for prediction of impact on air quality due to future projected growth of traffic volume with road improvement this air quality dispersion modelling study has been performed.

177. Quantitative assessment for predicted level of pollutants concentration has been done using AERMOD, a recommended model by USEPA for prediction of air quality from point, area and line sources. It is based on Gaussian dispersion which incorporates the MoninObukhov boundary layer dispersion parameters for estimating horizontal cross wind and vertical dispersion. In ISC-AERMOD View software, the line sources are characterized as volume sources. After drawing the road alignment and putting the information related to carriageway width, vertical dimension, source elevation, base elevation and release height, the model converts the road alignment to the number of volume sources. The model, then simulates the effect of emissions from continuous/variable volume sources on neighbourhood air quality and identified discrete receptors. The model is an hour-by-hour steady state Gaussian model which takes into account special features like Terrain adjustments, Gradual plume rise, Buoyancy-induced dispersion, Complex terrain treatment, etc. The total road alignment has been taken into consideration for the prediction of vehicular exhaust emission. Major criteria pollutants generated due to vehicular exhaust are oxides of nitrogen (NO_x), carbon monoxide (CO), fine particulate PM_{2.5} and sulphur dioxide (SO₂). Hence these four pollutants are taken into consideration in this study¹. Various input parameters for the prediction of pollutant concentrations have been considered as given below:

178. **Traffic Density.** A detailed study of the traffic density along the project roads was conducted as part of the detailed project designing. The project consist 5 state-highways (SH-58, SH-82, SH-84, SH-85 and SH-102) with total length of about 231.75 km. Furthermore, each sub-project road is having 2 homogenous sections excluding SH-102, which is having 3 homogenous sections. In order to consider worst case, maximum traffic of homogenous sections of the project roads were considered. Summary of traffic projection in terms of vehicles per day and PCUs at each sub-project and each section taking into consideration the optimistic scenario has been presented in project description chapter. The projected traffic density clearly indicates that the project roads will not be having sufficient capacity within 24 years of operations due to the road widening and upgradation, which is primarily due to large percentage of non-motorised vehicles movement in the project roads. Based on the assessment of current traffic speed and projected traffic speed due to road improvement, it is assumed that weighted average for cars in the base case will be 30 km/hr, whereas in post-project case it will be 60 km/hr throughout the project design life of 20 years.

179. **Emission Rate.** To assess the contribution of the vehicles emission, which will ply on the project road sections, the emission factors for NO_x and CO were generated by using MOBILE 6 Vehicle Emission Modelling Software, which takes into consideration the road type, surface, average speed as well as improvement in fuel efficiency over a period of time into consideration for generation of emission factors. The tailpipe emissions of PM_{2.5} were taken from the study carried out by the Automotive Research Association of India (ARAI) for different vehicle types. No dust emission due to resuspension of road dust during vehicle movement and wind have been considered in this modelling study. SO₂ emissions rate has been calculated based on the sulphur content of fuel (250 ppm) and fuel economy (mileage) of the passenger cars. The emission factors are based on speed. It is to be noted that the after road widening and strengthening, the ruling design speed is considered to be 80 km/hr. However, considering that the road is passes through various small towns and villages and also to be used by non-motorised/ slow moving traffic, as a conservative approach average speed is considered to be about 65 km/hr. The emission factors used for criteria pollutants are presented below in **Table 30**.

¹This modeling study does not take into consideration particulate matter generation because of resuspension of road dust, which may occur due to movement of vehicles on the road as well as wind conditions.

Table 30: Emission Factors for Criteria Pollutants

Pollutant	Year 2024		Year 2032		Year 2041	
	Avg. Speed (miles/hr)	Emission Rate (g/mile)	Avg. Speed (miles/hr)	Emission Rate (g/mile)	Avg. Speed (miles/hr)	Emission Rate (g/mile)
NO _x	40	0.45	40	0.35	40	0.3
CO	40	10.69	40	10.43	40	10.43
PM _{2.5}	40	0.18	40	0.18	40	0.18
SO ₂	40	0.22	40	0.22	40	0.22

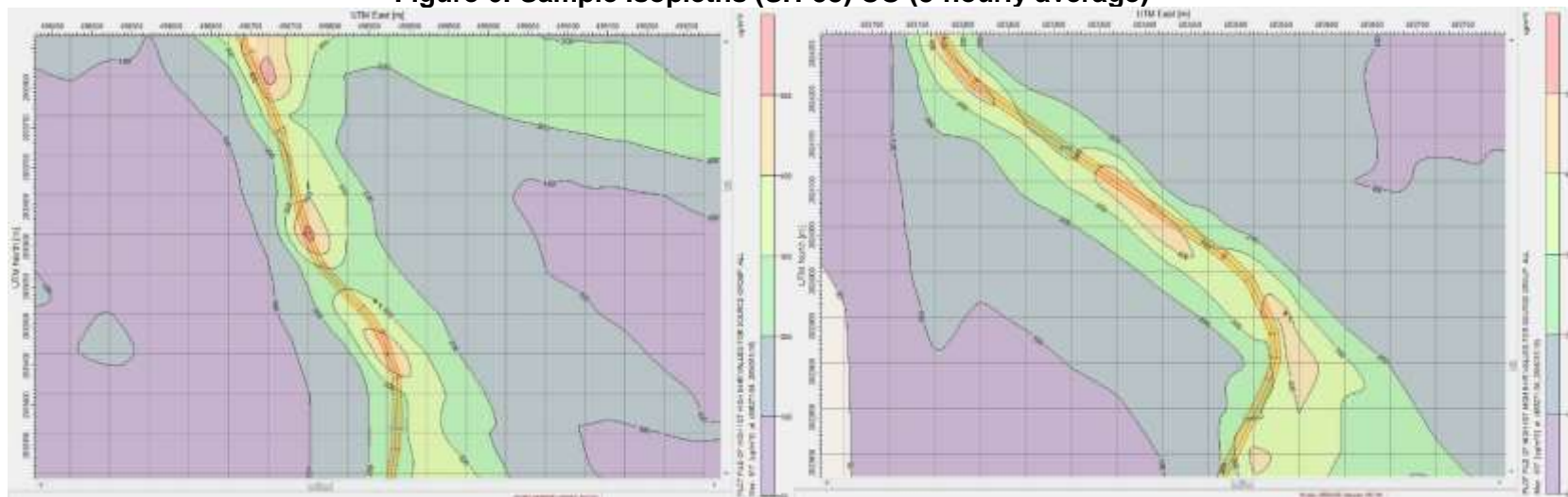
180. **Receptors.** The complete alignment of the 5 project roads has been drawn with respect to UTM coordinates. The area around these road sections were divided into 50 m x 50 m grids. A total of 15 ambient air quality sensitive locations (i.e. receptors) were considered along the project roads, within 25 m from the centre line of the road, which represent to different landuse conditions.

181. **Predicted Ground Level Concentrations:** The prediction of maximum ground level concentration on each road section has been carried out. The prediction for CO was conducted for 8-hourly concentrations, whereas for NO_x, PM_{2.5} and SO₂ were conducted for 24 hourly concentrations. Predicted concentrations of each homogenous road section for Year 2018 (base case) and for Year 2024, 2032 and 2041 (post-project case) are presented for all five sections. In addition to those ground level concentrations around the road for 8-hourly average CO concentration of SH-58 is illustrated in Fig 8 as a sample presentation of isopleths. The predicted concentrations at identified receptors are presented in **Table 31 and Table 32**.

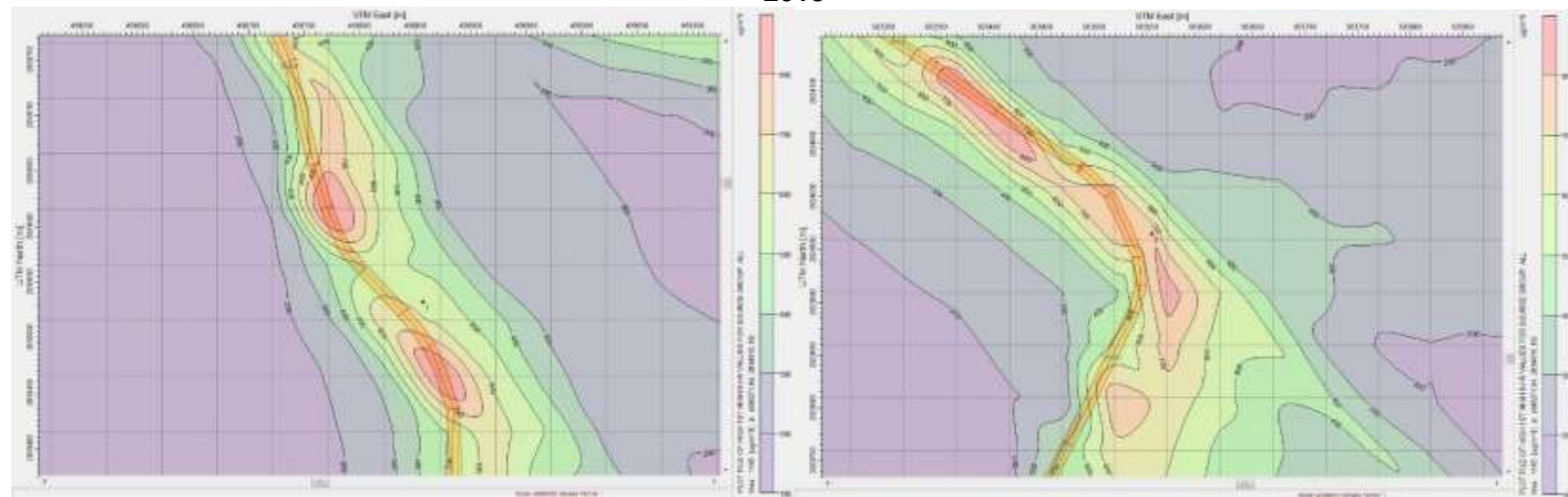
182. **Prediction results:** Analysis of modelling results ascertains that the predicted level of concentrations due to emissions from vehicle exhaust for all the four parameters along all the five project roads will be well within the permissible limit for entire project horizon for SO₂, however, CO and NO_x ground level concentrations at some locations along SH-82, SH-84, SH-85 and SH-102 during the later phases of the project is predicted to exceed the prescribed standards. The prediction results indicate that even PM_{2.5} ground level concentrations will be higher than the applicable standard in the Year 2041 at receptors around SH-84 and SH-85. This clearly indicates that the higher traffic volume in the project roads during the later phase of project life will require further upgradation of the roads to ensure better traffic movement and fuel efficiency.

183. **Conclusions:** In the existing scenario, due to lesser width and higher roughness, the average vehicle speed is low, which results in more exhaust gas emissions. In the post-project scenario, improved road conditions and congestion free traffic movement will reduce emissions. Furthermore, higher growth of traffic and better road conditions with improved average speed, will have significant increase in concentration of the criteria pollutants. This will result into exceedances during the later phase of the project life and would require further upgradation of the roads. Similar conclusion was also drawn by the DPR consultant based on the road design, projected traffic volume and carrying capacity of the upgraded roads.

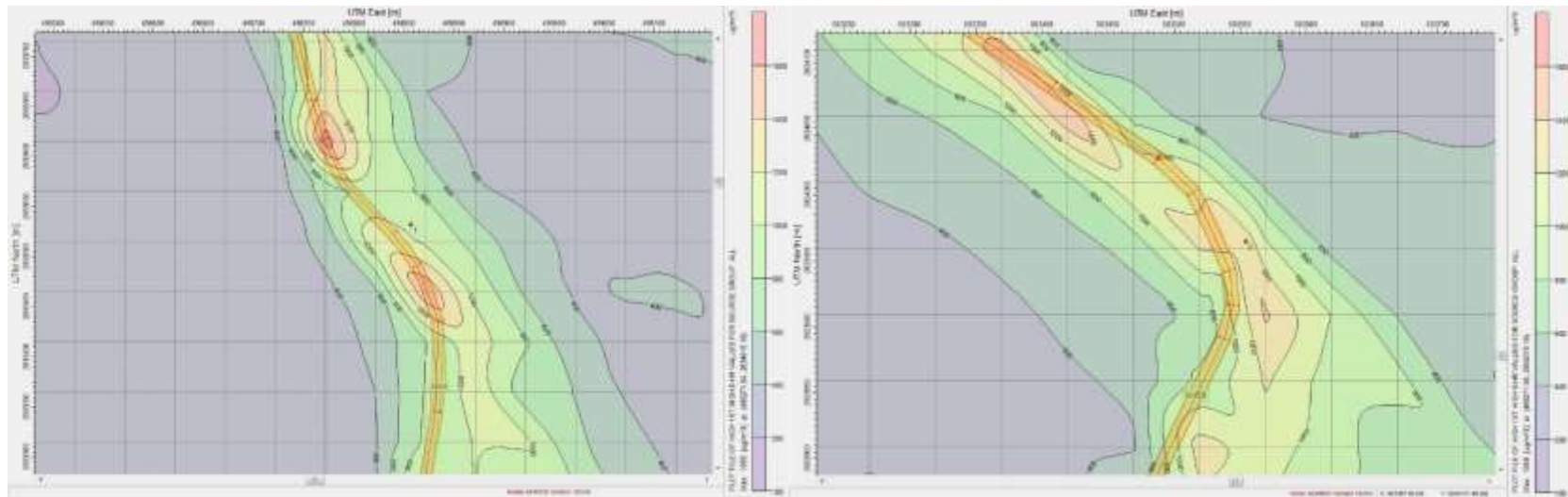
Figure 6: Sample Isopleths (SH-58) CO (8-hourly average)



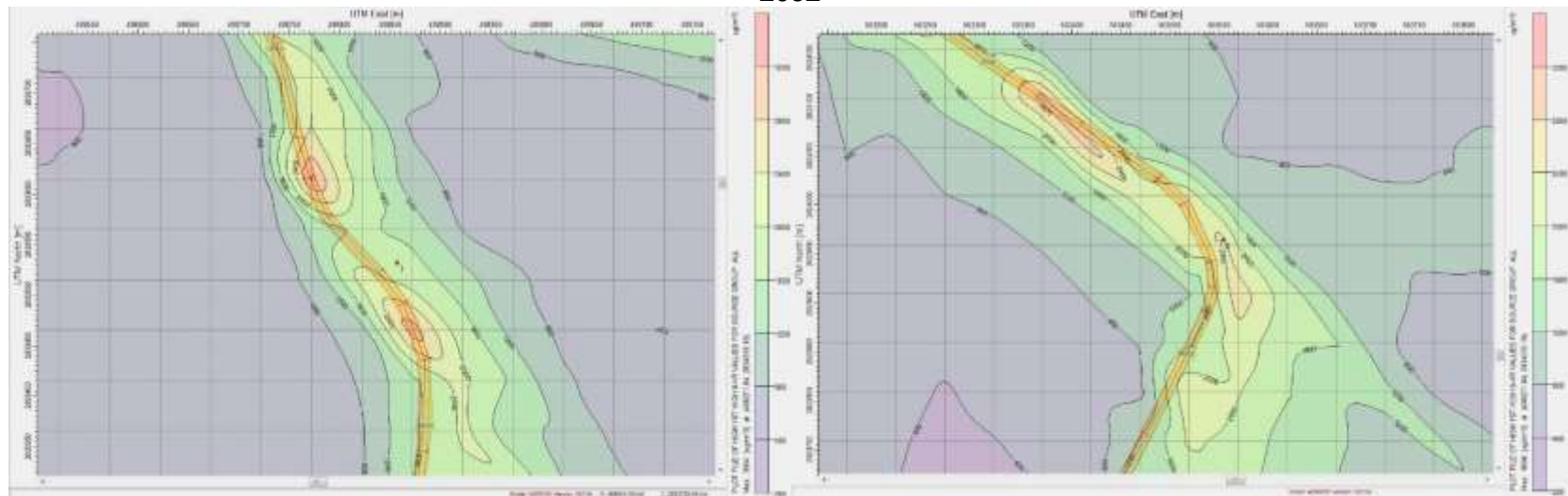
2018



2024



2032



2041

Table 31: Predicted Ground Level Concentrations of NOx and CO at Identified Receptors

Road	Receptor Locations (Village/Town Name)	Landuse Category	UTM Coordinates		Elevation (m)	CO				NOx			
			Easting (m)	Northing (m)		8 Hourly Maximum Ground Level Concentration (µg/m3)				24 Hourly Maximum Ground Level Concentration (µg/m3)			
			X	Y	Z	2018	2024	2032	2041	2018	2024	2032	2041
SH-58	Jogirar	Residential	498857	2833533	41	301	567	953	1798	7.5	10.8	14.5	23.4
	Chausa	Commercial	503555	2823965	39	590	1045	1632	2858	18.5	24.8	30.5	45.1
SH-82	Roh	Commercial	365708	2753256	93	638	1116	1620	2533	18.6	24.9	28.8	38.6
	Kawakol	Commercial	387163	2748147	108	1177	2059	2990	4674	40.5	54.0	62.6	83.8
	Khaira	Commercial	420029	2750691	92	321	532	738	1118	7.9	10.0	11.0	14.3
SH-84	Ghogha	PHC (Silence)	516749	2789142	39	1086	1770	2367	3444	41.1	51.0	54.4	67.9
	Sanhola	School (Silence)	516376	2774805	47	1922	3132	4191	6096	61.4	76.3	81.4	101.5
	Kurmahat	School (Silence)	513762	2764349	57	620	1040	1450	2170	14.9	19.4	21.5	27.6
	Sadpur	Residential	511157	2752955	74	1821	3093	4313	6475	63.9	82.8	92.0	118.4
SH-85	Akbar Nagar	Commercial	483165	2791040	39	851	1451	2062	3170	29.8	38.7	43.8	57.8
	Sakund	Commercial	481721	2783397	44	639	1090	1549	2381	22.1	28.7	32.5	42.9
	Chiriya	Commercial	484127	2776170	52	2083	3509	4959	7614	68.7	88.2	99.4	130.8
	Amarpur	Commercial	489929	2769547	62	1431	2411	3407	5232	49.3	63.3	71.3	93.8
SH-102	Jagdishpur	Residential	241070	2818758	69	428	818	1405	2628	10.5	15.3	21.0	33.6
	Piro	Commercial	238445	2804226	82	1105	2119	3655	6865	35.3	51.5	70.8	114.1
GOI Standards						2000 µg/m for all Landuse				80 µg/m3 for all landuse			
World Bank EHS Guidlines				Ineterim Target 1		No Standard Specified for CO				No prescibed Standard for 24 hrly concentration			
				Interim Target 2									
				Guidline									

Note: Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

Table 32: Predicted Ground Level Concentrations of PM_{2.5} and SO₂ at Identified Receptors

Road	Receptor Locations (village/ Town Name)	Landuse Category	UTM Coordinates		Elevation (m)	PM _{2.5}				SO ₂			
			Easting (m)	Northing (m)		24 Hourly Maximum Ground Level Concentration (µg/m ³)				24 Hourly Maximum Ground Level Concentration (µg/m ³)			
			X	Y	Z	2018	2024	2032	2041	2018	2024	2032	2041
SH-58	Jogirar	Residential	498857	2833533	41	2.1	4.3	7.4	14.0	2.6	4.3	7.4	14.0
	Chausa	Commercial	503555	2823965	39	5.2	9.9	15.7	27.1	6.4	9.9	15.7	27.1
SH-82	Roh	Commercial	365708	2753256	93	6.4	12.2	18.1	28.3	5.2	9.9	14.8	23.1
	Kawakol	Commercial	387163	2748147	108	13.9	26.4	39.3	61.5	11.4	21.6	32.2	50.3
	Khaira	PHC (Silence)	420029	2750691	92	2.7	4.9	6.9	10.5	2.2	4.0	5.7	8.6
SH-84	Ghogha	School (Silence)	516749	2789142	39	14.1	25.0	34.2	49.8	11.6	20.4	28.0	40.7
	Sanhola	Residential	516376	2774805	47	21.1	37.3	51.2	74.4	17.3	30.5	41.9	60.9
	Kurmahat	Commercial	513762	2764349	57	5.1	9.5	13.5	20.2	4.2	7.7	11.0	16.6
	Sadpur	Commercial	511157	2752955	74	22.0	40.5	57.8	86.8	18.0	33.1	47.3	71.0
SH-85	Akbar Nagar	Commercial	483165	2791040	39	10.2	18.9	27.6	42.4	8.4	15.5	22.5	34.7
	Sakund	Residential	481721	2783397	44	7.6	14.0	20.4	31.4	6.2	11.5	16.7	25.7
	Chiriya	Commercial	484127	2776170	52	23.6	43.1	62.5	95.9	19.3	35.3	51.1	78.5
	Amarpur	Residential	489929	2769547	62	16.9	30.9	44.8	68.8	13.9	25.3	36.6	56.3
SH-102	Jagdishpur	Commercial	241070	2818758	69	3.0	5.6	9.7	18.1	3.6	6.9	11.9	22.2
	Piro	Commercial	238445	2804226	82	9.9	19.0	32.8	61.6	12.1	23.2	40.1	75.3
GOI Standards						60 µg/m ³ 24 hrly for all landuse				80 µg/m ³ 24 hrly for all landuse			
World Bank EHS Guidelines				Ineterim Target 1		75 µg/m ³ 24 hrly for all landuse				125 µg/m ³ 24 hrly for all landuse			
				Interim Target 2		50 µg/m ³ 24 hrly for all landuse				50 µg/m ³ 24 hrly for all landuse			
				Interim Target 3		37.5 µg/m ³ 24 hrly for all landuse				None			
				Guidline		25 µg/m ³ 24 hrly for all landuse				20 µg/m ³ 24 hrly for all landuse			

Note: Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines

6. Noise Impacts during Operation Phase

184. During the operational phase, movement of traffic, traffic congestion, pedestrian interferences and increased use of horns due to interface between local/slow moving traffic with through traffic will be the prime source of noise. The noise levels at nearby schools, religious place may cause nuisance and irritation.

185. The significance of operational noise impacts commensurates with the number of sensitive structures and sensitive areas that exist along the project roads. As stated in chapter IV, there is large number of noise sensitive structures along all sub-projects. Most of them are very close to road (5-20 m) and within builtup-sections. List of all types of sensitive structures (educational institutes/health centres and religious) is appended as supplementary table to package specific EMPs and summarized in Table 27 of Chapter IV. Most of the religious structures are small shrine and symbolic in nature and there is no assemblage of visitors at one point of time, construction of solid noise barrier have not been considered. Health centres along the project roads are only for out door facilities not for any resident patients. Hence noise barriers at these locations also not considered. For all remaining noise sensitive receptors, especially schools/colleges provision of solid noise barrier has been made in EMP cost in case other measures like speed limitation, honking restrictions and multi-layered plantation proved to be ineffective.

186. **Prediction of Noise Level:** Noise modelling has been carried out for the all sub-projects (SH-58, SH-82, SH-84, SH-85 and SH-102) by using noise prediction tool (Sound PLAN). The noise prediction standards of Traffic Noise Model – FHWA; 1998 (TNM) was applied to predict the noise generation due to the traffic movement as well as its propagation in the surrounding environment. The road noise module is splitted into 5 separate road-sections; first the emissions of the line source are evaluated and assigned to the road source objects in the Geo-Database. In a second step, noise levels are calculated for standalone receivers or as part of the Grid Noise Map. Sound PLAN has implemented the TNM 2.5 rules and regulations of the FHWA standards. Assumptions considered in the modelling study include:

- Height of sources is 0.5 m above the carriageway.
- Model does not take into account background noise such as noise generated due to anthropogenic activities, industrial activities, movement/ operation of other noise generating sources, such as trains, aero planes, etc.
- Model does consider the ground level absorption of the noise, however, due to very limited specific information with respect to absorbing media all along the project road (e.g. walls, solid barriers, dense vegetation, etc.), same was not considered in this study. This also helps in considering the worst case scenario for the modelling study.
- Average meteorological conditions had been taken into consideration.
- During the pre-project scenario (Year 2018), average speed was considered as 25kmph and 40 kmph for buses and heavy vehicles during day and night time, respectively considering use of roads by non-motorized vehicles as well. Furthermore, for other vehicle categories same is considered as 40 kmph during daytime and 60 kmph during night time. Though the design speed of the project road is 100 kmph, however as a conservative approach, post project speed for heavy vehicles is considered as 40 kmph during daytime and 60 kmph during night time, whereas for other vehicles same is considered as 60 kmph and 80 kmph, respectively.
- Traffic forecast data provided in the DPR has been used to generate different scenarios of noise propagation during the project lifecycle.

- Considering the minor change in topography, terrain effect has also been considered.

187. In noise propagation model vehicles are classified onto 6 categories namely: Automobile, Medium Trucks, Heavy Trucks, Buses, Motorcycles, and Auxiliary vehicles. The entire project road has been divided into four homogenous sections based on the traffic density assessed in the DPR.

188. The prediction of noise propagation had considered following four assessment years based on the traffic projections provided in the DPR:

- | | |
|--------------------------------|-------------------------------------|
| ▪ 1 st Prediction | (Year 2018, i.e. current operation) |
| ▪ 2 nd Prediction - | Year 2024 (post upgradation) |
| ▪ 3 rd Prediction | Year 2032 |
| ▪ 4 th Prediction | Year 2041 |

189. For all the four assessment years, prediction of noise has been carried out all along the project road with a grid size of 20 m x 20 m as part of grid noise assessment. In addition to that, noise prediction was also carried out for select 17 noise sensitive receptors along the project roads, where noise levels were recorded during the baseline monitoring.

190. The outputs of the assessment are presented in **Table 33**. The table shows the noise levels that will be generated by traffic at the respective noise sensitive receptors along the project road on either side of the centerline of the road without mitigation. The grid noise maps of all 5 project roads for the base year 2018 are presented in **Figure 7**. Considering that noise level exceeds at some locations, it is necessary to have adequate mitigation measures to maintain prescribed levels near sensitive receptors as well as residential areas.

191. **Table 34** presents the noise levels with mitigation and assumes attenuation of noise due to: i) requirement for reduction in speed of traffic from 60 or 80km/hour to 20-30 km/hour at sensitive locations, ii) existing fencing walls around the sensitive structure compound if any and iii) wall of the house for residents staying inside the house. In accordance with the FHWA's Traffic Noise Model (TNM) there will be a reduction of approximately 6dB of noise when speed is reduced from 80km/hour to 20 km/hour. In addition walls such as boundary walls and the wall of a house (for a resident sitting inside the house) can cause a reduction of noise of atleast 3 dB. Literature³⁸ reviewed on this subject also provides similar numbers. Accordingly it has been assumed that there will be reduction of noise by approximately 9dB due to the combination of reduction in speed and existence of a house wall in residential and commercial areas.

192. It can be seen that without mitigation measures the noise levels are already exceeding with respect to applicable ambient noise standards for all sensitive landuse locations as well as in some of the residential receptors. Furthermore, additional traffic density in the project roads with better speed due to widening and strengthening of the road will result into further exceedances in the noise levels. However, implementation of the mitigation measures will significantly help to reduce the noise levels and infect help to even lower the noise levels in comparison to the baseline conditions in the initial 10 years of project operation.

³⁸<http://www.nonoise.org/resource/trans/highway/spnoise.htm>

Figure 7: Grid Noise Assessment along the Project Roads

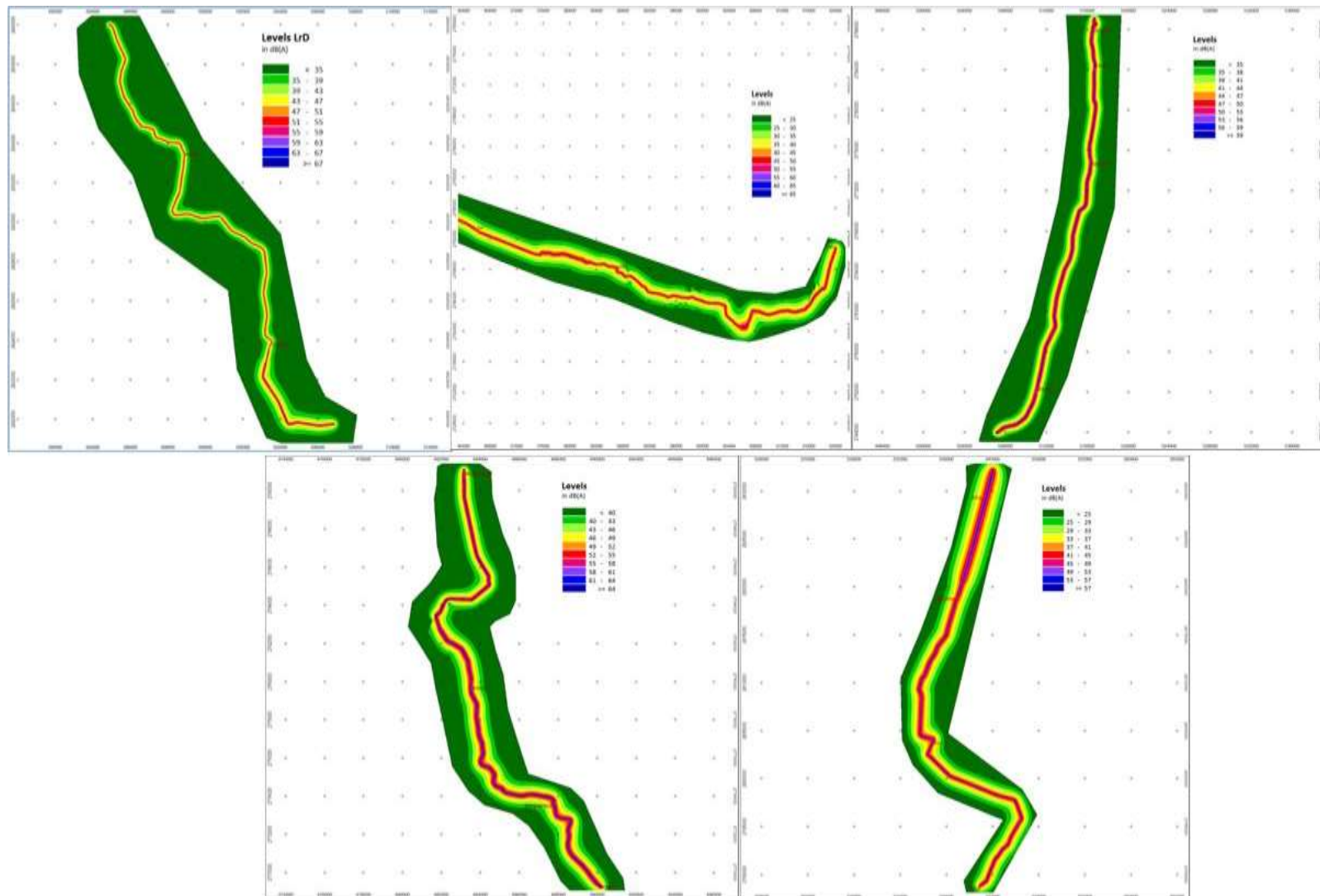


Table 33: Predicted Noise Levels along the Project Road (without mitigation)

Road	Receptor	Landuse	Predicted Noise due to Road Traffic								GOI Noise Standard as per Landuse		WB-EHS Noise Standard as per Landuse	
			Base Year		2024		2032		2041		Leq (day)	Leq (night)	Leq (day)	Leq (night)
			Leq (day)	Leq (night)	Leq (day)	Leq (night)	Leq (day)	Leq (night)	Leq (day)	Leq (night)				
SH-58	Jogirar	Residential	49.3	45.5	53.6	50	56	52.4	58.7	55.1	55	45	55	45
	Chausa	Commercial	49.2	45.5	53.7	50.1	56.1	52.5	58.9	55.2	65	55	70	70
SH-82	Roh	Commercial	53.5	49.7	57.6	54	59.3	55.7	61.2	57.6	65	55	70	70
	Kaliwal	Commercial	53.5	47.5	57.7	54.1	59.2	55.4	61.4	57.8	65	55	70	70
	Khaira	Commercial	57.3	53.5	60.8	55	62.4	56.5	64.4	60.8	65	55	70	70
SH-84	Ghogha	Commercial	56.9	53.1	60.7	57.1	62.1	58.5	63.7	60.1	65	55	70	70
	Tarar	School (Silence)	58.3	54.5	62.1	58.4	63.4	59.8	65	61.4	50	40	55	45
	Sanhola	PHC (Silence)	56.4	52.6	60.1	56.5	61.5	57.9	63.1	59.5	50	40	55	45
	Sadpur	School (Silence)	56.4	52.7	60.3	56.7	61.9	58.3	63.7	60.1	50	40	55	45
SH-85	Akbar Nagar	School (Silence)	53.4	49.7	57.5	53.8	59.1	55.5	61	57.4	50	40	55	45
	Amwa	Residential	55.7	51.9	59.6	55.9	59.6	56	63	59.4	55	45	55	45
	Sangram pur	Residential	55.9	52.1	59.9	56.3	61.5	57.9	63.3	59.7	55	45	55	45
	Amarpur	Commercial	56	52.3	60.7	57.1	63	59.4	64.1	60.5	65	55	70	70
SH-102	Behea	Commercial	54.5	50.7	59	55.4	61.4	57.8	64.1	60.5	65	55	55	45
	Jagdishpur	Commercial	54	50.2	58.5	54.9	61	57.4	63.7	60.1	65	55	55	45
	Piro	Commercial	53.3	49.5	57.9	54.3	60.3	56.7	60.7	57	65	55	55	45
	Bihta	Residential	50.6	46.9	55.2	51.6	57.7	54	60.4	56.8	55	45	55	45

Table 34: Predicted Noise Levels along the Project Road (with mitigation)

Road	Receptor	Landuse	Predicted Noise due to Road Traffic								Applicable Noise Standard as per Landuse		WB-EHS Noise Standard as per Landuse	
			Base Year		2024		2032		2041					
			Leq (day)	Leq (night)	Leq (day)	Leq (night)	Leq (day)	Leq (night)	Leq (day)	Leq (night)	Leq (day)	Leq (night)	Leq (day)	Leq (night)
SH-58	Jogirar	Residential	49.3	45.5	45.6	42.0	48	44.4	50.7	47.1	55	45	55	45
	Chausa	Commercial	49.2	45.5	45.7	42.1	48.1	44.5	50.9	47.2	65	55	70	70
SH-82	Roh	Commercial	53.5	49.7	49.6	46.0	51.3	47.7	53.2	49.6	65	55	70	70
	Kaliwal	Commercial	53.5	47.5	49.7	46.1	51.2	47.4	53.4	49.8	65	55	70	70
	Khaira	Commercial	57.3	53.5	52.8	47.0	54.4	48.5	56.4	52.8	65	55	70	70
SH-84	Ghogha	Commercial	56.9	53.1	52.7	49.1	54.1	50.5	55.7	52.1	65	55	70	70
	Tarar	School (Silence)	58.3	54.5	54.1	50.4	55.4	51.8	57	53.4	50	40	55	45
	Sanhola	PHC (Silence)	56.4	52.6	52.1	48.5	53.5	49.9	55.1	51.5	50	40	55	45
	Sadpur	School (Silence)	56.4	52.7	52.3	48.7	53.9	50.3	55.7	52.1	50	40	55	45
SH-85	Akbar Nagar	School (Silence)	53.4	49.7	49.5	45.8	51.1	47.5	53	49.4	50	40	55	45
	Amwa	Residential	55.7	51.9	51.6	47.9	51.6	48	55	51.4	55	45	55	45
	Sangrampur	Residential	55.9	52.1	51.9	48.3	53.5	49.9	55.3	51.7	55	45	55	45
	Amarpur	Commercial	56	52.3	52.7	49.1	55	51.4	56.1	52.5	65	55	70	70
SH-102	Behea	Commercial	54.5	50.7	51	47.4	53.4	49.8	56.1	52.5	65	55	55	45
	Jagdishpur	Commercial	54	50.2	50.5	46.9	53	49.4	55.7	52.1	65	55	55	45
	Piro	Commercial	53.3	49.5	49.9	46.3	52.3	48.7	52.7	49	65	55	55	45
	Bihta	Residential	50.6	46.9	47.2	43.6	49.7	46	52.4	48.8	55	45	55	45

Figure 8: Daytime Noise (without and with mitigation)

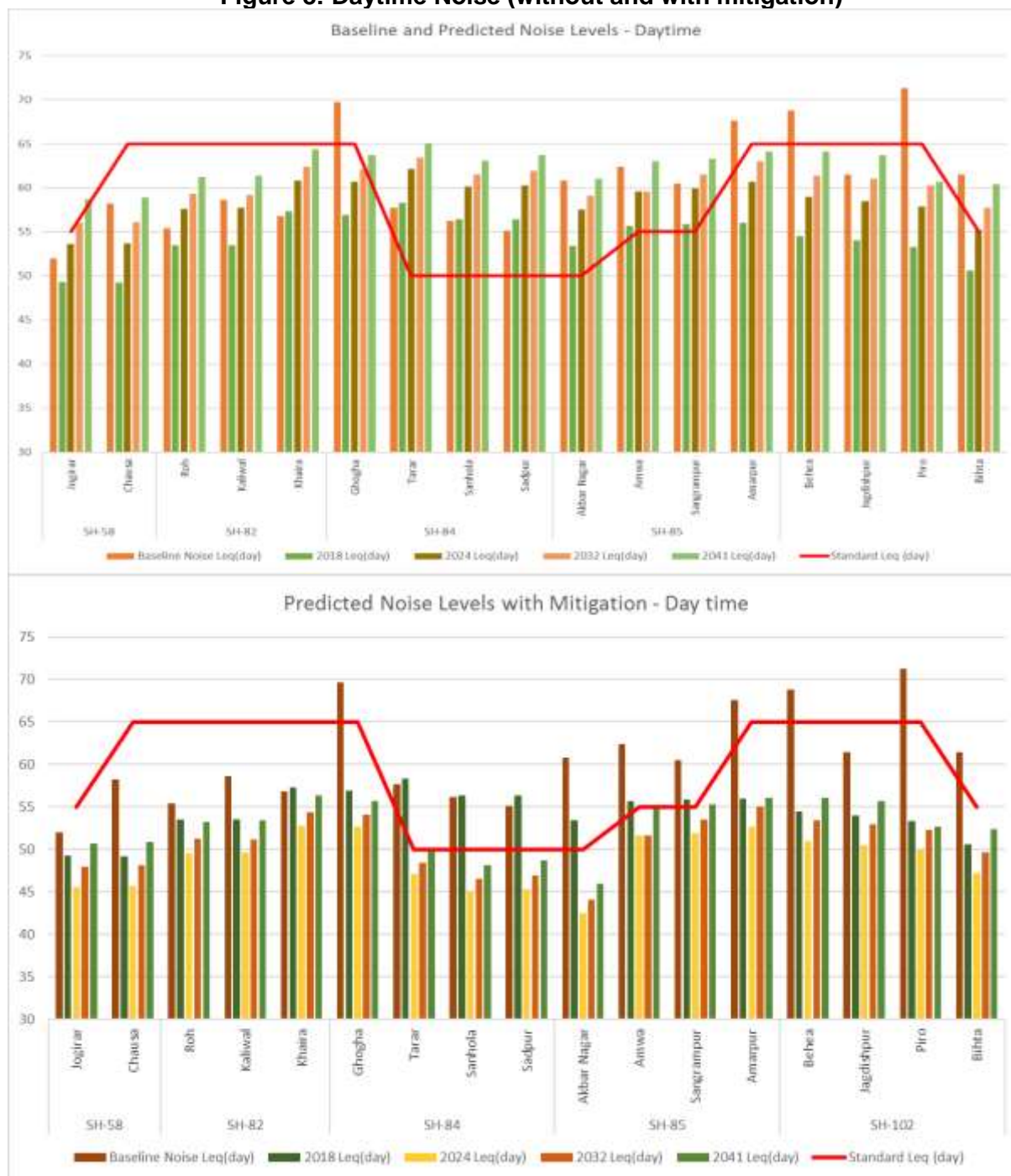
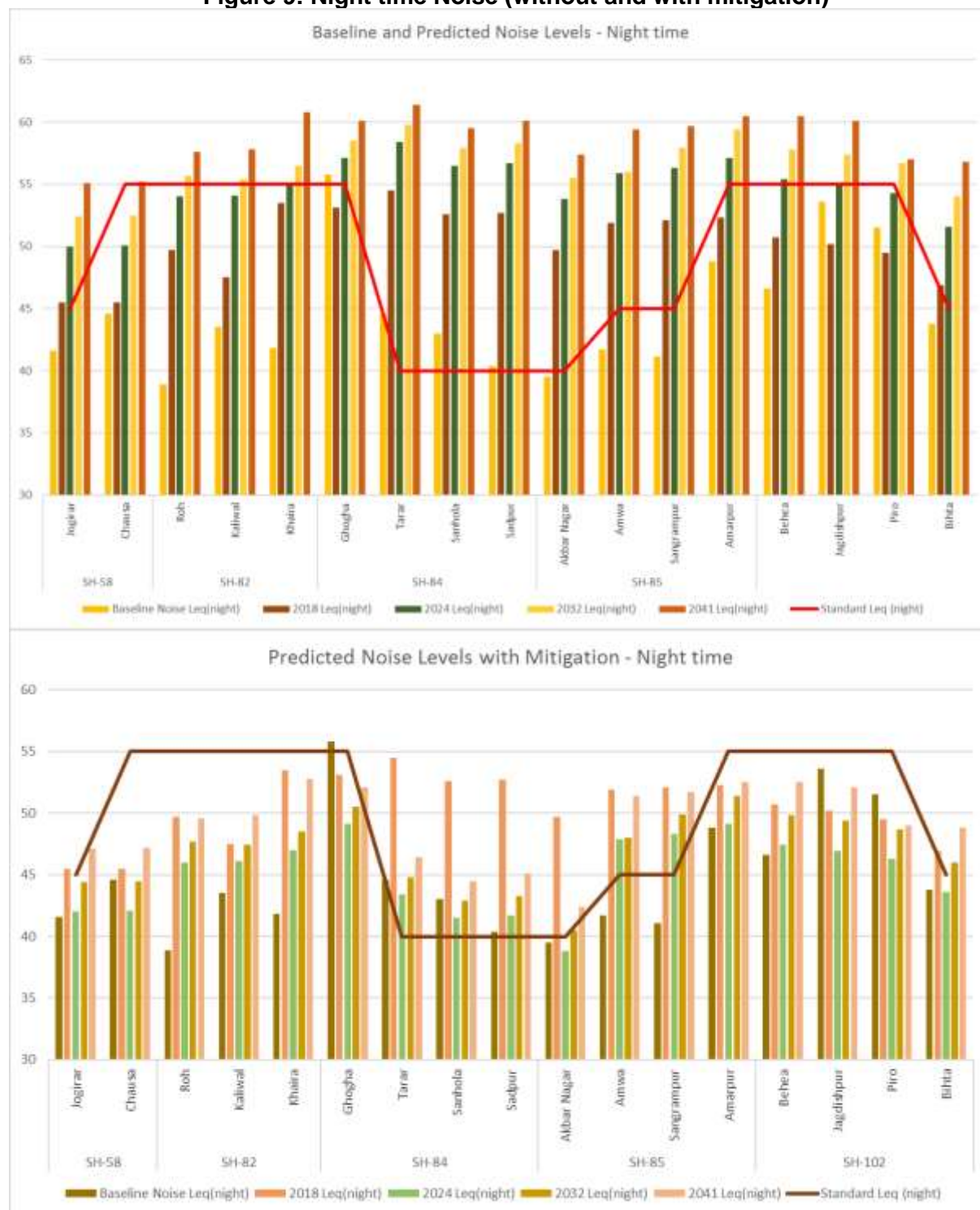


Figure 9: Night time Noise (without and with mitigation)

193. **Conclusions:** It is evident from the above tables that there will be significant increase in the noise levels due to increase in traffic intensity as well as average speed of vehicles over the road's design life. However, with appropriate mitigation measures such as lowering of speed from 80km/hour to 30km/hour in residential and commercial areas which has already been included in

the project design, the natural barrier effect from the wall of houses, and the provision for noise barriers near sensitive receptors the noise levels will be kept even below the baseline levels.

7. Ecological Impacts

194. **Flora:** Provision of extensive avenue plantation (1:7 on top of 1: 3 compensatory plantations) has been made as strategy to minimize adverse impact due to GHG emission. and improving micro-climate of the area. Portion of this additional plantation will be done in the degraded forest patches along SH-82. This will significantly help in habitat enhancement.

195. **Fauna:** In absence of any mitigation, incidences of vehicle-animal collision may increase with projected growth in traffic and high speed due to improved road surfaces. Adequate mitigative measures viz. informatory and cautionary sign boards, speed limitations by installing rumble strips, creation of water bodies on both sides to restrict wild animals to cross in search of water, clearance of roadside shrubs/bushes providing adequate sight distance to drivers have been incorporated in design to avoid any vehicle-animal collision. BSRDCL will support jurisdictional forest departments to monitor the effectivity and adequacy of these mitigation measures.

F. Climate Change Impacts and Risks

1. Climate Change Mitigation

196. One of the main triggering factors for climate change is increase in greenhouse gas emission. Transportation sector in India contributes to around 7.5% of the total GHG emission. Out of which road transportation alone has a share of 87%¹². Road construction accounts for 5% of its total life cycle GHG emission whereas, operation that is traffic accounts for rest 95%. GHG emission likely to be generated from the project roads have been computed using the Transport Emissions Evaluation Model for Projects (TEEMP) 3 developed by Clean Air Asia⁴ was utilized to assess the CO₂ gross emissions with and without the project improvements.

197. The main improvement from the project that was considered for the model are better surface roughness with less than 2m/km, and widening of roads from 1.0 or 1.5 lanes to uniform 2.0 lane. These were translated into impacts on traffic speed and hence fuel consumption. The model was also used to estimate CO₂ emissions during the construction stage of the project.

198. The model also allows for the inclusion of impacts related to traffic congestion with and without project through provisions for inserting data on the traffic numbers, lane width, number of lanes and volume/capacity saturation limit. Information that used for projecting the CO₂ emissions were:

- The project will rehabilitate and widen 5 sections of State Highway (SH-58, SH-82, SH-84, SH-85 and SH-102) with total road length of 231.75 km.
- The road configuration will change from 1.0 and/or 1.5 lanes to uniform 2.0 lanes with carriageway width of 7.0 m and will have an asphalt concrete surface;

¹CO₂ emissions from fuel combustion highlights (2012 Edition) by International Energy Agency

²Indian Network for Climate Change Assessment, MoEF, 2010

³ TEEMP is an excel-based spreadsheet models to evaluate emissions impacts of transport projects.

⁴ A network of 250 organizations in 31 countries established by the Asian Development Bank, World Bank, and USAID to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

- Existing road roughness is mostly 6.0 m/km and will be improved to less than 2.0 m/km and will be maintained within this limit in future;
- Construction will take place over a period of 18 months in 2018-19 and road operations will begin in 2019;
- Other improvements include the repair or reconstruction of damaged culverts, introduction of lined longitudinal and cross drains for road and removal of irregularities on the existing vertical profile and road safety appurtenances;
- As per feasibility study, the project road does not connect to corridor and therefore induced traffic is not expected.
- Traffic forecasts were taken from the detailed project report, which has assumed increase in traffic over the project life as follows:

Table 35: Projected traffic increase over the Project life

Year	2W	Cars	Auto	Buses	Trucks
2018-2021	8%	8%	8%	5%	7%
2022-2026	8%	8%	8%	5.5%	7.5%
2027-onwards	7.5%	7.5%	7.5%	5%	7%

199. Maximum PCU for 1.0 and 1.5 lanes were considered as 4,000 and 12,000 respectively in consistent to IRC guidelines. The volume/capacity saturation limit was taken at 1 for optimum travel speed and fuel consumption. Emission factors were mostly taken from the CPCB/ MoEF&CC (2007) Draft Report on Emission Factor Development for Indian Vehicles, Automotive Research Association of India, and C. Reynolds *et. al* (2011) Climate and Health Relevant Emissions from in-use Indian three-wheelers rickshaw as follows:

Table 36: CO₂ Emission Factors for different vehicle types¹

Vehicle Type	CO ₂ Emission Factor (kg/L)	
	Gasoline	Diesel
2-Wheel	2.28	
3-Wheel		2.63
Cars/ Jeeps	2.59	2.68
LCV		3.21
Bus		3.61
HCV		3.50

200. It was assumed that the 2-wheelers and 3-wheelers have average trip distance of 5 kmin each section, whereas all other vehicles do use the entire length as average trip distance. Furthermore, 2-wheelers and 3-wheelers constitute 100% and 90%, respectively of the total local traffic, whereas car, LCV, Bus and HCV constitute 80%, 70%, 90% and 70% respectively of the total local traffic. It has also been assumed that over the time, the fleet composition will change and the assumption taken for the same are as follows:

Table 37: Emission Standards of Fleet (%)

Vehicle type	Current Scenario				Year 2041		
	Pre-Euro	Euro I	Euro II	Euro III	Euro I	Euro II	Euro III
2-Wheel		50	50			30	70
3-Wheel	80	20			20	40	40
Cars/ Jeeps		40	40	20		40	60
LCV/ Bus/ HCV		70	20	10	10	40	50

¹It has been assumed that the emission factors will be reduced by 15% in 20 years.

Table 38: Input Parameters for TEEMP

S. No.	Particular	Project Roads				
		SH-58	SH-82	SH-84	SH-85	SH-102
1	Length of Road (km)	29.480	75.100	43.350	29.300	54.519
2	BAU - No. of Lanes	1, 1.5	1.5	1.5	1.5	1.5, 1
3	WPS - No. of Lanes	2	2	2	2	4, 2
4	BAU - Land Width (m)	2.75, 3.5	2.75	2.75	2.75	2.75, 3.5
5	WPS - Lane Width (m)	3.5	3.5	3.5	3.5	3.5
6	BAU - Roughness (m/km)	6	6	6	6	6
7	WPS - Roughness (m/km)	2	2	2	2	2

201. Emissions from road construction were estimated by using the emission factor for rural/urban roads, by using ADB - Carbon footprint 1), which is equivalent to 48,400 kg CO₂/km of road construction.

202. **Estimated carbon emissions.** The road upgrading resulting to surface roughness and road capacity improvements have implications in CO₂ emissions. Improved roughness results to higher speed and lesser emissions while increase road users increases emissions. These are further affected by traffic congestion once the volume/capacity saturation limit. CO₂ emissions will result from the processing and manufacturing of raw materials needed to upgrade the project road and in the case of project, to upgrade and strengthen the road length of approximately 232 km, total CO₂ emissions will be of the order of 11,217 tons, which will be generated during the first 2 years of road construction/ upgrade (as the total construction period is limited to 18 months).

Table 39: Estimated Total CO₂ Emission during Road Construction

Road	Length (km)	Emission Factor (tons CO ₂ /km)	CO ₂ Emission (tons)
SH-58	29.480	48.4	1,427
SH-82	75.100		3,635
SH-84	43.350		2,098
SH-85	29.300		1,418
SH-102	54.519		2,639
Total	231.749		11,217

203. The design life of road is 20 years. Total CO₂ emission at business-as-usual and with project scenarios (over the design life of road) were estimated as 221,001 tons/year and 99,339 tons/year, respectively. It is therefore evident that with project scenario the CO₂ emissions will be reduced 121,662 tons/ year, which is about 55% lesser than the business as usual. The business as usual scenario is having CO₂ emissions below the 100,000 tons per year threshold¹ set in the ADB SPS 2009. Therefore it is not necessary to implement options to reduce or offset CO₂ emissions under the project. The project's CO₂ emission intensity indicators are provided below:

Table 40: Overall Project CO₂ Emissions Intensity Indicators

Road	Road Length	CO ₂ Emission		
		Unit	Business-As-Usual	With Project
SH-58	29.480	Tons/year	2,914	1,747
SH-82	75.100	Tons/year	21,485	17,465
SH-84	43.350	Tons/year	27,107	25,817
SH-85	29.300	Tons/year	7,229	7,221
SH-102	54.519	Tons/year	74,450	21,765
Total	231.749	Tons/year	133,185	74,015

¹Page 38, Appendix I, footnote 10 of SPS 2009

204. The above tables clearly indicate that the Business-As-Usual scenario will have much higher CO₂ emissions in comparison of with project option particularly due to the present road condition as well as high traffic density in the project roads. With project scenario will bring wider roads, improved road conditions, ease in traffic movement, better fuel efficiency. It is also to be noted that major reduction comes from the improvement of road carrying capacity, as the traffic volume will reach to saturation limit with existing road infrastructure and it would be difficult to sustain 60 km/hr speed with existing 1 or 1.5 lanes during the entire project life.

2. Climate Risks and Adaptation needs

205. As per a report published in 2015 by Government of Bihar titled “Bihar State Action Plan on Climate Change-Building Resilience through Development”, future projected change in surface temperature (°C) during 2011-2040 with respect to 1961-1990 in simulation of different climate model shows following temperature and rainfall variations

Temperature

- Southern Bihar (Project Districts; Nawada and Jamui) = 1.2°C to 2.0°C
- North Bihar = 1.0°C to 1.6°C
- Western Bihar (Project District; Bhojpur) = 0.6°C to 1°C, increase
- Eastern Bihar (Project Districts: Banka Bhagalpur Madhepura) = 0.2°C to 0.4°C, increase

Rainfall

- Eastern (Project Districts: Banka Bhagalpur Madhepura) & Central Bihar: 5-10 % surplus
- South (Project District; Nawada and Jamui) & western (Project District; Bhojpur): 5 % deficit

206. **High Precipitation Impacting Roads/Bridge/Embankment:** Projected heavy rains in 3 eastern districts (SH-58, portion of SH-84 and SH-85) can cause disruption of the road networks, decreased accessibility, erosion of roads and embankments, surface water drainage problems, slope failures etc. Increased river flow resulting from precipitation and storminess may result in damages to bridges, pavements, and other road structures. Bridge / culvert capacities are reduced or exceeded, causing upstream flooding to occur.

207. **High Temperature Impacting Road Stability:** Extreme heat, combined with traffic loading, speed and density can soften asphalt roads, leading to increased wear and tear. It is likely that there would be concerns regarding pavement integrity such as softening, traffic-related rutting, embrittlement, migration of liquid asphalt. Additionally, thermal expansion in bridge expansion joints and paved surfaces may also be experienced.

208. Low to high risks identified for the project roads were earthquake, drought, cyclone and flooding. This was further corroborated by consultations at various levels to find out information on history of flooding, forest fire, cyclone and any other climatic risk in the project area.

209. **Earthquake:** Bihar is located in high seismic zone perched on the boundary of the tectonic plate joining the Himalayan tectonic plate near the Bihar-Nepal Border and having six sub-surface fault lines penetrating through its Gangetic planes in four directions. out of six project districts Bhojpur, Jamui, Banka and Nawada falls partly in Zone III (moderate risk zone) & IV (High Risk Zone), Bhagalpur in Zone IV and Madhepur falls in Zone IV & V (very high risk zone). Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone III.

210. **Forest Fire:** There are no natural forests along the project road except a small portion along SH-82. Rising temperatures and reduced top soil moisture due to increased evapotranspiration, the forest fire risk may escalate in the future.

211. **Drought:** Most of the project districts of the state is affected by drought. Two subproject districts (Bhagalpur & Madhepura) lies in drought free zone whereas Nawada and Jamui falls in severely affected zone and Banka & Bhojpur lies in intermittently affected zone Soil moisture loss through evapotranspiration is projected to increase as a result of projected increase in annual mean temperature. Increased drought frequency may lead to increased susceptibility to consolidation of the substructure.

212. **Cyclone:** As per Vulnerability Atlas of India, 27 districts in Bihar are fully affected by high-speed winds of 47 m/s intensity. The area of districts—Banka, Jahanabad, Arwal, and Nalanda is nearly 90% affected. Other districts of South Bihar except Nawada are partly affected by high-speed winds of 44 m/s. Nawada is, however, 100 % affected by high-speed winds of this intensity. In all 86 % of the total area of Bihar is prone to high-speed winds of 47 m/s intensity and only 14% of the area prone to high-speed winds of lesser intensity.

213. **Flood:** The Sub- project roads does not have flood problem. However, flash floods during 1999-2000 caused overtopping of CD structures in SH-84 and SH-85. Since entire asian monsoon region is likely to witness more extreme rainfall events in future due to global warming impact, all structure have been designed for 50 yr return period with anticipated risk of rarer flood generally of next higher frequency on the designed structures.

214. Key engineering measures taken to address the flood risks especially for the roads located in eastern parts (SH-58, Sh-84 and SH-85) are (i) increase in embankment height along low lying sections by an average of 1-1.5m to achieve enough free board for sub grade from the HFL (ii) widening of existing box/slab culvert with an average span of 1-2m to an average of 2-4m and existing pipe culverts with an average diameter of 0.6 – 1m to 1.2 – 4m diameter (with one or more hume pipes). All new pipe culverts will have a minimum of 1.2 m diameter and box culverts an average span of 4m (iii) Construction new road side drains and improvement of existing drains with a width of 1m and minimum depth of 750 mm in order to accommodate 1.2 m diameter pipe culvert crossings for main road and 1.0m diameter pipe for access culverts and (iv) all vented causeways have been replaced with high level minor/major bridges. Proposed freeboard of bridges has been made considering a 50 yr return period. As shown in the table below, costs for taking these measures add up to a total of \$20.42 million. This is approximately 10% of the total civil works costs of \$202 million. ADB is financing of 80% of civil works costs; hence \$16.34 million is the climate adaptation finance amount under the loan.

Table 41: Adaptation Measures Cost (million \$)

Roads/Details	SH-58	SH-82	SH-84	SH-85	SH-102	Total
Raising of embankment height	0.00	0.84	0.89	0.54	0.00	2.27
Increasing vent of existing culverts and new culverts	0.16	0.65	0.46	0.33	1.44	3.05
Improvement of roadside drains	0.39	4.83	1.14	0.67	3.32	10.35
Increasing waterway of existing bridges and new bridges	0.90	2.50	0.20	0.48	0.66	4.75
Total Cost (Million \$)	1.45	8.82	2.69	2.02	5.42	20.42

G. Assessment of Impacts Due to Proposed BRR Building

215. Prediction of Impact during Construction Phase: The activities that take place during construction phases of the project are leveling of site, construction and erection of buildings etc., and associated equipments in operation. The potential primary and secondary impacts on the environment, their prediction, significance and mitigation are to be discussed. Dismantling of unwanted existing structures, site clearance, storage and haulage of construction materials and disposal of surplus earth, debris and refuse is to mentioned clearly in the report.

216. Prediction of Impact during Operational Phases: The potential significant impacts are on topography, land use, soil quality, ambient air quality, noise levels, traffic densities, water resources, water quality, biological environment, demography and socio-economics. During construction and operational phase of the project, various activities may have impact on some or other environmental parameters. Various environmental attributes are to be studied during these phases for their overall impact on the surrounding environment.

1. Air Environment

217. Construction Phase: The source of air pollution during construction phase will be vehicular pollution, Stockpiles, transportation of goods and material and various construction activities. If not mitigated properly this may result in the built up of pollutants at site and nearby area.

218. Mitigation Measures

- Stockpile shall be located considering predominant wind direction (downwind).
- Regular sprinkling of water shall be done to suppress dust pollution.
- PUC certified vehicles shall be used for carrying construction materials.
- Covered transportation of construction material shall be promoted and ensured.
- Overloading of the vehicles shall be avoided.
- Covering of the construction site on all four sides to a considerable height to prevent dust emissions and other pollutants to the surrounding environment.
- Proper lubrication of vehicles and machinery shall be ensured to reduce emissions.
- Engines & exhaust systems shall be properly maintained.
- Low sulphur diesel (HSD) shall be used.
- Idling time shall be eliminated/ reduced to the minimum.
- Material drop shall be minimized at the transfer point and enclosure

219. Operational Phase: The source of air pollution during operational phase will be vehicular pollution and operation of DG set for power back up.

220. Mitigation Measures

- EPA/CPCB certified DG set shall be used.
- D.G. set shall be provided with effective stack height as per the norms of CPCB above the roof of the D.G. house.
- Low sulphur content fuel (HSD - Sulphur content 0.05%) shall be used.
- Sufficient width of driveways shall be provided to ensure smooth traffic movements.
- Speed humps shall be installed for speed restrictions inside the project area.
- Minimum 10-15% of total plot area shall be under landscape, which will help to contain the emission within permissible norms.

2. Water Environment

221. **Construction Phase:** The source of water pollution during construction phase will waste water generated from construction labour residence, leaching of contaminated water, surface run off from construction site etc. This may result in the contamination of ground water, nearby water bodies and nuisance in surrounding area.

222. **Mitigation Measures:**

- Septic tanks followed by soak pits shall be provided to treat waste water generated from labour residence.
- Awareness program shall be conducted to educate the team for judicious use of water.
- Soil and water management structures shall be in place prior to the commencement of construction works, and any advance activities likely to generate erosion and sedimentation impacts.
- Silt fencing with silt trap, Temporary silt fencing shall be installed at selected locations across the site.
- Stockpiles shall not be located in proximity to existing or proposed drainage lines and storm water inlets.

223. **Operational Phase:** The source of water pollution during operational phase will be waste water generation from project activities, rain water, sludge generated from waste water treatment etc. Excessive use of ground water (if any) is also a point of concern. Discharge of untreated waste water and sludge will result in the contamination of ground water, nuisance at site, chances of disease vector etc.

224. **Mitigation Measures**

- Closed system for waste water transportation at the site shall be followed to avoid odour and other possibilities of environment contamination.
- Regular cleaning of drains / associated structure shall be followed.
- Sludge pretreatment and utilization as manure.
- Sludge shall be pre treated before disposal.
- Water meters shall be installed at fresh water inlet, waste water inlet and waste water outlet to monitor the usage.
- Use of water efficient fixtures shall be considered, in place of conventional system, which will help in achieve approximately 31.36 % reduction in fresh water demand.

3. Noise Environment

225. **Construction Phase:** The source of noise pollution during construction phase will vehicular movement, construction machineries, DG set(if any) etc. This may result in the disturbance and discomfort to nearby residential areas.

226. **Mitigation Measures:**

- The construction area shall be shielded with help of tarpaulin sheets.
- Construction work especially heavy earth work shall be done during day time.
- Traffic planning and management shall be done.
- Proper maintenance of vehicles and machineries shall be ensured.
- The D.G. sets used shall be eco friendly with minimum noise.
- Ear plugs shall be provided to the workers.

227. **Operational Phase:** The source of noise pollution during operational phase will be vehicular noise and operation of DG set. This may result in the discomfort to residents and

nearby facilities.

228. Mitigation Measures

- CPCB certified DG set conforming to the standards for noise shall be used.
- D.G. sets shall be housed in an inbuilt acoustic enclosure, which will help to contain the noise within the permissible standards.
- Adequate driveway and parking including provisions of visitors parking shall be provided.
- There shall be less starting and stopping and the vehicles will be speed restricted to ensure the noise within the permissible limits.
- The area shall cover 10-15% area under landscape, which will help to absorb noise.

4. Solid Waste Management

229. Construction Phase: During construction phase waste will be generated from construction practices. The waste will contain excavated soil, construction debris, wood, concrete, metal scraps, plastic etc in varying composition.

230. Mitigation Measures

- Efforts shall be made to reuse the waste within the site itself.
- Surplus waste shall be sold to authorized recyclers and vendors.
- Municipal solid waste will be generated from workers and staff shall be collected and segregated in bins and sent to municipal vendor.
- The provisions of the Solid Waste (Management) Rules 2016 and the e-waste (Management) Rules 2016, and the Plastics Waste (Management) Rules 2016 shall be followed.

231. Operational Phase: The Generation of municipal waste from hostel as well as other activities is anticipated at the time of operation of the project.

232. Mitigation Measures

- The solid waste generated shall be first segregated and collected in different bins as plastic, glass, paper, and other waste separately and disposed off as per Municipal Solid Waste Rules.
- The waste shall be sent to Municipal Corporation sites through authorized vendors.
- Provisions of Solid Waste (Management) Rules 2016 and the e-waste (Management) Rules 2016, and the Plastics Waste (Management) Rules 2016 shall be followed.

5. Biological Environment

233. Construction Phase: During construction phase tree, shrub and herb will be cleared if required. Impact will be negligible & short term. The extent of impact will be limited to the project site only.

234. Mitigation Measures

- Vegetation/herb/shrub clearance shall be done only at the places where it is unavoidable.
- Topsoil shall be stored and reused at site only for landscaping.

- Appropriate erosion control and water diversion structures should be constructed at the same time as the vegetation is cleared so that the loosened soil is not left vulnerable to erosion.

235. **Operational Phase:** No **adverse** impact. Landscaping and plantation will result in positive impact of reduction of heat island effect, aesthetic beauty pollution absorbance etc.

6. Social Environment

236. **Construction Phase:** Due to construction activities surrounding area may get disturbed due to influx of labour, construction waste generation, noise generation from construction activities etc. Various basic facilities as listed below will be provided to construction labours at site to maintain hygiene and health environment at site. These negative impacts will be short term and will last for construction period only. However, the project will result in much positive impact like direct employment generation to the construction labours and other persons.

237. **Operational Phase:** During operation phase the project will result in many long term positive impacts viz., generation of indirect employment in the form of increased grocery shops, basic services, medical & departmental stores etc., development of basic infrastructure facility like road development, electricity lines, water supply lines etc, improvement in the quality of life as project is specifically targeting economically weaker section.

7. Energy Conservation (Operation Phase)

- LED lamps shall be used in place of fluorescent/incandescent lamps.
- Feasibility of solar energy utilisation shall be explored and implemented.
- VF drives shall be used in lifts.
- All capacitors shall be provided with Harmonic Filters to avoid distortion in Voltage.
- Automatic Power Factor correction panel with capacitor shall be used for Common Load & Fixed Capacitor for Transformer to minimize the losses.
- Insulation of exposed walls and roof shall be done to minimize heat gains inside the building. This will help to reduce the air conditioning demand of the buildings.
- Emphasis shall be given on low maintenance, low wattage and longer life in selection of chokes and lamps for all common area and external light fixtures.

8. Risk & Hazard

238. Construction workers are exposed to a wide variety of health hazards on the job. Exposure differs from trade to trade, from job to job, by the day, even by the hour. Exposure to any one hazard is typically intermittent and of short duration, but is likely to reoccur. The construction practices that shall be followed are given under:

- Information about chemical, physical and other health hazards shall be available at the work site in the languages that workers use.
- Contracts between contractors and subcontractors shall include safety features.
- Provisions could include establishing a unified safety organization at multi-employer work sites, performance requirements and rewards and penalties.
- Accidents and injuries shall be investigated and recorded. The purpose of reports is to identify causes that could have been controlled so that, in the future, similar occurrences can be prevented.
- Workers and supervisors shall receive training and education in safety. This education consists of teaching general principles of safety and health, is integrated

into task training, is specific for each work site and covers procedures to follow in the event of an accident or injury.

9. Lighting Protection

- The structures shall be protected against lightning in accordance with the requirement of IS 2309: 1989 with latest amendments.
- The risk factor requires provision of lightning protection and in addition considered necessary for the safety of tall buildings and human life.
- The lightning protection system shall comprise of a grid of horizontal air terminations and vertical finials provided at the terrace of each high rise tower at the highest point and that of the low rise buildings which are not within the protective angles of the high rise terminations.
- The horizontal & vertical air terminations shall be connected through a series of down earth conductors running along the sides of the building with earth tapes to the Pipe type earth electrodes / earth stations.
- Earth test points shall be provided.
- The lightning protection system shall be based on use of hot dip galvanized iron i.e. GI strip conductors and GI earth stations. OR
- Alternatively, controlled steamer emission system along with chemical earth pits may be employed, if client prefers so, but this system of lightning protection shall not be as per IS codes.
- All towers shall be protected from lightning by providing Controlled streamer emission (CSE) lightning arrestors installed at the highest point at the terrace level duly connected to GI tape/cable as per system design criteria.

10. Electric Hazard

- Proper selection of equipments;
- There shall be provision of an accessible and clearly identified switch near each fixed machine to cut off power in an emergency;
- For portable equipment, there shall be use of socket-outlets which are close by so that equipment will be easily disconnected in an emergency;
- The ends of flexible cables shall always have the outer sheath of the cable firmly clamped to stop the wires (particularly the earth) pulling out of the terminals;
- Damaged sections of cable shall be replaced completely;
- There shall be use of proper connectors or cable couplers to join lengths of cable
- There shall be proper protection of light bulbs and other equipment which could easily be damaged in use. And also creates risk of electric shock if they are broken;
- Electrical equipment used in flammable/explosive atmospheres shall be designed to stop it from causing ignition.

H. Cumulative and Induced Impacts

239. According to the ADB Environment Safeguards Sourcebook cumulative impact is described as: "The combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/or beneficial impacts that cannot be expected in the case of a stand-alone project." The sourcebook also describes induced impacts as: "Adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project, which may occur at later or at a different location.

240. Economic activities supporting transport like fuel stations, automotive repair shops, lodging, and restaurants are expected to increase with increase of traffic and induce development in the project area. Increase in agro-industrial activities are also expected to take advantage of improved access to urban centers where there are higher demand and better prices for agricultural products. The project area is rich in mineral reserves. Hence the project will accelerate industrial activities and induce development significantly. Further the increased industrial activities will significantly reduce migration. The improved road will provide better connectivity and result in (i) Reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in the area and state which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

241. In terms of environment safeguard issues the improved road surface is expected to result in less dust and noise due to traffic plying on the damaged roads. However, the increased traffic due to the improved road will generate more air pollution due to vehicle exhaust and noise. The smoother road conditions will also result in increase of traffic speeds, hence creating more risks for accidents amongst traffic users as well as the local communities in the project area. Improvement in local economic conditions can also result in unorganized and illegal establishment of settlements and businesses along the roads creating new problems of waste and pollution. To address these potential problems relevant local authorities will have to monitor developments and strictly enforce rules on

242. For addressing the impacts of air pollution and noise, regular maintenance of the road surface, maintenance and monitoring of newly planted trees have been included in the EMP for implementation during operation stage. For addressing safety related impacts, regular maintenance of the road furniture including safety related furniture, has been included in the EMP for implementation during operation stage. Relevant local authorities will need to monitor developments locally and strict enforce rules on location for establishment of new business and houses along the improved road. BSRDCL will also monitor this as the road is expected to require four laning after 10 years or so.

243. Information on other development projects in and around the project area was not available. Hence, it is difficult to assess cumulative impacts from other projects which may get implemented in the project area

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Meaningful consultation

244. Meaningful consultations in line with SPS 2009 were carried out during detailed design and IEE preparation. All the five principles of information dissemination, information solicitation, integration, co-ordination, and engagement into dialogue were incorporated in the consultation process. A framework of mitigating different environmental impacts likely from the project was strengthened and modified based on opinions of all those consulted, especially at the micro level by setting up a dialogue with the village people from whom information on site facts and prevailing conditions were collected. This will be continued during the implementation of the project through grievance redress mechanism.

B. Objectives of the Public Consultations

245. Public consultations were held to allow the incorporation of relevant views of the stakeholder's project design, mitigation measures, implementation issues, and enhance the distribution of benefits. Stakeholder's consultations were held with intent to understand their concerns, apprehensions, overall opinion and solicit recommendations to improve project design and implementation. Informal meetings, interviews were organized covering the entire project design stage. Consultations provide affected public a platform to ensure incorporation of their concerns in the decision making process and foster co-operation among officers of BSRDCL, the community and the stakeholders to achieve a cordial working relationship for smooth implementation of the project. It inculcates the sense of belongingness in the public about the project.

246. The discussions were designed to receive maximum inputs from the participants regarding their acceptability and environmental concerns arising out of the all fiver roads (sub-project). They were given the brief outline of the project to which their opinions was sought particularly in identifying and mitigating any potential adverse impact.

C. Methodology

247. Consultation with the stakeholders, beneficiaries, and community leaders were carried out using standard structured questionnaires as well as unstructured questionnaires. Questionnaire survey/ discussions were designed to obtain background information and details of general environmental issues that concern people in the project area. In addition, environmental issues were discussed with relevant organizations, government officials, beneficiaries, community leaders and experts. In addition, personal discussions with officials, on site discussion with affected stakeholders, and reconnaissance visits have also been made to the project area.

D. Project Stakeholders

248. All types of stakeholders were identified to ensure as wide coverage as possible like residents, shopkeepers and business-people who live and work along the road specially the project affected persons, road users/commuters, executing agency, government institutions whose remit includes areas or issues affected by the project (state environment and forest department, Pollution Control Board (PCB), Irrigation Department, fisheries and most importantly the beneficiary community in general.

E. Consultations with Government Agencies

249. The list of officials from various government departments including executing agency contacted during IEE preparation and issues discussed is summarized in **Table 42** below.

Table 42: Summary of Consultation held with Executing and Other Agencies

Person	Designation	Issues Discussed
Mr. P. K. Gupta, Mr. Ashustosh Kumar	DGM (Tech) DGM Tech	Apprised them about recent environment safeguard requirement of ADB. Need of various clearances and permit for the project. Collected technical informations and detailed design reports of sub-projects. Discussion about proposed institutional arrangement for implementation of EMP. Procedures and time frame for securing forest clearance and other permits
Mr. Nawab Alam	DGM (Tech) CPIU	
Mr. Mukesh Kumar	DGM (Tech), PIU Rajgir	
Mr. Ranendra Kumar	DGM (Tech), PIU Munger	
Mr. Anjani Kumar	DGM (Tech) PIU Madhepura	
Mr. Sanjit Kumar	Manager (Tech) Piu Rajgir	
Mr. Prem Shanker	Manager (Tech) CPIU	
Mr. Ravi Kant	Manager (Tech), PIU Madhepura	
Mr. Suresh Prasad	DFO, Bhojpur	Enquired about location of eco-sensitive areas if any near project sites. Discussed about the status of forest clearance of sub-projects and various requirements for fulfilling stage-I conditions and time frame involved. Enquired about the Tirhut model of plantation and if alternatively forest department can undertake additional plantation recommended for the project. DFO jamui shared information about wildlife movement in some sections of SH-82. DFOs informed that JFM exists in areas of natural forests.
Mr. Shashi Kant Kr.	DFO, Banka	
Mr. Alok Kumar	DFO, Nawada	
Mr. Prabhakar Jha	DFO, Jamui	
Mr. Uday Shanker	Range Officer, Jamui	
Mr. Vimal Kumar	Range Officer, Nawada	
	Range Officer Banka	
Mr. Sitaram Rajat	Surveyor, DFO Office, Banka Forest Division.	SH-84 & SH-85 are near the Vikramshila Dolphin Sanctuary. But the project road does not fall in the boundary of the dolphin sanctuary. No population of dolphin has been recorded in the river crossing the project roads.
Head Clerk	Head Clerk, DFO Office, Bhagalpur Forest Division (Contact number- 9430033748)	
Mr. Krishna Kumar Sinha	District Fishery Officer, Bhagalpur (Contact Number- 9473191550)	
Dr. Bharat Bhushan	Scientist, Krishi Vigyan Kendra, Nawada	Shared information about different agro-climatic zones and soil types of the area
Dr. Anupam Kumar	Wildlife Exper and Block Program Manager, Jeevika Nawada	Provided informations on floral and faunal diversity of forest stertches

DFO- Divisional Forest Officer

F. Consultations with Local People/Beneficiaries

250. The informal consultation generally started with explaining the project, followed by an explanation to potential impacts. Participant's views were gathered with regard to all aspects of the environment which may have direct or indirect impact on local people. Table 7.2 summarizes the details of consultation with local people. Key issues discussed are:

- Awareness and extent of the project and development components;
- Benefits of the project for the economic and social upliftment of community;
- Labour availability in the project area or requirement of outside labour;
- Local disturbances due to project construction work;
- Necessity of tree felling etc. at project sites;
- Impact on water bodies, water logging and drainage problem if any;

- Environment and health
- Flora and fauna of the project area
- Socio-economic standing of the local people

251. Local community welcomed the decision of road widening and improvement proposal. They perceived several benefits like faster and cheaper connectivity, improved accessibility to better infrastructure facilities, reduction in migration, increased economic activities and appreciation in value of land and many others. But at the same time they apprehended that the risk of accident, air and noise pollution will increase due to high traffic density after widening. Main demand and suggestions made by the participants are;

- i) Adequate compensation and rehabilitation assistance to affected households
- ii) Employment and petty contracts during construction
- iii) Curve improvement especially at Korchakka & Ghosai in SH-58; Choti Olpura, Sanhaura, Bhuria-Hanwara T-point (after crossing bridge) & Batsar (between Girls Middle School & Bank, a range a 600m stretch) in SH-84; Shadpur Mor, Dumaria (near the 'Rani Nursing Home') & Badsahganj Mor in SH-85; Pandey Gangot, Arwari Mor, Godan (Yogisthan) in SH-82; Tenduni Mor, Dhobi Ghatwa Mor, Dechna Bal Mor & Saihara (Near government canal) in SH-102.
- iv) Provision of side drains
- v) Provision of adequate culverts & improvement of existing cross drainage structures.
- vi) Provision of drinking water facility near bus-shelters, road-side villages
- vii) Road safety measures
- viii) Extensive plantation
- ix) Creation of new ponds in lieu of the borrow areas.
- x) Restriction on honking near built-up areas and sensitive receptors
- xi) Lighting in built-up areas and sensitive receptors
- xii) Measures to minimize air and noise pollution
- xiii) Water harvesting structures
- xiv) Bus Shelters
- xv) Parking areas in markets and truck lay-byes near industries.

252. Design considerations have been made to incorporate most of the suggestions and demands of the local people except those which are beyond the scope of project like improvement of already deteriorated water quality, Drinking water facility, electricity facility etc.

G. Consultations with Women and Vulnerable Groups

253. Further consultations with only women and vulnerable households (female headed households, households below poverty line etc.) were conducted as part of the social safeguards studies. Numbers of women consulted were 51 in SH-58, 27 in SH-84, 11 in SH-85, 31 in SH-82 & 18 in SH-102. The purpose of these exclusive discussions was to ensure women were aware about the project and understand their concerns and expected benefits out of the project.

254. There were various concerns that were raised by the women during the consultations. The women expressed a number of both key benefits and concerns that they perceive out of this project. The improvement of the road network will have positive impact as it will increase the frequency and quality of the transportation which will not only improve the accessibility issue but will also increase the value of land. They were also of opinion that the augmentation of the road network would help in creating employment opportunities for the local




people as well as to connect them with larger market out of this area easily for the agricultural product.




255. However, the women participants did voiced their concerns regarding the safety of them and their children as they were of opinion that the widening of the road would increase the frequency of the vehicles which would lead to the risk regarding accidents. They were informed that adequate provisions for road safety and have been integrated in the road design by the technical design team to address the accident risks. The other negative impacts that they raised was the increase in the level of air and noise pollution as a result of the project. In response they were informed that air and noise issues will be minimal. And necessary measures to reduce noise levels such as speed control, tree plantation and noise barriers will be installed in locations with sensitive receptors.

H. Disclosure of information

256. IEE report will be made available at BSRDCL HQ and respective PIUs. The same will be posted on BSRDCL's website. Based on ADB disclosure requirements, it will be posted on its website.

Table 43: Summary of key points discussed in FGDs conducted during IEE.




Location and No. of Participants	Information/Demands/Suggestions of Participants	Photo
SH-58- Udakishanganj-Bhatgawan Road		
Jamunia Tola 14 Persons (4females & 10 males)	<p>Information shared: the last flood occurred in in 2008. Road overtopped at few locations. Otherwise the area is not susceptible to flooding.</p> <p>Demands/ Suggestions side drains in the built-up areas, waiting-shed and safety measures for pedestrians, slow moving traffic and employment during construction.</p> <p>Integration of Suggestions in Design: All demands and suggestions already integrated in design like safety measures, widening of CD structures and provision of side drains and built-up areas. Local people will get preference in employment during construction subject to requirement and eligibility. Wating shed in habitated area included in design.</p>	 <p style="text-align: center;">Plate 1</p>
Korchakka 65 Persons (46 females & 19males)	<p>Information Shared: Area water-logged during flood of 2008. Accident prone location. People need to walk more than 1 km to fetch drinking water</p> <p>Demands/Suggestions: Bus-stand, road side drains and drinking water facility. Employment of local people during the road construction activities.</p> <p>Integration of Suggestions in Design: All demands and suggestion are included in design. Construction of bus stop and facility for drinking water are out of project scope. However, loss of any water source will be replaced with new at safer location.</p>	 <p style="text-align: center;">Plate 2</p>
Ghosai 18 Persons (1female & 15 males)	<p>Informations Shared: Last flood in 1987. Flood. 5 casualties reported during the recent electric pole shifting related to the road improvement work.</p> <p>Demand/Suggestions: Road authority must take cognizance of safety including electrical pole and other utlity shifting etc. Adequate safety majors especially near schools. Temples and other religious struction shall be shifted in consultation with locals.</p> <p>Integration of Suggestions in Design: Adequate safety measures, flood protection measures are proposed. CPRs will be relocated in consultation with local community. Side drains in built-up area has been considered in the design report in built-up sections. Design has covered necessary safety measures including for shifting of utility services.</p>	 <p style="text-align: center;">Plate 3</p>

SH-84 (Ghogha-Panjwara Road)		
<p>Olpura, District- Bhagalpur, 23 Persons (11females & 12 males)</p>	<p>Information shared: Last flood in 1999. Choti Olpura & Sanhaura (nearby location) are accident prone locations in the project road</p> <p>Demands/Suggestions: They also demanded for road side drain and time to time maintenance of cross drainage structures in the area to get rid of waterlogging problem in the by lane to the main project road. Demanded for passenger waiting-shed. Quality drinking water available under ground at a depth of 100-120 feet in the locality.</p> <p>Integration of Suggestions in Design: Design has included improvement of road side drains in all the built-up areas of the project road. There is provision of CD structures with adequate carrying capacity in the design scope for the project road. All the safety measures have been considered to be installed along with cautionary signages. Passenger waiting shed is out of the project's scope.</p>	 <p>Plate 4</p>
<p>Bhuria, District- Bhagalpur, 23 Persons (7females & 16males)</p>	<p>Information Shared: Devastating Flood in 1999. The area was under recurring flood crisis till the River Gherwa was not embanked. Trace of excess iron in groundwater.</p> <p>Demands/Suggestions: Rigid pavement with covered drains in settlement. Suggested for solar street lighting in the built-up & market areas for the safety of the people.</p> <p>Integration of Suggestions in Design: Rigid pavement already proposed in built-up section. Various safety measures like speed limitation, zebra-crossing, signages etc. have been proposed to avoid accident risk. Solar street lighting not proposed. However, the local bodies taking initiatives to install solar lighting in market areas.</p>	 <p>Plate 5</p>
<p>Batsar, District-Banka 22 Persons (9 female & 13 males)</p>	<p>Information Shared: Potable drinking water occurs at a depth from 27 feet to 35 feet in the area. Last flood occurs in the area on 1995. Location from Girls Middle School upto the Bank near main market covering a stretch of 600m.is accident prone.</p> <p>Demands/Suggestions: Covered side drains with foot path and provision of road safety measures.</p> <p>Integration of Suggestions in Design: Most of the demands including safety measures in along discussed are integrated in design.</p>	 <p>Plate 6</p>

SH-85 (Akbar Nagar-Amarpur Road)		
Shadpur, District-Bhagalpur, 17 Persons (All males)	<p>Information shared and Suggestions made: Road overlay done recently. Road side plantation has been carried out by the forest department. Flood due to Chanan river has been witnessed by the participants in last year (2016). Flood water level raised upto 3 feet in the main road. Inundation upto the Akbar Nagar main road (starting point of SH-85). Ground water level is at 120 feet but potable water available at 250 feet. Shadpur Mor becomes accident prone area recently after the improved condition of the road. More than 10 accidents occurred in last two months.</p> <p>Integration of Suggestions in Design: Design has included improvement of road side drains in built-up areas & all the CD structures including embankment raise. All the safety measures have been considered to be installed along with cautionary signages especially in sharp-curves. Controlled felling of trees during widening process to be considered to save new plantation along the project road. Additional plantation on top of compensatory plantation proposed.</p>	 <p>Plate 7</p>
Dumaria, District-Banka, 22 Persons (7females & 15males)	<p>Information and Suggestions: An accident prone sharp turn at Dumaria, near the 'Rani Nursing Home'. 'Chapri Mor', 4 km towards Amarpur is another nearby accident prone area. Last flood witnessed by the participants on 1995 when the main road flooded upto 2 feet height. People are looking forward to involve in the proposed project as labour workforce. Some of the vendors open their shop on existing ROW but ready to move if necessary during the widening of the project road.</p> <p>Integration of Suggestions in Design: Several safety measures like speed limitation, zebra-crossing, signages etc. to minimize on-road accident have been proposed. Design has included improvement of road side drains in built-up areas & all the CD structures including embankment raise. Recruitment of local man-power for labour work during project road widening/up gradation is beyond the scope of this report.</p>	 <p>Plate 8</p>
Badshahganj, District-Banka 16 Persons (4female & 12 males)	<p>Information and Suggestions: Road side drain is major demand by the local people in the built-up areas. None of the participants including aged fellow have witnessed flood in this area. Badshahganj Mor is an accident prone area with very sharp curve. Ground water level is at 25 feet. People are interested to involve in the proposed project as labour force during the construction stage.</p> <p>Integration of Suggestions in Design: Provision of road side drain has been considered in the road design. Sufficient provision for road safety has been considered while designing the project road. Local people will be preferred for work-force during construction.</p>	 <p>Plate 9</p>

SH-82(Kadirganj-Khaira Road)		
<p>Pandey Gangot, Dist- Nawada, 17 persons (9females & 8males)</p>	<p>Information and Suggestions: No Flood in this area. Farmer in this locality witnessed water scarcity for agriculture activities. Depth of ground water in this area is at 120 feet. People face drought-like situation in the month of March & April every year. People demanded for drinking water facility along the project road at a certain interval. 300m from Pandey Gangot towards Kadirganj is accident prone area. Recently 3-4 major accident took place in that point.</p> <p>Integration of Suggestions in Design: Several safety measures like speed limitation, zebra-crossing, signages etc. have been proposed to minimize on-road accident. Provision of road side drinking water facility is not in the scope of this report.</p>	 <p>Plate 10</p>
<p>Jorawar Dih Dist.- Nawada 23 persons (3females & 20 males)</p>	<p>Information and Suggestions: Arwari Mor near Saraswati Chowk is accident prone location. Depth of ground water in this area is at 70-100 feet. There is road side drain in one side of the main road. People have demanded for drains in other side of the road in the built-up stretch. No flood in this area.</p> <p>Integration of Suggestions in Design: Several safety measures like speed limitation, zebra-crossing, signages etc. have been proposed to minimize on-road accident. Both side drain in the built-up stretch of the road has been considered in the design.</p>	 <p>Plate 11</p>
<p>Ropewell (Yogisthan) Dist.- Jamui 27 persons (8females & 19 males)</p>	<p>Information and Suggestions: Demanded a cross drainage structure near Yogisthan to avoid waterlogging during rainy season. Depth of ground water in this area fluctuates in between 100 to 150 feet. Labours from this area interested to associate with the road development project as work-force. This Panchayat has been deprived from irrigation facility even after being close to 'Garhi Dam' (2km from Ropewell). 'Godan' near Ropewell is accident prone area. Demanded road side drain from 'Godan' to Pharki Patthar'. Villagers are dependent on forest product such as timber for their livelihood.</p> <p>Integration of Suggestions in Design: Provision of adequate cross drainage structures already included in the design. Several safety measures like speed limitation, zebra-crossing, signages etc. have been proposed to minimize on-road accident. Both side drains on road-side in the built-up stretch has been considered in the design.</p>	 <p>Plate 13</p>

<p>Guwa Ghoghra, Dist.- Nawada 16 persons (5females & 11 males)</p>	<p>Information and Suggestions: Potable ground water is available at 50 feet. People demanded for PCC in the built-up stretches along with side drains. Suggested for adequate safety measures near academic establishments. There are few records of accidents near the sharp-turn before the road enters the dense forest area.</p> <p>Integration of Suggestions in Design: Provision of PCC and & road side drains in built-up sections of the road is considered in the design. Adequate safety measures have been considered throughout the roads in design.</p>	 <p>Plate 12</p>
<p>Badaldih (Chanarwar) Dist.- Jamui 9 persons (2 females & 7 males)</p>	<p>Information and Suggestions: Strongly demanded to complete the under construction major bridge over Kiul River on the project road near Jharkhand Mor bordering with the state of Jharkhand. This bridge is under construction since last 8 years. The delayed construction work of this vital bridge compels the people to travel 20km extra. Occasional flash flood witnessed by the local people due to the water release by the Garhi dam. Safety measures demanded by locals near the approach of the bridge to avoid accident.</p> <p>Integration of Suggestions in Design: Adequate CD structures provided in the design to get rid of flash flood. Safety measures proposed throughout the corridor.</p>	 <p>Plate 14</p>
<p>Pan Bharwah Dist.- Jamui 10 persons (4females & 6males)</p>	<p>Information and Suggestions: The livelihood of the local people dependent on nearby forest products. Demanded for embankment raise of the major bridge over Kiul (Killi) river. The bridge flooded even in recent flood (2017). Ground water is available at 150 feet. But the poor economic condition of the villagers deprived from quality ground water. People have to depend on river water which is of very poor quality. Demanded for drinking water facility in road side for the villagers. 'Baba Jhakhraj Temple' is a major tourist destination in the area.</p> <p>Integration of Suggestions in Design: Provision of embankment raising and replacement of poor CDs proposed. Road side drinking water facility is beyond the scope of this report. Safety measures throughout the corridor.</p>	 <p>Plate 15</p>
<p>Sahiara, Dist.- Bhojpur 17 persons (6 females & 11 males)</p>	<p>Information and Suggestions: Sharp turn near the government canal making it accident prone. There is no impact of flood in the area. Quality drinking water is available at 70 feet. Requested for road side drains especially in the built-up and market areas. Also suggested for safety measures near the academic establishments to control accident.</p> <p>Integration of Suggestions in Design: Realignment and improvisation of road geometry considered in the design. Several safety measures like speed limitation, zebra-crossing, signages etc. have been proposed to minimize on-road accident especially in sharp-tuning and near sensitive locations such as schools, hospitals etc. . Both side drains on road in the built-up stretch has been considered in the design.</p>	 <p>Plate 19</p>

RD-05: SH-102 (Bihia-Jagdishpur-Piro-Bihita Road)		
<p>Tenduni, Dist.- Bhojpur 15 persons (5females & 10 males)</p>	<p>Information and Suggestions: Adequate pollution control measures during the construction especially near built-up area and academic institutes. Potable ground water at a depth of 20 feet only. There is no impact of flood in this area. The existing road has been improved recently but no drains in built-up stretches. Demanded for road side drains in the area. Livelihood depends on agriculture mainly.. Tenduni Mor is prone to accident. Demanded safety measures in Tenduni Mor and near academic institutes.</p> <p>Integration of Suggestions in Design: Timely monitoring of air, noise, water and soil have been considered in the EMP during construction and operation stage of the project. Both side drains on road-side in the built-up stretch has been considered in the design. Several safety measures like speed limitation, zebra-crossing, signages etc. have been proposed to minimize on-road accident especially near sharp-curve and sensitive locations. There is also provision of cautionary signage near sensitive receptors.</p>	 <p>Plate 16</p>
<p>Dhobi Ghatwa, Dist.- Bhojpur 16 persons (1 females & 15 males)</p>	<p>Information and Suggestions: Very good ground water quality in this area at a depth of 10-15 feet only. There is no impact of flood in the area. There are few examples of accident in the Dhobi Ghatwa Mor after the improvisation of the road recently. The existing road has been improved few months back but no drains in built-up stretches. Demanded for road side drains in the area. People demanded for PCC of road in the built-up areas.</p> <p>Integration of Suggestions in Design: Several safety measures like speed limitation, zebra-crossing, signages etc. have been proposed to minimize on-road accident especially near sharp-curves. Provision of PCC structure in the built-up area is beyond the scope of this report.</p>	 <p>Plate 17</p>
<p>Dechna Bal, Dist.- Bhojpur 16 persons (6females & 10males)</p>	<p>Information and Suggestions: Demanded a cross drainage structure near Jetnabadh to drain out rain water. Labours from this area interested to associate with the road development project as work-force. There is no impact of flood in this area. Dechna Bal Mor is accident prone after the improvisation of the project road. Demanded for road safety provision in built-up areas and near academic institutes. Quality ground water quality is available at 40 feet.</p> <p>Integration of Suggestions in Design: Provision of adequate cross drainage structures already included in the design. Several safety measures like speed limitation, zebra-crossing, signages etc. have been proposed to minimize on-road accident. Preference to local people in construction work..</p>	 <p>Plate 18</p>

VII. ENVIRONMENTAL MANAGEMENT PLAN, INSTITUTIONAL REQUIREMENTS AND GRIEVANCE REDRESS MECHANISM

A. Environment Management Plan

257. Environmental Management Plan (EMP) is intended to set out clearly and unambiguously the likely negative impacts of construction and/or operation of the project, the action that is required to avoid or mitigate each impact and the responsibility for taking each action. Responsibility is made legally binding when actions are subsequently specified in contracts. The EMP (Appendices 13-22) also ensures that the positive impacts are conserved and enhanced. It addition, it provides measures for institutional strengthening and effectiveness assessment through defined monitoring plan, reporting and corrective & preventive action planning. More specifically the objectives of the EMP are:

- i. To ensure compliance with Asian Development Bank's applicable safeguard policies, and regulatory requirements of Bihar and the Government of India;
- ii. To formulate avoidance, mitigation and compensation measures for anticipated adverse environmental impacts during construction and maintenance and ensure that environmentally sound, sustainable and good practices are adopted;
- iii. To stipulate monitoring and institutional requirements for ensuring safeguard compliance

258. The EMP has been prepared based on all foreseen impacts at the time of preparing this IEE. It is a living document. If any new or unforeseen impacts occur during project implementation, the EMP will be updated by the CSC Environmental Specialist. The new impacts maybe due to design changes or changes in project situation or other reasons. If the new or unforeseen impacts are deemed significant BSRDCL will immediately notify ADB to agree on the need for revising the IEE report as well.

B. Environment Monitoring Program

259. The monitoring and evaluation are critical activities in implementation of the project. Monitoring involves periodic checking to ascertain whether activities are going according to plan or not. It provides the necessary feedback for project management to ensure project objectives are met and on schedule. The reporting system is based on accountability to ensure that the environmental mitigation measures are implemented. Environmental monitoring program has the underlying objective to ensure that the intended environmental mitigations are realized and these results in desired benefits to the target population causing minimal deterioration to the environmental parameters. Such program targets proper implementation of the EMP. The broad objectives are:

- i. To evaluate the performance of mitigation measures proposed in the EMP.
- ii. To evaluate the adequacy of environmental assessment.
- iii. To suggest ongoing improvements in management plan based on the monitoring and to devise fresh monitoring on the basis of the improved EMP.
- iv. To enhance environmental quality through proper implementation of suggested mitigation measures.
- v. To meet the requirements of the existing environmental regulatory framework and community obligations.

1. Performance Indicators

260. The significant physical, biological and social components affecting the environment at critical locations serve as wider/overall performance Indicators. However, the following specific environmental parameters can be quantitatively measured and compared over a period of time and are, therefore, selected as specific Performance Indicators (PIs) for monitoring because of their regulatory importance and the availability of standardized procedures and relevant expertise. A comprehensive monitoring plan for all performance indicators has been prepared for all stages appended as (Appendices 13-22). This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost and responsibility for implementation and supervision. Performance indicators requiring quantitative measurements are:

- i. Air quality with respect to PM2.5, PM10, CO, NOx and SO2 at selected location.
- ii. Water quality with reference to DO, BOD, Oil and grease, COD, Suspended Solids and Turbidity, Alkalinity rivers/streams and water bodies at selected points.
- iii. Noise levels at sensitive receptors (schools, hospitals, community/religious places).
- iv. Survival rates of trees planted as compensatory plantation and additional plantations to be taken up as a strategy to curb GHG emission.

261. **Ambient Air Quality (AAQ) Monitoring:** Ambient air quality parameters recommended for monitoring road development projects are PM2.5, PM10, Carbon Monoxide (CO), Oxides of Nitrogen (NOx) and Sulphur Dioxide (SO2). These are to be monitored, right from the commencement of construction activity at selected locations of plants and machinery, crushers on sites, excavation works etc. Data should be generated once in a season excluding monsoon in accordance with the National Ambient Air Quality Standards as per CPCB recent notification of 2009 (**Appendix 2**).

262. **Water Quality Monitoring:** The physical and chemical parameters recommended for analysis of water quality relevant to road development projects are pH, total solids, total dissolved solids, total suspended solids, oil and grease, COD, Chloride, Lead, Zinc and Cadmium. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are given in the Environmental Monitoring Plan. The monitoring of the water quality is to be carried out at locations identified along the project road during construction and operation phase. The Indian Standard Specifications – IS10500: 1991 is given in **Appendix 2**. Surface water quality will be monitored as per fresh water classification of CPCB (**Appendix 2**).

263. **Noise Level Monitoring:** The measurements for monitoring noise levels would be carried out at sensitive receptors and construction sites along the project roads. The Ambient Noise Standards formulated by Central Pollution Control Board (CPCB) in 1989 or the standards by State Pollution Control Board if such standards are stringent than those of the CPCB are to be complied. The CPCB standards are given in **Appendix 2**. Sound pressure levels would be monitored on twenty-four hour basis. Noise should be recorded at “A” weighted frequency using a “slow time response mode” of the measuring instrument.

264. **Success of Re-vegetation:** BSRDC will implement the additional plantation guided, through Contractors of forest departments with strong community participation and ensure at least 80% survival of trees after 3 years. Annual reports pertaining to the accomplishment and survival will form part of the annual environmental monitoring report to be submitted to the ADB. Suggested plantation locations are multi-layered plantation near sensitive receptors and other community property resources and forest areas of SH-82.

265. **Records of Accidents:** Contractors to keep records of all types (construction sites/road accident) of accidents during construction period. During the operation stage monitoring, BSRDCL will maintain records of traffic accidents including those caused due to vehicle-animals collisions through their field offices with support from forest department and local people.

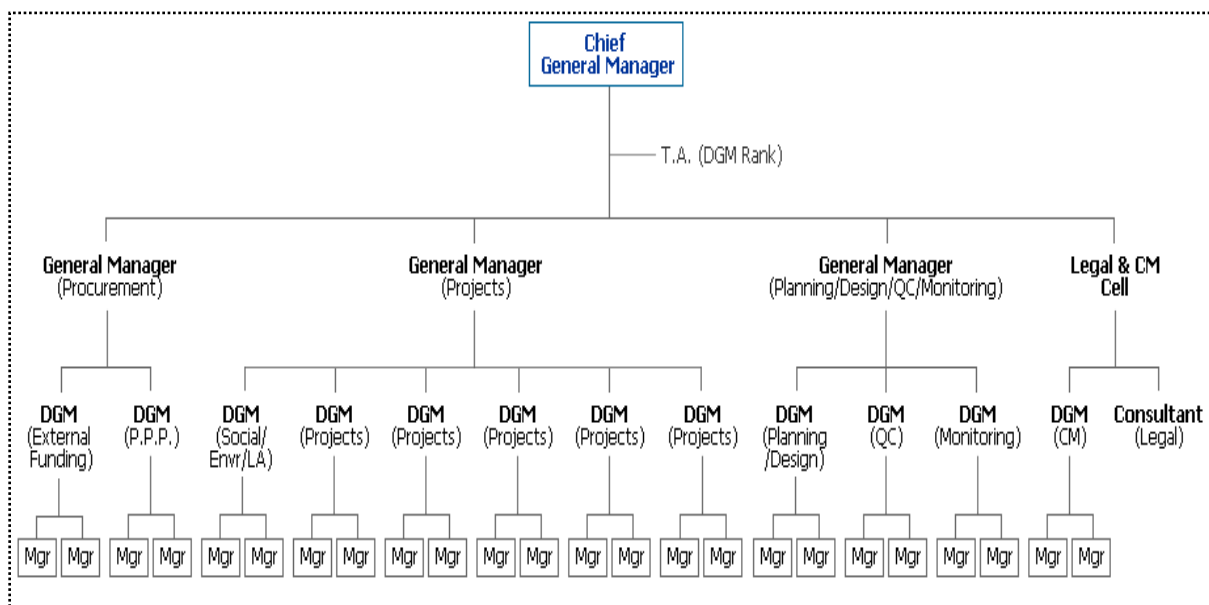
C. EMP/EMOP for the Proposed BRRI Building

266. A specific EMP includes the environmental issues, mitigative measure, performance and monitoring indicators, responsible agency for implementation and supervision and cost towards implementation and supervision. As mentioned earlier, the project is at conceptual stage and detailed design is yet to be initiated and hence absolute information on each component is not available. However, a generic EMP has been prepared considering impacts typically triggered due to any building construction project. This later on needs be translated to a specific and more comprehensive form once project details are finalized

D. Organizational Set-up of Implementing Agency

267. BSRDCL is the implementing agency for the project. It is an independent agency under the ambit of RCD and mandated with construction and maintenance of state highways and other roads and bridges with its own resources, Public Private Partnership or external funding. It is headed by Chief General Manager (CGM) supported by a technical advisor and 3 General Managers. General Managers (Projects) will have overall responsibility for implementation of sub-projects. For implementation of EMP/ RP, an environment, social development and resettlement cell (ESDRC) has been set up in BSRDCL. The cell is headed by a Deputy General Manager (DGM) supported by a Manager (Tech). The DGM for Environment and Social is responsible for coordinating the environmental related work of the corporation and co-ordinate with ADB to monitor all environmental requirements of this subproject. The existing organizational structure of implementing agency has been illustrated in **Figure 10**.

Figure 10: Existing Organizational Set-up of Implementing Agency



TA: Technical Advisor, GM: General Manager, DGM: Deputy General Manager PPP: Public Private Partnership, LA: Land Acquisition, QC: Quality Control, CM: Contract Management

E. Proposed Institutional Arrangement

268. BSRDCL, as the Project Executing Agency, shall be responsible for overall implementation of the project, and shall perform, its obligations as set forth herein and the project agreement through Government of Bihar. BSRDCL will largely follow the same proven arrangement for EMP while implementing other road projects assisted by ADB like BSHP-II and BSHP-II; Additional Financing. Proposed arrangement has been described in following paragraphs.

269. For sub-project planning and implementation, Project Implementation Unit/s (PIUs) has been established. Out of 4 PIUs, (Madhepura; SH-58, Rajgir; SH-82, CPIU⁴⁵; SH-102 and Munger; SH-84&85) to oversee the implementation, PIU Munger is newly created and resource allocations are under process. Remaining is already fully functional. PIUs are headed by Project Director (PD)/ Deputy General Manager (Technical) at the sub-project level supported by the Manager (social and environment). He/She will be safeguards focal person and be responsible for overseeing implementation of EMP and RP.

270. A construction supervision consultant (CSC) firm will be recruited to supervise and administer civil works contracts and to ensure the works are executed in accordance with the drawings, technical specifications and contract conditions including implementation of EMP. The CSC team will include one environmental specialist and one wildlife specialist. Roles and responsibilities of all four groups involved in implementation of EMP have been outlined in Table 43. Proposed institutional arrangement has been illustrated through a flow diagram (**Figure 11**).

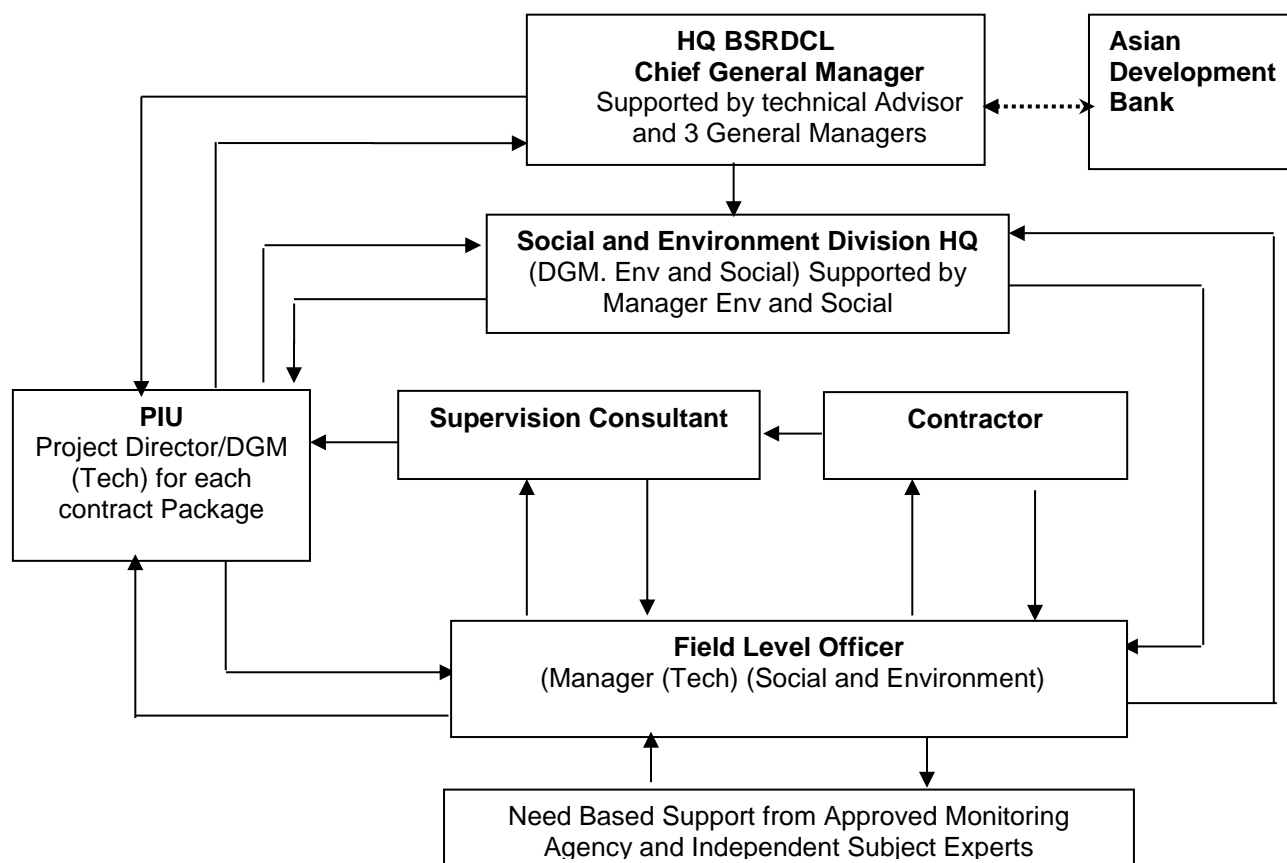
Table 44: Responsibilities for Environmental Safeguards Implementation

S. No	Agency	Responsibility
1.	BSRDCL (HQ)	<ul style="list-style-type: none"> – Ensure that project complies with ADB's SPS,2009 and GOI laws and regulations – Ensure that contract documents include all relevant parts of the environmental assessment and project agreements. – Ensure that sufficient funds are available to properly implement all agreed environmental safeguards measures – Obtain all statutory clearances and permissions – Review and approve the Contractor's Implementation Plan with Supervision Consultant for the environmental measures, as per the EMP – Review the environmental performance of the project through an assessment of the periodic environmental monitoring reports submitted by the Supervision Consultants – overall project coordination and management through PIU supported by PMC and CSC – Formation of Grievance Redress Mechanism – Submit annual safeguards monitoring reports to ADB and its closure – Ensure updating of the EMP if any new or unanticipated environmental impacts occur during project implementation due to design change or other reasons

⁴⁵ Central Project Implementation Unit

S. No	Agency	Responsibility
		<ul style="list-style-type: none"> – If there are significant new or unforeseeable impacts, immediately inform ADB to make a decision on the need for also updating the IEE report
2.	Project Implementation Unit (PIU) – Field Level	<ul style="list-style-type: none"> – Ensure that Project complies with ADB's SPS and GoI laws and regulations – Ensure that the environment checklist is completed on time by contractor, reviewed by CSC and submitted to BSRDCL – Participating in State and District level meetings related to forestry clearance and other compliances. – Periodic appraisal of progress and reporting to the HQ – Facilitating the contractor to obtain necessary permissions/ approvals and its submission to HQ and further to ADB – Directly interact with project affected persons and record their views and grievances and transmit the same to HQ – Settle grievances if any at field level. – Review and approve the package specific EMP's and EMOP's and make necessary modifications if required. – Facilitate the establishment of a grievance redress mechanism, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances related to environment safeguards – Ensure that all mitigation measures as given in the EMP are implemented properly – Ensure proper conduction of environmental monitoring during pre-construction, construction and operation phases – Verify the monitoring checklist/report prepared by the CSC – Ensure annual environmental monitoring reports are prepared and submitted to ADB for disclosure on their website on an annual basis – Identify environmental corrective actions and prepare a corrective action plan, as necessary, for submission to ADB during project implementation
3.	Environment Specialist, Construction Supervision Consultant (CSC)	<ul style="list-style-type: none"> – Review IEE and EIA to acquaint him/herself about the project and environmental safeguard requirements. – Identify statutory/regulatory requirements (clearances /permits/NOC for the project and ensure all are secured before physical commencement of work – Provide technical assistance and follow ups with concerned authority for securing these clearances. – Prepare and provide checklist/formats to contractor for periodic pollution monitoring and OHS reporting in line with EMP and EMOP. – Review method of construction technology to make it most environmentally acceptable and develop good construction practices and guidelines to assist contractor. – Review the adequacy of existing onsite facilities (waste management, storm water drainage, oil spillage prevention, fire-fighting, emergency preparedness and other OHS requirements. before start of construction) – Review and approve EMP submitted by contractor and check whether it is in line with EMP of IEE and present site conditions.

S. No	Agency	Responsibility
		<ul style="list-style-type: none"> – Conduct workshops/training for contractor and PIU staffs before and periodically during construction. – Conduct periodic consultations programs with communities along highway to know if any activities of contractor causing inconvenience like excessive noise, dust, debris disposal etc to them. – Conduct regular site inspections to examine environmental compliances and suggest corrective actions; – In times of emergencies, where necessary coordinate with the relevant government agencies. – Formulate environmental awareness plan – Assess practicality of proposed GRC and modify as per local conditions. – Maintain proper records of all grievances received and addressed under the project – Prepare Annual Monitoring Plan. – Update IEE in case there is any change in alignment or other scope of work. – Provide necessary support to the PIU to ensure proper disclosure of project related information to stakeholders
4.	Contractor	<ul style="list-style-type: none"> – Responsible for the physical implementation of the mitigation measures proposed in the Environmental Management Plans (EMP) associated with the construction activities. – Responsible for implementation of the Environmental Monitoring Program (EMOP) on collection of environmental quality data. Prepare contract package specific (EMOP) for approval by the CSC and/or PIU before the start of physical works – Ensure that adequate budget provisions are made for implementing all mitigation measures specified in the EMP and EMOP – Participate in induction training on EMP provisions and requirements delivered by the PIU – Obtain necessary environmental license(s), permits etc. from relevant agencies for associated facilities for project road works, quarries, hot-mix plant etc. prior to commencement of civil works contracts – Implement all mitigation measures in the EMP – Ensure that all workers, site agents, including site supervisors and management participate in training sessions delivered by PMC/CSC. – Ensure compliance with contractual obligations – Collect the baseline data on environmental quality before the start of physical works and continue collection of environmental quality data as given in the Environmental Monitoring Plan during construction – Participate in resolving issues as a member of the GRC – Respond promptly to grievances raised by the local community or and implement corrective actions

Figure 11: Flow Diagram Illustrating Proposed EMP Implementation Arrangement

F. Institutional / Capacity Building

271. Several trainings and capacity building programmes have been conducted in past by BSRDCL to enhance the capacity of its officials related to implementation of environment safeguards in ADB's assisted projects. However, since the officers are not permanently positioned and there is periodic transfers within or outside the department and vice-versa so it is imperative to devise a training program to acquaint the freshly joined officers about safeguard requirements, including EMP implementation and monitoring the resultant effects. Training module is also aimed to create awareness among workers and local community. The institutions/agencies like regional office of MoEF, SPCB/CPCB, Indian Institute of Technologies and forestry institutions, can be consulted for such trainings. Independent subject's experts/consultants (e.g., for the environmental awareness program, impact assessment specialist will be the resource person) can also be the resource persons to impart trainings. These experts /agencies shall be appointed based on specific need for the training. A separate budget for training has been allocated under the CSC budget.

Table 45: Training/Workshop Module for EMP Implementation

S.No	Target group	Subject(s)	Method	Time Frame
1	All staffs of BSRDCL including PIUs involved in	Environmental Overview: Environmental Regulations, sub-project related provisions of various Acts/ Guidelines, Procedures of EC and FC, process and methodology for IEE, EMPs	Lectures cum interaction	Before beginning of the implementation

S.No	Target group	Subject(s)	Method	Time Frame
	implementation of the project			on of the subproject.
2	Managers (Env) at PIU, Supervision Consultant's Environmental Specialists and Select NGOs	Implementation of EMPs: Basic features of an EMP, Planning, designing and execution of environmental mitigation and enhancement measures, monitoring and evaluation of environmental conditions – during construction and operation	Workshop s and Seminars	Before the construction begins
3	Environmental officer, design team, Supervision Consultant Construction Contractors' staff	Environmentally Sound Construction Practices: Clean construction technology, alternatives materials and techniques for construction, Waste Management and minimization in construction, pollution control devices and methods for construction sites and equipment, Environmental clauses in contract documents and their implications, protection of flora and fauna Environmental monitoring during construction	Workshop s and Site visits	Before the construction
4	PIU and Supervision Consultant, NGOs and community representatives	Monitoring Environmental Performance during Construction: Air, Water, Soil and Noise, tree survival Monitoring requirement and techniques, Evaluation and Review of results, Performance indicators and their applicability, possible corrective actions, reporting requirements and mechanisms	Lectures, Workshop and site visits	During initial phases of construction
5	-do-	Long-term Environmental Issues in Project Management: Designing and implementing environmental surveys for ambient air, noise, biological and water quality surveys, data storage, retrieval and analysis, contract documents and environmental clauses, risk assessment and management, contingency planning and management and value addition	Workshop s and seminars	During implementation of the Subproject
6	Public /contractors workers	Awareness programmes on environmental protection and measures being implemented by BSRDCL and their role in sustaining the measures taken including for noise pollution, air pollution, safety, soil conservation, and agricultural productivity enhancement	Workshop s	During construction and initial phase say 3 years of operation
7	BSRDC, CSC and Contractor.	Restoration of sites viz borrow areas, construction Camps, Crushing units, HMP etc. And Reporting Formats/procedure	Lecture/ Presentati ons	before Contractor Demobilizatio n

G. Grievance Redress Mechanism

272. All the three parties involved in this project implementation i.e. Contractor, CSC and executing agency will maintain complaint registers at their following respective offices:

- Contractor's main site offices i.e. office of the Project Manager;

- CSC's main site office i.e. office of the Engineer's Representative; and
- PIU DGM office i.e. Employer's field office

273. **Level 1 – PIU level:** All public complaints regarding environmental issues received by any of the above mentioned offices will be entered into the register with specific details such as name and address of the person or representative of the community registering a complaint, the details of complaint, and time. DGM/Project Director (PIU) and CSC representative will immediately communicate the details of the complaint to the Contractor. The environment and safety officer of the contractor will promptly investigate and review the environmental complaint and implement appropriate corrective actions to arrest or mitigate the cause of the complaints within 3 days time of receiving the complaint. The contractor will report to CSC environment expert about the action taken on the complaint, also within 3 days time of receiving the complaint, for his further intimation to DGM PIU. The person making the complaint will also be intimated by the complaint receiving person or his representative, about the action taken, within 3 days.

274. **Level 2 – State level:** Grievances not redressed by the PIU level will be brought to the State level Grievance Redress Committee (GRC). The State level GRC will be headed and chaired by General Manager (Projects) and will comprise of the following:

- i) General Manager (Projects), BSRDCL
- ii) Environmental Specialist, CSC
- iii) A representative from the respective local community
- iv) Representative of concerned agency such as Forestry Department or State Pollution Control Board depending on the nature of the complaint/issue

275. The main responsibilities of the GRC will be to: (i) record grievances, categorize, and prioritize grievances and resolve them as soon as possible; (ii) immediately inform the EA of serious cases; and (iii) report to complainants on decisions made regarding their grievances within three weeks of receiving the grievance from the PIU level. The decision must include the agreed timeline for addressing the grievance. Grievances related to resettlement benefits, compensation, relocation, replacement cost and other assistance will be addressed by following the grievance redress system provided in the RP.

276. The Grievance Redress Mechanism has also been illustrated through a flow chart given as **Figure 12**.

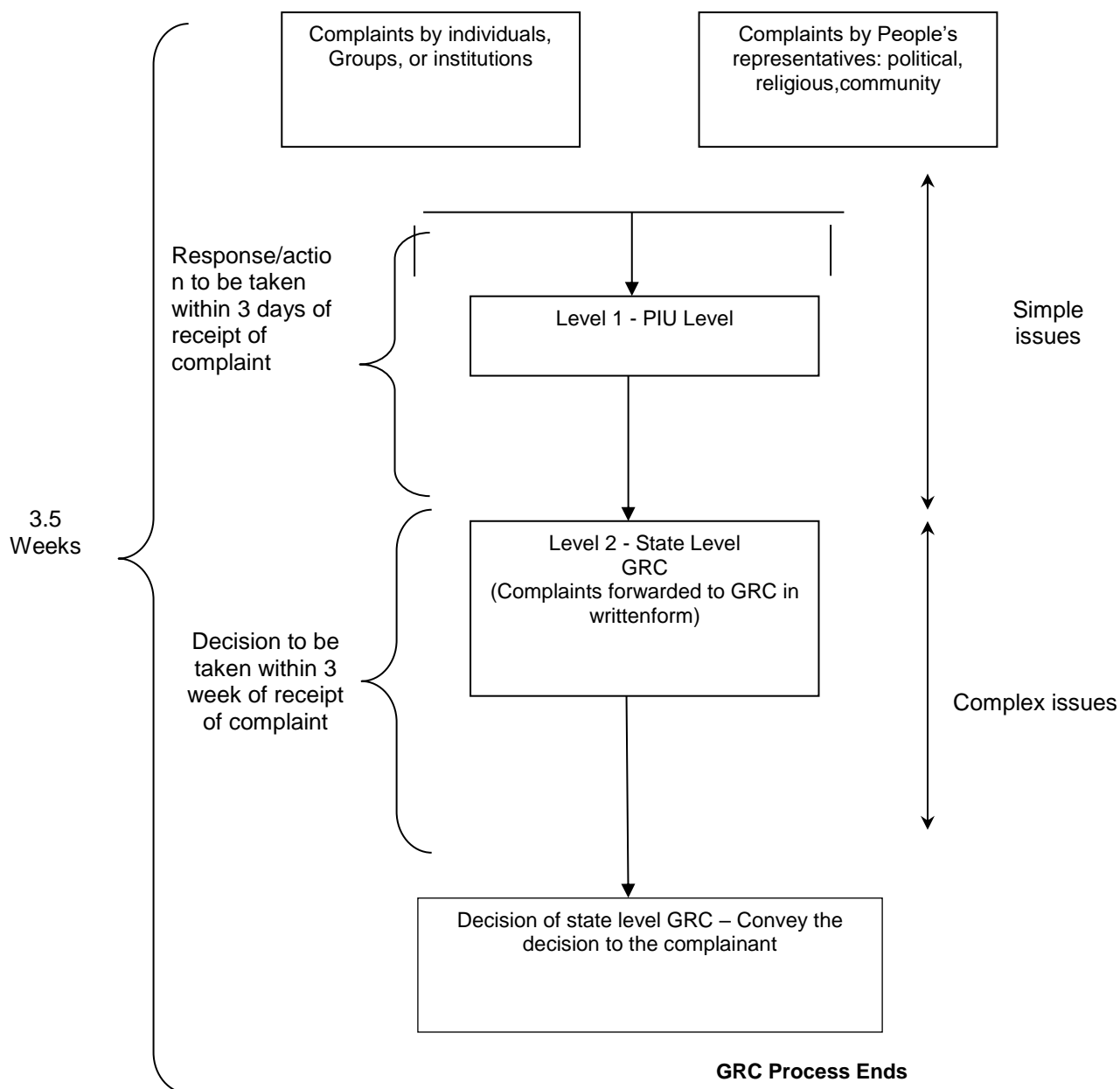


Figure 12: Flow Diagram Showing Grievance Redressal Mechanism

H. Environment Management Budget

277. Most of the measures have been addressed as part of good engineering practices, the costs for which have been accounted for in the engineering/cost. All costs towards pre-construction clearances/permission will be borne by executing agency. These costs are indicative. The environmental budget for the various environmental management measures proposed under the project is presented in Table 45. A total budget amount of Rs. 454223272.00 or \$ 6779452.00 has been allocated for implementation of environment safeguards under the project.

Table 46: Estimated Environment Management Cost (INR)

S. No	Activity	BSHP- III/1/SH-58	BSHP- III/2/SH-84	BSHP- III/3/SH-84	BSHP- III/4/SH-85	BSHP- III/5/SH-82	BSHP- III/6/SH-82	BSHP- III/7/SH-82	BSHP- III/8/SH-102	BSHP- III/8/SH-102	Total (INR)
1. Wildlife conservations											
1.1	Warning Cum Informatory Sign-Boards	Not Required	Not Required	Not Required	Not Required	Not Required	4X2X75000 = 600000.0 for location refer Table 27 of IEE	4X2X75000 = 600000.0 for location refer Table 27 of IEE	Not Required	Not Required	1200000.00
1.2	Rumble Strips	Not Required	Not Required	Not Required	Not Required	Not Required	5x2x50000 =500000.0 At Km 44.4, Km 44.9, Km 45.4, 45.9 and Km 53.6	Not Required	Not Required	Not Required	500000.00
1.3	2 Check Dam/Water Body on either side of Forest stretch	Not Required	Not Required	Not Required	Not Required	Not Required	2X100000 =2000000	2X100000 =2000000	Not Required	Not Required	4000000.00
2. Forest Diversion and Tree Cutting											
2.1	Net Present Value @ 626000/ha as assessed by Forest Dept.	NA	For diversion of 96.18 Ha forest area = Rs. 60208680	For diversion of 96.18 Ha forest area= 35738340	Diversion of 27.695 ha of forest land in Nawada Division covering full stretch of Package 5 and major portion of Package 6 =17337070 NPV for Jamui Division yet to be assessed				For Diversion of 55.46 Ha= 34717960		148002050
2.2	Compensatory Plantation@ 1:3 @ 2500/Tree for non-forest road and 1;2 where CA land in lieu of diverted land has to be given	3051 trees against 1017 trees = 7627500	CA @ 138564.16/Ha for 190 ha =Rs. 26327190	CA @ Rs 133192.3 /ha for 114 ha = 15183930	CA. @ Rs 126335/ha for 60 ha = 7580102				CA amount not yet assessed by forest land The estimated amount as per forest proposal prepared during DPR =18800000		75518722

S. No	Activity	BSHP- III/1/SH-58	BSHP- III/2/SH-84	BSHP- III/3/SH-84	BSHP- III/4/SH-85	BSHP- III/5/SH-82	BSHP- III/6/SH-82	BSHP- III/7/SH-82	BSHP- III/8/SH-102	BSHP- III/8/SH-102	Total (INR)
3. Additional Plantation											
3.1	Additional Plantation @ 1:7 Unit rate= Rs 2500/Tree	7119 trees against 1065 trees =17797500	7455 trees for loss of 1065 trees =18637500	7959 trees for loss of 1137 trees =19897500	9877 for loss of 1411 trees= 24692500	6650 trees for 950 trees = 16625000	8736 trees for loss of 1248 trees = 21840000	6825 trees for the loss of 975 tree= 17062500	11725 for loss of 1675 trees= 29312500	5796 trees for loss of 828 trees= 14490000	180355000
4. Pollution Monitoring											
3.1	Monitoring of Air, Water Noise, soil Pls refer EMOP Table for No. Of Samples, Frequency and Duration	904500.00	904500.00	819500.00	819500.00	837500.00	837500.00	774500.00	837500.00	837500.00	7572500
5. Noise Barrier											
4.1	Construction of Solid Noise Barrier at Sensitive Receptors	Lump sum for 15 structures = 4000000	Lump sum for 20 structures = 3500000	Lumpsum for 18 structures =3150000	Lump sum for 25 structures = 4000000	Lump sum for 19 structures = 3325000	Lump sum for 11 structures = 1925000	Lump sum for 12 structures = 2100000	Lump sum for 30 structures = 5100000	Lump sum for 15 structures = 2550000	29650000
6. Water Sprinkling for Dust Suppression											
4.2	In built-up stretch, 2 tanker/day twice a day for 30 days@ 1500/Tanker	810000	315000	360000	1080000	450000	315000	450000	675000	1170000	5625000
7. Training and Capacity Building											
4.3	Training for Effective Implementation of EMP	200000	200000	200000	200000	200000	200000	200000	200000	200000	1800000
Total		31339500	110092870	24427000	81714270	46354672	28217500	23187000	89642960	19247500	454223272

Note: Cost Estimates for Net Present Value (NPV) and Compensatory Afforestation (CA) is not calculated separately for individual package since forest clearance process has been initiated for entire length of state highway passing through protected forest. Hence, the NPV and CA cost has been included in any one of the Packages of SH-84, SH-82 and SH-102.

Table 47: Summary of Cost Estimates

S. No	Activity	Budget Source	Amount (INR)	Implementation Responsibility
1	NPV for Forest Land	BSRDCL	148,002,050	BSRDCL through Forest Department
2	Compensatory Afforestation for Roads under Forest (SH-82, SH-82 and SH-102)		6,789,1222	
3	Compensatory Plantation for SH-58		7,627,500	
4	Additional Plantation	BSRDCL	180,355,000	BSRDCL through Contractors of Forest Department
5	Monitoring of Air, Noise Water, Soil	BOQ Item	7,572,500	
6	Wildlife Mitigations (Informatory Sign Boards+Rumble Strips+Creation of Water Bodies in forest Area of SH-82)	Provisional Sum of Civil Works	5,700,000	Design to be finalised by CSC
7	Noise Barrier		29,650,000	
8	Water Sprinkling for Dust Suppression		5,625,000	
9	Training and Capacity Building	CSC Cost	1,800,000	CSC
Total			454223272	

VIII. CONCLUSION AND RECOMMENDATION

A. Road widening and Improvement

278. The scope of works under BSRIP III involves upgrading of 5 state highways aggregating 231.75 km through widening of existing roads into 2 lanes with paved shoulders. Since it is an expansion project, stress on existing natural resource viz, land, water, soil and aggregates are not significant. Further, the project is outside any legally protected, eco-sensitive, or critical habitat areas. Most of the adverse impacts are co-terminus with the construction stage, site specific, limited within the RoW, and are easily mitigated through good engineering and environmentally acceptable practices. Hence, classified as environment **Category B** in accordance with the ADB's SPS 2009.

279. Significant environmental impacts anticipated are: i) pre-construction phase: permanent loss of trees, increase in road crashes from inadequate road alignment and design, increase in animal-vehicle collision from unregulated higher vehicular speed in forest area (a small portion in SH-82) and localized water-logging in some builtup areas due to inadequate drainage; ii) construction phase: loss of productive soil for embankment, increased dust, generation of noise, accidents risk and health hazard to construction workers due to poor camp and site management. Inadequate clean-up operation, restoration and rehabilitation prior to decommissioning may cause disturbances to local community. Potential impacts during pre-construction may be minimised through design changes like permanent loss of some trees can be avoided by minor adjustments/eccentric widening and residual impacts are compensated through mandatory compensatory plantation and additional plantation. Disturbance to wildlife movement in forest area can be minimized by installation of signages to caution the drivers, provision of rumble strip to regulate speed and creating water bodies on both sides to restrict them crossing the road in search of water.

280. During construction phase, adequate guidance and resources are provided by BSRDCL to the Contractor to comply with the borrow area management requirements, suppress dust, control noise, and implement proper closure. BSRDCL, through its Project Implementation Units (PIUs), will ensure the effective implementation of the environmental management plan. To provide regular monitoring information and technical advice to the PIUs a Construction Supervision Consultant (CSC), will be engaged who will be responsible to examine environmental compliances and suggest corrective actions and guide contractors to enhance the environmental performance of the project.

281. Meaningful consultations have been conducted during the project preparation stage and all concerns of the affected persons and stakeholders have been incorporated in the IEE and the EMPs. These consultations were represented by key environmental agencies and roadside communities. The road-specific EMPs and concomitant costs is part of the bidding documents A Grievance Redress Mechanism has been formed to continue receiving feedback and complaints, if any, from affected parties and addressing them during the construction stage and operation stage. This IEE report is disclosed on the ADB and BSRDCL websites.

282. The initial environmental examination ascertains that the project is unlikely to cause any significant environmental impacts. Need of undertaking detailed EIA is not envisaged at this stage. BSRDCL shall ensure that EMP and EMoP are included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract. The same shall be revised if necessary during project implementation or if there is any change in the project design and with approval of ADB.

B. Creating Infrastructure for Bihar Road Research Institute

283. Proposed Site of BRRI is outside any eco-sensitive or protected area. Presently it is a vacant plot and previously being used for batching/hot mix plant. The site is within Municipal area and confirms Patna Master Plan-2031. All environmental services viz. Storm water drains, sewage line etc. are already laid. However, necessary permission need to be obtained from local bodies with details of incremental load to confirm if any capacity augmentation of existing infrastructure is required in view of upcoming building.

284. Site is largely devoid of trees. Most of the trees are along periphery of the site and remaining may be adjusted by ameliorate the design layout. There is no significant impact except noise/vibration and increased dust due to construction activities, transport and storage of material. All these impacts are short-term and localised. Implementation of recommendations outlined in generic EMP will significantly avoid/minimise the adverse impacts during construction phase. Operation phase impacts are mostly beneficial due to large scale plantation, landscaping and restructuring/improvement of existing Facilities.

285. BSRDCL to obtain all necessary permits and clearances as described in this section. Most importantly if the total built-up area exceeds the threshold limit of 20000 sq. m, BSRDCL to secure environmental clearance from State Environmental Impact Assessment Authority. Even though the project does not attract environmental clearance it is recommended that a specific and more comprehensive environmental management plan (EMP) shall be prepared and implemented to ensure compliance with the environmental conditions specified above. A dedicated Environment Monitoring Cell with defined functions and responsibility shall be put in place to implement the EMP. The environmental cell shall ensure that the environment infrastructure like Sewage Treatment Plant (if proposed), Landscaping, Rain Water Harvesting, Energy efficiency and conservation, water efficiency and conservation, solid waste management, renewable energy etc. are kept operational and meet the required standards. The environmental cell shall also keep the record of environment monitoring and those related to the environment infrastructure.

APPENDIX 1: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

ROADS AND HIGHWAYS

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES), for endorsement by Director, RSES and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: Bihar State Highways III Project

Sector Division: Roads and Highways

Screening Questions	Yes	No	Remarks
A. project siting is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		x	No cultural heritage site is located within the road ROW or vicinity.
▪ Protected area		x	None of the project road is inside or adjacent to any notified protected area. However, protected and reserved forest patches are present in few stretches along project roads except Dumka-Hansdiha road.
▪ Wetland		x	None.
▪ Mangrove		x	None
▪ Estuarine		x	None
▪ Buffer zone of protected area		x	None
▪ Special area for protecting Biodiversity		x	No special biodiversity area is located within the project area.
B. potential environmental impacts will the project cause...			
▪ Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	x		No encroachment of historical places. However, some religious structures exist along the project road which may get partially impacted. Disfiguration of landscape is not envisaged since it is expansion/improvement of existing roads without only 1 short (1.4 km) bypass at Ghogha hence involving large scale cut and fills is not involved. Quarry material will be procured from existing licensed quarries. Opening and operation of new quarry, if needed will follow consent conditions of Pollution Control Board and environmental clearance from DEIAA.
▪ Encroachment on precious ecology (e.g. sensitive or protected areas)?		x	No National Parks, wildlife sanctuaries or similar eco-sensitive areas along the project road. However, forest land diversion is required for road widening in all roads since roadside trees are notified as protected forest except SH-58

Screening Questions	Yes	No	Remarks
			<p>A small portion of SH-82 intermittently (Ch. 42.7 near Mahodar to Km 54.1 near Chanarwar and 66.4 Km near Kurwatad to Km. 68.8 near Baba Jhakhraj) passes through fringe area of natural forest. No loss of any rare, threatened or endangered floral species is envisaged due to clearance of vegetation for widening. Undefined movement of some wild animals mainly of Blue Bulls⁴⁶ (<i>Boselaphus tragocamelus</i>; Schedule⁴⁷ V) was reported by local people. Besides, occasional crossing of Spotted Deer (<i>Axis-axis</i>; Schedule III), Sambhar (<i>Cervus unicolor</i>; Schedule II), and rare sighting of Sloth Bear (<i>Melursus ursinus</i>; Schedule) was also reported by local people. None of the animal species are under threatened or endangered categories as per IUCN classification. Sloth bear is under vulnerable category.</p> <p>Adequate measures like provision of additional culverts, rumble strips, sign boards, speed restriction and creation of water structure on either side in forest area etc. have been proposed to enable their free and safe movement. Further, creation of water structure on either side in forest area will restrict them to cross the road in search of water.</p>
<ul style="list-style-type: none"> Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site? 	x		<p>Project area is drained by a No. of rivers and also intersecting some of sub-project roads. Most of them is non-perennial in nature.</p> <p>Bridge construction on rivers will be done during lean flow period. In some cases minor channels may be diverted for a very short period and will be brought back to its original course immediately after construction.</p>
<ul style="list-style-type: none"> Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction? 		x	<p>A temporary earthen bund or silt fencing will be provided around the construction site to avoid any sedimentation in nearby streams/ponds. Adequate sanitary facilities and drainage in the workers camps will help to avoid this possibility. Construction activity in this project will not contain any harmful ingredients.</p>
<ul style="list-style-type: none"> Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing? 	x		<p>Air pollution level is likely to be increased for short duration during construction period. Appropriate distance from settlement area and wind direction may be taken into account to locate air polluting facility like stone crushing unit etc. use of</p>

⁴⁶ Presently, this species is under Schedule III of Wildlife Act, 1972. Due to its large population causing heavy crop damage, MOEF has issued an advisory to include it in Vermin category of Schedule V so that killing/hunting of such animals are outside purview of law.

⁴⁷ Wildlife Protection Act, 1972 has six schedules which give varying degrees of protection. [Schedule I](#) and part II of [Schedule II](#) provide absolute protection - offences under these are prescribed the highest penalties. Species listed in [Schedule III](#) and [Schedule IV](#) is also protected, but the penalties are much lower. [Schedule V](#) includes the animals which may be hunted.

Screening Questions	Yes	No	Remarks
			environment friendly equipments/machineries will help to reduce air pollution.
<ul style="list-style-type: none"> Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation? 		x	Workers may get exposed to dust and noise during construction activities. However the exposure levels are likely to be short and insignificant. Workers will be provided requisite PPEs to minimise such exposure and associated harmful occupational health effects. Extensive safety measures have been included for occupational health in specific conditions of the contract. Road designs also address the safety issues comprehensively for the operation stage.
<ul style="list-style-type: none"> Noise and vibration due to blasting and other civil works? 	x		Blasting is not involved. Ambient noise level is expected to marginally exceed due to various construction activities, maintenance workshops, and earthmoving equipment., their occurrence will be intermittent and co-terminus with the project construction. All stationary noise making equipment will be installed with acoustic enclosures. Timings of noise construction activities will be regulated near sensitive receptors. Multi-layered plantation proposed.
<ul style="list-style-type: none"> dislocation or involuntary resettlement of people 		x	Project will cause significant number of economically and physically displaced persons involving some vulnerable groups. Most of them are squatters and encroachers. Indigenous population is negligible. For exact figure, pls refer resettlement plans which is under preparations.
<ul style="list-style-type: none"> Dislocation and compulsory resettlement of people living in right-of-way? 		x	
<ul style="list-style-type: none"> Disproportionate impacts on the poor, women and children, indigenous peoples or other vulnerable groups? 		x	
<ul style="list-style-type: none"> Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress? 		x	Deterioration in ambient air quality will be localized and temporarily during construction stage only. The project area is largely located in open areas.. Extensive plantation along the highway and improved road conditions will improve the air quality of the area.
<ul style="list-style-type: none"> Hazardous driving conditions where construction interferes with pre-existing roads? 		x	Suitable traffic management plan will be designed and implemented by the contractor to prevent any hazardous driving conditions.
<ul style="list-style-type: none"> Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations? 		x	Proper provisions for sanitation, health care and solid waste disposal facilities will be available in the contract documents to avoid such possibility. workers will be made aware about communicable diseases
<ul style="list-style-type: none"> Creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents? 		x	No such condition is anticipated. Most of borrow areas are likely to be converted into ponds. Fish culture will be promoted in these ponds which will naturally restrict mosquito breeding.
<ul style="list-style-type: none"> Accident risks associated with increased vehicular traffic, leading 		x	Adequate safety measures will be adopted to avoid such conditions.

Screening Questions	Yes	No	Remarks
to accidental spills of toxic materials?			
<ul style="list-style-type: none"> Increased noise and air pollution resulting from traffic volume? 	x		Increase in noise and air pollution is expected during construction phase. Adequate mitigation measures will be adopted to minimise them. During operation phase, the main source of noise and air will be traffic. Improved road conditions, extensive plantation will help reduce the noise and air impact. Moreover, the alignment mostly passes through open agricultural land which will provide adequate dispersion of gaseous emission. If measures suggested for noise sensitive receptors prove inadequate, solid noise barrier will be placed.
<ul style="list-style-type: none"> Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road? 	x		This is expected from accidental spillage. Adequate safety provisions have been proposed to avoid such situation.
<ul style="list-style-type: none"> Social conflicts if workers from other regions or countries are hired? 		x	Most of the workers will be from local areas and hence such conflict is not anticipated.
<ul style="list-style-type: none"> Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)? 		x	Workers will be mostly from local villages. Worker from remote places will be provided with adequate facility. The ratio of local and outside workers will be such balanced that there is minimum burden on existing social infrastructures and services.
<ul style="list-style-type: none"> Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation? 		x	There are well defined legislations and regulations for transport, storage and its use. All these legislations and regulations will form part of contract obligations which has to be necessarily complied by contractor. Similarly, during operation phase the transportors/carriers need to adhere it.
<ul style="list-style-type: none"> Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning. 		x	<p>Adequate measures have been adopted to mitigate such risks.</p> <p>Adequate awareness will be created amongst people and workers through information disclosure, safety signage and public consultation about safety aspects.</p>

A. Checklist for Preliminary Climate Risk Screening

Country/Project Title: India/Bihar State Highways III Project

Sector: Transport

Subsector: Road

Division/Department: SATC/SARD

Screening Questions		Score	Remarks ⁴⁸
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	The project area has a history of drought but this has very little impact on the road upgrading. The study area largely does not have flood problem. Overtopping of some bridges/culverts was recorded in past flood of 1999-2000 in some sections of Sh-85 and SH-85. Since then no overtopping is not reported.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	All CD structures have been designed for 50yr return period with anticipated risk of rarer flood of next higher frequency. Waterway of all CD structures with inadequate vent size has been increased. Free board of 0.6m to 1m from deck level has been considered for all bridges
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	1	<p>As per a report published in 2015 by Government of Bihar titled "<u>Bihar State Action Plan on Climate Change-Building Resilience through Development</u>", future projected change in surface temperature (°C) during 2011-2040 with respect to 1961-1990 in simulation of different climate model shows following temperature and rainfall variations</p> <p>Temperature Southern Bihar (Project Districts; Nawada and Jamui) =1.2°C to 2.0°C North Bihar=1.0°C to 1.6°C Western Bihar (Project District; Bhojpur) = 0.6°C to 1°C, increase Eastern Bihar (Project Districts: Banka Bhagalpur Madhepura) = 0.2°C to 0.4°C, increase</p> <p>Rainfall Eastern (Project Districts: Banka Bhagalpur Madhepura) & Central Bihar: 5-10 % surplus South (Project District; Nawada and Jamui) & western (Project District; Bhojpur) : 5 % deficit</p> <p>As per Vulnerability Atlas of India, 27 districts in Bihar are fully affected by high-speed winds of 47 m/s intensity. The area of districts—Banka, Jahanabad, Arwal, and Nalanda is nearly 90% affected. Other districts of South Bihar except</p>

⁴⁸ If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Screening Questions		Score	Remarks ⁴⁸
			Nawada are partly affected by high-speed winds of 44 m/s. Nawada is, however, 100 % affected by high-speed winds of this intensity. In all 86 % of the total area of Bihar is prone to high-speed winds of 47 m/s intensity and only 14% of the area prone to high-speed winds of lesser intensity
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	1	The warmest predicted average monthly temperature may increase the frequency of road repair due to rutting.
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	The predicted increase in temperature is at levels that may cause rutting but not at a scale that can jeopardize the achieving the project objective of providing safe and efficient transport.

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

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

Result of Initial Screening (Low, Medium, High): MEDIUM

Other Comments: _____

Prepared by: Karma Yangzom, Environmental Specialist, SATC.

APPENDIX 2: WORLD BANK AND GOI AMBIENT AIR QUALITY STANDARDS

A comparison between the ambient air quality requirements between the World Bank (WB) Environment, Health and Safety (EHS) guidelines and the National Ambient Air Quality standards (NAAQS) under the Air (Prevention and Control of Pollution) Act, 1981 of GOI as given in table below shows that the NAAQS has requirements on three more parameters (Pb, Co and NH₃) in comparison to the WB EHS. The NAAQS has differentiated standards for two types of areas: i) industrial, residential, rural and other areas and ii) ecologically sensitive areas. The WB EHS has guideline values which are the required standards but allows for gradual compliance to the guideline values through staged interim targets. Most WB EHS guideline requirements are more stringent than NAAQS except for the NO₂ one year average in ecologically sensitive areas where the NAAQS requirements are more stringent.

Ambient Air Quality Parameter	Averaging Period	WB Guideline Value		GOI Standards for Industrial, Residential, Rural and Other Areas	GOI Ecologically Sensitive Area (notified by Central Government)
Sulfur dioxide (SO ₂) (ug/m ³)	24-hr	125	(Interim target 1)	80	80
		50	(Interim target 2)		
		20	(guideline)		
	10 min	500	(guideline)		
	Annual	None		50	20
Nitrogen dioxide (NO ₂) (ug/m ³)	1 Year	40	(guideline)	40	30
	24 Hour	None		80	80
	1 Hour	200	(guideline)		
PM ₁₀ (ug/m ³)	1 Year	70	(Interim target 1)		
		50	(Interim target 2)		
		30	(Interim target 3)		
		20	(guideline)	60	60
	24-hr	150	(Interim target 1)		
		100	(Interim target 2)		
		75	(Interim target 3)		
		50	(guideline)	100	100
PM _{2.5} (ug/m ³)	1 year	35	(Interim target 1)		
		25	(Interim target 2)		
		15	(Interim target 3)		
		10	(guideline)	40	40
	24-Hour	75	(Interim target 1)		
		50	(Interim target 2)		
		37.5	(Interim target 3)		
		25	(guideline)	60	60
Ozone (O ₃) (ug/m ³)	8-hr daily max	160	(Interim target 1)		
		100	(guideline)	100	100
Lead (Pb) (ug/m ³)	Annual			0.5	0.5
	24 hours			1.0	1.0
Carbon Monoxide (CO) (ug/m ³)	8 hours			2000	2000
	1 hour			4000	4000
Ammonia (NH ₃) (ug/m ³)	Annual			100	100
	24 hours			400	400

APPENDIX 3: NOISE LEVEL STANDARDS OF WORLD BANK EHS AND THE GOI NAAQS

A comparison on noise level requirements between the WB EHS guidelines and the NAAQS under the Air (Prevention and Control of Pollution) Act, 1981 of GOI as given in table B shows that the required levels are equal for residential, institutional and educational areas. The NAAQS requirements for commercial areas are more stringent while the WB EHS requirement for daytime noise in industrial area is more stringent.

Receptor	WB EHS indB(A)		GOI NAAQS indB(A)	
	Daytime	Nighttime	Daytime	Night time
	7:00-22:00	22:00-7:00	6:00-22.00	22:00-6:00
Residential	55	45	55	45
Institutional; educational			None	None
Industrial	70	70	75	70
Commercial			65	55
Silence Zone	None	None	50	40

Permissible Exposure in Case of Continuous Noise for Work Zone Area
[as per Model Rules of Factories Act, 1948]

Total Time of Exposure (continuous or a number of short term exposures) per day, in hr	Permissible Sound Pressure Level indB(A)
8	90
6	92
4	95
3	97
2	100
1	102
1&1/2	105
1/2	107
1/4	110
1/8	115

Notes: 1.No exposure in excess of 115 dB (A) is to be permitted.
 2. For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column 1, the permissible sound pressure level is to be determined by extrapolation on a proportionate basis.

APPENDIX 4: DRINKING WATER QUALITY STANDARDS
(As per IS: 10400-1991)

Sl. No.	Parameter and Unit	Desirable Limit	Permissible Limit in Absence of Alternate Source
1.	Colour (Hazen units)	5	25
2.	Odour	Unobjectionable	-
3.	Taste	Agreeable	-
4.	Turbidity (NTU)	5	10
5.	pH	5-8.5	No relaxation
6.	Total Coliforms (MPN/100 mL)	nil	-
7.	Pathogenic Organisms or Virus	nil	-
8.	TDS (mg/L)	500	2000
9.	Mineral Oil (mg/L)	0.01	0.03
10.	Free Residual Chlorine (mg/L)	0.2	-
11.	Cyanide (mg/L as CN)	0.05	No relaxation
12.	Phenol (mg/L C ₆ H ₅ OH)	0.001	0.002
13.	Total Hardness (mg/L as CaCO ₃)	300	600
14.	Total Alkalinity (mg/L as CaCO ₃)	200	600
15.	Chloride (mg/L as Cl)	250	1000
16.	Sulphate (mg/L as SO ₄)	200	400
17.	Nitrate (mg/L as NO ₃)	45	100
18.	Fluoride (mg/L as F)	1	1.5
19.	Calcium (mg/L as Ca)	75	200
20.	Magnesium (mg/L as Mg)	30	100
21.	Copper (mg/L as Cu)	0.05	1.5
22.	Iron (mg/L as Fe)	0.3	1
23.	Manganese (mg/L as Mn)	0.1	0.3
24.	Zinc (mg/L as Zn)	5	15
25.	Boron (mg/L as B)	1	5
26.	Aluminium (mg/L as AL)	0.03	0.2
27.	Arsenic (mg/L as As)	0.05	No relaxation
28.	Mercury (mg/L as Hg)	0.001	No relaxation
29.	Lead (mg/L as Pb)	0.05	No relaxation
30.	Cadmium (mg/L as Cd)	0.01	No relaxation
31.	Chromium (VI) (mg/L as Cr)	0.05	No relaxation
32.	Selenium (mg/L as Se)	0.01	No relaxation
33.	Anionic Detergents (mg/L MBAS)	0.2	1
34.	PAH (mg/L)	nil	-
35.	Pesticides (µg/L)	Absent	0.001
36.	Alpha Emitters (10 ⁻⁶ µc/mL)	nil	0.0001
37.	Beta Emitters (10 ⁻⁶ µc/mL)	nil	0.001

APPENDIX 5: STANDARDS FOR FRESHWATER CLASSIFICATION (CPCB 1979)

Parameters	BOD mg/l	pH	D.O. in mg/l	Oil & Grease mg/l
CPCB standard Class A (drinking water without conventional treatment but after disinfections)	≤2.0	6.5 – 8.5	≥6.0	--
CPCB standard Class B (for outdoor bathing)	≤3.0	6.5 – 8.5	5.0	--
CPCB standard Class C (drinking water after conventional treatment and disinfections)	≤2.0	6 – 9	≥4.0	--
CPCB standard Class D (for propagation of wild life, fisheries)	--	6.5 – 8.5	≥4.0	≤0.1
CPCB standard Class E (for irrigation)	--	6.0-8.5	--	--

‘--’ Indicates not applicable/relevant

APPENDIX 6: BASELINE AIR QUALITY STATUS IN THE PROJECT AREA

SH-84								
S.No	Location	Station Code	Date of Monitoring	Concentration of Pollutants				
				PM 10 ($\mu\text{g}/\text{m}^3$)	PM 2.5 ($\mu\text{g}/\text{m}^3$)	SO₂ ($\mu\text{g}/\text{m}^3$)	NO₂ ($\mu\text{g}/\text{m}^3$)	CO ($\mu\text{g}/\text{m}^3$)
1	Ghogha.	AQ-1	07/08.12.10	175	96	7.0	42.1	BDL
2	Sanhaula	AQ-2	06/07.12.10	169	87	5.0	38.9	BDL
3	Kurmahat .	AQ-3	05/06.12.10	167	92	4.7	45.5	BDL
4	Madhya Vidhalaya Sadpur	AQ-4	04/05.12.10	109	67	4.8	28.6	BDL
5	Barahat.	AQ-5	03/04.12.10	169	71	6.6	42.5	BDL
SH-85								
S. No	Location	Station Code	Date of Monitoring	Concentration of Pollutants				
				PM 10 ($\mu\text{g}/\text{m}^3$)	PM 2.5 ($\mu\text{g}/\text{m}^3$)	SO₂ ($\mu\text{g}/\text{m}^3$)	NO₂ ($\mu\text{g}/\text{m}^3$)	CO ($\mu\text{g}/\text{m}^3$)
1	Chainage-0.00 Km, Akbar Nagar	AQ-1	11/12.12.10	116	68	70.2	42.5	BDL
2	Primary Health Center, Shaakund	AQ-2	10/11.12.10	127	75	5.6	37.8	BDL
3	Chiriya Village.	AQ-3	09/10.12.10	98	67	5.2	35.6	BDL
4	Chainage-29.50 Km ,Amarpur.	AQ-4	08/09.12.10	63	52	6.5	34.2	BDL
SH-82								
S. No	Location	Station Code	Date of Monitoring	Concentration of Pollutants				
				PM 10 ($\mu\text{g}/\text{m}^3$)	PM 2.5 ($\mu\text{g}/\text{m}^3$)	SO₂ ($\mu\text{g}/\text{m}^3$)	NO₂ ($\mu\text{g}/\text{m}^3$)	CO ($\mu\text{g}/\text{m}^3$)
1	Kadirganj	AQ-1	20.04.2018	77.96	35.58	14.69	20.38	--
2	Khaira	AQ-2	20.04.2018	79.70	35.68	14.89	22.31	--
3	Kowakol	AQ-3	20.04.2018	81.86	39.80	16.54	22.24	--
SH-58								
S. No	Location	Station Code	Date of Monitoring	Concentration of Pollutants				
				PM 10 ($\mu\text{g}/\text{m}^3$)	PM 2.5 ($\mu\text{g}/\text{m}^3$)	SO₂ ($\mu\text{g}/\text{m}^3$)	NO₂ ($\mu\text{g}/\text{m}^3$)	CO ($\mu\text{g}/\text{m}^3$)
1	Chosa	AQ-1	17.04.2018	82.76	40.55	16.60	21.40	--
2	Jogirar	AQ-2	17.04.2018	78.75	41.44	12.25	20.51	--
SH-102								
S. No	Location	Station Code	Date of Monitoring	Concentration of Pollutants				
				PM 10 ($\mu\text{g}/\text{m}^3$)	PM 2.5 ($\mu\text{g}/\text{m}^3$)	SO₂ ($\mu\text{g}/\text{m}^3$)	NO₂ ($\mu\text{g}/\text{m}^3$)	CO ($\mu\text{g}/\text{m}^3$)
1	Jagdishpur, Arrah	AQ-1	21.12.2013	78.4	36.1	22.8	30.2	840
2	Ojhalia More, Piro	AQ-2	21.12.2013	82.6	40.2	20.4	26.8	780

APPENDIX 7: NOISE LEVEL IN PROJECT AREA

SH-84						
S. No.	Station	Location	Date of monitoring	Leq dB (A)	Leq dB (A)	Remark
				Day	Night	
1.	NQ 1	Station Road Ghogha at 1+400	07/08.12.10	69.7	55.8	Commercial Area
2.	NQ 2	Primary School Tarar at 5+000	05/06.12.10	57.7	44.6	Silence Zone
3.	NQ 3	Primary Health Centre, sanahaula at 16+000	06/07.12.10	56.2	43.0	Silence Zone
4.	NQ 4	Madhya Vidhlaya , Sadpur at 40+000	04/05.12.10	55.1	40.4	Silence Zone
5.	NQ 5	Lakhpura at 48+000	02/03.12.10	64.6	44.7	Residential Zone
6.	NQ 6	Par Gadhi Village at 51+000	03/04.12.10	62.9	44.6	Residential Zone
SH-85						
S. No.	Station	Location	Date of monitoring	Leq dB (A)	Leq dB (A)	Remark
				Day	Night	
1	NQ 1	Near Primary School, Akbarnagar at 0+050	11/12.12.2010	60.8	39.5	Silence
2	NQ 2	Amba village at 14+300	10/11.12.2010	62.4	41.7	Residential
3	NQ 3	Sangrampur Village at 21+000	09/10.12.2010	60.5	41.1	Residential
4	NQ 4	Amarpur Village at 28+600	08/09.12.2010	67.6	48.8	Commercial
SH-82						
S. No.	Station	Location	Date of monitoring	Leq dB (A)	Leq dB (A)	Remark
				Day	Night	
1	NQ 1	Kadirganj	20.04.2018	55.4	38.9	Commercial
2	NQ 2	Khaira	20.04.2018	56.8	41.8	Commercial
3	NQ 3	Kowakol	20.04.2018	58.6	43.5	Commercial
SH-58						
S. No.	Station	Location	Date of monitoring	Leq dB (A)	Leq dB (A)	Remark
				Day	Night	
1	NQ 1	Chosa	20.04.2018	58.2	44.6	Commercial
2	NQ 2	Jogirar	20.04.2018	52.0	41.6	Residential
SH-102						
S. No.	Station	Location	Date of monitoring	Leq dB (A)	Leq dB (A)	Remark
				Day	Night	
1	NQ 1	Bihia	--	68.8	46.6	Commercial
2	NQ 2	Jagdishpur	--	61.5	53.6	Commercial
3	NQ 3	Piro	--	71.3	51.5	Commercial
4	NQ-4	Bihta	--	61.5	43.8	Residential

APPENDIX 8: GROUND WATER QUALITY IN PROJECT AREA**SH-84**

S. No.	Parameter	Unit	GW1 (Hand Pump in Village Alpura)	GW2 (Hand Pump in Block office Dhoriya)
1	pH at 220C		6.46	6.88
2	Temperature	°C	22	22
3	Turbidity	NTU	4.0	<1.0
4	Total Hardness as CaCO ₃	mg/l	544	188
5	Total Alkalinity	mg/l	221.76	194
6	Chlorides as Cl	mg/l	176.16	19.79
7	Sulphates as SO ₄	mg/l	89.96	<4.0
8	Nitrate as NO ₃	mg/l	<0.5	<0.5
9	Fluoride	mg/l	<0.1	<0.1
10	Sodium	mg/l	18	21
11	Potassium	mg/l	1.0	1.0
12	Salinity	mg/l	318	36
13	Total Nitrogen	mg/l	<0.5	<0.5
14	Total Phosphorus	mg/l	<0.05	<0.05
15	Dissolved Oxygen	mg/l	6.3	6.0
16	Iron	mg/l	2.77	0.61
17	Magnesium	mg/l	46.08	14.4
18	Copper	mg/l	<0.02	<0.02
19	Phenolic compounds	mg/l	<0.001	<0.001
20	Mercury	mg/l	<0.005	<0.005
21	Cadmium	mg/l	<0.002	<0.002
22	Selenium	mg/l	<0.005	<0.005
23	Arsenic	mg/l	<0.01	<0.01
24	Cyanide	mg/l	<0.01	<0.01
25	Lead	mg/l	<0.005	<0.005
26	Zinc	mg/l	0.96	0.03
27	Anionic Detergents	mg/l	<0.02	<0.02
28	Chromium as Cr+6	mg/l	<0.1	<0.1
29	Aluminium	mg/l	<0.01	<0.01
30	Boron	mg/l	<0.5	<0.5
31	Manganese	mg/l	0.68	0.18

SH-85

S. No.	Parameter	Unit	GW1 (Hand Pump in Village Alpura)	GW2 (Hand Pump in Block office Dhoriya)
1	pH	-	7.45	7.30
2	Temperature	°C	20	19
3	Turbidity	NTU	3.0	<1.0
4	Total Hardness	mg/l	232	188
5	Total alkalinity	mg/l	221	209.88
6	Chlorides (as Cl)	mg/l	35.63	11.88
7	Iron (as Fe)	mg/l	<0.05	<0.05
8	Sulphate (as SO ₄)	mg/	<4.0	<4.0

S. No.	Parameter	Unit	GW1 (Hand Pump in Village Alpura)	GW2 (Hand Pump in Block office Dhoriya)
9	Nitrate (as NO ₃)	mg/l	<0.5	<0.5
10	Fluorides (as F)	mg/l	<0.1	<0.1
11	Sodium	mg/l	26	17
12	Potassium	mg/l	8	1
13	Total Nitrogen	mg/l	<0.5	<0.5
14	Total Phosphorous	mg/l	<0.05	<0.05
15	Dissolved oxygen	mg/l	6.0	5.9
16	Magnesium (as Mg)	mg/l	24.9	14.4
17	Copper (as Cu)	mg/l	<0.02	<0.02
18	Phenolic Compound	mg/l	<0.001	<0.001
19	Mercury (as Hg)	mg/l	<0.005	<0.005
20	Cadmium (as Cd)	mg/l	<0.002	<0.002
21	Selenium as Se	mg/l	<0.005	<0.005
22	Arsenic as As	mg/l	<0.01	<0.01
23	Salinity	mg/l	64	21
24	Lead (as Pb)	mg/l	<0.005	<0.005
25	Zinc (as Zn)	mg/l	<0.02	<3.46
26	Anionic Detergent	mg/l	<0.02	<0.02
27	Chromium (as Cr+5)	mg/l	<0.1	<0.1
28	Aluminum as Al	mg/l	<0.01	<0.01
29	Boron as B	mg/l	<0.5	<0.5
30	Manganese as Mn	mg/l	<0.61	<0.12
31	Cyanide	mg/l	<0.01	<0.01

SH-82

S.No.	Parameter	Test Method	Results		
			Kadirganj	Khaira	Kowakol
1.	Colour	IS-3025(Part-04)	<5.0	<5.0	<5.0
2.	Odour	IS-3025(Part-05)	Agreeable	Agreeable	Agreeable
3.	Taste	IS-3025(Part-07)	Agreeable	Agreeable	Agreeable
4.	Turbidity	IS-3025(Part-10)	<1.0	<1.0	<1.0
5.	pH value	IS-3025(Part-11)	7.38	7.29	7.05
6.	Total Dissolve Solid (TDS)	IS-3025(Part-16)	764.0	638.0	522.0
7	Total Hardness (as CaCO ₃)	IS: 3025 (Part-21)	324.0	272.0	280.0
8	Calcium (as Ca)	IS: 3025 (Part-40)	99.20	86.40	80.0
9	Chloride (as Cl)	IS: 3025 (Part-32)	91.21	76.0	60.80
10	Copper (as Cu)	IS : 3025 (Part42)	<0.05	<0.05	<0.05
11	Fluoride (as F)	IS: 3025 (Part-60)	0.68	0.41	0.32
12	Free Residual Chlorine	IS: 3025 (Part-26)	<0.1	<0.1	<0.1
13	Iron (as Fe)	IS: 3025(Part-53)	0.067	< 0.05	< 0.05
14	Magnesium (as Mg)	IS: 3025 (Part-46)	18.47	13.61	19.44
15	Manganese (as Mn)	Clause 35 of IS 3025	<0.1	<0.1	<0.1
16	Nitrate (as NO ₃)	IS: 3025 (Part-34)	3.80	3.08	2.01
17	Selenium (as Se)	IS: 3025 (Part-56)	<0.01	<0.01	<0.01
18	Sulphate (as SO ₄)	IS: 3025 (Part-24)	33.54	25.64	17.22
19	Zinc (as Zn)	IS: 3025 (Part-49)	< 1.0	< 1.0	< 1.0
20	Anionic Detergents	Annex K of	<0.001	<0.001	<0.001

S.No.	Parameter	Test Method	Results		
			Kadirganj	Khaira	Kowakol
	(as MBAS)	IS 13428			
21	Phenolic Compound (as C ₂ H ₅ OH)	IS: 3025 (Part-43)	<0.001	<0.001	<0.001
22	Aluminum (as Al)	IS: 3025 (Part-55)	<0.01	<0.01	<0.01
23	Cadmium (as Cd)	IS-3025(Part-41)	<0.001	<0.001	<0.001
24	Lead (as Pb)	IS-3025(Part-47)	<0.01	<0.01	<0.01
25	Arsenic (as As)	IS-3025(Part-37)	<0.01	<0.01	<0.01
26	Total Chromium (as Cr)	IS-3025(Part-52)	<0.01	<0.01	<0.01
27	<i>Escherichia coli</i>	IS-1622	Absent	Absent	Absent
28	<i>Coliform Bacteria</i>	IS-1622	Absent	Absent	Absent

SH-58

S. No.	Parameter	Test Method	Results		Units
			Chosa	Jogirar	
1.	Colour	IS-3025(Part-04)	<5.0	<5.0	Hazen
2.	Odour	IS-3025(Part-05)	Agreeable	Agreeable	-
3.	Taste	IS-3025(Part-07)	Agreeable	Agreeable	-
4.	Turbidity	IS-3025(Part-10)	<1.0	<1.0	NTU
5.	pH value	IS-3025(Part-11)	7.33	7.15	-
6.	Total Dissolve Solid	IS-3025(Part-16)	537.0	365.0	mg/l
7	Total Hardness(as CaCO ₃)	IS: 3025 (Part-21)	116.0	96.0	mg/l
8	Calcium (as Ca)	IS: 3025 (Part-40)	33.60	28.80	mg/l
9	Chloride (as Cl)	IS: 3025 (Part-32)	57.0	39.90	mg/l
10	Copper (as Cu)	IS : 3025 (Part42)	<0.05	<0.05	mg/l
11	Fluoride (as F)	IS: 3025 (Part-60)	0.30	0.22	mg/l
12	Free Residual Chlorine	IS: 3025 (Part-26)	<0.1	<0.1	mg/l
13	Iron (as Fe)	IS: 3025(Part-53)	< 0.05	< 0.05	mg/l
14	Magnesium (as Mg)	IS: 3025 (Part-46)	7.78	5.83	mg/l
15	Manganese (as Mn)	f IS 3025	<0.1	<0.1	mg/l
16	Nitrate (as NO ₃)	IS: 3025 (Part-34)	<0.1	<0.1	mg/l
17	Selenium (as Se)	IS: 3025 (Part-56)	<0.01	<0.01	mg/l
18	Sulphate (as SO ₄)	IS: 3025 (Part-24)	11.30	13.45	mg/l
19	Zinc (as Zn)	IS: 3025 (Part-49)	< 1.0	< 1.0	mg/l
20	Anionic Detergents (as MBAS)	Annex K of IS 13428	<0.001	<0.001	mg/l
21	Phenolic Compound	IS: 3025 (Part-43)	<0.001	<0.001	mg/l
22	Aluminum (as Al)	IS: 3025 (Part-55)	<0.01	<0.01	mg/l
23	Cadmium (as Cd)	IS-3025(Part-41)	<0.001	<0.001	mg/l
24	Lead (as Pb)	IS-3025(Part-47)	<0.01	<0.01	mg/l
25	Arsenic (as As)	IS-3025(Part-37)	<0.01	<0.01	mg/l
26	Total Chromium	IS-3025(Part-52)	<0.01	<0.01	mg/l
27	<i>Escherichia coli</i>	IS-1622	Absent	Absent	--
28	<i>Coliform Bacteria</i>	IS-1622	Absent	Absent	--

SH-102

S.N.	Parameters	Method of Test	Results *	
			Handpump at Jagdishpur	Handpump at Ojharia More
1	Colour	IS 3025 (Part-4)	< 5.00	< 5.00
2	Odour	IS 3025 (Part-5)	Odourless	Odourless
3	Taste	IS 3025 (Part-7))	Agreeable	Agreeable
4	pH	IS 3025 (Part-11)	7.24	7.18
5	Turbidity on NTU	IS 3025 (Part-10)	< 1.00	< 1.00
6	Total Dissolved Solids	IS 3025 (Part-16)	284.0	318.0
7	Total Hardness as CaCO ₃	IS 3025 (Part-21)	156.0	172.0
8	Calcium Hardness as Ca	IS 3025 (Part-40)	48.0	40.0
9	Magnesium as Mg	IS 3025 (Part-46)	8.8	17.0
10	Iron as Fe	APHA 3500 (Fe-B)	0.12	0.10
11	Residual Free Chlorine	APHA 4500 (Cl C)	< 0.1	< 0.1
12	Total Alkalinity as CaCO ₃	IS 3025 (Part-23)	170.0	210.0
13	Chloride as Cl	APHA 4500 (Cl B)	26.0	38.0
14	Sulphate as SO ₄	IS 3025 (Part-24)	12.0	10.0
15	Fluoride as F	APHA 4500 (F D)	0.22	0.16
16	Nitrate as NO ₃	IS 3025 (Part-45)	8.6	6.2
17	Coliform (MPN Value)	IS 1622	NIL	NIL

**in mg/l. except colour, Odour, Taste, Turbidity, & pH*

APPENDIX 9: SURFACE WATER QUALITY IN PROJECT AREA**SH-84**

S. No.	Parameter	Unit	SW1 (Fazalpur River)	SW2 (Gehra Pond)
1	pH at 22°C		7.49	7.62
2	Temperature	°C	20	21
3	Turbidity	NTU	4.0	<1.0
4	Dissolved solids	mg/l	258	110
5	Total Hardness as CaCO ₃	mg/l	184	84
6	Total Alkalinity	mg/l	225.72	87
7	Chlorides as Cl	mg/l	21.77	5.9
8	Sulphates as SO ₄	mg/l	<4.0	<4.0
9	Nitrate as NO ₃	mg/l	<0.5	<0.5
10	Fluoride	mg/l	<0.1	<0.1
11	Sodium	mg/l	32	8.8
12	Potassium	mg/l	5.0	3
13	Salinity	mg/l	39	11
14	Total Nitrogen	mg/l	<0.5	<0.5
15	Total Phosphorus	mg/l	<0.05	<0.05
16	Oil and grease	mg/l	<1.4	<1.4
17	Dissolved Oxygen	mg/l	6.2	5.8
18	COD	mg/l	7.84	7.84
19	BOD	mg/l	<2.0	<2.0
20	Iron	mg/l	0.46	0.57
21	Magnesium	mg/l	16.32	5.76
22	Copper	mg/l	<0.02	<0.02
23	Phenolic compounds	mg/l	<0.001	<0.001
24	Mercury	mg/l	<0.005	<0.005
25	Cadmium	mg/l	<0.002	<0.002
26	Selenium	mg/l	<0.005	<0.005
27	Arsenic	mg/l	<0.01	<0.01
28	Cyanide	mg/l	<0.01	<0.01
29	Lead	mg/l	<0.005	<0.005
30	Zinc	mg/l	<0.02	<0.02
31	Anionic Detergents	mg/l	<0.02	<0.02
32	Chromium as Cr+6	mg/l	<0.01	<0.01
33	Aluminium	mg/l	<0.01	<0.01
34	Boron	mg/l	<0.5	<0.5
35	Manganese	mg/l	0.1	<0.02
36	Total coliform	MPN/100ml	30	26
37	Faecal coliform	/100ml	Present	Absent

SH-85

S. No	Parameter	Unit	SW1 (Chanan River)	SW2 (Chirya Pond)
1	pH	-	7.67	7.30
2	Temperature	°C	23	22
3	Turbidity	NTU	8.0	5.0
4	TDS	mg/l	196	272
5	Total Hardness	mg/l	124	148

S. No	Parameter	Unit	SW1 (Chanan River)	SW2 (Chiriya Pond)
6	Total alkalinity	mg/l	166.32	166.32
7	Chlorides as Cl	mg/l	17.81	47.50
8	Iron (as Fe)	mg/l	2.54	2.88
9	Sulphate (as SO ₄)	mg/	<4.0	<4.0
10	Nitrate (as NO ₃)	mg/l	<0.5	1.63
11	Fluorides as F	mg/l	<0.1	<0.1
12	Sodium	mg/l	28	34
13	Potassium	mg/l	3.0	3.0
14	Total Nitrogen	mg/l	<0.5	1.80
15	Total Phosphorous	mg/l	<0.05	<0.21
16	Dissolved oxygen	mg/l	6.1	6.2
17	Magnesium as Mg	mg/l	8.64	15.36
18	Copper as Cu	mg/l	<0.02	<0.02
19	Phenolic Compound	mg/l	<0.001	<0.001
20	Mercury as Hg	mg/l	<0.005	<0.005
21	Cadmium as Cd	mg/l	<0.002	<0.002
22	Selenium as Se	mg/l	<0.005	<0.005
23	Arsenic as As	mg/l	<0.01	<0.01
24	Cyanide (as CN)	mg/l	<0.01	<0.01
25	Lead (as Pb)	mg/l	<0.005	<0.005
26	Zinc (as Zn)	mg/l	<0.02	<0.031
27	Anionic Detergent	mg/l	<0.02	<0.02
28	Chromium (as Cr+6)	mg/l	<0.1	<0.1
29	Aluminium as Al	mg/l	<0.01	<0.01
30	Boron as B	mg/l	<0.5	<0.5
31	Manganese as Mn	mg/l	0.04	0.25
32	Faecal coliform	MPN/ 100 ml	Present	Present
33	Total coliform	MPN/100mL	32	34
34	Oil and Grease	mg/l	<1.4	<1.4
35	BOD	mg/l	<2.0	<2.0
36	COD	mg/l	4.8	4.8

SH-82

S.No	Parameter	Test Method	Results Darima Pond	Units
1.	pH	IS:3025(Part-11)	7.42	-
2.	Colour	IS:3025(Part-4)	<5.0	Hazen
3.	Dissolved Oxygen (as O ₂) Min.	IS:3025(Part-38)	7.6	mg/l
4.	Biological Oxygen Demand (Max.) (at 27°C for 3 days)	IS:3025(Part-44)	1.0	mg/l
5.	Chloride (as Cl), Max.	IS:3025(Part-32)	24.70	mg/l
6.	Sulphate (as SO ₄), Max.	IS: 3025 (Part-24)	14.71	mg/l
7.	Nitrate (as NO ₃), Max.	IS: 3025 (Part-34)	5.47	mg/l
8.	Iron (as Fe), Max.	IS:3025(Part-53)	0.58	mg/l
9.	Fluoride (as F), Max.	APHA-4500 F	0.12	mg/l
10.	Total Dissolved Solid	IS:3025(Part-16)	329.0	mg/l
11.	Phenolic Compound (as C ₂ H ₅ OH)	IS: 3025 (Part-43)	<0.001	mg/l
12.	Anionic Detergents (as MBAS)	Annex K of IS 13428	<0.1	mg/l
13.	Cadmium (as Cd)	IS-3025(Part-41)	<0.01	mg/l

S.No	Parameter	Test Method	Results Darima Pond	Units
14.	Hexa Chromium (as Cr+6)	Annex J of IS-13428	<0.001	mg/l
15.	Total Hardness (as CaCO ₃)	IS:3025(Part-21)	112.0	mg/l
16.	Calcium(as Ca)	IS:3025(Part-40)	32.0	mg/l
17.	Magnesium(as Mg)	IS:3025(Part-46)	7.78	mg/l

SH-58

S.No	Parameter	Test Method	Results Kalasan Pond	Units
1.	pH	IS:3025(Part-11)	7.34	-
2.	Colour	IS:3025(Part-4)	<5.0	Hazen
3.	Dissolved Oxygen (as O ₂) Min.	IS:3025(Part-38)	7.7	mg/l
4.	Biological Oxygen Demand (Max.) (at 27°C for 3 days)	IS:3025(Part-44)	0.80	mg/l
5.	Chloride (as Cl), Max.	IS:3025(Part-32)	58.90	mg/l
6.	Sulphate (as SO ₄), Max.	IS: 3025 (Part-24)	25.82	mg/l
7.	Nitrate (as NO ₃), Max.	IS: 3025 (Part-34)	9.02	mg/l
8.	Iron (as Fe), Max.	IS:3025(Part-53)	0.28	mg/l
9.	Fluoride (as F), Max.	APHA-4500 F	0.26	mg/l
10.	Total Dissolved Solid	IS:3025(Part-16)	562.0	mg/l
11.	Phenolic Compound (as C ₂ H ₅ OH)	IS: 3025 (Part-43)	<0.001	mg/l
12.	Anionic Detergents (as MBAS)	Annex K of IS 13428	<0.1	mg/l
13.	Cadmium (as Cd)	IS-3025(Part-41)	<0.01	mg/l
14.	Hexa Chromium (as Cr+6)	Annex J of IS-13428	<0.001	mg/l
15.	Total Hardness (as CaCO ₃)	IS:3025(Part-21)	156.0	mg/l
16.	Calcium(as Ca)	IS:3025(Part-40)	43.20	mg/l
17.	Magnesium(as Mg)	IS:3025(Part-46)	11.66	mg/l

APPENDIX 10: STAGE-1 LETTER OF SH-82, SH-84 AND SH-85



GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FORESTS & CLIMATE CHANGE
REGIONAL OFFICE (RANCHI)
BUNGALOW NO.A-2, SHYAMLI COLONY, RANCHI - 834002
TEL: 0651-2410007, 2410002, E-mail: ro.ranchi-mef@gov.in



No.5-BHC235/2014-BHU /51

Dated 13th May, 2015

To

The Principal Secretary,
Department Environment and Forests,
Government of Bihar, Sinchai Bhawan,
Secretariat, Patna.

Sub: Diversion of 27.695 ha of forest land for widening & strengthening of Qadirganj-Sono (0.00 – 48.0. Km) Section of SH-82 in Nawada district of Bihar.

Sir,

I am to refer your letter No.Van.Bhumi-22/14-430(E)/Pa.Va. dated 25.08.2014 on the above mentioned subject seeking prior approval of the Ministry of Environment, Forests and Climate Change under section 2 of Forest(Conservation) Act, 1980.

After due consideration of the proposal of the State Government and on the basis of approval of Regional Empowered Committee, the Central Government, hereby, conveys "in-principle" approval for diversion of 27.695 ha of forest land for widening & strengthening of Qadirganj-Sono (0.00 – 48.0. Km) Section of SH-82 in Nawada district of Bihar, subject to the fulfillment of the following conditions.

1. Legal status of forest land proposed for diversion shall remain unchanged.
2. The State Govt. shall charge the Net Present Value (NPV) of forest area proposed to be diverted under this proposal from the user agency as per the Orders of the Hon'ble Supreme Court of India dated 28.03.2008, 24.04.2008 and 09.05.2008 in Writ Petition (Civil) No.202/1995 and the guidelines issued by this Ministry vide its letter No. 5-3/2007-FC dated 05.02.2009 in this regard.
3. Additional amount of NPV of the diverted forest land, if any, becoming due after finalization of the same by the Hon'ble Supreme Court of India, shall be charged by the State Govt. from the user agency.
4. Compensatory Afforestation over the degraded forest land twice in extent to the forest land being diverted shall be raised and maintained by the State Forest Department at the cost of the user agency. The user agency shall

A. S. HAZAR

13.5.2015

transfer the cost of plantation and its maintenance for 10 years (revised as on the date to incorporate the existing wage structure) to State Forest Department.

5. The State Government shall deposit Net Present Value and all other funds with the Ad-hoc Body of Compensatory Afforestation Fund Management and Planning Authority (CAMPA), in SB Account No. **SB01025201** of Corporation Bank, CGO Complex, Phase-I, Lodhi Road, New Delhi – 110 003 (RTGS/IFSC No. **CORP0000371**) or in SB Account No. **344902010105410** of Union Bank of India, Sunder Nagar, New Delhi – 110 003, (RTGS/IFSC No. **UBIN0534498**) through the RTGS/NEFT mode, as per the instructions communicated vide letter No.12-2/2010-CAMPA dated 13.05.2011 and dated 24.06.2011.
6. State Government shall upload the details of compensatory levies demanded and received from the project proponent in the Ministry website and submit compliance in this regard.
7. The Nodal Officer will recheck and report the density of the forest land proposed for diversion before submitting the compliance of "in-principle" approval to this Office, as recommended by REC.
8. The boundary of the forest land proposed for diversion, shall be demarcated on ground at the project cost, by erecting four feet high reinforced cement concrete pillars, each inscribed with its serial number, DGPS coordinates, forward and back bearing and distance from adjoining pillars etc.
9. Felling of trees as required should be done under the supervision of the Forest Department.
10. The user agency shall raise strip plantation on both sides and central verge of the road.
11. Earth or any other material shall not be brought from and debris resulting during construction shall not be disposed of in the adjoining forest area by the user agency.
12. It will be the responsibility of the User Agency to ensure that the labourers and staff engaged in construction activity do not damage the nearby forest flora and fauna.
13. The lay out plan of the proposed forest land shall not be changed without prior approval of the Ministry of Environment, Forests and Climate Change.

Antsharcan

14. The forest land proposed for diversion shall, under no circumstances, be transferred to any other agency, department or person without prior approval of the Ministry of Environment, Forests and Climate Change.
15. The forest land shall not be used for any purpose other than that specified in the proposal.
16. The user agency and the State Government shall ensure compliance to provisions of the all Acts, Rules, Regulations and Guidelines, for the time being in force, as applicable to the project.
17. Any other conditions that the Ministry of Environment & Forests may impose from time to time in the interest of afforestation, conservation and management of flora and fauna in the area, shall be complied by the user agency.

After receipt of the compliance report on fulfillment of the conditions as stipulated above, from the State Government, formal approval will be issued in this regard under Section 2 of Forest (Conservation) Act, 1980. **Transfer of forest land to user agency should not be effected by the State Government till formal order approving diversion of forest land is issued by the Central Government.**

Yours faithfully,

ANBharan
13.5.2015
(A.N.Sharan)

Addl. Principal Chief Conservator of Forests
o/c

Copy to:-

1. The Inspector General of Forests(FC), Ministry of Environment, Forests and Climate Change, Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi-110 003.
2. The Principal Chief Conservator of Forests, Bihar, 4th Floor, Technology Bhawan, Vishweshwariah complex, Bailey road, Patna - 800 015.
3. The CCF & Nodal Officer, Forest Department, Govt. of Bihar, Technology Bhawan, Visheshwarya Complex, Belli Road, Patna - 800015.
4. The Divisional Forest Officer, Nawada Forest Division, Nawada, Bihar.
5. The Deputy General Manager, BSRDC, Project Implementation Unit-Rajgir, Bengali Para, Nagraj House, Rajgir - 803116.
6. Guard File.

ANBharan
13.5.2015

Addl. Principal Chief Conservator of Forests
o/c

F. No. 8-31/2012 - FC
Government of India
Ministry of Environment and Forests
(FC Division)

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi - 110510
Dated: 05th November 2012.

To
Chief Conservator of Forests cum
Nodal Officer (Forest Conservation)
Bihar, Patna.

22/11/12

Sub: Diversion of 96.18 ha of forest land for widening of Dhodha Barahat road km 0 to 53.073 under Banka district, Bihar.

Sir,

I am directed to refer to your letter No. Van Bhumi-15/2012 250(E)/P.V. dated 12/4/2012 on the above mentioned subject seeking prior approval of the Central Government under Section 2 of the Forest (Conservation) Act, 1980 and to say that the proposal has been examined by the Forest Advisory Committee constituted by the Central Government under section-3 of the said Act.

2. After careful examination of the proposal of the State Government, the Central Government hereby agrees 'in-principle' for diversion of 96.18 ha of forest land for widening of Dhodha Barahat road km 0 to 53.073 under Banka district, Bihar subject to fulfillment of the following conditions.

- (i) Legal status of the diverted forest land shall remain unchanged;
- (ii) Compensatory afforestation over the degraded forest land double in extent to the forest land being diverted shall be raised and maintained by the State Forest Department at the cost of the User Agency;
- (iii) The land identified for the purpose of CA shall be clearly depicted on a Survey of India toposheet of 1:50,000 scale.
- (iv) The User Agency shall transfer the cost of raising and maintaining the compensatory afforestation, at the current wage rate, to the State Forest Department. The scheme may include appropriate provision for anticipated cost increase for works scheduled for subsequent years;
- (v) The State Government shall charge the Net Present Value (NPV) of the forest land being diverted under this proposal from the User Agency as per the orders of the Hon'ble Supreme Court of India dated 28.03.2008, 24.04.2008 and 09.05.2008 in Writ Petition (Civil) No. 202/1995 and the guidelines issued by this Ministry vide its letter No. 5-3/2007-FC dated 05.02.2009 in this regard;
- (vi) At the time of payment of the Net Present Value (NPV) at the then prevailing rate, the User Agency shall furnish an undertaking to pay the additional amount of NPV, if so determined, as per the final decision of the Hon'ble Supreme Court of India;


John

22/11/12

- (vii) All the funds received from the user agency under the project, except the funds realized for regeneration/ demarcation of safety zone, shall be transferred to Ad-hoc CAMPA in the Saving Bank Account pertaining to the State concerned;
- (viii) The User Agency shall obtain the Environment Clearance as per the provisions of the Environmental (Protection) Act, 1986, if required;
- (ix) No labour camp shall be established on the forest land;
- (x) The User Agency shall provide fuels preferably alternate fuels to the labourers and the staff working at the site so as to avoid any damage and pressure on the nearby forest areas;
- (xi) The boundary of the diverted forest land, mining lease and safety zone, as applicable, shall be demarcated on ground at the project cost, by erecting four feet high reinforced cement concrete pillars, each inscribed with its serial number, forward and back bearing and distance from pillar to pillar;
- (xii) The layout plan of the proposal shall not be changed without the prior approval of the Central Government.
- (xiii) The forest land shall not be used for any purpose other than that specified in the proposal;
- (xiv) The forest land proposed to be diverted shall under no circumstances be transferred to any other agency, department or person without prior approval of the Central Government;
- (xv) No damage to the flora and fauna of the adjoining area shall be caused;
- (xvi) Any tree felling shall be done only when it is unavoidable and that too under strict supervision of the State Forest Department.
- (xvii) The State Government shall complete settlement of rights, in terms of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, if any, on the forest land to be diverted and submit the documentary evidence as prescribed by this Ministry in its letter No. 11-9/1998-FC (pt.) dated 03.08.2009, in support thereof;
- (xviii) The user agency shall submit the annual self compliance report in respect of the above conditions to the State Government and to the concerned Regional Office of the Ministry regularly.
- (xix) Any other condition that the concerned Regional Office of this Ministry may stipulate, from time to time, in the interest of conservation, protection and development of forests & wildlife; and
- (xx) The User Agency and the State Government shall ensure compliance to provisions

- (xxii) The user agency shall arrange to raise strip plantation on either side of the road and central verge at project cost, as per IRC specification, with maintenance of 7-10 years. The user agency shall also submit design of providing at least 2-3 rows of long rotation indigenous trees, as per provision of IRC-SP-21-2009 (Guidelines on landscaping & tree plantation), on either side of the road before final clearance.
 - (xxiii) Wherever possible and technically feasible, the User Agency shall undertake afforestation measures along the roads within the area diverted under this approval, in consultation with the State Forest Department at the project cost.
 - (xxiv) The reclamation of quarry should be done under the supervision of the State Forest Department. The quarry shall be reclaimed and afforested completely before the project is closed.
 - (xxv) Overburden shall not be dumped outside the width of the road. The muck generated in the earth cuttings will be disposed off at the designate dumping sites and in no case the muck/debris will be allowed to roll down the hill slopes.
 - (xxvi) The user agency will provide retaining walls, breast walls and drainage as per requirement to make the slope stable.
 - (xxvii) The User agency will undertake comprehensive soil conservation measures at the project cost in consultation with the State Forest Department.
 - (xxviii) The user agency shall not collect any toll from the vehicles carrying forest officers on duty.
 - (xxix) The designing of culverts/bridges, if any, over the natural streams/rivers/canals should be done in such a manner that it does not hamper the natural course of water, does not give rise to water-logging, and also does not hamper movement of wild animals.
 - (xxx) The Compensatory Afforestation scheme may be revised to provide for 10 years maintenance as per directions of the Ministry and submitted to the Ministry. The funds for compensatory afforestation shall be realized accordingly.
3. After receipt of the compliance report on the fulfillment of the above mentioned conditions contained in para 2 above, from the State Government of Bihar, formal approval will be issued in this regard under Section 2 of the Forest (Conservation) Act, 1980. The transfer of forest land to the User Agency shall not be affected by the State Government till formal orders approving the diversion of forest land are issued by the Central Government.

Yours faithfully,


(Shiv Pal Singh)

- (xxii) The user agency shall arrange to raise strip plantation on either side of the road and central verge at project cost, as per IRC specification, with maintenance of 7-10 years. The user agency shall also submit design of providing at least 2-3 rows of long rotation indigenous trees, as per provision of IRC-SP-21-2009 (Guidelines on landscaping & tree plantation), on either side of the road before final clearance.
 - (xxiii) Wherever possible and technically feasible, the User Agency shall undertake afforestation measures along the roads within the area diverted under this approval, in consultation with the State Forest Department at the project cost.
 - (xxiv) The reclamation of quarry should be done under the supervision of the State Forest Department. The quarry shall be reclaimed and afforested completely before the project is closed.
 - (xxv) Overburden shall not be dumped outside the width of the road. The muck generated in the earth cuttings will be disposed off at the designate dumping sites and in no case the muck/debris will be allowed to roll down the hill slopes.
 - (xxvi) The user agency will provide retaining walls, breast walls and drainage as per requirement to make the slope stable.
 - (xxvii) The User agency will undertake comprehensive soil conservation measures at the project cost in consultation with the State Forest Department.
 - (xxviii) The user agency shall not collect any toll from the vehicles carrying forest officers on duty.
 - (xxix) The designing of culverts/bridges, if any, over the natural streams/rivers/canals should be done in such a manner that it does not hamper the natural course of water, does not give rise to water-logging, and also does not hamper movement of wild animals.
 - (xxx) The Compensatory Afforestation scheme may be revised to provide for 10 years maintenance as per directions of the Ministry and submitted to the Ministry. The funds for compensatory afforestation shall be realized accordingly.
3. After receipt of the compliance report on the fulfillment of the above mentioned conditions contained in para 2 above, from the State Government of Bihar, formal approval will be issued in this regard under Section 2 of the Forest (Conservation) Act, 1980. The transfer of forest land to the User Agency shall not be affected by the State Government till formal orders approving the diversion of forest land are issued by the Central Government.

Yours faithfully,


(Shiv Pal Singh)

बिहार सरकार
कार्यालय : मुख्य वन संरक्षक, कार्य नियोजना, प्रशिक्षण एवं विस्तार, बिहार।

प्रथम तल: एन०एच० मयन, विश्वेश्वरैया परिसर, बेली रोड, पटना-800 015

संख्या- *FC-199*

प्रेषक,

एस० एस० चौधरी, मा०ब०से०,
मुख्य वन संरक्षक-सह-
नोडल पदाधिकारी (वन संरक्षण),
बिहार, पटना।

सेवा में,

- वन प्रमंडल पदाधिकारी,
बौका वन प्रमंडल, बौका।

- उपमहाप्रबंधक (तकनीकी),
परियोजना कार्यान्वयन इकाई,
बिहार स्टेट रोड डेवलपमेंट कॉरपोरेशन, राजगीर।

पटना, दिनांक- *10/5/12*

विषय - बौका जिला के अन्तर्गत अकबरनगर-अमरपुर (0.00-30.00 कि०मी०) पथ के कुल लंबाई 30 कि०मी० के चौड़ीकरण हेतु वन (संरक्षण) अधिनियम, 1980 के तहत 57.09 हे० वन भूमि के अपयोजन का प्रस्ताव।

प्रसंग - भारत सरकार, पर्यावरण एवं वन मंत्रालय, पूर्वी क्षेत्रीय कार्यालय, मुवनेश्वर का पत्रांक F.No. 8-114/2011-FC दिनांक 06.03.2012

महाशय,

प्रासंगिक पत्र (छायाप्रति संलग्न) द्वारा भारत सरकार ने विषयांकित पथ के उन्मूलन हेतु 57.09 हेक्टेयर वन भूमि के अपयोजन के प्रस्ताव पर सैद्धान्तिक सहमति निम्नलिखित शर्तों के साथ प्रदान की है-

57.09 हेक्टेयर अपयोजित होने वाली वन भूमि का NPV की राशि 6.26 लाख रुपये प्रति हेक्टेयर के दर से कुल 357.3834 लाख रुपये प्रयोक्ता एजेन्सी विभाग को उपलब्ध कराएगी।

प्रयोक्ता एजेन्सी संबंधित राशि को Ad-hoc Body of Compensatory Afforestation Fund Management and Planning Authority (CAMPA) in A/C Name CAF Bihar of A/C No. SB01025201 in Corporation Bank CGO, Complex, Phase-1, लोदी रोड, नई दिल्ली 110003 (RTGS/IFSC No. CORP0000371) अथवा SB A/C No. 344902010105410 of Union Bank of India, Sunder Nagar, नई दिल्ली 110003, (RTGS/IFSC No. UBIN0534498) के द्वारा RTGS/NEFT Mode द्वारा फंड ट्रांसफर कर जमा कराया जायेगा। as per the instruction communicated vide letter No. 12-2/2010-CAMPA dated 13.5.2011 and dated 24.06.2011 उक्त जमा की गयी राशि की सूचना इस कार्यालय को संबंधित बैंक द्वारा प्रदत्त UTR No. एवं दिनांक की मूलप्रति के साथ दी जायेगी।

फोन/फैक्स न०-0612-2545109

ई-मेल cc@wp.bih@hotmail.com

उपर्युक्त के अतिरिक्त प्रसंगाधीन पत्र में उल्लिखित कडिका 1 से 19 में अधिरोपित शर्तों का अनुपालन सुनिश्चित करते हुए समेकित प्रतिवेदन इस कार्यालय को यथाशीघ्र समर्पित करने का कष्ट करें ताकि भारत सरकार से विषयाधीन मामले में अन्तिम स्वीकृति प्राप्त करने की कार्यवाई की जा सके।

अनु०-यथोक्त।

विश्वासभाजन,

मुख्य वन संरक्षक-सह-
नोडल पदाधिकारी (वन संरक्षण),
बिहार, पटना।

F. No. 8-114/2011 - PC
Government of India
Ministry of Environment & Forests
(PC Division)

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi-110 510
Dated: 6th March, 2012.

To,

Principal Secretary (Forests)
Government of Bihar,
Patna.

Sub: Diversion of 57.09 ha of forest land for widening of Akbarpur-Amarpur Section of SH-85 in Bhagalpur and Banka Districts of Bihar in favour of Bihar State Road Development Corporation Ltd.

Sir,

I am directed to refer to the State Government of Bihar letter No. Vanbhoomi-30/11 454(E)/P V dated 21st September, 2011, where-under a proposal seeking prior approval of the Central Government, in accordance with Section-2 of the Forest (Conservation) Act, 1980, for diversion of 57.09 ha of forest land for widening of Akbarpur-Amarpur Section of SH-85 in Bhagalpur and Banka Districts of Bihar in favour of Bihar State Road Development Corporation Ltd. was submitted to this Ministry, and to say that the said proposal has been examined by the Forest Advisory Committee constituted by the Central Government under Section-3 of the aforesaid Act.

After careful consideration of the proposal of the State Government and on the basis of the recommendations of the Forest Advisory Committee, the Central Government hereby accords stage-I approval of the Central Government under the Forest (Conservation) Act, 1980 for diversion of 57.09 ha of forest land for widening of Akbarpur-Amarpur Section of SH-85 in Bhagalpur and Banka Districts of Bihar in favour of Bihar State Road Development Corporation Ltd. subject to the fulfillment of the following conditions:

- i) Legal status of the diverted forest land shall remain unchanged;
- ii) Compensatory afforestation over degraded forest land, double in extent to the forest land being diverted, shall be raised and maintained by the State Forest Department from the funds to be provided by the User Agency;
- iii) The User Agency shall transfer the cost of raising and maintaining the compensatory afforestation, at the current wage structure, to the State Forest Department;
- iv) The State Government shall charge the Net Present Value (NPV) of the forest land diverted under this proposal from the User Agency at the rates as per the Orders of the Hon'ble Supreme Court of India dated

PC
D. up
8/3/12

28.03.2008, 24.04.2008 and 09.05.2008 in Writ Petition (Civil) No. 202/1995 and the guidelines issued by this Ministry vide its letter No. S-3/2007-FC dated 05.02.2009 in this regard;

- v) At the time of payment of the Net Present Value (NPV) at the present rate, the User Agency shall furnish an undertaking to pay the additional NPV, if so determined, as per the final decision of the Hon'ble Supreme Court of India;
- vi) All the funds received from the User Agency under the project shall be transferred to Ad-hoc CAMPA in the account pertaining to the State.
- vii) The User Agency shall obtain the Environment Clearance as per the provisions of the Environmental (Protection) Act, 1986, if required under the said Act;
- viii) No labour camp shall be established on the forest land;
- ix) To prevent injury/mortality of wild animals, the user agency shall install sign boards and construct speed breakers etc. at appropriate locations to ensure that maximum speed of vehicles in the portion of highways located in the forest land is not more than 60 kmph;
- x) The user agency in consultation with the State Forest Department shall identify the location of the migratory corridors and other areas frequently used by wild animals to cross the highways and install sign boards on both side of such corridors/areas to warn the driver to be cautious and lower the speed to prevent injury/mortality of wild animals;
- xi) Felling of trees on the forest land being diverted shall be reduced to the bare minimum and the trees should be felled under strict supervision of the State Forest Department;
- xii) Sufficient firewood, preferably the alternate fuel shall be provided by the User Agency to the labourers after purchasing the same from the State Forest Department or the Forest Development Corporation or any other legal source of alternate fuel;
- xiii) The User Agency shall ensure that no damage is caused to the wildlife available in the area because of this project;
- xiv) The boundary of the forest land being diverted shall be demarcated on ground at the project cost, using four feet high RCC pillars, each pillar inscribed with the serial number, DGPS coordinates, forward and backward bearings and distance from adjoining pillars etc.;
- xv) The forest land shall not be used for any purpose other than that specified in the proposal;
- xvi) The State Government shall complete settlement of rights, in terms of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, if any, on the forest land to be diverted and

submit the documentary evidence as prescribed by this Ministry in its letter No. 11-9/1998-FC (pt.) dated 03.08.2009, in support thereof;

- xvii) Any other condition that the Chief Conservator of Forests (Eastern), Eastern Regional Office, Bhubaneswar or the State Government of Bihar may impose from time to time for protection and improvement of flora and fauna in the forest area; and
- xviii) The User Agency and the State Government shall ensure compliance to provisions of all the Acts, Rules, Regulations and Guidelines, for the time being in force, as applicable to the project.
- xix) Plantation of suitable species shall be taken up on both sides of the road and central verge at project cost. The strip of the land on both sides shall be handed over to the Forest Department for plantation.

3. After receipt of a report on compliance to the conditions stipulated in Paragraph -2 above, from the State Government, final/stage-II approval of the Central Government, in accordance with section 2 of the Forest (Conservation) Act, 1980, will be considered by this Ministry. Till receipt of the said final/ stage-II approval of the Central Government from this Ministry, transfer of the said forest land to the user agency shall not be affected by the State Government.

Yours faithfully

Sh

(Shiv Pal Singh)

Sr. Assistant Inspector General of Forests

Copy to:

1. The Principal Chief Conservator of Forests, Government of Bihar, Patna.
2. The Nodal Officer (FCA), Forest Department, Government of Bihar, Patna.
3. The Chief Conservator of Forests (C), Ministry of Environment & Forests, Regional Office (EZ), A/3, Chandrasekharpur, Bhubaneswar - 751023.
4. The User Agency.
- ✓ 5. Monitoring Cell, FC Division, MoEF, New Delhi.
6. Guard File.

Sh 5/5/12
(Shiv Pal Singh)

Sr. Assistant Inspector General of Forests

APPENDIX 11: STATUS OF FOREST DIVERSION PROPOSAL FOR SH-102

बिहार सरकार,
पर्यावरण एवं वन विभाग
कार्यालय, प्रधान मुख्य वन संरक्षक, बिहार, पटना।

(कैम्पा एवं वन संरक्षण विभाग)

राष्ट्रीय राज, अरण्य भवन, राष्ट्रीय पीर अली रॉड मार्ग, पटना-800 014
संख्या FC-

प्रेषक,

ए० के० पाण्डेय, भा० व० से०,
अपर प्रधान मुख्य वन संरक्षक (कैम्पा)
—सह-नोडल पदाधिकारी (वन संरक्षण),
बिहार, पटना।



सेवा में,

प्रधान सचिव,
पर्यावरण एवं वन विभाग,
बिहार सरकार, पटना।

पटना 14, दिनांक-

विषय — SH-102 बिहियों-जगदीशपुर-पीर-बिहटा (0.00-54.519 किलोमीटर) के चौड़ीकरण एवं सुदृढीकरण हेतु वन (संरक्षण) अधिनियम, 1980 के तहत 55.46 हे० वन भूमि अपयोजन प्रस्ताव पर सौद्धान्तिक स्वीकृति के संबंध में।

महाशय,

उपर्युक्त विषयक संबंध में सूचित करना है कि SH-102 बिहियों-जगदीशपुर-पीर-बिहटा (0.00-54.519 किलोमीटर) के चौड़ीकरण एवं सुदृढीकरण के लिये वन (संरक्षण) अधिनियम, 1980 के तहत 55.46 हे० वन भूमि अपयोजन हेतु उप महाप्रबंधक (तक०), केन्द्रीय कार्यान्वयन इकाई BSRDCL पटना का प्रस्ताव वन संरक्षक, पटना अंचल, पटना के माध्यम से प्राप्त हुआ है। विषयवस्तु पथ पर्यावरण एवं वन विभाग, बिहार सरकार की अधिसूचना संख्या 1255 (ई०) दिनांक 29.09.1994 द्वारा "सुरक्षित वन" के रूप में अधिसूचित है। लेकिन भूमि का रसायनिक पथ निर्माण विभाग का है। इस क्रम में वर्तमान पथ को उत्कृष्ट करके हुए चौड़ीकरण एवं सुदृढीकरण करने का योजना है। प्रस्तावित पथ के चौड़ीकरण एवं सुदृढीकरण में 55.46 हे० वन भूमि का अपयोजन होना प्रस्तावित है। इस क्रम में पथ किनारे अवस्थित 4759 को मार्किंग किया गया है जिसमें से परियोजना निर्माण के क्रम में वन प्रमंडल पदाधिकारी एवं प्रयोक्ता एजेंसी द्वारा 2503 वृक्षों के पतन का आकलन किया गया है जिसकी विवरणी निम्नलिखित है—

क्रम सं०	पातित होने वाले वृक्षों की संख्या	
	30-60 CM तक	60 CM से अधिक
1	211	2292

अपयोजित होने वाली वन भूमि के पथान्तों को दर्शाते हुए मूल टोपोग्राफी नक्शा Geo-referenced नक्शा Index के साथ संलग्न किया गया है जो वन प्रमंडल पदाधिकारी एवं प्रयोक्ता एजेंसी द्वारा हस्ताक्षरित है।

वन प्रमंडल पदाधिकारी द्वारा भाग-11 की प्रविष्टि में वनों का पानरपतिक घनत्व 0.2 एवं प्रयोक्ता एजेंसी द्वारा वन (संरक्षण) अधिनियम, 1980 का उल्लंघन नहीं करने की सूचना अंकित किया गया है। परियोजना निर्माण में अपयोजित होने वाली वन भूमि के बदले जिला पदाधिकारी भोजपुर द्वारा निर्गत वनाधिकार अधिनियम, 2006 (FRA, 2006) प्रमाण पत्र इस पत्र के साथ संलग्न है।

परियोजना निर्माण के कम में कुल 55.46 हे० अपयोजित होने वाली वन भूमि के बदले क्षतिपूर्क वनीकरण हेतु दुगुने 110.92 हे० अवकृष्ट वन भूमि अर्थात् 111.00 हे० वन भूमि को गया वन प्रमंडल, गया के अंतर्गत प्रक्षेत्र अन्तर्गत गलहौर, कजूर PF को चिन्हित करते हुए वृक्षारोपण का प्रावकलन वन प्रमंडल पदाधिकारी, गया से प्राप्त की गयी है। क्षतिपूर्क वनीकरण के लिये चिन्हित वन भूमि का Geo-referenced नक्शा एवं वन भूमि क्षतिपूर्क वनीकरण के लिये उपर्युक्त है का प्रमाण पत्र भी प्रस्ताव के साथ संलग्न है।

वन (संरक्षण) अधिनियम, 1980 के अन्तर्गत केन्द्र सरकार द्वारा निर्गत दिशा-निर्देश की क्लिका 2.5 (II) के आलोक में निम्नांकित शर्तों के साथ प्रस्ताव की अनुशंसा की जा सकती है—

1. भूमि का वैधानिक स्वरूप यथावत रहेगा।
2. 55.46 हे० वन भूमि के लिये नेट प्रजेन्ट गैल्यू (NPV) के मद में रु० 6.26 लाख प्रति हे० के दर से रु० 3,47,17,960/- (रुपये तीन करोड़ रीतालीस लाख सत्रह हजार नौ सौ साठ) मात्र प्रयोक्ता एजेंसी द्वारा पर्यावरण एवं वन विभाग के पक्ष में जमा कराया जायेगा।
3. अपयोजित होने वाली 55.46 हे० वन भूमि के बदले में क्षतिपूर्क वृक्षारोपण के लिये गया वन प्रमंडल-अन्तर्गत 111.00 हे० अवकृष्ट वन भूमि गलहौर, कजूर सुरक्षित वन में चिन्हित करते हुए रु० 2,11,62,020/- मात्र का प्रावकलन प्रस्ताव के साथ संलग्न है। क्षतिपूर्क वृक्षारोपण की राशि प्रयोक्ता एजेंसी द्वारा तात्कालिक मजदूरी दर पर उपलब्ध करायी जाएगी।
4. वृक्षों का पातन विभागीय देखरेख में प्रयोक्ता एजेंसी द्वारा अपने खर्च पर किया जाएगा एवं पातित काष्ठ को विभागीय वनागार तक पहुँचाया जाएगा। प्राप्त काष्ठ की नीलामी इत्यादि के लिए विभाग को 600/- रुपये प्रति घनमीटर की दर से राशि प्रयोक्ता एजेंसी द्वारा उपलब्ध कराएगी।
5. 60 से०मी० से कम परिधि के पौधों को पातन नहीं किया जायेगा, इन पौधों को वन प्रमंडल पदाधिकारी के निदेशानुसार प्रयोक्ता एजेंसी द्वारा Translocate किया जायेगा। प्रस्ताव की दो प्रतियाँ अनुलग्नक के साथ अग्रेतर कार्रवाई हेतु इस पत्र से संलग्न कर भेजी जा रही। उक्त प्रस्ताव पर प्रधान मुख्य वन संरक्षक, बिहार का अनुमोदन प्राप्त है।

प्रनु०—यथोक्त।

विकाससमाज,

ह०/-

(ए० के० पाण्डेय)

अपर प्रधान मुख्य वन संरक्षक (कैम्पा)
—सह—नोडल पदाधिकारी (वन संरक्षण),
बिहार, पटना।

ज्ञापक— FC- 343 दिनांक— 10/04/2018
मतिलिपि— जय महाप्रबंधक (तक०), केन्द्रीय कार्यान्वयन इकाई, BSRDCL, पटना/वन प्रमंडल पदाधिकारी, भोजपुर वन प्रमंडल, आरा को सूचनाार्थ एवं आवश्यक कार्रवाई हेतु प्रेषित।

(ए० के० पाण्डेय)
अपर प्रधान मुख्य वन संरक्षक (कैम्पा)
—सह—नोडल पदाधिकारी (वन संरक्षण),
बिहार, पटना।

APPENDIX 12: LIST OF PARTICIPANTS OF PUBLIC CONSULTATIONS

Initial Environment Examination (IEE) of SH-58
Bihar State Road Improvement-III Project (BSRIP-III) - Funded by ADB
Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
Attendance List for FGD

FGD #	Venue: <u>शिवपुर</u>	Date:	Time:	
Sl. No.	Name	Address	Age Gender Profession Mobile No. Signature	
1.	बिहारी चंद्र	शिवपुर	48 M मजदूर	777376480
2.	बिहारी चंद्र	शिवपुर	65 M मजदूर	
3.	बिहारी चंद्र	शिवपुर	52 M मजदूर	
4.	बिहारी चंद्र	शिवपुर	38 M मजदूर	
5.	बिहारी चंद्र	शिवपुर	65 M मजदूर	
6.	बिहारी चंद्र	शिवपुर	50 M मजदूर	
7.	बिहारी चंद्र	शिवपुर	45 M मजदूर	
8.	Bhimshun Choudhary	Kanchhika	60 M Labour	
9.	Chann Choudhary	Kanchhika	45 M Labour	
10.	Subash Choudhary	Kanchhika	31 M Labour	763578810
11.	Pawan Choudhary	Kanchhika	32 M Labour	
12.	बिहारी चंद्र	Kanchhika	48 M Labour	
13.	बिहारी चंद्र	Kanchhika	50 M Labour	
14.	बिहारी चंद्र	Kanchhika	41 M Labour	
15.	Ratan Choudhary	Kanchhika	35 M Labour	
16.	Balbiram Choudhary	Kanchhika	35 M Labour	

L. T. of BSRDC

Attendance List for FGD							
FGD #	Venue: गोरगाँव	Date:	Time:				
Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
31	Mami Dasi	Konchaleka	32	F	Labour		सुनीता
32	Niso Dasi	Konchaleka	22	F	Labour	725046899	निहाल
33	Chandani Dasi	Konchaleka	28	F	Labour		सुनीता
34	Dhanvraa Chakraborty	Konchaleka	23	M	Labour	725046149, 72221012	
35	Rinki Dasi	Konchaleka	25	F	Labour		
36	Babita Dasi	Konchaleka	30	F	Labour		सुनीता देवी
37	Usha Dasi	Konchaleka	45	F	Labour	8292811599	सुनीता
38	Nidha Dasi	Konchaleka	30	F	Labour		सुनीता देवी
39	Omni'la Dasi	Konchaleka	38	F	Labour		
40	Kalpna Dasi	Konchaleka	37	F	Labour	952333430	सुनीता देवी
41	Rajwani Dasi	Konchaleka	42	F	Labour	955005336	सुनीता देवी
42	Bashya Dasi	Konchaleka	45	F	Labour		सुनीता देवी
43	Pran Dasi	Konchaleka	36	F	Labour	9973507722	सुनीता देवी
44	Fulon Dasi	Konchaleka	42	F	Labour		सुनीता देवी
45	Sunila Dasi	Konchaleka	45	F	Labour		सुनीता देवी
46	Soni Dasi	Konchaleka	40	F	Labour		सुनीता देवी
47	Soni Dasi	Konchaleka	39	F	Labour	746389153	सुनीता देवी

Initial Environment Examination (IEE) of SH-58
 Bihar State Road Improvement-III Project (BSRIP-III) -funded by ADB
 Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
 Attendance List for FGD

Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
48.	Ranjio Dasi	Korachakka	45	F	Labourer		
49.	Rita Dasi	Korachakka	28	F	Labourer	7033323198	
50.	Sumita Dasi	Korachakka	24	F	Labourer	9939222960	
51.	Rubi Dasi	Korachakka	25	F	Labourer	83508950	
52.	Pinki Dasi	Korachakka	40	F	Labourer		
53.	Sunjo Dasi	Korachakka	38	F	Labourer		
54.	Kabita Dasi	Korachakka	38	F	Labourer		
55.	Urmila Dasi	Korachakka	40	F	Labourer	7284873495	
56.	Ruchiya Dasi	Korachakka	42	F	Labourer		
57.	Bholiya Dasi	Korachakka	40	F	Labourer		
58.	Punam Dasi	Korachakka		F	Labourer		
59.	Smita Choudhary	Korachakka	36	F	Labourer	9177632005	
60.	Photo Choudhary	Korachakka	34	F	Labourer		
61.	Venay Choudhary	Korachakka	30	F	Labourer	96782650	
62.	Rubiya Dasi	Korachakka	36	F	Labourer		
63.	Rita Dasi	Korachakka	30	F	Labourer		
64.	Anisha Dasi	Korachakka	26	F	Labourer		
65.	Sushil Choudhary	Korachakka	28	F	Labourer		

Initial Environment Examination (IEE) of SH- 58

Bihar State Road Improvement-III Project (BSRIP-III) -funded by ADB

Implementing Agency Bihar State Road development Corporation Limited (BSRDC)

Attendance List for FGD

EGD # 01 Venue: खोसई चौक Date: 14/08/17 Time: 11 am

Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
1.	शुभ ठा	खोसई	61	M	खेती/शुभ	9546208218	शुभ ठा
2.	देवी लाल	खोसई	61	M	"	8051522921	देवी लाल
3.	बलराम लाल	खोसई	40	M	"	7888596428	बलराम लाल
4.	आमनलाल ठा	खोसई	50	M	"	-	आमनलाल ठा
5.	अजितलाल ठा	खोसई	62	M	"	8466080933	अजितलाल ठा
6.	रमेशलाल ठा	खोसई	55	M	"	-	रमेशलाल ठा
7.	श्रीराम कुमार (खोसई चौक के ठा)	खोसई	50	M	"	8677300592	श्रीराम कुमार (खोसई चौक के ठा)
8.	रामलाल ठा	खोसई	57	M	"	-	रामलाल ठा
9.	रमेश ठा	खोसई	70	M	"	-	रमेश ठा
10.	बलराम ठा	खोसई	30	M	"	8930548915	बलराम ठा
11.	महेन्द्र ठा	खोसई	65	M	मजदूर	8278589694	महेन्द्र ठा
12.	बलराम ठा	खोसई	55	F	मजदूर	-	बलराम ठा
13.	शुभ ठा	खोसई	35	M	मजदूर	-	शुभ ठा
14.	श्रीराम ठा	खोसई	22	M	मजदूर	-	श्रीराम ठा
15.	बलराम ठा	खोसई	25	M	मजदूर	-	बलराम ठा

Initial Environment Examination (IEE) of SH - 28
 Bihar State Road Improvement II Project (BSRIP-II) - funded by ADB
 Implementing Agency Bihar State Road Development Corporation Limited (BSRDC)

Attendance List for FGD

FGD #	Venue: 28/05/20	Date:	Time:	Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
1.	Vinod Kumar	Chhoti Agara	20	M	Education	9155041700					Borah
2.	Sukdev Yadav	Griff 28/05/20	80	M	Ret. Railway	9155213207					
3.	Malankar Pat. Yadav	Do	65	M	Ret. Railway						
4.	Raj Kumar Yadav	Do	40	M	Agriculture	9572194498					
5.	Kailash Yadav	Do	37	M	Agriculture						
6.	Shovan Kumar	Do	27	M	Agriculture	8507673376					Sorvan
7.	NIKESH Kumar	Do	17	M	Education	7833703378					Siddh
8.	Neeraj Kumar	Do	21	M	Education	9705201309					Neeraj
9.	Indrajeet Kumar	Do	25	M	B.A	9801898248					Indrajeet
10.	Abhyan Kumar	Do	17	M	Education	9801898248					Abhyan
11.	SUSANT Kumar	Do	19	M	BA	9621770491					SUSANT
12.	Debi Devi	Do	55	F	Labour						
13.	Laxmi Kumar	Do	34	M	B.A	9709788333					Laxmi
14.	सावित्री देवी	Do	30	F		9801898248					सावित्री
15.	Santi Devi	Do	60	F		Do					
16.	श्रीमती कुमारी		22	F	Education						श्रीमती

Initial Environment Examination (IEE) of SH-24
Bihar State Road Improvement-III Project (BSRIP-III)-funded by ADB
Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
Attendance List for FGS

FGD #	Name	Venue	Address	Age	Gender	Profession	Mobile No.	Signature
12	सारो देवी	Chandipura	45	F				सारो देवी
18	वन्दना देवी	DO	40	F				वन्दना देवी
19	Lalita Devi	DO	43	F				
20	सिंदु देवी	DO	38	F				सिंदु देवी
21	माता देवी	DO	35	F				
22	कौमल कुमारी	DO	16	F	Education			कौमल कुमारी
23	Rishi Devi	DO	77	F				

Initial Environment Examination (IEE) of SH-84
 Bihar State Road Improvement III Project (BSRIP-III) - funded by ADB
 Implementing Agency Bihar State Road Development Corporation Limited (BSRDC)
 Attendance List for FGD

FGD #	Name	Address	Age	Gender	Profession	Mobile No.	Signature
1.	Shirshankar Mandal	Bhuniya (Mandir)	34	M	LIC Agent	9939889152	
2.	राज कुमार	Bhuniya	40	M	समान सेवा	916246403	राज कुमार
3.	अमर कुमार	Bhuniya	42	M	Farming	9939889028	अमर कुमार
4.	Shirshankar Mandal	Bhuniya	60	M			शिरशंकर मंडल
5.	Manoj Kumar Sah		39	M			मनोज कुमार
6.	Sadhu Mandal		48	M			सदु मंडल
7.	SURESH DASI (यंग)	BHUNIYA	34	F	HOUSEWIFE	7909096237	सुरेश देवी
8.	MANNA KUMAR	BHUNIYA	28	F	HOUSEWIFE	8457525090	मन्ना कुमारी
9.	Chandrika Sah	Bhuniya	41	M			चंद्रिका साह
10.	Chand Kumar	Bhuniya	23	M	CSC VLE		चंद कुमार
11.	Laxmi Khatun	13	20	F	Housewife		लक्ष्मी कुमारी
12.	Manju Dasi	Bhuniya	60	F	Housewife		मंजु देवी
13.	Bindashwan Dasi	Bhuniya	75	M			बिंदुशंकर देवी
14.	Sangharya Mandal	Bhuniya	40	M			संगर्य मंडल
15.	Shambhu Mandal	Bhuniya	32	M			शंभु मंडल
16.	Apali Dasi	Bhuniya	28	F	Housewife		अपली देवी
17.	Rina Dasi	Bhuniya	28	F	Housewife		रीना देवी
18.	Chand Yadav	Bhuniya	45	M	Agribusiness		चंद यादव







Initial Environment Examination (IEE) of SH-84
Bihar State Road Improvement III Project (BSRIP-III) funded by ADB
Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
Attendance List for FGD

Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
19.	Pushkaram Mandal	Bhariga	38	M	Signature	9199141658	पुष्कराम मंडल
20.	Munna Das Mandal	Do Maligama	38	M	Signature	9162357925	मुन्ना दास
21.	Opunichanka Mandal	Maligama	65	M	Artist	9131897134	ओपुनिचंका मंडल
22.	Saughat Das Ghosh	Bhariga	68	M	Business	-	
23.	Gobindri Dasi	Bhariga	55	F	Laban	-	

Initial Environment Examination (IEE) of SH- B9
 Bihar State Road Improvement-III Project (BSRIP-III) funded by ADB
 Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
 Attendance List for FGD

FGD #	Name	Venue: <u>Balsan</u>	Date:	Time:	Address	Age	Gender	Profession	Mobile No.	Signature
1.	Masooda Jha	Balsan (Khagra)	37	M	Agriculture	9973829155	मसूदा झा			
2.	Sanjay kumar Jha	Khagra	47	M	Agriculture	9203609710	संजय कुमार झा			
3.	Rajendra kumar Jha	Khagra	35	M	Agriculture	9973014722	राजेंद्र कुमार झा			
4.	Naraj kumar Jha	Khagra	35	M	Vinay Kojhar	8274914427	नाराज कुमार झा			
5.	Anup Lal Jha	Balsan	65	M	Agriculture	3134914427	अनूप लाल झा			
6.	Sanjay kumar Vams	Balsan	35	M	Hand Made	9461859068	संजय कुमार वाम			
7.	Maharani Devi	Khagra	54	F	Agriculture	-	महारानी देवी			
8.	Pooja Saman Jha	Balsan	30	F	Agriculture	9199002878	पूजा सामन झा			
9.	Sakshi Devi	Balsan	35	F	Agriculture	-	साक्षी देवी			
10.	Kavita Jha	Balsan	40	F	House wife	-	काविता झा			
11.	Anita Jha	Do	44	F	House wife	-	अनिता झा			
12.	Premlata Devi	Do	55	F	House wife	-	प्रेमलता देवी			
13.	Mukta Devi	Do	60	F	Housewife	-	मुक्ता देवी			
14.	Sanjay Jha	Balsan	40	F	Agriculture	9931397331	संजय झा			
15.	Sujat Jha	Balsan	22	F	Agriculture	8406013715	सुजात झा			
16.	Bhagwan Mandi	Balsan	65	M	Agriculture		भगवान मंडी			

Initial Environment Examination (IEE) of SH-25
Bihar State Road Improvement III Project (BSRIIP-III) funded by ADB
Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
Attendance List for FGD

Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
17.	Rakesh Verma	Batser	32	M	Agriculture	8274847894	
18.	Narayan Kant Bhatia Verma	Khagun	37	M	Agriculture	9801191412	
19.	Suresh Verma	Batser	35	M	Agriculture	9771118607	
20.	Anil Kumar	Batser	68	M	Agriculture	9835421865	
21.	Anil K. Verma	Batser	23	M	Agriculture	9773241622	
22.	Anil K. Verma	Khagun	19	M	Education	9525194131	

Initial Environment Examination (IEE) of SM-85
 Bihar State Road Improvement-II Project (BSRIP-II) - funded by ADB
 Implementing Agency Bihar State Road Development Corporation Limited (BSRDC)
 Attendance List for IEO

Sl. No.	Name	Village	Address	Age	Gender	Profession	Phone No.	Signature
1.	Kameshwar Yadav	Sardpur		50	M	Agriculture		
2.	Prasadi Yadav	Sardpur		80	M	Agriculture		
3.	Ashok Kumar Mishra	Sardpur		40	M	Agriculture	785211290	
4.	Anil Kumar Jaiswal	Sardpur		45	M	Agriculture	808442623	
5.	Hari Kishan Mishra	Sardpur		65	M	Agriculture		
6.	Anurag Yadav	Sardpur		40	M	Agriculture	9162519896	
7.	Ranjit Kumar	Sardpur		22	M	Agriculture	7852036206	
8.	Bikram Kumar	Sardpur		20	M	Agriculture		
9.	Chandan Kumar	Sardpur		28	M	Agriculture		
10.	Avinash Kumar	Sardpur		19	M	Agriculture	897532021	
11.	Sonu Kumar	Sardpur		21	M	Agriculture		
12.	Ghoshil Yadav	Sardpur		50	M	Agriculture		
13.	Sridhar Yadav	Sardpur		58	M	Business	7654430700	
14.	Bhim Thakur	Sardpur		70	M	Agriculture		
15.	Pankaj Yadav	Sardpur		25	M	Agriculture		
16.	Prakash Kumar	Sardpur		40	M	Agriculture		
17.	Pawan Manjhi	Sardpur		35	M	Labour		

Initial Environment Examination (IEE) of SH-35
Bihar State Road Improvement-III Project (BSRIP-III) funded by ADB
Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
Attendance List for FGD

Sl. No.	Name	Village	Address	Age	Gender	Profession	Mobile No.	Signature
1.	Atmaram Singh	Dumaiya		55	M	Agriculture	9572277558	31/07/2016
2.	Vijay Kumar Singh	Dumaiya		65	M	Agriculture	9199515267	31/07/2016
3.	Kapildas Singh	Dumaiya		60	M	Agriculture	9939223927	Kapildas Singh
4.	Ram Prakash Singh	Dumaiya		59	M	Agriculture	9773248394	31/07/2016
5.	Kamran Jaffer	Ganikpur		45	M	Agriculture	7631173588	11/08/2016
6.	Rahil Khan	Sangraupur		29	M	Agriculture	7071036169	Rahil Khan
7.	Munir Kumar Singh	Dumaiya		47	M	Business	9806525027	Munir Kumar
8.	Duskar Singh	Dumaiya		50	M	Agriculture	-	Duskar Singh
9.	Sunil Kumar Singh	Dumaiya		63	M	Agriculture	-	Sunil Kumar
10.	Babish Mahabir Singh	Dumaiya		64	M	Agriculture	-	Babish Mahabir Singh
11.	Ram Kishoren Singh	Dumaiya		65	M	Agriculture	-	Ram Kishoren Singh
12.	Duskar Singh	Dumaiya		60	M	Agriculture	-	Duskar Singh
13.	Anwar K. Singh	Dumaiya		44	M	Agriculture	-	Anwar K. Singh
14.	Ramni Mahabir Singh	Dumaiya		75	M	Agriculture	9199515266	Ramni Mahabir Singh
15.	Anar Devi	Dumaiya		70	F	House Wife	-	Anar Devi
16.	Usha Devi	Dumaiya		60	F	House Wife	-	Usha Devi

Initial Environment Examination (IEE) of SH-82
Bihar State Road Improvement-III Project (BSRIP-III) -funded by ADB
Implementing Agency Bihar State Road development Corporation Limited (BSRDC)

Attendance List for FGD

FGD# _____ Venue: Ward No. 12 Pandey Ganga Date: _____ Time: _____

Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
1.	Sahendra Yadav	Pandey Ganga	45	M	Labour		
2.	Chander Kumar	Pandey Ganga	24	M	Agriculture		
3.	Rajesh Yadav	Do	30	M	Agriculture	9155778065	
4.	Santa Devi	Do	22	F	House wife		
5.	Rashmi Kumari	Do	15	F	Student		
6.	Asha Kumari	Do	15	F	Student		
7.	Rinki Devi	Do	30	F	House wife		
8.	Pooja Devi	Do	24	F	House wife		
9.	Sharan Prasad	Do	35	M	Labour		
10.	Ravindra Yadav	Do	40	M	Business	7257431951	
11.	Rama Devi	Do	50	F	House wife	8271639205	
12.	Prabhat Kumar Sharm	Do	17	M	Student	7959832489	
13.	Brijesh Kumar	Do	15	M	Student H. School		
14.	Dulamma Devi	Do	45	F	Labour		
15.	Lakshya Devi	Do	65	F	Labour		
16.	Nanku Yadav	Do	70	M	Agriculture		
17.	Sonam Devi	Do	70	F	House wife		

Initial Environment Examination (IEE) of SRE
 Bihar State Road Improvements-III Project (BSRIP-III) - funded by ADB
 Implementing Agency Bihar State Road development Corporation Limited (BSRDC)

Attendance List for EGO

FGO #	St. No.	Name	Venue: <u>लोहावर गाँव</u> Address	Age	Gender	Profession	Mobile No.	Signature
1.		Pargana Mandal	Jorawan Dih	80	M	Agriculture		
2.		Devdharu Kunt	Do	60	M	Agriculture	9700864962	
3.		Swirbalek Mandal	Do	45	M	Agriculture	9931300898	
4.		Narsh Pansol	Do	55	M	Agriculture	-	
5.		Brahmdeo Yadav	Do	50	M	Agriculture	-	
6.		Laba Kumar	Do	44	M	Agriculture	9585045202	
7.		Ganesh Mandal	Do	40	M	Agriculture	-	
8.		Ramswaroop Yadav	Do	50	M	Agriculture	-	
9.		Devendra Mandal	Do	60	M	Agriculture	-	
10.		Laxmukhi Devi	Do	40	f	H. Wife	-	
11.		Soni Devi	Do	45	f	"	-	
12.		Minna Devi	Do	45	f	"	-	
13.		Anam Kumar	Do	14	m	Student	7287000402	
14.		Shrilekshna	Do	33	FA		9162463636	
15.		Buddhi Kumar	Do	22	m	Student	9155521622	
16.		Ankur Kumar	Do	14	m	Student	9155455377	

Initial Environment Examination (IEE) of SH-37
Bihar State Road Improvement-III Project (BSRIIP-III) funded by ADB
Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
Attendance List for FGD

FGD #	Venue	Address	Age	Gender	Profession	Mobile No.	Signature
17	Jateesh Kumar	Jozawardi	16	M	Student	8752019300	Sateesh
18	Sumit Kumar	Jozawardi	20	M	Student	9368754579	Sumit
19	Rahul Kulk	Jozawardi	25	M	Student	70112701	Rahul
20	Kampr Ray	Jozawardi	40	M	Student	970852788	Kampr
21	Akshay Kumar	Jozawardi	17	M	Student	7475769573	Akshay Kumar
22	Rahul Kumar	Jozawardi	19	M	Student	9122022944	Rahul
23	Binda manel	Jozawardi	65	M	Farmer	7321825420	B

Bihar State Road Improvement-III Project (BSRIP-III) -funded by ADB
Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
Attendance List for FGD

FGD #	Venue: मोरार लोहरा	Date:	Time:				
Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
1.	अनुपमारी यादव	मोरार लोहरा	65	M	Agriculture	9973736226	अनुपमारी यादव
2.	अशोक यादव	Do	75	M	Agriculture		अशोक यादव
3.	सुरेश यादव	Do	60	M	Agriculture		सुरेश यादव
4.	मोहन कुमार	Do	22	M	Agriculture	9471235324	मोहन कुमार
5.	कांत राम	Do	30	M	Agriculture		कांत राम
6.	अशोक यादव	Do	32	M	Driver	999769003	अशोक यादव
7.	Sinku Kumar	Do	20	M	Driver	9969553291	Sinku Kumar
8.	Hari Rajak	Do	65	M	Agriculture		Hari Rajak
9.	Sanyu Yadav	Do	65	M	Agriculture		Sanyu Yadav
10.	Arun Sah	Do	61	M	Agriculture	9631240361	Arun Sah
11.	रमेश यादव	Do	60	M	Agriculture		रमेश यादव
12.	सुनीता देवी	Do	38	F	hwb		सुनीता देवी
13.	निरिखा देवी	Do	80	f	hwb		निरिखा देवी
14.	रीना देवी	Do	30	f	hwb		रीना देवी
15.	लीला देवी	Do	35	f	hwb		लीला देवी
16.	जोषा देवी	Do	40	f	hwb		जोषा देवी

Initial Environment Examination (IEE) of SH-207
 Bihar State Road Improvement-III Project (BSRIP-III) -funded by ADB
 Implementing Agency Bihar State Road development Corporation Limited (BSRDC)
 Attendance List for FGD

FGD #	Venue: शिवपुर	Date:	Time:				
Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
1.	Manish Kumar	Ropaul	23	M	Unemployed	9631324506	Manish Kumar
2.	Sarwan Prasad Sahu	Ropaul	25	M	Agriculture	9199168700	Sarwan Sahu
3.	Chandrika Tuxi	Ropaul	65	M	Agriculture		
4.	Anil Kumar	Ropaul	33	M	Agriculture	8521976024	Anil Kumar
5.	Dhananjay - शिवपुर	Ropaul	23	M	Agriculture		Dhananjay
6.	शिवपुर	Ropaul	45	M	Labourer		
7.	शिवपुर	Ropaul	40	M	Labourer	7762003030	
8.	शिवपुर	Ropaul	45	M	Labourer		
9.	Ram Bahai Das	Ropaul	69	M	Labourer	7782065041	
10.	Mahender Rajak	Ropaul	50	M		9801637262	
11.	शिवपुर	Ropaul	72	M		8969605518	
12.	शिवपुर	Ropaul	42	M	Agriculture	9939656009	शिवपुर
13.	शिवपुर	Ropaul	28	M	Agriculture	875934803	शिवपुर
14.	शिवपुर	Ropaul	35	F	Agriculture	-	
15.	शिवपुर	Ropaul	20	F	Agriculture	-	
16.	शिवपुर	Ropaul	40	F	House wife	-	


Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
12	पिंकी देवी	Roparwal	25	F	Housewife		
13	सुखनवा देवी	Roparwal	30	F	Housewife		
14	अंजू देवी	Roparwal	20	F	Housewife		
20	श्यामा देवी	Roparwal	50	F	Housewife		
21	वशिखा देवी	Roparwal	48	F	Housewife		
22	प्रेम कुमार	Roparwal	25	M	Labour	70918163	TO under Km
23	ब्रम्हदेव/राम	Roparwal	40	M	Labour	7542861715	
24	मदन शाह	Roparwal	45	M	Labour	9931282731	
25	Bengaluru	Roparwal	30	M	Labour	9973570359	Bengaluru
26	गुरी नराम	Roparwal	60	M	Labour		
27	Mohan Singh	Roparwal	42	M	Labour		Mohan Singh

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Bihar State Road Improvement-III Project (BSRIP-III) -funded by ADB

Implementing Agency Bihar State Road development Corporation Limited (BSRDC)

Attendance List for FGD

FGD #	Venue: <u>पनसरा</u>	Date:	Time:	
Sl. No.	Name	Address	Age Gender Profession Mobile No. Signature	
1.	राजू मौरा	पनसरा	60 M Labour	
2.	अनूप कुमार मौरा	पनसरा	35 M Agriculture	
3.	राहुल कुमार मौरा	पनसरा	14 M Student 7463952122	
4.	अमन कुमार मौरा	पनसरा	22 M Labour 9631257596	
5.	अमित मौरा	पनसरा	24 M Labour	
6.	अनुराज मौरा	पनसरा पनसरा मौरा	19 M Labour 7463887120	
7.	सुषमा देवी	पनसरा	25 F House wife	
8.	हेमा देवी	पनसरा	25 F Labour	
9.	सुषमा देवी	पनसरा	23 F House wife	
10.	सुषमा देवी	पनसरा	24 F House wife	

Initial Environment Examination (IEE) of Sit-
Bihar State Road Improvement-III Project (BSRIP-III) -funded by ADB
Implementing Agency Bihar State Road development Corporation Limited (BSRDC)

Attendance List for FGD

FGD #	Name	Village	Address	Age	Gender	Profession	Mobile No.	Signature
1.	Mithlesh Kumar	Tendani		32	M	Agriculture	9204760925	
2.	Dinesh Singh	Tendani		50	M	Agriculture		
3.	Uma Kant Singh	Tendani		55	M	Agriculture		
4.	Ram Surat Singh	Tendani		74	M	Agriculture		
5.	Rajeshwari Kumar	Tendani		80	F	Labour		
6.	Nemohari Singh	Tendani		32	M	Agriculture	8809004371	
7.	Rajesh Singh	Tendani		50	M	Agriculture		
8.	Ramkant Singh	Tendani		45	M	Business	9952754857	
9.	Bhagati Singh	Tendani		50	M	Business	7977 7557360372	
10.	Mantu Kumar	Tendani		30	M	Agriculture	8809004371	
11.	Shanku Kumar	Maini Tola		50	F	Housewife		
12.	Shanku Kumar	Tendani		50	F	Housewife		
13.	Shanku Kumar	Tendani		55	F	Housewife		
14.	Madan Singh	Tendani		55	M	Agriculture	8809004371	
15.	Ashraf Devi	Tendani		35	F	Housewife		
16.								

1.	Umesh Daswan	Sahiyon	42	M	Agriculture	8575862493	3772141ha
2.	Rajendra Shrivastava	Do	45	M	-	9525435321	2105-4-11/11
3.	Manoj Shrivastava	Do	30	M	-	-	26721/11
4.	Sanjay Kumar	Do	18	M	-	-	9910711/11
5.	Harendera Pawan	Do	26	M	-	8578093833	2105-4-11/11
6.	Lalji Pawan	Sahiyon	50	M	Agriculture	-	1105-4-11/11
7.	Darshit Pawan	Sahiyon	65	M	Labour	-	1105-4-11/11
8.	Arunthash Singh	Sahiyon	55	M	Agriculture	9135376248	3772141ha
9.	Chitrayan Pawan	Do	18	M	Student	7070172368	2105-4-11/11
10.	Sant Lal	Do	70	M	Labour	-	1105-4-11/11
11.	Sukumar Dasi	Do	68	F	Labour	-	1105-4-11/11
12.	Shiv Kumar	Do	50	F	Labour	-	1105-4-11/11
13.	Rajeshwar Dasi	Do	45	F	Labour	-	1105-4-11/11
14.	Bhishu Kumar	Do	19	M	Student	7507444235	2105-4-11/11
15.	Ramendra Dasi	Do	40	F	H. W.	-	2105-4-11/11
16.	Sumitra Dasi	Do	40	F	H. W.	-	2105-4-11/11

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 Bihar State Road Improvement-II Project (BSRIP-II) - funded by ADB
 Implementing Agency Bihar State Road Development Corporation Limited (BSRDC)
 Attendance List for FGD

FGD # _____ Venue: Atara Baudh G.P. Date: _____ Time: _____

Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
1.	Dhanjay Kumar	Atara Baudh G.P.	23	M	Agriculture	9352469309	
2.	Silaram Yadav	Parvathpur	60	M	Agriculture		
3.	Bhaskar Prasad	Dumra Baudh	22	M	Labourer		
4.	Abhishek Majhi	Atara Baudh G.P.	25	M	Labourer		
5.	Dumra Majhi	Do	20	M	Labourer		
6.	Pratap Singh	Do	25	F	Labourer		
7.	Etwariga Devi	Do					
8.	Lebhariga Devi	Do					
9.	Kantab Devi	Do					
10.	Sonur Devi	Do					
11.	Rohit Majhi	Do	25	M	Labourer		
12.	Dharmabhai Devi	Do					
13.	Dipak Kumar	Rajya	22	M	Business	9359416289	
14.	Kantab Devi	Atara Baudh	45	F	Business		
15.	Bijendra Choudhary		55	M	Agriculture		
16.	Dhanjay Kumar	Rajya	45	M	Agriculture		

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 Bihar State Road Improvement III Project (BSRIP-III) funded by ADB
 Implementing Agency Bihar State Road Development Corporation Limited (BSRDC)
 Attendance List for FGD

Sl. No.	Name	Address	Age	Gender	Profession	Mobile No.	Signature
1.	बलराम राम	चौधरी बलराम अधवा गाँव	60	M	गाई	-	बलराम राम
2.	श्रीधर झा	महेश झा (चौधरी बलराम)	35	M	अग्रिक	9985617470	श्रीधर झा
3.	Duramod Singh	धरमोद ग्लोबल	35	M	अग्रिक	9937315119	धरमोद सिंह
4.	Suresh Singh	सुरेश ठोले	42	M	अग्रिक	-	सुरेश सिंह
5.	Deemari Shama	देवी ग्लोबल	68	M	अग्रिक	916625792	देवी शर्मा
6.	Bimal chandhary						बिमल चंद
7.	Dasmath Ram				अग्रिक		दशमथ राम
8.	Rampay Singh					999929162	रामपय सिंह
9.	Sudama Singh						सुदामा सिंह
10.	Durga chandhary						दुर्गा चंद
11.	Mayan Singh	धरमोद ग्लोबल अधवा गाँव	60	M	अग्रिक		मयान सिंह
12.	Rajendra Kumar	राजेंद्र ठोले	35	M	अग्रिक		राजेंद्र कुमार
13.	Rani Kumar	रानी ग्लोबल	28	F	House wife		रानी कुमार
14.	Dipti ji	धरमोद	75	M	अग्रिक		दीप्ति जी
15.	Dharmendra Sharma	धरम ठोले अधवा गाँव	26	M	अग्रिक	9531308100	धरमेश्वर शर्मा
16.	Chhota Lal Kumar	छोटा लाल ग्लोबल	30	M	अग्रिक	9990341332	छोटा लाल

APPENDIX 13: ENVIRONMENTAL MANAGEMENT PLAN FOR SH-58 (UDAKISHANGANJ-BHATGAWA)

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement/Road Safety								
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	<ul style="list-style-type: none">Heavily built-up and geometrically deficit sections have been avoidedProvision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures.CBR value of sub grade adopted in consistent to MORTH guidelinesOverloading to be checked at weigh stationIncrease in vent size/waterway of cross drainsProvision of additional balancing culvertsProvision of adequate side drains with suitable outfallls.	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 IRC-SP:50-1999.	Realignment//geometric improvements of curves at CH Km-6.400, 13.600. 14.400, 21.900, 22.300, 24.200 and 27.00 RCC drain (Both Side):1700m Construction of 15 new culverts, reconstruction/ widening of 22 culvert, waterways of 10 bridges increased	<u>MI</u> : Design and number of cross and side drains, <u>PT</u> : Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Geometric Improvements of curvesProvision of crash barriers at accident prone areas and bridgesSpeed limitations near educational institutes, hospitals and other CPR.Provision of retro-reflective warning signboards near curves, school, hospital, religious places and other sensitive locationProvision of sidewalks in the built-up sections, on both sides.Signs and marking viz., delineators, object markers, hazard markers, safety barriers at hazardous locations,Street Lighting in built-up sections and bridge locations proposedMajor Junctions to be improved as per IRC/MORTH guidelines.	Design requirement IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MoRTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	Crash barrier for 2000 mand 3000nos. Cat Eyes in the project road. Speed Regulatory signage ,in built-up sections/sensitive locations and road junction at22 locations (Refer Supplementary Tables to EMP) Road Markers/Road Stud with Lens Reflector: 3000nos Delineators (road way indicators, hazard markers, object markers): 450nos. 2major Junctions at Udakishunganj (ch 0.000) and Bhatgawan (29.480 are to be improved.	<u>MI</u> : number and location of crash barriers, informatory and cautionary sign boards and street lighting as per design <u>PT</u> : numbers and location are in accordance with site needs :	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Natural Hazard/Climate Change Risk								
2.1 Damage to pavement integrity like Rutting, embankment softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening, rutting, asphalt migration/thermal expansion of joint	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
2.2 Earthquake	<ul style="list-style-type: none">Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area	Dislodgement of superstructure shall be taken as per Clause 222 of IRC: 6.	Entire Stretch	MI: CD Structure PT: Design conforms BIS and IRC guidelines	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
2.3 Flooding/Water-Logging	<ul style="list-style-type: none">15, additional culverts proposed.CD structures designed for 50year return periodWaterways of bridges and culverts have been increased.Roadside drains to be provided	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for	RCC drain: 1700m Unlined drain in rural area. Closed drain in urban area Water logging anticipated at Ch-0.7-1.3km (JamuniaTola), Ch-5.3-6.1km (Karchokka), Ghosai (20.3km).	MI: Design and numbers of cross & side drains, design and number of bridges PT: Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none">Road improvement work to be accommodated within available ROW to the extent possible.Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines.Complete all necessary land and property acquisition procedures prior to the commencement of civil work.Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework.Compensation and assistance as per project Resettlement PlanImplementation of Income restoration plan as per approved RPPreference in employment and petty	<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.</p> <p>Contract Clause for preference to local people during employment.</p>	Throughout the corridor (Pls Refer RP)	<p>MI: compensation and assistance to DPs as per entitlement matrix of RP No. of grievance related to RP implementation</p> <p>PT: Minimal number of Complaints/ grievances.</p> <p>Cases if any are resolved at GRC level No case of</p>	<p>Check LA records; design drawings vs. land plans;</p> <p>Interview with affected persons</p> <p>Check status of employment given to local people during construction</p>	Part of administrative and resettlement costs	BSRDCL and implementing NGO	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> contracts during construction to APs Constitute GRC as per approved RP 			grievance referred to arbitrator/court.				
4. Diversion of Forest Land and Cutting of Trees								
4.1 Deterioration in climatic condition. Increase in Green House effect/climate change impact	<ul style="list-style-type: none"> Geometric adjustments made to minimize tree cutting. Obtain tree cutting permission from forest/Revenue department as the case may be. Compensatory plantation (1:3) as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 Provision for additional plantation on 1: 7 basis to be implemented through contractors of forest department. 	Forest Conservation Act, 1980	Total number of affected trees=1017 ⁴⁹ Forest Area: Nil	<p><u>MI</u>: location of geometric adjustments to minimize tree cutting, budget allocated for compensatory and additional plantation</p> <p><u>PT</u>: Unnecessary tree felling avoided. Budget allocation for compensatory plantation is adequate,</p>	Review final design. Check budget provision for compensatory afforestation and additional plantation.	Covered under costs for DPR consultants	BSRDCL, Design consultants forest department	BSRDCL /Forest department
5. Shifting of Utilities								
3.1 Disruption of utility services to local community	<ul style="list-style-type: none"> Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. All telephone and electrical poles/wires and underground cables should be shifted before start of construction Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any Relocation of. wells, hand pumps at suitable locations with consent from local community. 	Project requirement	Throughout the corridor	<p><u>MI</u>: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p><u>PT</u>: No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/ BSRDCL/utility company	BSRDCL /CSC

⁴⁹Figure mentioned is based on inventory prepared by DPR team.

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
B. Construction Stage								
1. Air Quality								
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none">Contractor to submit location and layout plan for storage areas of construction materials approved by CSCTransport, loading and unloading of loose and fine materials through covered vehicles.Paved approach roads.Storage areas to be located downwind of the habitation area.Water spraying on earthworks, unpaved haulage roads and other dust prone areas.Provision of PPEs to workers.	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	MI: PM10 level measurements Complaints from locals due to dust PT: PM10 level< 100 g/m³Number of complaints should be 0.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Contractor	BSRDCL /CSC
1.2 Emission of air pollutants(HC,SO2,NO X,COetc)fromvehiclesd uetotrafficcongestionan duseofequipmentandm achinery	<ul style="list-style-type: none">Regular maintenance of machinery and equipment.Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement.Only crushers licensed by the SPCB shall be usedDG sets with stacks of adequate height and use of low sulphur diesel as fuel.LPG should be used as fuel source in construction camps instead of woodAmbient air quality monitoringContractor to prepare traffic management and dust suppression plan duly approved by BSRDCL	The Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	MI: Levels of HC, SO2, NO2, and CO. Status of PUC certificates PT: SO2 and NO2 levels are both less than 80ug/m³. PUC certificate of equipment and machinery is upto date	Standards CPCB methods Review of monitoring data maintained by contractor	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none">All equipment to be timely serviced and properly maintained.Construction equipment and machinery to be fitted with silencers and maintained properly.Only IS approved equipment shall be used for construction activities.Timing of noisy construction activities shall be done during night time and weekend near schools,Implement noisy operations intermittently to reduce the total noise generated	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	MI: day and night Noise levels. Number of complaints from local people PT: Zero complaints or no repeated complaints by local people. Average day and night time	As per Noise rule, 2000 Consultation with local people Review of noise level monitoring data maintained by contractor	Included in civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential, built up and forest areas construction today light hours. Honking restrictions near sensitive areas PPEs to workers Noise monitoring as per EMOp. 			noise levels are within permissible limits for work zone areas	Observation of construction site			
3. Land and Soil								
3.1 Landuse Change and Loss of productive/topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse 	Project requirement	Throughout the project section and borrow areas Land to be identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits	Included in civil works cost	Contractor	BSRDCL /CSC
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments Side slopes of all cut and fill areas will be graded and covered with stone pitching grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. The earth stockpiles to be provided with gentle slopes to avoid soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	MI: Occurrence of slope failure or erosion issues PT: No slope failures. Minimal erosion issues	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC
3.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from DEIAA prior to opening any new borrow area. Comply to EC conditions of DEIAA Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. Depths of borrow pits to be regulated and sides not steeper than 25%. Topsoil to be stockpiled and protected for use at the rehabilitation stage. 	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause 305.2.2 MORT&H Specifications for	Borrow site locations as identified in DPR However contractor is free to select any other borrow area after consent from EA and securing all permits.	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of	Review of design documents and site observations Compare site conditions with EC conditions by	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> Transportation of earth materials through covered vehicles. Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation Borrow areas not to be dug continuously. To the extent, borrow areas shall be sited away from habitated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 	Road and Bridgeworks Guidelines for Borrow Areas management		<p>accidents. Complaints from local people.</p> <p>PT: No case of non-compliance to conditions stipulated by DEIAA in clearance letter. Zero accidents. Zero complaints.</p>	DEIAA			
3.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. Obtain environmental clearance from DEIAA in case of opening new quarry 	Clause No. 111.3 MORT&H Specifications for Road and Bridgeworks Guidelines VI for Quarry Areas Management Environmental Protection Rules	<p>As per DPR, sand shall be collected from Chanan River with lead distance of 108 km while the stone shall be collected from Mirza Chauki with lead distance of 144 km</p> <p>However, the contractor is free to choose the source after securing all permit</p>	<p>MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p>PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. 	Design requirement	Parking areas, Haulage roads and construction yards.	<p>MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p>PT: Zero</p>	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> Land taken for construction camp and other temporary facility shall be restore to its original conditions 			occurrence of destroyed/compacted land and undestroyed land				
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEFCC/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	<p>MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p>PT: Soil test conforming to no – contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC
4. Water Resources								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Groundwater Augmentation by converting borrow areas into ponds 	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	<p>MI: Approval from competent authority Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil works cost	Contractor	BSRDCL /CSC
4.2 Disposal of water during construction	<ul style="list-style-type: none"> Provisionsshallbemadetconnectroa dsidedrainswithexistingnearbynatur 	ClauseNo.1010E PAct1986MORT&	Throughout the Project section	MI: Drainage system in	Standards methods	Included in civil works	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	al drains.	HSpecificationsforRoadandBridgeworks		construction site. Presence/absence of water logging in project area. PT: Existence of proper drainage system. No water logging in project area	Site observation and review of documents	cost		
4.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level as per IRC/MORTH guidelines. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Seasonal streams & Nallah (ch. 4.8, 8.2 and 9.3) crossing the project road	<p>MI: Proper flow of water in existing streams and rivers</p> <p>PT: No complain of water shortage by downstream communities. No record of overtopping/ water logging</p>	<p>Review of design documents</p> <p>Site observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC
4.4 Siltation in water bodies due to construction activities/earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridgeworks</p> <p>World-wide best practices</p>	Seasonal streams & Nallah (ch 4.8, 8.2 and 9.3 passing through the proposed road along with a Govt. Fishery near the project road. No River nearby the project road	<p>MI: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p>PT: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	<ul style="list-style-type: none"> Parking and refueling away from water bodies/waterways Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors. Construction camp to be sited away from water bodies. Wastes must be collected, stored and taken to approved disposal site only. Water quality shall be monitored 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Seasonal streams & Nallah (ch 4.8, 8.2 and 9.3) passing through the proposed road along with a Govt. Fishery near the project road. No River nearby the project road	MI: Water quality of ponds, streams, rivers and other water bodies in project Presence of oil floating in water bodies in project area PT: Surface water quality meets freshwater quality standards prescribed by CPCB	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	Contractor	BSRDCL /CSC
5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior approval of competent authority. Mandatory compensatory plantation at 1:3 basis by Forestry Department 1:7 Additional plantation Employment preference to vulnerable Regular maintenance trees planted. Provision of LPG in construction camp Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. Controlled use of pesticides/ fertilizers 	Forest Conservation Act 1980 + IRC:SP:21 and IRC:SP:66	Throughout project corridor Estimated No. of affected tree=1017 Additional Plantation near Sensitive receptors, river banks, borrow areas	MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. PT: Survival of Compensatory Plantation @ 70% and Additional plantation @ 80% survival	Review of relevant documents – tree cutting permit, compensatory plantation plan Field observations	Additional plantation and compensatory plantation cost is included in project costs under BSRDCL.	Mandatory Compensatory plantation by forest Department and Additional plantation by contractor of forest department	BSRDCL /CSC
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	<ul style="list-style-type: none"> All camps should be established with prior permission from SPCB. Layout plan shall be recommended 	Design Requirement The Water	All construction camps	MI: Location of campsites and distance from	On site observation	Included in civil works cost	Contractor and EO	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> by CSC and approved by EA Camps to maintain minimum distance from following: <ul style="list-style-type: none"> # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from through traffic route 	(Prevention and Control of Pollution) Act, 1974 and its amendments thereof		habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	Interaction with workers and local community			
6.2 Worker's Health in construction camp/ construction sites	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be 	The Building and Other Construction workers (Regulating of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 And amendments thereof	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „ Engineer“.							
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORTH guidelines and General Conditions of Contract Document	At all Dumping/Disposal Sites	<p>MI: Location of dumping sites Number of public complaints.</p> <p>PT: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Contractor.	BSRDCL /CSC
7.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. 	Design Requirement, MORTH guidelines and General Conditions of Contract Document	Throughout the project corridor	<p>MI: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p>PT: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.		

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 							
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	<p>Design requirement and IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document</p>	Throughout the project corridor especially at intersections.	<p>MI: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents PT: No complaints</p> <p>No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Contractor	BSRDCL /CSC
8.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever cattle movement is expected. Large number of box culverts has been 	Same as above	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p>MI: Presence/ absence of access routes for pedestrians. Road signage</p> <p>Number of complaints from local people</p>	Field observation Interaction with local people	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals			PT: Easy access to schools, temples and public places. Zero complaints				
8.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. Appointment of a safety officer. All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. Provision of PPEs to workers. Provision of a readily available first aid unit including an adequate supply of dressing materials. The contractor will not employ any persons below the age of 18 years Use of hazardous materials should be minimized and/or restricted. Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. Safety Officer must be appointed by the contractor. 	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	Site observation Review records on safety training and accidents Interact with construction workers	Included in civil works cost	Obligation of Contractor	BSRDCL /CSC
8.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. Provision of temporary diversions and awareness to locals before 	Same as above	Construction sites and Accident Prone Areas especially at curves (CH Km-6.400, 13.600, 14.400, 21.900, 22.300, 24.200 and 27.00).	MI: Safety signs and their location Incidents of accidents Complaints from local people PT: Zero incident of accidents. Zero	Site inspection Consultation with local people	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> opening new construction fronts. Alternate access facility to common properties near construction zones Fencing and speed limitation wherever cattle movement is anticipated.. 			complaints.				
9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<u>MI</u> : camp, Condition borrows areas and construction sites, Presence/absence of construction debris after construction works is over <u>PT</u> : Clean and tidy sites. No trash or debris left on site. Site restored/leveled	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found satisfactory	Included in civil works cost.	Contractor	BSRDCL /CSC
Operation and Maintenance stage								
1. Air Quality								
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none"> Compensatory tree plantations shall be maintained as prescribed by forest department.80% survival rate for additional plantation shall be maintained Regular maintenance of the road will be done to ensure good surface condition Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken. Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption. Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipments 	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<u>MI</u> : Ambient air quality (PM10, CO,SO2 NO2) <u>PT</u> : Levels are equal to or below baseline levels (Air Quality Standard, CPCB)	As per CPCB requirements Site inspection	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation and honking restrictions near sensitive receptors locations.Construction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution(Regulation and Control)Rules,2000andamendments thereof	Sensitive receptors as given in supplementary table to EMP	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites	Included in Operation/ Maintenance cost	BSRDCL	
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/ Maintenance cost	BSRDCL	
4. Siltation/Water-logging								
4.1 Siltation/ Contamination	<ul style="list-style-type: none">Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.Monitoring of surface water bodies	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation/ Maintenance cost	BSRDCL	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of waterborne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	NearsurfaceWaterbodies/cross drains/side drains	<u>MI</u> : Presence/absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance cost	BSRDCL/ADB	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the roadsideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	MI: Presence and extent of vegetation growth on either side of road. Number of accidents. PT: No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation/ Maintenance cost	BSRDCL	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be forced strictly. Further encroachment of squatters within the ROW will be prevented.No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local lawMonitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling. Help lines for accident reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.Tow-way facility for the break down vehicles if possible.	IRC:SP:55-2014	Accident Prone Areas especially at curves (CH Km-6.400, 13.600, 14.400, 21.900, 22.300, 24.200 and 27.00).	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law PT: Fatal and non fatal accident rate is reduced after improvement	Review accident records Site observations	Included in Operation/ Maintenance cost	BSRDCL	
6.3. Transport of Dangerous Goods	<ul style="list-style-type: none">Existence of spill prevention and control and emergency responsive systemEmergency plan for vehicles carrying hazardous material	-	Throughout the project stretch	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	Included in Operation/ Maintenance cost	BSRDCL	

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan

The “Project engineer” or “the engineer” is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The “environmental officer” is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of “the engineer”.

**Supplementary Tables to EMP
Noise Sensitive Receptor**

Chainage (in km)	Structures	LHS/RHS	Distance from Center Line to the Boundary Wall (in m)
0.3	Private School	LHS	12
0.5	ShatrughanChnadrakanta College	LHS	12
0.8	Middle School	RHS	9
5	BidyaNath Inter College	RHS	16
7.4	Nayatola High School	RHS	14
13.3	Private School	RHS	15
20.6	LP School	RHS	7
22.5	Residential Pvt. School	LHS	9
22.7	Middle School	RHS	5.5
23	LP School	RHS	7
24.4	Govt. PHC	RHS	6
24.8	LP School	RHS	20
25.5	Govt. Inter College	RHS	5.5
26	Anganbadi Centre	LHS	15
29.2	SBVM School	LHS	6

List of Other Common Properties

Chainage (in km)	Structures	LHS/RHS	Distance from Center Line (in m)
2.2	Temple	LHS	4
2.25	Temple	LHS	6
3.3	Temple	LHS	3
4.3	Temple	RHS	6.5
6.1	Temple	LHS	5
8.9	Temple	LHS	4
11.6	Temple	RHS	3.5
11.8	Temple	LHS	4
12.6	Temple	LHS	4
13.2	Temple	RHS	3.5
13.7	Temple	LHS	5
15.9	Temple	LHS	6
17.8	Temple	LHS	15
18	Temple	RHS	15
19.1	Temple	RHS	7
20.3	Temple	LHS	6.5
21.9	Temple	LHS	4
22.8	Temple	LHS	7
22.9	Temple	LHS	11
23.3	Temple	LHS	4
25	Temple	RHS	4
25.9	Temple	RHS	5
26.5	Temple	LHS	4.5
27.2	Temple	RHS	4.5
30.5	Temple	LHS	4

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air Quality	Construction stage	PM 10 PM2.5 SO ₂ , NO _x , CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site, HMP site and representative sample 1 each for residential, commercial/Industrial and Sensitive Locations (Total 5 Locations)-	24 hr. continuous, 3/year for 2.5 years	Air quality standard by CPCB	5x9000x3x2.5 =Rs 3,37,500	Contractor through approved monitoring agency	BSRDC /CSC
	Operation stage			Representative sample 1 each for residential, commercial and industrial area (3 Locations)-	24 hr. continuous, 3/year for 1 year	Air quality standard by CPCB	3X9000x3X1 =Rs 81,000	BSRDC through approved monitoring agency	BSRDC
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential area and Surface water of Perennial Rivers/Ponds (4 Samples) -	3/year for 2.5 years	Water quality standard by CPCB	4x 6000x3X2.5 =Rs 1,80, 000	Contractor through approved monitoring agency	BSRDC /SC
	Operation stage			Groundwater at 2 locations and surface water at 2 locations and pond developed due to Borrows areas – (Total 4 Samples)	3/year for 1 year	Water quality standard by CPCB	4X3x6000X1 =Rs 72,000	BSRDC through approved monitoring agency	BSRDC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Construction sites, Construction Camp and 1each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr. continuous, 3*/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3000x3x2.5 =Rs.112,500	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage			Near Sensitive and residential/Commercial areas(3 Locations)	3 / year for 1 year		3x3000x3X1 =Rs 27, 000	BSRDC through approved monitoring agency	BSRDC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3*2*5000*2.5 =75,000	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location (2 Locations)	Twice for the first year of operation	CPCB standard	2*2*5000X1 =20000	BSRDC through approved agency	BSRDC
Soil Erosion	Construction Stage			Throughout the Project Corridor especially at	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
	Operation Stage	Visual check for Soil erosion and siltation		River banks, bridge locations and river training structures	Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CSC
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Construction Sites and Labour Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: BSRDC	Compensatory: BSRDC/Local Forest Departments Additional Plantation: BSRDC through contractors of forest Dept.	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	IRC: SP:2009		Additional Plantation: BSRDC Cost	The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period BSRDC will be responsible for monitoring additional plantation	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	
Monitoring Costs: INR 904500 Lakhs (0.905 Million)									

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central Pollution Control Board, IS: Indian Standard

APPENDIX 14: ENVIRONMENTAL MANAGEMENT PLAN FOR GHOGHA-BAZAR SECTION OF SH-84

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement/Road Safety								
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	<ul style="list-style-type: none">Embankment height raisedHeavily built-up and geometrically deficit sections have been avoidedProvision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures.CBR value of sub grade adopted in consistent to MORTH guidelinesOverloading to be checked at weigh stationIncrease in vent size/waterway of cross drainsProvision of additional culvertsEmbankment height raisedAdequate side drains with suitable outfallls.	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 IRC-SP:50-1999.	Lined drain of 6.74 km (both side)in urban areas. Bypasses at Ghogha near railway crossing Heavily built-up stretch requiring rigid/concrete pavement=3.370km Culverts- 6 additional, 23 replacements & 13 widening. Replacement of existing bridge at Gehra Nadi (CH-15.680) & newly constructed bridge at CH-19.143 to be retained.	<u>MI</u> : Design and number of cross and side drains, <u>PT</u> : Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Geometric Improvements of curvesProvision of crash barriers at accident prone areas and bridgesSpeed limitations near educational institutes, hospitals and other CPR.Provision of retro-reflective warning signboards near curves, school, hospital, religious places and other sensitive locationProvision of sidewalks in the built-up sections on covered drainsSigns and marking viz., delineators, object markers, hazard markers, safety barriers at hazardous locations,Service roads along builtup sectionsStreet Lighting in built-up sections and bridge locations proposedMajor Junctions to be improved as per IRC/MORTH guidelines.	Design requirement IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MORTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	Speed Regulatory signage in built-up/ sensitive locations. Service Road for a length of 1.050 km (Km.0.360 to Km1.410 Street lighting in built-up sections and bridge locations. 3 major junctions at Km 0+000 (Ghogha), 1+960, 15+299 (Jagdishpur) are to be improved with appropriate signages	<u>MI</u> : number and location of crash barriers, informatory and cautionary sign boards, service roads and street lighting as per design <u>PT</u> : numbers and location are in accordance with site needs :	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Natural Hazard/Climate Change Risk								
2.1 Damage to pavement integrity like Rutting, embankment softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening, rutting, asphalt migration/thermal expansion of joint	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
2.2 Earthquake	Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area	Dislodgement of superstructure shall be taken as per Clause 222 of IRC: 6.	Entire Stretch	MI: Culverts, Bridges, PT: Design conforms BIS and IRC guidelines	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
2.3 Flooding/Water-Logging	<ul style="list-style-type: none">6 new culverts proposed.Replacement of 23 culverts & widening of 13 existing culvertsReplacement of existing bridge at Gehra Nadi (CH-15.680)CD structures designed for 50year return periodWaterways of bridges and culverts have been increased.Roadside drains to be provided	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for	Roadside drains (both sides together)=6.74 km	MI: Design and numbers of cross & side drains, design and number of bridges PT: Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none">Road improvement work to be accommodated within available ROW to the extent possible.Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines.Complete all necessary land and property acquisition procedures prior to the commencement of civil work.Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework.Compensation and assistance as per project Resettlement PlanImplementation of Income restoration plan as per approved RP	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy. Contract Clause for preference to local people during employment.	Throughout the corridor (Pls. refer RP)	MI: Payment of compensation and assistance to DPs as per entitlement matrix of RP Number of complaints/grievances related to compensation and resettlement PT: Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at	Check LA records; design drawings vs. land plans; Interview with affected persons Check status of employment given to local people during construction	Part of administrative and resettlement costs	BSRDCL and implementing NGO	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Preference in employment and petty contracts during construction to APs Constitute Grievance Redress Committee as per approved RP 			GRC level. No case referred to arbitrator/court.				
4. Diversion of Forest Land and Cutting of Trees								
4.1 Deterioration in climatic condition. Increase in Green House effect/climate change impact	<ul style="list-style-type: none"> Geometric adjustments made to minimize tree cutting. Obtain tree cutting permission from forest department Obtain Forest Clearance under Forest Conservation Act Compensatory plantation (1:3) as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 Provision for additional plantation on 1: 7 basis to be implemented through contractor of forest department. 	Forest Conservation Act, 1980	<p>Total number of affected trees=2222 (put together for entire stretch of SH-84 including both packages)</p> <p>Forest Area=96.18 Ha put together for entire stretch of SH-84</p>	<p>MI: location of geometric adjustments to minimize tree cutting, budget allocated for compensatory and additional plantation</p> <p>PT: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,</p>	Review final design. Check budget provision for compensatory and additional plantation.	Covered under costs for DPR consultant s	BSRDCL, Design consultants forest department	BSRDCL/Forest department
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. All telephone and electrical poles/wires and underground cables should be shifted before start of construction Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any Relocation of wells, hand pumps at suitable locations with consent from local community. 	Project requirement	Throughout the corridor	<p>MI: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p>PT: No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/BSRDCL/utility company	BSRDCL /CSC
B. Construction Stage								
1. Air Quality								
1.1 Dust Generation due to construction activities and transport, storage and handling of	<ul style="list-style-type: none"> Contractor to submit location and layout plan for storage areas of construction materials approved by CSC 	MORT&H Specifications for Road and Bridge works	Throughout project corridor	MI: PM10 level measurements Complaints from locals due to dust	Standards CPCB methods Observations	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
construction materials	<ul style="list-style-type: none"> Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document		PT: PM10 level < 100 g/m ³ Number of complaints should be 0.	Public consultation Review of monitoring data maintained by contractor			
1.2 Emission of air pollutants (HC, SO ₂ , NO _x , CO etc.) from vehicles due to traffic congestion and use of equipment and machinery	<ul style="list-style-type: none"> Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the SPCB shall be used DG sets with stacks of adequate height and use of low sulphur diesel as fuel. LPG should be used as fuel source in construction camps instead of wood Ambient air quality monitoring Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL 	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	MI: Levels of HC, SO ₂ , NO ₂ , and CO. Status of PUC certificates PT: SO ₂ and NO ₂ levels are both less than 80ug/m ³ . PUC certificate of equipment and machinery is upto date	Standards CPCB methods Review of monitoring data maintained by contractor	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during night time and week end near schools, Implement noisy operations intermittently to reduce the total noise generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential, 	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	MI: day and night Noise levels. Number of complaints from local people PT: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas	As per Noise rule, 2000 Consultation with local people Review of noise level monitoring data maintained by contractor Observation of construction site	Included in civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	built up and forest areas construction today light hours. ▪ Honking restrictions near sensitive areas PPEs to workers ▪ Noise monitoring as per EMoP.							
3. Land and Soil								
3.1 Landuse Change and Loss of productive/topsoil	▪ Non-agricultural areas to be used as borrow areas to the extent possible. ▪ If using agricultural and, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. ▪ Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse	Project requirement	Throughout the project section and borrow areas (5 locations) Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits	Included in civil works cost	Contractor	BSRDCL /CSC
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	▪ Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments ▪ Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. ▪ The earth stock piles to be provided with gentle slopes to soil erosion.	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	MI: Occurrence of slope failure or erosion issues PT: No slope failures. Minimal erosion issues	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC
3.3 Borrow area management	▪ Obtain EC from DEIAA prior to opening any new borrow area. ▪ Comply to EC conditions of DEIAA ▪ Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. ▪ Depths of borrow pits to be regulated and sides not steeper than 25%. ▪ Topsoil to be stockpiled and protected for use at the rehabilitation stage. ▪ Transportation of earth materials through covered vehicles. ▪ Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act)+Clause 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines for Borrow Areas management	Borrow sites location (5 borrow areas identified in DPR, LHS- km 14.00; RHS- km 4.000, 7.000, 8.000, 20.000) However contractor is free to select any other borrow area after consent from EA and securing all permits.	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people. PT: No case of non-compliance to conditions	Review of design documents and site observations Compare site conditions with EC conditions by DEIAA	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> and rehabilitation Borrow areas not to be dug continuously. To the extent, borrow areas shall be sited away from habitated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 			stipulated by DEIAA in clearance letter. Zero accidents. Zero complaints.				
3.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. Obtain environmental clearance from DEIAA in case of opening new quarry 	ClauseNo.111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	<p>Sand: Gherwa River (two locations) and Sukanya River</p> <p>Stone: Mirza Chowki, La IMattiya: and Bhalijore</p> <p>However, the contractor is free to choose the source after securing all permits</p>	<p>MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p>PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p>MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p>PT: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area PT: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC
4. Water Resources								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Groundwater Augmentation by converting borrow areas into ponds 	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	MI: Approval from competent authority. Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local people	Included in civil works cost	Contractor	BSRDCL /CSC
4.2 Disposal of water during construction	<ul style="list-style-type: none"> Provision shall be made to connect roadsides drains with the existing natural drains. 	Clause No.1010 EP Act 1986 MORT&H Specifications for Road and Bridge works	Throughout the Project section	MI: Condition of drainage system in construction site. Presence/absence of water logging in project area. PT: Existence of proper drainage system. No water	Standards methods Site observation and review of documents	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
				logging in project area				
4.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	<p>Rivers, canal, streams and nallah passing through the proposed road.</p> <p>Streams (km 19.143); Gherwa River (km 15.680), Sanaula Main Canal at chainage Km 5.05, and km10.03)</p>	<p>MI: Proper flow of water in existing streams and rivers</p> <p>PT: No complain of water shortage by downstream communities. No record of overtopping/ water logging</p>	<p>Review of design documents</p> <p>Site observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC
4.4 Siltation in water bodies due to construction activities/earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridgeworks</p> <p>Worldwide best practices</p>	<p>Rivers, canal, streams and nallah passing through the proposed road.</p> <p>Streams (km 19.143); Gherwa River (km 15.680), Sanaula Main Canal at chainage Km 5.05, and km10.03)</p>	<p>MI: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p>PT: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included incivil works cost	Contractor	BSRDCL /CSC
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	<ul style="list-style-type: none"> Parking and refueling away from water bodies/waterways Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to 	The Water (Prevention and Control of Pollution) Act, 1974 and amendm entsthereof.	Local streams (km 19.143); Gherwa River (km 15.680), Sanaula Main Canal at chainage Km 5.05, and km10.03)	<p>MI: Water quality of ponds, streams, rivers and other water bodies in project</p> <p>Presence of oil floating in water bodies in project area</p> <p>PT: Surface water quality meets</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors.</p> <ul style="list-style-type: none"> Construction camp to be sited away from water bodies. Wastes must be collected, stored and taken to approve disposal site only. Water quality shall be monitored 			freshwater quality standards prescribed by CPCB				
5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior approval of competent authority. Mandatory compensatory plantation at 1:3 basis by Forestry Department Additional plantation 1:7 Employment preference to vulnerable Regular maintenance trees planted. Provision of LPG in construction camp Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. Controlled use of pesticides/ fertilizers 	ForestConservati onAct1980 + IRC:SP:21andIRC:SP:66	<p>Throughout project corridor</p> <p>Additional Plantation near Sensitive receptors, river banks, borrow areas</p>	<p><u>MI</u>: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted.</p> <p><u>PT</u>: Survival of Compensatory Plantation @ 70% and Additional plantation @ 80%</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan</p> <p>Field observations</p>	Additional plantation and compensa tory plantation cost is included in project costs under BSRDCL.	Mandatory Compensatory plantation by forest Department and Additional plantation by contractor of forest department	BSRDCL /CSC
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	<ul style="list-style-type: none"> All camps should be established with prior permission from SPCB. Layout plant shall be recommended by CSC and approved by EA Camps to maintain minimum distance from following: # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from through traffic route 	Design Requirement The Water (Prevention and Control of Pollution) Act, 1974 and its amendments thereof	All construction camps	<p><u>MI</u>: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps</p> <p><u>PT</u>: Distance of campsite is less than 500m from listed locations</p>	<p>On site observation</p> <p>Interaction with workers and local community</p>	Included in civil works cost	Contractor and EO	BSRDCL /CSC
6.2 Worker's Health in co	<ul style="list-style-type: none"> The location, layout and basic facility 	The Building and O	All construction	<u>MI</u> : Camp health	Camp records	Part of the	Contractor	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
Construction camp/construction sites	<ul style="list-style-type: none"> provision of each labor camp will be submitted to CSC and approved by EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „ Engineer“. 	Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	camps	<p>records</p> <p>Existence of proper first aid kit in camp site</p> <p>Complaints from workers.</p> <p>PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.</p>	<p>Site observation</p> <p>Consultation with contractor workers and local people living nearby</p>	civil works costs		/CSC
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in 	Design Requirement, MORT&H guidelines and General Conditions of	At all Dumping/Disposal Sites	<p>MI: Location of dumping sites Number of public complaints.</p> <p>PT: No public</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Contractor.	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>the pit design to avoid leachate seepage into the soil, which may later affect ground water quality</p> <ul style="list-style-type: none"> Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Contract Document		complaints. Consent letters for all dumping sites available with contractor				
7.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	<p>MI: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p>PT: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.		
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; 	Design requirement and IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional	Throughout the project corridor especially at intersections.	<p>MI: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site.</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p>	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road.</p> <ul style="list-style-type: none"> The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	<p>Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document</p>		<p>Complaints from road users. No of accidents <u>PT</u>: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	Interaction with people in vehicles using the road			
8.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever cattle movement is expected. Large number of box and slab culverts has been proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals 	Same as above	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Contractor	BSRDCL /CSC
8.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language 	Same as above	Construction sites	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage</p>	Site observation Review records on safety training and	Included in civil works cost	Obligation of Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	at the construction sites <ul style="list-style-type: none"> Training to workers on safety procedures and precautions. Appointment of a safety officer. All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. Provision of PPEs to workers. Provision of readily available first aid unit including an adequate supply of dressing materials. The contractor will not employ any persons below the age of 18 years Use of hazardous material should be minimized and/or restricted. Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. Accident Prevention Officer must be appointed by the contractor. 			Training records on safety Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	accidents Interact with construction workers			
8.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. Provision of temporary diversions and awareness to locals before opening new construction fronts. Alternate access facility to common properties near construction zones Fencing and speed limitation wherever cattle movement is anticipated. 	Same as above	Construction sites and Accident Prone Area especially at Ch- 0.6km (Ghogha), 2.3km (Chotilpura), 14.9km (Sanhaura), 16.8km (Ghuria-Hanwara Turning).	MI: Safety signs and their location Incidents of accidents Complaints from local people PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Contractor	BSRDCL /CSC
9. Site Restoration and Rehabilitation								
9.1 Clean-up	Contractor will prepare site restoration	Project	Throughout the	MI: camp,	Site observation	Included	Contractor	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
Operations, Restoration and Rehabilitation	<div>plans, which will be approved by the 'Engineer'.</div> <div><div><div></div></div><div>The clean-up and restoration operations are to be implemented by the contractor prior to demobilization.</div><div>All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer.</div><div>All the opened borrow areas will be rehabilitated and 'Engineer' will certify</div></div>	requirement	project corridor, construction camp sites and borrow areas	<div>Condition borrows areas and construction sites, Presence/absence of construction debris after construction works is over</div> <div>PT: Clean and tidy sites. No trash or debris left on site. Site restored/leveled.</div>	<div>Interaction with locals</div> <div>Issue completion certificate after restoration of all sites are found satisfactory</div>	in civil works cost.		/CSC
Operation and Maintenance stage								
1. Air Quality								
1.1 Air pollution due to vehicular movement	<div><div><div></div></div><div>Compensatory tree plantations shall be maintained as prescribed by forest department.80% survival rate for additional plantation shall be maintained</div><div>Regular maintenance of the road will be done to ensure good surface condition</div><div>Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.</div><div>Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption.</div><div><div><div></div></div><div>Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipments</div></div></div>	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<div>MI: Ambient air quality (PM₁₀, CO,SO₂ NO₂)</div> <div>PT: Levels are equal to or below baseline levels (Air Quality Standard, CPCB)</div>	<div>As per CPCB requirements</div> <div>Site inspection</div>	Included in Operation/ Maintenance cost	BSRDCL	
2. Noise								
2.1 Noise due to movement of traffic	<div><div><div></div></div><div>Effective traffic management and good riding conditions shall be maintained</div><div>Speed limitation and honking restrictions near sensitive receptors.</div><div>Construction of noise barriers near sensitive receptors with consent of local community</div></div>	Noise Pollution (Regulation and Control)Rules,20 00andamendments thereof	Sensitive receptors as given in supplementary table to EMP	<div>MI: Noise levels</div> <div>PT: Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)</div>	<div>Noise monitoring as per noise rules ,2000</div> <div>Discussion with people at</div>	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none">The effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.				sensitive receptor sites			
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/ Maintenance cost	BSRDCL	
4. Siltation/Water-logging								
4.1 Siltation/ Contamination	<ul style="list-style-type: none">Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.Monitoring of surface water bodies	Project requirement	Near surface Water bodies	MI: Water quality PT: No turbidity of surface water bodies due to the road	Site observation	Included in Operation/Maintenance cost	BSRDCL	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging	Site observation	Included in Operation/Maintenance cost	BSRDCL	
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance cost	BSRDCL/ADB	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in	Project requirement IRC: SP:21-2009	Throughout the project stretch	MI: Presence and extent of vegetation growth on either side	Visual inspection Check accident	Included in Operation/ Maintenance	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> IRC:SP:21-2009 to be maintained Regular maintenance/trimming of plantation along the roadside No invasive plantation near the road. 			of road. Number of accidents. PT: No accidents due to vegetation growth	records	ce cost		
6.2 Accident risk associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures, including speed limits, will be forced strictly. Further encroachment of squatters within the ROW will be prevented. No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local law Monitor/ensure that all safety provisions included in design and construction phase are properly maintained Highway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. Tow-way facility for the break down vehicles if possible. 	IRC:SP:55-2014	Accident Prone Areas especially at Ch-0.6km (Ghogha) , 2.3km (Chotiulpura), 14.9km (Sanhaula), 16.8km (Ghuria-Hanwara Turning).	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law PT: Fatal and non fatal accident rate is reduced after improvement	Review accident records Site observations	Included in Operation/ Maintenance cost	BSRDCL	
6.3. Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	-	Throughout the project stretch	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	Included in Operation/ Maintenance cost	BSRDCL	

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan

The “Project engineer” or “the engineer” is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The “environmental officer” is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of “the engineer”.

**Supplementary Tables to EMP
Noise Sensitive Receptor**

Sl. No.	Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
1	0.4	Private School (Temporary Building)	RHS	5
2	1.5	Library	LHS	3
3	3.5	Private School	RHS	7
4	3.9	Private School	RHS	8
4	4.7	Tarar College	RHS	13
5	5.1	Tarar Middle School (Boundary)	RHS	6.5
6	7.5	Middle School	RHS	7
7	8.2	Middle School	LHS	30
8	9.9	Middle School	RHS	9
9	12.2	LP School	RHS	10
10	12.3	Middle School	LHS	11
11	12.65	Pvt. School	LHS	30
12	14.9	Middle School	RHS	12
13	16.4	Govt. PHC Sanhaura	RHS	8
14	16.5	Pvt. School	RHS	10
15	17	Middle School	LHS	30
16	19.2	Middle School	RHS	10

List of Other Common Properties

Sl. No.	Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
1	3	Temple	LHS	8
2	3.4	Pond	RHS	15
3	4.2	Pax	LHS	7
4	4.3	Petrol Pump	RHS	5
5	4.9	Temple	RHS	7
6	5.1	Temple	LHS	4.5
7	5.2	Temple	RHS	8
8	6.96	Temple	RHS	6
9	7.5	Temple	RHS	10
10	9.1	Pond	RHS	15
11	9.3	Temple	RHS	3
12	9.6	Temple	RHS	6
13	10.1	Temple	LHS	4
14	10.6	Temple	LHS	3.5
15	10.6	Pond	LHS	10
16	12.2	Pond	LHS	3
17	12.35	Temple	RHS	6
18	13.2	Temple	LHS	4
19	13.6	Temple	LHS	3
20	13.6	Temple	RHS	3.5
21	14.2	Petrol Pump	LHS	10
22	14.7	Pond	LHS	5
23	15.3	Block Office Sanhaura	LHS	7
24	15.4	Panchayat Bhawan	LHS	15
25	15.9	Masjid	RHS	15
26	16	Police Station Sanhaura (Boundary)	LHS	5
27	16.1	Temple	RHS	8
28	16.3	Temple	RHS	5
29	18	Temple	RHS	5
30	18.2	Temple	RHS	6
31	20.6	Temple	RHS	6

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air Quality	Construction stage	PM 10 PM2.5 SO ₂ , NO _x , CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site/ HMP site and representative sample one each for residential, commercial/Industrial and Sensitive Locations (Total 4 Locations)-	24 hr. continuous, 3/year for 2.5 years	Air quality standard by CPCB	5x9000x3x2.5 = ₹ 2,70,000	Contractor through approved monitoring agency	BSRDC /CSC
	Operation stage			Representative sample 1 each for residential, commercial and industrial area (3 Locations)-	24 hr. continuous, 3/year for 1 year	Air quality standard by CPCB	3X9000x3X1 = ₹ 81,000	BSRDC through approved monitoring agency	BSRDC
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential area and Surface water of Perennial Rivers/Ponds (4 Samples) -	3/year for 2.5 years	Water quality standard by CPCB	4x 6000x3X2.5 = ₹ 1, 80, 000	Contractor through approved monitoring agency	BSRDC /SC
	Operation stage			Groundwater at 1 locations and surface water at 1 locations and 1 pond developed due to Borrows areas – (Total 3 Samples)	3/year for 1 year	Water quality standard by CPCB	3X3x6000X1 = ₹54,000	BSRDC through approved monitoring agency	BSRDC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Active Construction sites and 1 each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr. continuous, 3/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3000x3x2.5 = ₹1,12,500	Contractor through approved monitoring agency	BSRDC/CS C
	Operation stage			Near Sensitive locations and residential/Commercial areas (3 Locations)	3 / year for 1 year		3x3000x3X1 = ₹ 27,000	BSRDC through approved monitoring agency	BSRDC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3*2*5000*2.5 = ₹75,000	Contractor through approved monitoring agency	BSRDC/CS C
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location (2Locations)	Twice for the first year of operation	CPCB standard	2*2*5000X1= ₹ 20000	BSRDC through approved agency	BSRDC
Soil Erosion	Construction Stage			Throughout the Project Corridor especially at	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CS C

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
	Operation Stage	Visual check for Soil erosion and siltation		River banks, bridge locations and river training structures	Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CS C
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CS C
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Construction Sites and Labour Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CS C
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: BSRDC	Compensatory: BSRDC/Local Forest Departments Additional Plantation: BSRDC through contractor of forest dept. The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period BSRDC will be responsible for monitoring additional plantation	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	IRC: SP:2009		Additional Plantation: BSRDC Cost		
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CS C
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	
Monitoring Costs: (INR) ₹ 8.2Lakhs (0.82 Million)									

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central

APPENDIX 15: ENVIRONMENTAL MANAGEMENT PLAN FOR BAZAR-PANJWARA SECTION OF SH-84

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility ImplementationSupervision	
A. Design and Pre-construction Stage								
1. Alignment/Pavement/Road Safety								
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	<ul style="list-style-type: none">Embankment height raisedHeavily built-up and geometrically deficit sections have been avoidedProvision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures.CBR value of sub grade adopted in consistent to MORTH guidelinesOverloading to be checked at weigh stationIncrease in vent size/waterway of cross drainsProvision of additional culvertsEmbankment height raisedAdequate side drains with suitable outfalls.	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 IRC-SP:50-1999.	Embankment raised at Km 31.61 to 32.30 and Km 34.15 to 35.25 Lined drain in urban areas. Heavily built-up stretch requiring rigid/concrete pavement Additional Culverts and widening of existing CDs with inadequate waterways	MI: Design and number of cross and side drains, PT: Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Geometric Improvements of curvesProvision of crash barriers at accident prone areas and bridgesSpeed limitations near educational institutes, hospitals and other CPR.Provision of retro-reflective warning signboards near curves, school, hospital, religious places and other sensitive locationProvision of sidewalks in the built-up sections on covered drainsSigns and marking viz., delineators, object markers, hazard markers, safety barriers at hazardous locations,Street Lighting in built-up sections and bridge locations proposedMajor Junctions to be improved as per IRC/MORTH guidelines.	Design requirement IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MORTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 “. IRC: SP: 67-2012	Speed Regulatory signage, in built-up/ sensitive locations. Crash barrier at ch- km 27.800, 31.550, 32.100, 35.420. Street lighting in built-up sections and bridge locations. Major junction to be improved	MI: number and location of crash barriers, informatory and cautionary sign boards, service roads and street lighting as per design PT: numbers and location are in accordance with site needs : :	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
2. Natural Hazard/Climate Change Risk								
2.1 Damage to pavement integrity like Rutting, embankment softening and migration	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified	IRC 37 2012 for flexible pavement design, IRC 81 1997 for	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat	Review of design documents and drawings and comparison with	Covered under costs for DPR consultant	Contractor	BSRDC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	binder and polymer modified binders.	strengthening of flexible pavement		PI: No softening, rutting, asphalt migration/thermal expansion of joint	site conditions			
2.2 Earthquake	<ul style="list-style-type: none"> Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area 	Dislodgement of superstructure shall be taken as per Clause 222 of IRC: 6.	Entire Stretch	<u>MI</u> : Culverts, Bridges, <u>PT</u> : Design conforms BIS and IRC guidelines	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
2.3 Flooding/Water-Logging	<ul style="list-style-type: none"> 5 new culverts proposed. 32 replacement & 10 widening of existing culverts Replacement of 5 existing minor bridges CD structures designed for 50year return period Waterways of bridges and culverts have been increased. Roadside drains to be provided 	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for	Potential water logging areas	<u>MI</u> : Design and numbers of cross & side drains, design and number of bridges <u>PT</u> : Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none"> Road improvement work to be accommodated within available ROW to the extent possible. Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. Complete all necessary land and property acquisition procedures prior to the commencement of civil work. Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. Compensation and assistance as per project Resettlement Plan Implementation of Income restoration plan as per approved RP Preference in employment and petty contracts during construction to APs Constitute Grievance Redress Committee as per approved RP 	<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.</p> <p>Contract Clause for preference to local people during employment.</p>	Throughout the corridor (Please Refer RP)	<u>MI</u> : Payment of compensation and assistance to DPs as per entitlement matrix of RP Number of complaints/grievances related to compensation and resettlement <u>PT</u> : Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case referred to arbitrator/court.	Check LA records; design drawings vs. land plans; Interview with affected persons Check status of employment given to local people during construction	Part of administrative and resettlement costs	BSRDCL and implementing NGO	BSRDCL
4. Diversion of Forest Land and Cutting of Trees								
4.1 Deterioration in climatic condition.	<ul style="list-style-type: none"> Geometric adjustments made to minimize tree cutting. 	Forest Conservation Act,	Total number of affected trees=2222	<u>MI</u> : location of geometric	Review final design. Check	Covered under	BSRDCL, Design	BSRDCL/F orest

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
Increase in Green House effect/climate change impact	<ul style="list-style-type: none"> Obtain tree cutting permission from forest department Obtain Forest Clearance under Forest Conservation Act Compensatory plantation (1:3) as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 Provision for additional plantation on 1: 7 basis to be implemented by contractor of forest department 	1980	<p>put together for entire stretch of SH-84 including both packages</p> <p>Forest Area=96.18 Ha put together for entire stretch of Sh-84 involving both packages</p>	<p>adjustments to minimize tree cutting, budget allocated for compensatory and additional plantation</p> <p><u>PT</u>: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,</p>	budget provision for compensatory and additional plantation.	costs for DPR consultants	consultants forest department	department
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. All telephone and electrical poles/wires and underground cables should be shifted before start of construction Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any Relocation of wells, hand pumps at suitable locations with consent from local community. 	Project requirement	Throughout the corridor	<p><u>MI</u>: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p><u>PT</u>: No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/ BSRDCL/utility company	BSRDCL /CSC
B. Construction Stage								
1. Air Quality								
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Contractor to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<p><u>MI</u>: PM10 level measurements Complaints from locals due to dust</p> <p><u>PT</u>: PM10 level < 100 g/m³ Number of complaints should be 0.</p>	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.2 Emission of air pollutants (HC, SO ₂ , NO _x , CO etc) from vehicles due to traffic congestion and use of equipment and machinery	<ul style="list-style-type: none"> Provision of PPEs to workers. Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the SPCB shall be used DG sets with stacks of adequate height and use of low sulphur diesel as fuel. LPG should be used as fuel source in construction camps instead of wood Ambient air quality monitoring Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL 	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	<p>MI: Levels of HC, SO₂, NO₂, and CO. Status of PUC certificates</p> <p>PT: SO₂ and NO₂ levels are both less than 80ug/m³. PUC certificate of equipment and machinery is upto date</p>	<p>Standards CPCB methods</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during night time and week end near schools, Implement noisy operations intermittently to reduce the total noise generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential, built up and forest areas construction to daylight hours. Honking restrictions near sensitive areas PPEs to workers Noise monitoring as per EMoP. 	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	<p>MI: day and night Noise levels. Number of complaints from local people</p> <p>PT: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas</p>	<p>As per Noise rule, 2000</p> <p>Consultation with local people</p> <p>Review of noise level monitoring data maintained by contractor</p> <p>Observation of construction site</p>	Included in civil works costs	Contractor	BSRDCL /CSC
3. Land and Soil								
3.1 Land use Change and Loss of productive/topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural and, top soil to be preserved and laid over either on the embankment slope for growing 	Project requirement	Throughout the project section and borrow areas (3 locations)	<p>MI: Borrow pit locations/Top soil storage area</p> <p>PT: Zero</p>	Review borrow area plan, site visits	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> vegetation to protect soil erosion. Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse 		Land identified for camp, storage areas etc.	complaints or disputes registered against contractor by land owner				
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. The earth stockpiles to be provided with gentle slopes to soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	<p>MI: Occurrence of slope failure or erosion issues</p> <p>PT: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC
3.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from DEIAA prior to opening any new borrow area. Comply to EC conditions of DEIAA Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. Depths of borrow pits to be regulated and sides not steeper than 25%. Topsoil to be stockpiled and protected for use at the rehabilitation stage. Transportation of earth materials through covered vehicles. Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation Borrow areas not to be dug continuously. To the extent, borrow areas shall be sited away from habitated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines for Borrow Areas management	<p>Borrow sites location (3) borrow areas identified in DPR, CH- km 25.500, 36.500, 41.400)</p> <p>However contractor is free to select any other borrow area after consent from EA and securing all permits.</p>	<p>MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p>PT: No case of non-compliance to conditions stipulated by DEIAA in clearance letter. Zero accidents. Zero complaints.</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by DEIAA</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
3.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. Obtain environmental clearance from DEIAA in case of opening new quarry 	ClauseNo.111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	<p>Sand: Gherwa River (two locations) and Sukanya River</p> <p>Stone: MirzaChowki, LalMattiya: and Bhalijore</p> <p>However, the contractor is free to choose the source after securing all permits</p>	<p>MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p>PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p>MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p>PT: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	<p>MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p>PT: Soil test conforming to no –contamination. No sighting of spilled oil or</p>	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors <ul style="list-style-type: none"> Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 			bitumen in construction site or camp site				
4. Water Resources								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Groundwater Augmentation by converting borrow areas into ponds 	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	MI: Approval from competent authority. Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local people	Included in civil works cost	Contractor	BSRDCL /CSC
4.2 Disposal of water during construction	<ul style="list-style-type: none"> Provision shall be made to connect roads drains with existing nearby natural drains. 	Clause No. 1010E P Act 1986 MORT & H Specifications for Road and Bridge works	Throughout the Project section	MI: Condition of drainage system in construction site. Presence/absence of water logging in project area. PT: Existence of proper drainage system. No water logging in project area	Standards methods Site observation and review of documents	Included in civil works cost	Contractor	BSRDCL /CSC
4.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) 	Design requirement, Clause 501.8.6. MORT & H Specifications for Road and Bridge	Rivers, canal, streams and nallah passing through the proposed road. Streams (km 23.603, 31.480, 32.050); Mirchain iNadi (km 27.770)	MI: Proper flow of water in existing streams and rivers PT: No complain of water shortage by downstream communities. No record of overtopping/ water logging	Review of design documents Site observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	and will be bring back to its original course immediately after construction.							
4.4 Siltation in water bodies due to construction activities/earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, Clause No 50 1.8.6.MORT&H Specifications for Road and Bridge works</p> <p>Worldwide best practices</p>	<p>Rivers, canal, streams and nallah passing through the proposed road.</p> <p>Streams (km 23.603, 31.480, 32.050); Mirchaini Nadi (km 27.770)</p>	<p>MI: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p>PT: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Contractor	BSRDCL /CSC
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	<ul style="list-style-type: none"> Parking and refueling away from water bodies/waterways Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors. Construction camp to be sited away from water bodies. Wastes must be collected, stored and taken to approved disposal site only. Water quality shall be monitored 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Local Streams (km 23.603, 31.480, 32.050); Mirchaini Nadi (km 27.770).	<p>MI: Water quality of ponds, streams, rivers and other water bodies in project</p> <p>Presence of oil floating in water bodies in project area</p> <p>PT: Surface water quality meets freshwater quality standards prescribed by CPCB</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC
5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior approval of competent authority. Mandatory compensatory plantation at 1:3 basis by Forestry Department 	Forest Conservation Act 1980 + IRC:SP:21 and IRC:SP:66	<p>Throughout project corridor</p> <p>Additional Plantation near Sensitive receptors,</p>	<p>MI: ROW width</p> <p>Number of trees for felling</p> <p>Compensatory plantation plan</p> <p>Number of trees replanted.</p>	Review of relevant documents – tree cutting permit, compensatory plantation plan	Additional plantation and compensatory plantation cost is	Mandatory Compensatory plantation by forest Department and Additional plantation by	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Additional plantation @ 1:7 Employment preference to vulnerable Regular maintenance trees planted. Provision of LPG in construction camp Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. Controlled use of pesticides/ fertilizers 		river banks, borrow areas	PT: Survival of Compensatory Plantation @ 70% and Additional plantation @ 80%	Field observations	included in project costs under BSRDCL.	contractor of forest department	
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	<ul style="list-style-type: none"> All camps should be established with prior permission from SPCB. Layout plan shall be recommended by CSC and approved by EA Camps to maintain minimum distance from following: <ul style="list-style-type: none"> # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from through traffic route 	Design Requirement The Water(Prevention and Control of Pollution)Act,1974 and its amendments thereof	All construction camps	MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included in civil works cost	Contractor and EO	BSRDCL /CSC
6.2 Worker's Health in construction camp/construction sites	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the 	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water(Prevention and Control of Pollution) Act, 1974 and amendments thereof	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>workers of host community.</p> <ul style="list-style-type: none"> Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „Engineer“. 							
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	At all Dumping/ Disposal Sites	<p><u>MI</u>: Location of dumping sites Number of public complaints.</p> <p><u>PT</u>: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Contractor.	BSRDCL /CSC
7.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	<p><u>MI</u>: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.		

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Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	traffic management and safety. Conduct of regular safety audit on safety measures.							
8.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever cattle movement is expected. Large number of box and slab culverts has been proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals 	Same as above	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Contractor	BSRDCL /CSC
8.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. Appointment of a safety officer. All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. Provision of PPEs to workers. Provision of readily available first aid unit including an adequate supply of dressing materials. The contractor will not employ any persons below the age of 18 years Use of hazardous material should be minimized and/or restricted. Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. Accident Prevention Officer must be appointed by the contractor. 	Same as above	Construction sites	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Contractor	BSRDCL /CSC
8.4 Accident risk to local	Restrict access to construction sites	Same as above	Construction sites	<u>MI</u> : Safety signs	Site inspection	Included in	Contractor	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
community	<ul style="list-style-type: none"> only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. Provision of temporary diversions and awareness to locals before opening new construction fronts. Alternate access facility to common properties near construction zones Fencing and speed limitation wherever cattle movement is anticipated. 		and Accident Prone Area especially near residential and sensitive locations.	and their location Incidents of accidents Complaints from local people <u>PT</u> : Zero incident of accidents. Zero complaints.	Consultation with local people	civil works cost		/CSC
9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including riverbeds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<u>MI</u> : camp, Condition borrows areas and construction sites, Presence/absence of construction debris after construction works is over <u>PT</u> : Clean and tidy sites. No trash or debris left on site. Site restored/leveled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found satisfactory	Included in civil works cost.	Contractor	BSRDCL /CSC
Operation and Maintenance stage								
1. Air Quality								
1.1 Air pollution due to vehicular movement	<ul style="list-style-type: none"> Compensatory tree plantations shall be maintained as prescribed by forest department. 80% survival rate for additional plantation shall be maintained Regular maintenance of the road will be done to ensure good surface condition Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken. 	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<u>MI</u> : Ambient air quality (PM ₁₀ , CO, SO ₂ , NO ₂) <u>PT</u> : Levels are equal to or below baseline levels (Air Quality Standard, CPCB)	As per CPCB requirements Site inspection	Included in Operation/Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none">▪ Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption.▪ Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipments							
2. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">▪ Effective traffic management and good riding conditions shall be maintained▪ Speed limitation and honking restrictions near sensitive receptors.▪ Construction of noise barriers near sensitive receptors with consent of local community▪ The effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.▪ Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution(Regulation and Control)Rules,2000andamendments thereof	Sensitive receptors as given in supplementary table to EMP	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites	Included in Operation/ Maintenance cost	BSRDCL	
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">▪ Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.▪ Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/ Maintenance cost	BSRDCL	
4. Siltation/Water-logging								
4.1 Siltation/ Contamination	<ul style="list-style-type: none">▪ Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.▪ Monitoring of surface water bodies	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation/ Maintenance cost	BSRDCL	
4.2 Water logging due to blockage of drains.	<ul style="list-style-type: none">▪ Regular visual checks and cleaning (at least once before monsoon) of	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross	<u>MI</u> : Presence/absence of water	Site observation	Included in Operation/	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
culverts or streams	drains to ensure that flow of water is maintained through cross drains and other channels/streams. <ul style="list-style-type: none">Monitoring of water borne diseases due to stagnant water bodies		drains/side drains	logging along the road <u>PT</u> : No record of overtopping/ Water logging		Maintenance cost		
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>T</u> : Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance cost	BSRDCL/ADB	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the roadsideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation/ Maintenance cost	BSRDCL	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be forced strictly.Further encroachment of squatters within the ROW will be prevented.No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local lawMonitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.Tow-way facility for the break down vehicles if possible.	IRC:SP:55-2014	Accident Prone Areas	<u>MI</u> : Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law <u>PT</u> : Fatal and non fatal accident rate is reduced after improvement	Review accident records Site observations	Included in Operation/ Maintenance cost	BSRDCL	
6.3.Transportof Dangerous Goods	<ul style="list-style-type: none">Existence of spill prevention and control and emergency responsive systemEmergency plan for vehicles carrying hazardous material	-	Throughout the project stretch	<u>MI</u> : Status of emergency system – whether operational or not <u>PT</u> : Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	Included in Operation/ Maintenance cost	BSRDCL	

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan

The “Project engineer” or “the engineer” is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The “environmental officer” is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of “the engineer”.

**Supplementary Tables to EMP
Noise Sensitive Receptor**

Sl. No.	Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
1	21.1	LP School	RHS	20
2	21.5	Pvt. School	LHS	7
3	21.5	Girls Middle School	LHS	8
4	22.1	High School Batsar	RHS	30
5	22.1	Middle School Batsar	LHS	7
6	23.2	Govt. Sub PHC	RHS	20
7	23.8	Urdu Middle School	RHS	15
8	26.4	Madrassa School	RHS	40
9	27.9	Middle School KurmaHaat	RHS	10
10	30.8	Private School	RHS	7
11	31	Private School	RHS	10
12	31	Private School	LHS	6
13	31.1	Private School	LHS	30
14	34.6	Middle School	LHS	8
15	36.9	Middle School	RHS	20
16	39.2	Pvt. High School	LHS	7
17	40.9	Govt. PHC Saadpur	LHS	15
18	40.95	Middle School Saadpur	LHS	7

List of Other Common Properties

Sl. No.	Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
1	21.7	Temple	RHS	10
2	21.7	MNREGA Bhawan	RHS	8
3	22.1	Mandir	LHS	4
4	22.4	Temple	LHS	6
5	23.7	Mosque	RHS	6
6	27	Mazhar	LHS	7
7	27	Graveyard	LHS	10
8	29.4	Temple	RHS	4
9	30.5	Temple	RHS	4
10	30.8	Temple	LHS	4
11	31.1	Petrol Pump	RHS	20
12	31.6	Temple	RHS	5
13	32.5	Temple	LHS	5
14	33.4	Temple	LHS	6
15	34.4	Temple	LHS	6
16	34.9	Temple	RHS	10
17	35	Pond	RHS	8
18	36.4	Temple	LHS	5
19	36.8	Temple	RHS	10
20	40.9	Temple	LHS	6
21	42.2	Temple	LHS	6
22	42.5	Temple	LHS	8

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision	
Air Quality	Construction stage	PM 10 PM2.5 SO2, NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site/ HMP site and representative sample one each for residential, commercial/Industrial and Sensitive Locations (Total 4 Locations)-	24 hr continuous, 3/year for 2.5 years	Air quality standard by CPCB	4x9000x3x2.5 = ₹ 2,70,000	Contractor through approved monitoring agency	BSRDC /CSC	
	Operation stage			Representative sample 1 each for residential, commercial and industrial area (3 Locations)-	24 hr continuous, 3/year for 1 year	Air quality standard by CPCB	3X9000x3X1 = ₹ 81,000	BSRDC through approved monitoring agency	BSRDC	
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential areas and Surface water of Perennial Rivers/Ponds (4 Samples) -	3/year for 2.5 years	Water quality standard by CPCB	4x 6000x3X2.5 = ₹ 1, 80, 000	Contractor through approved monitoring agency	BSRDC /SC	
	Operation stage			Groundwater at 1 locations and surface water at 1 locations and 1 pond developed due to Borrows areas – (Total 3 Samples)	3/year for 1 year	Water quality standard by CPCB	3X3x6000X1 = ₹54,000	BSRDC through approved monitoring agency	BSRDC	
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968Using Noise level meter	Active Construction sites and 1each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr continuous, 3*/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3000x3x2.5 = ₹1,12,500	Contractor through approved monitoring agency	BSRDC/CSC	
	Operation stage			Near Sensitive locations and residential/ Commercial areas (3 Locations)	3 / year for 1 year		3x3000x3X1 = ₹ 27,000	BSRDC through approved monitoring agency	BSRDC	
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3*2*5000*2.5 = ₹75,000	Contractor through approved monitoring agency	BSRDC/CSC	
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location (2Locations)	Twice for the first year of operation	CPCB standard	2*2*5000X1= ₹ 20000	BSRDC through approved agency	BSRDC	
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation			Throughout the Project Corridor especially at River banks, bridge locations and river training structures	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CSC
	Operation Stage					Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CSC
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Constructi on Sites and Labour Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: BSRDC	Compensatory: BSRDC/Local Forest Departments Additional Plantation: BSRDC through contractor of forest dept. The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period BSRDC will be responsible for monitoring additional plantation	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	IRC: SP:2009		Additional Plantation: BSRDC Cost		
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	
Monitoring Costs: (INR) ₹ 8.195 Lakhs (0.82 Million)									

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central Pollution Control Board, IS: Indian Standard

APPENDIX 16: ENVIRONMENTAL MANAGEMENT PLAN FOR AKBARNAGAR-AMARPUR SECTION OF SH-85

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility		
							Implementation	Supervision	
A. Design and Pre-construction Stage									
1. Alignment/Pavement/Road Safety									
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	<ul style="list-style-type: none">Embankment height raised Heavily built-up and geometrically deficit sections have been avoidedProvision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures.CBR value of sub grade adopted in consistent to MORTH guidelinesOverloading to be checked at weigh stationIncrease in vent size/waterway of cross drainsProvision of additional culvertsEmbankment height raised Adequate side drains with suitable outfallIs.	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 IRC-SP:50-1999.	Heavily built-up stretch requiring rigid/concrete pavement=6.786 km Realignment at Km. 21+510 to Km. 21+760. embankment raise for 2.48km (at Ch. 11.9-13, 13.8-14.3, 21.4-22.8km) Lined drain= 13.572 km Vent/waterway of 71 culverts and 5 bridges to be increased	MI: Design and number of cross and side drains, PT: Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL	
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Geometric Improvements of curvesProvision of crash barriers at accident prone areas and bridgesSpeed limitations near educational institutes, hospitals and other CPR.Provision of retro reflective warning signboards near curves, school, hospital, religious places and other sensitive locationProvision of sidewalks in the built-up sections on covered drainsSigns and marking viz., delineators, object markers, hazard markers, safety barriers at hazardous locations,Street Lighting in built-up sections and bridge locations proposedMajor Junctions to be improved as per IRC/MORTH guidelines.	Design requirement IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MORTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 “. IRC: SP: 67-2012	Speed Regulatory signage, in built-up/ sensitive locations. Crash barrier atSpeed Restriction sign posts at all the built-up areas Delineator: 25-30nos. Major junctions (5) and Minor junctions (41) to be improved with appropriate signage's	MI: number and location of crash barriers, informatory and cautionary sign boards, and street lighting as per design PT: numbers and location are in accordance with site needs :	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL	
2. Natural Hazard/Climate Change Risk									
2.1 Damage to pavement integrity like Rutting, embankment softening and migration	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified	IRC 37 2012 for flexible pavement design, IRC 81 1997 for	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat	Review of design documents and drawings	Covered under costs for DPR consultant	Contractor	BSRDC	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	binder and polymer modified binders.	strengthening of flexible pavement		PI: No softening, rutting, asphalt migration/thermal expansion of joint	and comparison with site conditions			
2.2 Earthquake	<ul style="list-style-type: none"> Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area 	Dislodgement of superstructure shall be taken as per Clause 222 of IRC: 6.	Entire Stretch	MI: Culverts and Bridges, PT: Design conforms BIS and IRC guidelines	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
2.3 Flooding/Water-Logging	<ul style="list-style-type: none"> 12 new culverts proposed. CD structures designed for 50year return period Waterways of bridges and culverts have been increased. Roadside drains to be provided 	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for	Realigned between Km. 21+510 to Km. 21+760 Overtopping at Ch. 3.6, 21.5, 21.63 & 22.19km. Total Length of embankment raised- 2.48km (at Ch. 11.9-13, 13.8-14.3, 21.4-22.8km) Lined drain= 13.572 km Vent/waterway of 71 culverts and 5 bridges to be increased	MI: Design and numbers of cross & side drains, design and number of bridges PT: Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none"> Road improvement work to be accommodated within available ROW to the extent possible. Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. Complete all necessary land and property acquisition procedures prior to the commencement of civil work. Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. Compensation and assistance as per project Resettlement Plan Implementation of Income restoration plan as per approved RP 	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy. Contract Clause for preference to local people during	Throughout the corridor (PIs Refer RP)	MI: Payment of compensation and assistance to DPs as per entitlement matrix of RP Number of complaints/grievances related to compensation and resettlement PT: Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at	Check LA records; design drawings vs. land plans; Interview with affected persons Check status of employment given to local people during construction	Part of administrative and resettlement costs	BSRDCL and implementing NGO	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Preference in employment and petty contracts during construction to APs Constitute Grievance Redress Committee as per approved RP 	employment.		GRC level. No case referred to arbitrator/court.				
4. Diversion of Forest Land and Cutting of Trees								
4.1 Deterioration in climatic condition. Increase in Green House effect/climate change impact	<ul style="list-style-type: none"> Geometric adjustments made to minimize tree cutting. Obtain tree cutting permission from forest department Obtain Forest Clearance under Forest Conservation Act Compensatory plantation (1:3) as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 Provision for additional plantation on 1: 7 basis to be implemented by contractors of forest department. 	Forest Conservation Act, 1980	Total number of affected trees=1390 ⁵⁰ Forest Area=57.09 Ha	<u>MI</u> : location of geometric adjustments to minimize tree cutting, budget allocated for compensatory and additional plantation <u>PT</u> : Unnecessary tree felling on forest land avoided. Budget is adequate,	Review final design. Check budget provision for compensatory afforestation and additional plantation.	Covered under costs for DPR consultants	BSRDCL, Design consultants forest department	BSRDCL/ Forest department
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. All telephone and electrical poles/wires and underground cables should be shifted before start of construction Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any Relocation of wells, hand pumps at suitable locations with consent from local community. 	Project requirement	Throughout the corridor	<u>MI</u> : Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities <u>PT</u> : No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/ BSRDCL/utility company	BSRDCL /CSC
B. Construction Stage								
1. Air Quality								
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Contractor to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered 	MORT&H Specifications for Road and Bridge works Air (P and CP)	Throughout project corridor	<u>MI</u> : PM10 level measurements Complaints from locals due to dust	Standards CPCB methods Observations	Included in civil works cost	Contractor	BSRDCL /CSC

⁵⁰Figure mentioned is based on inventory prepared by DPR team.

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers.	Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document		PT: PM10 level < 100 g/m ³ Number of complaints should be 0.	Public consultation Review of monitoring data maintained by contractor			
1.2 Emission of air pollutants (HC, SO ₂ , NO _x , CO etc) from vehicles due to traffic congestion and use of equipment and machinery	Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the SPCB shall be used DG sets with stacks of adequate height and use of low sulphur diesel as fuel. LPG should be used as fuel source in construction camps instead of wood Ambient air quality monitoring Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	MI: Levels of HC, SO ₂ , NO ₂ , and CO. Status of PUC certificates PT: SO ₂ and NO ₂ levels are both less than 80 µg/m ³ . PUC certificate of equipment and machinery is upto date	Standards CPCB methods Review of monitoring data maintained by contractor	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during night time and weekend near schools. Implement noisy operations intermittently to reduce the total noise generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential, built up and forest areas construction today light hours. Honking restrictions near sensitive areas PPEs to workers	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	MI: day and night Noise levels. Number of complaints from local people PT: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas	As per Noise rule, 2000 Consultation with local people Review of noise level monitoring data maintained by contractor Observation of construction site	Included in civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	▪ Noise monitoring as per EMoP.							
3. Land and Soil								
3.1 Landuse Change and Loss of productive/topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural and, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse 	Project requirement	<p>Throughout the project section and borrow areas (7locations)</p> <p>Land identified for camp, storage areas etc.</p>	<p>MI: Borrow pit locations/Top soil storage area</p> <p>PT: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Contractor	BSRDCL /CSC
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. The earth stockpiles to be provided with gentle slopes to soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	<p>MI: Occurrence of slope failure or erosion issues</p> <p>PT: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC
3.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from DEIAA prior to opening any new borrow area. Comply to EC conditions of DEIAA Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. Depths of borrow pits to be regulated and sides not steeper than 25%. Topsoil to be stockpiled and protected for use at the rehabilitation stage. Transportation of earth materials through covered vehicles. Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation Borrow areas not to be dug continuously. To the extent, borrow areas shall be sited away from habitated areas. 	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines for Borrow Areas management	<p>Borrow sites location (7 borrow area identified in DPR, LHS ch- km 6.340, 7.50, 16.250, 23.600; RHS- km 4.500, 11.900, 28.00)</p> <p>However contractor is free to select any other borrow area after consent from EA and securing all permits.</p>	<p>MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p>PT: No case of non-compliance to conditions stipulated by DEIAA in clearance letter. Zero accidents.</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by DEIAA</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 			Zero complaints.				
3.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. Obtain environmental clearance from DEIAA in case of opening new quarry 	Clause No. 111. 3MORT&H Specifications for Road and Bridge works Guidelines for Quarry Areas Management Environmental Protection Rules	<p>Sand: Gherwa River (0.00km); Getamath River (29.300 km) and Sukanya River (29.300 km)</p> <p>Stone: 2 Stone quarry located at chainage 6.340 and 11.900 km with a lead distance of 1.5 km and 2.0 km. However, the contractor is free to choose the source after securing all permits</p>	<p>MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p>PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p>MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p>PT: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil- 	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	<p>MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p>PT: Soil test conforming to no</p>	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>Interceptors shall be provided at wash down and refueling areas.</p> <ul style="list-style-type: none"> Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MOEFCC/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed-off in an identified dumping site approved by the State Pollution Control Board 			<p>–contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>				
4. Water Resources								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Groundwater Augmentation by converting borrow areas into ponds 	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	<p>MI: Approval from competent authority. Complaints from local people on water availability</p> <p>PT: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil works cost	Contractor	BSRDCL /CSC
4.2 Disposal of water during construction	<ul style="list-style-type: none"> Provision shall be made to connect roads with existing near by natural drains. 	Clause No. 1010 EPA Act 1986 MO RT & H Specifications for Road and Bridge works	Throughout the Project section	<p>MI: Condition of drainage system in construction site. Presence/absence of water logging in project area.</p> <p>PT: Existence of proper drainage system. No water logging in project area</p>	<p>Standards methods</p> <p>Site observation and review of documents</p>	Included in civil works cost	Contractor	BSRDCL /CSC
4.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. 	<p>Design requirement, Clause No 501.8.6. MORT & H Specifications for Road and Bridge</p>	<p>Rivers, canal, streams and nallah passing through the proposed road.</p> <p>Nallah, 8 Ponds (Significant- Shahkund- km 10.2, Amba- km 15.8,</p>	<p>MI: Proper flow of water in existing streams and rivers</p> <p>PT: No complain of water shortage by downstream communities. No record of</p>	<p>Review of design documents</p> <p>Site observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction. 		Chiriya km 17.9); Rivers-Chanan (km 3.8), Belasiriver (km 21.630), Gherwa River (km 0.00); Getamath River (km 29.300) and Sukanya River (km 29.300); Canal (km 7.5)	overtopping/ water logging				
4.4 Siltation in water bodies due to construction activities/earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, ClauseNo501. 8.6.MORT&H Specification for Road and Bridge works</p> <p>World wide best practices</p>	<p>Rivers, canal, streams and nallah passing through the proposed road.</p> <p>Nallah, 8 Ponds (Significant- Shakund- km 102, Amba- km 15.8, Chiriya km 17.9); Rivers-Chanan (km 3.8), Belasiriver (km 21.630), Gherwa River (km 0.00); Getamath River (km 29.300) and Sukanya River (km 29.300); Canal (km 7.5); Small channels – Medhiyanath nadi and Dona nadi</p>	<p><u>MI</u>: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Contractor	BSRDCL /CSC
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	<ul style="list-style-type: none"> Parking and refueling away from water bodies/waterways Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors. Construction camp to be sited away from water bodies. Wastes must be collected, stored and taken to approve disposal site only. 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Nallah, 8 Ponds (Significant- Shakund- km 102, Amba- km 15.8, Chiriya km 17.9); Rivers-Chanan (km 3.8), Belasi river (km 21.630), Gherwa River (km 0.00); Getamath River (km 29.300) and Sukanya River (km 29.300); Canal (km 7.5); Small channels – Medhiyanath nadi and Dona nadi	<p><u>MI</u>: Water quality of ponds, streams, rivers and other water bodies in project</p> <p>Presence of oil floating in water bodies in project area</p> <p><u>PT</u>: Surface water quality meets freshwater quality standards prescribed by CPCB</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	Water quality shall be monitored							
5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior approval of competent authority. Mandatory compensatory plantation at 1:3 basis by Forestry Department Additional compensatory plantation 1:7 Employment preference to vulnerable Regular maintenance trees planted. Provision of LPG in construction camp Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. Controlled use of pesticides/ fertilizers 	ForestConservationAct1980 + IRC:SP:21andl RC:SP:66	<p>Throughout project corridor</p> <p>Estimated No. of affected tree=1390 Forest Area:57.09ha</p> <p>Additional Plantation near Sensitive receptors, river banks, borrow areas</p>	<p>MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted.</p> <p>PT: Survival of Compensatory Plantation @ 70% and Additional plantation @ 80%</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan</p> <p>Field observations</p>	Additional plantation and compensatory plantation cost is included in project costs under BSRDCL.	Mandatory Compensatory plantation by forest Department and Additional plantation by contractor of forest department	BSRDCL /CSC
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	<ul style="list-style-type: none"> All camps should be established with prior permission from SPCB. Layout plant shall be recommended by CSC and approved by EA Camps to maintain minimum distance from following: <ul style="list-style-type: none"> # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from through traffic route 	Design Requirement The Water (Prevention and Control of Pollution) Act,1974 and its amendments thereof	All construction camps	<p>MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps</p> <p>PT: Distance of campsite is less than 500m from listed locations</p>	<p>On site observation</p> <p>Interaction with workers and local community</p>	Included in civil works cost	Contractor and EO	BSRDCL /CSC
6.2 Worker's Health in construction camp/ construction sites	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and 	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of	All construction camps	<p>MI: Camp health records</p> <p>Existence of proper first aid kit in camp site</p> <p>Complaints from workers.</p> <p>PT: No record of illness due to</p>	<p>Camp records</p> <p>Site observation</p> <p>Consultation with contractor workers and local people living nearby</p>	Part of the civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations.</p> <ul style="list-style-type: none"> No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „Engineer“. 	Pollution) Act, 1974 and amendments thereof		unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.				
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORTH guidelines and General Conditions of Contract Document	At all Dumping/ Disposal Sites	<p><u>MI</u>: Location of dumping sites Number of public complaints.</p> <p><u>PT</u>: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Contractor.	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or CSC	Contractor records Field observation Interaction with local people	Included in civil works cost.		
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. 	Design requirement and IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 - 1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014 The Building and other Construction	Throughout the project corridor especially at intersections.	MI: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site	Review traffic management plan Field observation of traffic management and safety system Interaction with people in vehicles using the road	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document						
8.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever cattle movement is expected. Large number of box and slab culverts has been proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals 	Same as above	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Contractor	BSRDCL /CSC
8.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. Appointment of a safety officer. All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. Provision of PPEs to workers. Provision of readily available first aid unit including an adequate supply of dressing materials. The contractor will not employ any person below the age of 18 years Use of hazardous materials should be minimized and/or restricted. Emergency plan (to be approved by engineer) shall be prepared to 	Same as above	Construction sites	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	respond to any accidents or emergencies. ▪ Accident Prevention Officer must be appointed by the contractor.							
8.4 Accident risk to local community	▪ Restrict access to construction sites only to authorized personnel. ▪ Physical separation must be provided for movement of vehicular and human traffic. ▪ All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. ▪ Provision of temporary diversions and awareness to locals before opening new construction fronts. ▪ Alternate access facility to common properties near construction zones ▪ Fencing and speed limitation wherever cattle movement is anticipated.	Same as above	Construction sites and Accident Prone Area especially at major junctions at Ch- 0.0km (Akarnagar), 8.248 km (Janipur), 9.950 km (Shahkunda), 22.980 km (Pawai) and 24.280 km (Satgharua) and Ch. 7.8km (Saadpur Mor), 13.32km (Paach Kathia), 21.6 (Dumaria), 24.9 (Naya Chowk), 27.7km (Badshahganj).	MI: Safety signs and their location Incidents of accidents Complaints from local people PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Contractor	BSRDCL /CSC
9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations, Restoration and Rehabilitation	▪ Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. ▪ The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. ▪ All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. ▪ All the opened borrow areas will be rehabilitated and 'Engineer' will certify	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	MI: camp, Condition borrows areas and construction sites, Presence/absence of construction debris after construction works is over PT: Clean and tidy sites. No trash or debris left on site. Site restored/leveled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found satisfactory	Included in civil works cost.	Contractor	BSRDCL /CSC
Operation and Maintenance stage								
1. Air Quality								
1.1 Air pollution due to vehicular movement	▪ Compensatory tree plantations shall be maintained as prescribed by forest department. 80% survival rate for additional plantation shall be maintained ▪ Regular maintenance of the road will be done to ensure good surface	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	MI: Ambient air quality (PM ₁₀ , CO, SO ₂ , NO ₂) PT: Levels are equal to or below	As per CPCB requirements Site inspection	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<div>condition</div> <ul style="list-style-type: none">Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption.Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipments			baseline levels (Air Quality Standard, CPCB)				
2. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation and honking restrictions near sensitive receptors.Construction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution(Regulation and Control) Rules, 2000 and amendments thereof	Sensitive receptors as given in supplementary table to EMP	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites	Included in Operation/ Maintenance cost	BSRDCL	
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/ Maintenance cost	BSRDCL	
4. Siltation/Water-logging								
4.1 Siltation/ Contamination	<ul style="list-style-type: none">Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water	Site observation	Included in Operation/Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none">Monitoring of surface water bodies			bodies due to the road				
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water-bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	MI: Presence/absence of water logging along the road PT: No record of overtopping/ Water logging	Site observation	Included in Operation/Maintenance cost	BSRDCL	
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	ForestConservationAct1980	Project tree plantation sites	MI: Tree/plants survival rate T: Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance ce cost	BSRDCL/ADB	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the roadsideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	MI: Presence and extent of vegetation growth on either side of road. Number of accidents. PT: No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation/ Maintenance ce cost	BSRDCL	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be enforced strictly.Further encroachment of squatters within the ROW will be prevented.No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local lawMonitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling. Help lines for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.Tow-way facility for the break down vehicles if possible.	IRC:SP:55-2014	Accident Prone Areas especially at major junctions at Ch-0.0km (Akbarnagar), 8.248 km (Janipur), 9.950 km (Shahkund), 22.980 km (Pawai) and 24.280 km (Satgharua) and Ch. 7.8km (Saadpur Mor), 13.32km (Paach Kathia), 21.6 (Dumaria), 24.9 (Naya Chowk), 27.7km (Badshahganj)).	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law PT: Fatal and non fatal accident rate is reduced after improvement	Review accident records Site observations	Included in Operation/ Maintenance ce cost	BSRDCL	
6.3.TransportofDangerousGoods	<ul style="list-style-type: none">Existence of spill prevention and control and emergency responsive system	-	Throughout the project stretch	MI: Status of emergency system –	Review of spill prevention and	Included in Operation/	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Emergency plan for vehicles carrying hazardous material 			whether operational or not <u>PT</u> : Fully functional emergency system	emergency response plan Spill accident records	Maintenance cost		

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan

The "Project engineer" or "the engineer" is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The "environmental officer" is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of "the engineer".

**Supplementary Tables to EMP
Noise Sensitive Receptor**

Sl. No.	Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
1	0.1	Middle School	RHS	3
2	6.2	ME School	RHS	20
3	6.4	Govt. PHC Pakhrukhi	RHS	3
4	7.1	Middle School	RHS	7
5	9.6	Madrassa School	RHS	20
6	9.6	LP School	LHS	50
7	9.8	Girls High School, Shahkund	LHS	8
8	10.9	Govt. Hospital	RHS	7
9	12.5	Middle School	RHS	15
10	12.6	Govt. Sub PHC	RHS	20
11	14.7	Mod Narayan College	LHS	7
12	14.9	Higher Secondary School	LHS	7
13	15.3	Sub PHC	LHS	6
14	16.1	Madrassa School	LHS	30
15	16.3	Sub PHC	LHS	6
16	19.5	Middle School Charia	RHS	8
17	19.8	Primary School	RHS	12
18	21.3	Private School	LHS	6
19	21.5	Middle School Dumaria	LHS	6
20	21.6	Private Nursing Home	LHS	6
21	24.2	Primary School	LHS	6
22	24.2	Anganbadi Centre	LHS	6
23	24.5	Govt. PHC Powai	RHS	50
24	29.8	Govt. Referral Hospital	LHS	18

List of Other Common Properties

Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
0	Temple (T-Point with NH 80)	(T-Point with NH 80)	
0.15	Temple	LHS	12
3	Brick Kiln	LHS	20
3.6	Temple	RHS	2.5
6.8	Gram Panchayat	LHS	4.5
7.1	Media Centre	RHS	7
8.7	Temple	RHS	4.5
9.1	Temple	LHS	4.5
9.4	Temple	RHS	6
9.6	Mosque	RHS	6
10.3	Police Station, Shahkund	LHS	20
10.4	Mosque	LHS	15
10.7	Temple	LHS	6
11.8	Community Centre	RHS	6
12.1	Temple	RHS	4.5
12.6	Temple	RHS	45
12.7	Temple	RHS	5
13.32	Temple	LHS	6
13.7	Temple	RHS	5
14.5	Brick Kiln	LHS	7
15.1	Temple	LHS	30
18.8	Temple	RHS	6
19.1	Mosque (Boundary Wall)	RHS	6
19.1	Mosque (Main Building)	RHS	20
19.2	Mazhar	RHS	3.5
19.25	Temple	LHS	4.5
19.8	Temple	LHS	5

Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
20.2	Temple	RHS	4.5
20.2	Temple	LHS	4
21.4	Temple	LHS	5
21.8	Mosque	LHS	25
24.1	Brick Kiln	LHS	15
24.3	Temple	LHS	5
24.9	Temple	LHS	4
27.4	Temple	RHS	4
27.8	Temple	RHS	5
27.9	Temple	RHS	4
28.6	Temple	RHS	4
28.6	Brick Kiln	RHS	20
28.9	Petrol Pump	RHS	14
29.5	Mazhar	RHS	10
29.8	Temple	RHS	5

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Air Quality	Construction stage	PM 10 PM2.5 SO ₂ , NO _x , CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site, HMP site and representative sample 1 each for residential, commercial/Industrial and Sensitive Locations (Total 5 Locations)-	24 hr continuous, 3/year for 2.5 years	Air quality standard by CPCB	5x9000x3x2.5 =Rs 3,37,500	Contractor through approved monitoring agency	BSRDC /CSC
	Operation stage			Representative sample 1 each for residential, commercial and industrial area (3 Locations)-	24 hr continuous, 3/year for 1 year	Air quality standard by CPCB	3X9000x3X1 =Rs 81,000	BSRDC through approved monitoring agency	BSRDC
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential area and Surface water of Perennial Rivers/Ponds (4 Samples) -	3/year for 2.5 years	Water quality standard by CPCB	4x 6000x3X2.5 =Rs 1,80, 000	Contractor through approved monitoring agency	BSRDC /SC
	Operation stage			Groundwater at 2 locations and surface water at 2 locations and pond developed due to Borrows areas – (Total 4 Samples)	3/year for 1 year	Water quality standard by CPCB	4X3x6000X1 =Rs 72,000	BSRDC through approved monitoring agency	BSRDC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Construction sites, Construction Camp and 1each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr continuous, 3*/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3000x3x2.5 =Rs.112,500	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage			Near Sensitive and residential/Commercial areas(3 Locations)	3 / year for 1 year		3x3000x3X1 =Rs 27, 000	BSRDC through approved monitoring agency	BSRDC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3*2*5000*2.5=75,000	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location (2 Locations)	Twice for the first year of operation	CPCB standard	2*2*5000X1=20000	BSRDC through approved agency	BSRDC
Soil Erosion	Construction Stage			Throughout the Project Corridor especially at	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
	Operation Stage	Visual check for Soil erosion and siltation		River banks, bridge locations and river training structures	Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CSC
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Construction Sites and Labour Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: BSRDC	Compensatory: BSRDC/Local Forest Departments	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	IRC: SP:2009		Additional Plantation: BSRDC Cost	Additional Plantation: BSRDC through contractor of forest dept. The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period BSRDC will be responsible for monitoring additional plantation	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	
Monitoring Costs: INR 945000 Lakhs (0.9 Million)									

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central Pollution Control Board, IS: Indian Standard

APPENDIX 17: ENVIRONMENTAL MANAGEMENT PLAN FOR KADIRGANJ-DEWANGARH SECTION OF SH-82

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement/Road Safety								
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	<ul style="list-style-type: none">Embankment height raised, heavily built-up and geometrically deficit sections have been avoidedProvision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures.CBR value of sub grade adopted in consistent to MORTH guidelinesIncrease in vent size/waterway of cross drainsProvision of additional culvertsEmbankment height raisedAdequate side drains	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 IRC-SP: 50-1999 IRC:37-2001, chapter-4 (Para-d) IRC: 37-2001 (Para 5.2) IRC. S.P: 73-2007 (Para 4.2.7.7)	Heavily built-up stretch requiring rigid/concrete pavement=5.1 km 10 curve locations including 1 reverse curve. Vent/waterway of culverts and minor bridges to be increased.	MI: Design and number of cross and side drains, PT: Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Geometric Improvements of curvesProvision of crash barriers at accident prone areas and bridgesSpeed limitations near educational institutes, hospitals and other CPR.Chevron sign at curvesProvision of retro-reflective warning signboards near curves, school, hospital, religious places and other sensitive locationProvision of sidewalks in the built-up sections on covered drainsSigns and marking viz., delineators, object markers, hazard markers, safety barriers at hazardous locations,Street Lighting in built-up sections and bridge locations proposedMajor Junctions to be improved as per IRC/MORTH guidelines.	Design requirement IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MoRTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 “. IRC: SP: 67-2012	Speed Regulatory signage, in built-up/ sensitive locations. Speed Restriction sign posts at all the built-up areas & junctions. Crash barriers at bridges Speed Limit Sign at 10 locations. One major junction at km 0.000; Roh More to be improved.	MI: number and location of crash barriers, informatory and cautionary sign boards, and street lighting as per design PT: numbers and location are in accordance with site needs.	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
2. Natural Hazard/Climate Change Risk								
2.1 Damage to pavement integrity like Rutting, embankment softening and migration of liquid asphalt.	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening,	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
Thermal expansion in bridge expansion joints and paved surfaces	binders.	flexible pavement		rutting, asphalt migration/thermal expansion of joint				
2.2 Earthquake	<ul style="list-style-type: none"> Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area 	Dislodgement of superstructure shall be taken as per Clause 222 of IRC: 6.	Entire Stretch	<p>MI: Bridges, Culverts and ROB</p> <p>PT: Design conforms BIS and IRC guidelines</p>	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
2.3 Flooding/Water-Logging	<ul style="list-style-type: none"> CD structures designed for 50year return period Waterways of bridges and culverts have been increased. Roadside drains to be provided 	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for	<p>Embankment raised for entire stretch of the project road.</p> <p>Vent/waterway of culverts and minor bridges to be increased</p>	<p>MI: Design and numbers of cross & side drains, design and number of bridges</p> <p>PT: Design and numbers are in accordance with site needs</p>	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDCL
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none"> Road improvement work to be accommodated within available ROW Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. Complete all necessary land and property acquisition procedures prior to the commencement of civil work. Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. Compensation and assistance as per project Resettlement Plan Implementation of Income restoration plan as per approved RP Preference in employment and petty contracts during construction to APs Constitute Grievance Redress Committee as per approved RP 	<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.</p> <p>Contract Clause for preference to local people during employment.</p>	Throughout the corridor (PIs, Refer RP)	<p>MI: Payment of compensation and assistance to DPs as per entitlement matrix of RP</p> <p>Number of complaints/grievances related to compensation and resettlement</p> <p>PT: Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case referred to arbitrator/court.</p>	<p>Check LA records; design drawings vs. land plans;</p> <p>Interview with affected persons</p> <p>Check status of employment given to local people during construction</p>	Part of administrative and resettlement costs	BSRDCL and implementing NGO	BSRDCL
4. Diversion of Forest Land and Cutting of Trees								
4.1 Deterioration in climatic condition. Increase in Green House effect/climate	<ul style="list-style-type: none"> Geometric adjustments made to minimize tree cutting. Obtain tree cutting permission from forest department 	Forest Conservation Act, 1980	Total number of affected trees=4246 put together of all 3 packages of SH-82	MI: location of geometric adjustments to minimize tree	Review final design. Check budget provision for	Covered under costs for DPR	BSRDCL, Design consultants forest	BSRDCL/ Forest department

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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change impact	<ul style="list-style-type: none"> Obtain Forest Clearance under Forest Conservation Act Compensatory plantation (1:3) as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 Provision for additional plantation on 1: 7 basis to be implemented through contractor of forest department 		Forest Area=27.695Ha (put together for entire stretch of SH-82 falling in Nawada Division only remaining being assessed)	cutting, budget allocated for compensatory and additional plantation <u>PT</u> : Unnecessary tree felling on forest land avoided. Budget allocation is adequate,	compensatory afforestation and additional plantation.	consultants	department	
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. All telephone and electrical poles/wires and underground cables should be shifted before start of construction Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any Relocation of wells, hand pumps at suitable locations with consent from local community. 	Project requirement	Throughout the corridor	<u>MI</u> : Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities <u>PT</u> : No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/ BSRDCL/utility company	BSRDCL /CSC
B. Construction Stage								
1. Air Quality								
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Contractor to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<u>MI</u> : PM10 level measurements Complaints from locals due to dust <u>PT</u> : PM10 level< 100 g/m ³ Number of complaints should be 0.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.2 Emission of air pollutants(HC,SO ₂ ,NO _x , COetc)from vehicles due to traffic congestion and use of old equipment and machinery	<ul style="list-style-type: none"> Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the SPCB shall be used DG sets with stacks of adequate height and use of low sulphur diesel as fuel. LPG should be used as fuel source in construction camps instead of wood Ambient air quality monitoring Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL 	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	<p>MI: Levels of HC, SO₂, NO₂, and CO. Status of PUC certificates</p> <p>PT: SO₂ and NO₂ levels are both less than 80ug/m³. PUC certificate of equipment and machinery is upto date</p>	<p>Standards CPCB methods</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during night time and weekend near schools, Implement noisy operations intermittently to reduce the total noise generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential, built up and forest areas construction today light hours. Honking restrictions near sensitive areas PPEs to workers Noise monitoring as per EMOp. 	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	<p>MI: day and night Noise levels. Number of complaints from local people</p> <p>PT: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas</p>	<p>As per Noise rule, 2000</p> <p>Consultation with local people</p> <p>Review of noise level monitoring data maintained by contractor</p> <p>Observation of construction site</p>	Included in civil works costs	Contractor	BSRDCL /CSC
3. Land and Soil								
3.1 Land use Change and Loss of productive/topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing 	Project requirement	Throughout the project section and borrow areas identified in DPR	<p>MI: Borrow pit locations/Top soil storage area</p> <p>PT: Zero</p>	Review borrow area plan, site visits	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> vegetation to protect soil erosion. Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse 		Land to be identified for camp, storage areas etc.	complaints or disputes registered against contractor by land owner				
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. The earth stockpiles to be provided with gentle slopes to soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	<p>MI: Occurrence of slope failure or erosion issues</p> <p>PT: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC
3.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from DEIAA prior to opening any new borrow area. Comply to EC conditions of DEIAA Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. Depths of borrow pits to be regulated and sides not steeper than 25%. Topsoil to be stockpiled and protected for use at the rehabilitation stage. Transportation of earth materials through covered vehicles. Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation Borrow areas not to be dug continuously. To the extent, borrow areas shall be sited away from habitated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, 1986; Air Act) + Clause 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines for Borrow Areas management	<p>Borrow sites location (LHS Ch- km 3.13, 4.57, 7.1, 14.8, 24.353, 26.5; RHS Ch- km 0.75, 4.57, 7.9, 15.9, 24.353, 26.5)</p> <p>However contractor is free to select any other borrow area after consent from EA and securing all permits.</p>	<p>MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p>PT: No case of non-compliance to conditions stipulated by DEIAA in clearance letter. Zero accidents. Zero complaints.</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by DEIAA</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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3.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. Obtain environmental clearance from DEIAA in case of opening new quarry 	Clause No. 111. 3MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	<p>Sand: Kiul River at a lead distance of 30 km.</p> <p>Stone: One stone quarry have been identified in project area at Seikhpura with lead distance of 100km.</p> <p>However, the contractor is free to choose the source after securing all permits</p>	<p>MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p>PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p>MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p>PT: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth 	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	<p>MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p>PT: Soil test conforming to no –contamination. No sighting of</p>	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MOEF/SPCB authorized vendors <ul style="list-style-type: none"> Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 			spilled oil or bitumen in construction site or camp site				
4. Water Resources								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Groundwater Augmentation by converting borrow areas into ponds 	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	MI: Approval from competent authority Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local people	Included in civil works cost	Contractor	BSRDCL /CSC
4.2 Disposal of water during construction	<ul style="list-style-type: none"> Provision shall be made to connect roads with existing near by natural drains. 	Clause No. 1010 EPA Act 1986 MO RT & HS specifications for Road and Bridge works	Throughout the Project section	MI: Condition of drainage system in construction site . Presence/absence of water logging in project area. PT: Existence of proper drainage system. No water logging in project area	Standards methods Site observation and review of documents	Included in civil works cost	Contractor	BSRDCL /CSC
4.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases 	Design requirement, Clause No 501.8.6. MORT & H Specifications for Road and Bridge	Rivers, canal, streams and nallah passing through the proposed road. Bhagree River (26+100).	MI: Proper flow of water in existing streams and rivers PT: No complain of water shortage by downstream communities. No record of overtopping/ water logging	Review of design documents Site observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction.							
4.4 Siltation in water bodies due to construction activities/earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, Clause No 501. 8.6. MORT&H Specifications for Road and Bridge works</p> <p>Worldwide best practices</p>	Rivers, canal, streams and nallah passing through the proposed road. Bhagree River (26+100).	<p>MI: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p>PT: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Contractor	BSRDCL /CSC
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	<ul style="list-style-type: none"> Parking and refueling away from water bodies/waterways Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors. Construction camp to be sited away from water bodies. Wastes must be collected, stored and taken to approved disposal site only. Water quality shall be monitored 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Bhagree River (26+100).	<p>MI: Water quality of ponds, streams, rivers and other water bodies in project</p> <p>Presence of oil floating in water bodies in project area</p> <p>PT: Surface water quality meets freshwater quality standards prescribed by CPCB</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC
5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior 	Forest Conservation Act 1980 + IRC:SP:21 and I	Throughout project corridor	MI: ROW width Number of trees for felling Compensatory	Review of relevant documents – tree cutting	Additional plantation and compensa	Mandatory Compensatory plantation by forest	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> approval of competent authority. Mandatory compensatory plantation at 1:3 basis by Forestry Department Additional plantation @ 1:7 Employment preference to vulnerable Regular maintenance trees planted. Provision of LPG in construction camp Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. Controlled use of pesticides/ fertilizers 	RC:SP:66	Additional Plantation near Sensitive receptors, river banks, borrow areas	plantation plan Number of trees replanted. <u>PT</u> : Survival of Compensatory Plantation @ 70% and Additional plantation @ 80%	permit, compensatory plantation plan Field observations	tory plantation cost is included in project costs under BSRDCL.	Department and Additional plantation by contractor of forest department	
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	<ul style="list-style-type: none"> All camps should be established with prior permission from SPCB. Layout plant shall be recommended by CSC and approved by EA Camps to maintain minimum distance from following: <ul style="list-style-type: none"> # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from through traffic route 	Design Requirement The Water (Prevention and Control of Pollution) Act, 1974 and its amendments thereof	All construction camps	MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps <u>PT</u> : Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included incivil works cost	Contractor and EO	BSRDCL /CSC
6.2 Worker's Health in construction camp/ construction sites	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The 	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. <u>PT</u> : No record of illness due to unhygienic conditions or	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations.</p> <ul style="list-style-type: none"> No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „Engineer“. 	amendments thereof		vectors. Zero cases of STD. Clean and tidy camp site conditions.				
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORTH guidelines and General Conditions of Contract Document	At all Dumping/ Disposal Sites	<p><u>MI</u>: Location of dumping sites Number of public complaints.</p> <p><u>PT</u>: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Contractor.	BSRDCL /CSC
7.2 Reuse and	<ul style="list-style-type: none"> The existing bitumen surface shall be 	Design	Throughout the	MI: Percentage of	Contractor	Included in		

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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disposal of construction and dismantled waste	<p>utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes.</p> <ul style="list-style-type: none"> All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Requirement, MORTH guidelines and General Conditions of Contract Document	project corridor	<p>reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p>PT: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>records</p> <p>Field observation</p> <p>Interaction with local people</p>	civil works cost.		
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved 	<p>Design requirement and IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other</p>	Throughout the project corridor especially at intersections.	<p>MI: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p>PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<div>diversions will be constructed.</div> <ul style="list-style-type: none"> ▪ Restriction of construction activity to only one side of the existing road ▪ The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". ▪ Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document						
8.2 Pedestrians, animal movement	<ul style="list-style-type: none"> ▪ Temporary access and diversion, with proper drainage facilities. ▪ Access to the schools, temples and other public places must be maintained when construction takes place near them. ▪ Fencing wherever cattle movement is expected. ▪ Large number of box and slab culverts has been proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals 	Same as above	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Contractor	BSRDCL /CSC
8.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> ▪ Contractors to adopt and maintain safe working practices. ▪ Usage of fluorescent and retro refractory signage, in local language at the construction sites ▪ Training to workers on safety procedures and precautions. ▪ Appointment of a safety officer. ▪ All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. ▪ Provision of PPEs to workers. ▪ Provision of readily available first aid unit including an adequate supply of dressing materials. ▪ The contractor will not employ any person below the age of 18 years ▪ Use of hazardous material should be 	Same as above	Construction sites	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> minimized and/or restricted. Emergency plan (to be approved by engineer shall be prepared to respond to any accidents or emergencies. Accident Prevention Officer must be appointed by the contractor. 							
8.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. Provision of temporary diversions and awareness to locals before opening new construction fronts. Alternate access facility to common properties near construction zones Fencing and speed limitation wherever cattle movement is anticipated. 	Same as above	<p>Construction sites and Accident Prone Area especially at sharp curve and junctions.</p> <p>Curve locations</p>	<p>MI: Safety signs and their location Incidents of accidents</p> <p>Complaints from local people PT: Zero incident of accidents. Zero complaints.</p>	<p>Site inspection</p> <p>Consultation with local people</p>	Included in civil works cost	Contractor	BSRDCL /CSC
9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<p>MI: Camp, Condition borrows areas and construction sites, Presence/absence of construction debris after construction works is over</p> <p>PT: Clean and tidy sites. No trash or debris left on site. Site restored/leveled.</p>	<p>Site observation</p> <p>Interaction with locals</p> <p>Issue completion certificate after restoration of all sites are found satisfactory</p>	Included in civil works cost.	Contractor	BSRDCL /CSC
Operation and Maintenance stage								
1. Air Quality								
1.1 Air pollution due to vehicular	<ul style="list-style-type: none"> Compensatory tree plantations shall be maintained as prescribed by forest 	Environmental Protection Act,	Throughout the Corridor	MI: Ambient air quality	As per CPCB requirements	Included in Operation/	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
movement	<p>department.80% survival rate for additional plantation shall be maintained</p> <ul style="list-style-type: none">▪ Regular maintenance of the road will be done to ensure good surface condition▪ Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.▪ Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption.▪ Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipments	1986; The Air (Prevention and Control of Pollution) Act, 1981		<p>(PM₁₀, CO,SO₂ NO₂)</p> <p><u>PT</u>: Levels are equal to or below baseline levels (Air Quality Standard, CPCB)</p>	Site inspection	Maintenance cost		
2. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">▪ Effective traffic management and good riding conditions shall be maintained▪ Speed limitation and honking restrictions near sensitive receptors.▪ Construction of noise barriers near sensitive receptors with consent of local community▪ The effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.▪ Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution(Regulation and Control)Rules,2000andamendments thereof	Sensitive receptors as given in supplementary table to EMP	<p><u>MI</u>: Noise levels</p> <p><u>PT</u>: Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)</p>	Noise monitoring as per noise rules ,2000	Included in Operation/ Maintenance cost	BSRDCL	
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">▪ Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.▪ Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes (entire stretch) and other probable soil erosion areas.	<p>MI: Existence of soil erosion sites Number of soil erosion sites</p> <p><u>PT</u>: Zero or minimal</p>	On site observation	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
				occurrences of soil erosion				
4. Siltation/Water-logging								
4.1 Siltation/ Contamination	<ul style="list-style-type: none">Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.Monitoring of surface water bodies	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation/ Maintenance cost	BSRDCL	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/ absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation/ Maintenance cost	BSRDCL	
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	ForestConservati onAct1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>T</u> : Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance cost	BSRDCL/ADB	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the roadsideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Corridor	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation/ Maintenance cost	BSRDCL	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented.No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local lawMonitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling. Help lines for accidental reporting and ambulance	IRC:SP:55-2014	Accident Prone Area especially at sharp curve and junctions. Curve locations	<u>MI</u> : Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law	Review accident records Site observations	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	services with minimum response time for rescue of any accident victims, if possible. ▪ Tow-way facility for the break down vehicles if possible.			PT: Fatal and non fatal accident rate is reduced after improvement				
6.3.Transportof Dangerous Goods	▪ Existence of spill prevention and control and emergency responsive system ▪ Emergency plan for vehicles carrying hazardous material	-	Throughout the Corridor	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	included in Operation/Maintenance cost	BSRDCL	

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan, BRPNN: Bihar Rajya PullNirman Nigam Limited.

The “Project engineer” or “the engineer” is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The “environmental officer” is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of “the engineer”.

**Supplementary Tables to EMP
Noise Sensitive Receptor**

Sl. No.	Chainage (in km)	Sensitive Noise Receptor	LHS/RHS	Distance from Center Line (in m)
1	5.4	Primary School	RHS	7
2	7.3	Private School	LHS	5
3	7.8	Middle School	RHS	5
4	8.2	Govt. PHC, Roh	RHS	7
5	8.4	Anganvadi	RHS	6
6	8.4	BalVikashYojna	RHS	7
7	8.8	Missionary Private School	RHS	6
8	11.8	Middle School	LHS	10
9	12.9	Primary School	LHS	20
10	13.4	Primary School	LHS	17
11	17.6	Middle School	Both Side	5
12	17.8	Primary School	LHS	7
13	18.2	Private School	LHS	30
14	18.4	Library	RHS	5
15	18.5	Private School	RHS	8
16	20.4	Primary School	LHS	4
17	21.2	Private School	LHS	8
18	21.3	Primary School	LHS	20

List of Other Common Properties

Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
3.3	Temple	RHS	6
5	Petrol Pump	LHS	8
5.4	Temple	RHS	7
7.6.	Roh Block Office	RHS	15
7.7	Police Station Roh	RHS	5
9	Petrol Pump	RHS	7
11.8	Temple	RHS	7
12.9	Temple	RHS	6
17.9	Temple	LHS	12
20.7	Mazhar	RHS	5
21.4	Temple	LHS	4.5
22.4	Temple	LHS	5
23.5	Temple	RHS	8
24.8	Mazhar	RHS	12

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air Quality	Construction stage	PM 10 PM2.5 SO ₂ , NO _x , CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site/, HMP site and representative sample for residential, commercial/Industrial and Sensitive Locations (Total 4 Locations)-	24 hr continuous, 3/year for 2.5 years	Air quality standard by CPCB	4x9000x3x2.5 = ₹2,70,000	Contractor through approved monitoring agency	BSRDC /CSC
	Operation stage			Representative sample 1 each for residential, commercial/Industrial and Sensitive Locations (Total 3 Locations)-	24 hr continuous, 3/year for 1 year	Air quality standard by CPCB	3X9000x3X1 = ₹ 81,000	BSRDC through approved monitoring agency	BSRDC
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential area and Surface water of Perennial Rivers/Ponds (4 Samples)	3/year for 2.5 years	Water quality standard by CPCB	4x 6000x3X2.5 = ₹ 1,80, 000	Contractor through approved monitoring agency	BSRDC /SC
	Operation stage			Groundwater at 2 locations and surface water at 1 locations and pond developed due to Borrows areas (Total 4 Samples)	3/year for 1 year	Water quality standard by CPCB	4X3x6000X1 = ₹ 72,000	BSRDC through approved monitoring agency	BSRDC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968Using Noise level meter	Construction sites, Construction Camp and 1each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr continuous, 3*/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3000x3x2.5 = ₹1,12,500	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage			1 each at Sensitive and residential Commercial areas(3 Locations)	3 / year for 1 year		3x3000x3X1 = ₹ 27, 000	BSRDC through approved monitoring agency	BSRDC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3*2*5000*2.5 = ₹ 75,000	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location (3 Locations)	Twice for the first year of operation	CPCB standard	2*2*5000X1 = ₹ 20000	BSRDC through approved agency	BSRDC
Soil Erosion	Construction Stage			Throughout the Project Corridor especially at	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
	Operation Stage	Visual check for Soil erosion and siltation		River banks, bridge locations and river training structures	Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CSC
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Construction Sites and Labor Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: BSRDC	Compensatory: BSRDC/Local Forest Departments Additional Plantation: BSRDC through contractor of forest dept. The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period BSRDC will be responsible for monitoring additional plantation	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	IRC SP:2009		Additional Plantation: BSRDC Cost		
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	
Monitoring Costs: INR 8.38 Lakhs (0.838 Million)									

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central Pollution Control Board, IS: Indian Standard

APPENDIX 18: ENVIRONMENTAL MANAGEMENT PLAN FOR DEWANGARH-BADALDIH SECTION OF SH-82

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement/Road Safety								
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	<ul style="list-style-type: none">Embankment height raised, heavily built-up and geometrically deficit sections have been avoidedProvision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures.CBR value of sub grade adopted in consistent to MORTH guidelinesOverloading to be checked at weigh stationsIncrease in vent size/waterway of cross drainsProvision of additional culvertsEmbankment height raisedAdequate side drains with suitable outfalls.	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 IRC-SP: 50-1999 IRC:37-2001, chapter-4 (Para-d) IRC: 37-2001 (Para 5.2) IRC. S.P: 73-2007 (Para 4.2.7.7)	Heavily built-up stretch requiring rigid/concrete pavement=3.15 km Curve locations Vent/waterway of culverts and minor bridges to be increased	MI: Design and number of cross and side drains, PT: Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Geometric Improvements of curvesProvision of crash barriers at accident prone areas and bridgesChevron sign at 22 locationsSpeed limitations near educational institutes, hospitals and other CPR.Provision of retro-reflective warning sign boards near curves, school, hospital, religious places and other sensitive locationProvision of sidewalks in the built-up sections on covered drainsSigns and marking viz., delineators, object markers, hazard markers, safety barriers at hazardous locations,Street Lighting in built-up sections and bridge locations proposedMajor Junctions to be improved as per IRC/MORTH guidelines.	Design requirement IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MoRTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	Speed Regulatory signage, in built-up/ sensitive locations. Speed Restriction sign posts at all the built-up areas & junctions. Crash barriers at bridges Speed Limit Sign at 22 locations. 1 major junction at Km 32.00 Kauwakol to be improved.	MI: number and location of crash barriers, informatory and cautionary sign boards, and street lighting as per design PT: numbers and location are in accordance with site needs : 	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
2. Natural Hazard/Climate Change Risk								
2.1 Damage to pavement integrity like	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as	IRC 37 2012 for flexible pavement	Entire stretch	MI: Pavement Surface and bridge	Review of design documents and	Covered under costs	Contractor	BSRDC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.1 Deterioration in climatic condition. Increase in Green House effect/climate change impact	<ul style="list-style-type: none"> Geometric adjustments made to minimize tree cutting. Obtain tree cutting permission from forest department Obtain Forest Clearance under Forest Conservation Act Compensatory plantation (1:3) as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 Provision for additional plantation on 1: 7 basis to be implemented through contractor of forest department 	Forest Conservation Act, 1980	<p>Total number of affected trees=4246 put together for entire length of SH-82 involving 3 construction packages</p> <p>Forest Area=27.695Ha for entire length of Sh-82 falling under Nawada forest Division. Remaining being assessed</p>	<p><u>MI</u>: location of geometric adjustments to minimize tree cutting, budget allocated for compensatory and additional plantation</p> <p><u>PT</u>: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,</p>	Review final design. Check budget provision for compensatory afforestation and additional plantation.	Covered under costs for DPR consultants	BSRDCL, Design consultants forest department	BSRDCL/ Forest department
5. Wildlife Movement								
5.1 Road design causing disruption in wildlife movement/ Vehicle- wild animals collision and	<ul style="list-style-type: none"> Provision for rumble strip, cautionary sign boards both ways for speed limits up to 30 Kmph Provision for habitat enhancement viz. plantation of fodder plants in forest areas and species to be selected as recommended in IEE report Creation of Water Bodies on both sides in the forest area to Existing slab culverts not catering to the perennial flow of water could also serve as animal crossings/pass. 	Project Requirement	Gua Ghoghra (km 41.1) Mahodor (Km 42.7) Pratappur (km 49.4) Ropawel (51.2) Maholia Tad (53.6) Chanarwar (54.0)	<p><u>MI</u>: budget allocation for rumble strips, cautionary and informatory sign boards, habitat enhancement</p> <p><u>PT</u>: Budget amount is enough to fulfill proposed mitigations</p>	Review of bid documents and project budget plan	Covered under design Cost	BSRDCL/ Design Consultant	BSRDCL/ CSC in coordination with Forest Department
6. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. All telephone and electrical poles/wires and underground cables should be shifted before start of construction Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any Relocation of wells, hand pumps at 	Project requirement	Throughout the corridor	<p><u>MI</u>: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p><u>PT</u>: No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/ BSRDCL/utility company	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	suitable locations with consent from local community.							
B. Construction Stage								
1. Air Quality								
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Contractor to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<p>MI: PM10 level measurements Complaints from locals due to dust</p> <p>PT: PM10 level < 100 g/m³ Number of complaints should be 0.</p>	<p>Standards CPCB methods Observations Public consultation</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Contractor	BSRDCL /CSC
1.2 Emission of air pollutants (HC, SO ₂ , NO _x , CO etc) from vehicles due to traffic congestion and use of equipment and machinery	<ul style="list-style-type: none"> Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the SPCB shall be used DG sets with stacks of adequate height and use of low sulphur diesel as fuel. LPG should be used as fuel source in construction camps instead of wood Ambient air quality monitoring Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL 	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	<p>MI: Levels of HC, SO₂, NO₂, and CO. Status of PUC certificates</p> <p>PT: SO₂ and NO₂ levels are both less than 80 ug/m³. PUC certificate of equipment and machinery is upto date</p>	<p>Standards CPCB methods</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during night time and weekend near schools, Implement noisy operations intermittently to reduce the total noise 	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6.	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	<p>MI: day and night Noise levels. Number of complaints from local people</p> <p>PT: Zero complaints or no repeated complaints by local people. Average day and night time</p>	<p>As per Noise rule, 2000</p> <p>Consultation with local people</p> <p>Review of noise level monitoring data maintained by contractor Observation of</p>	Included in civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential, built up and forest areas construction to daylight hours. Honking restrictions near sensitive areas PPEs to workers Noise monitoring as per EMoP. 	MORT&H Specifications for Road and Bridge works		noise levels are within permissible limits for work zone areas	construction site			
3. Land and Soil								
3.1 Landuse Change and Loss of productive/topsoil	<ul style="list-style-type: none"> Non-agricultural are as to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse 	Project requirement	<p>Throughout the project section and borrow areas</p> <p>Land to be identified for camp, storage areas etc.</p>	<p>MI: Borrow pit locations/Top soil storage area</p> <p>PT: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Contractor	BSRDCL /CSC
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. The earth stock piles to be provided with gentle slopes to soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	<p>MI: Occurrence of slope failure or erosion issues</p> <p>PT: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC
3.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from DEIAA prior to opening any new borrow area. Comply to EC conditions of DEIAA Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. Depths of borrow pits to be regulated 	IRC Guidelines on borrow areas and for quarries(Enviro nmentalprotecti onActandRules ,1986; Water	Borrow sites location (LHS Ch-km 30, 31.200, 36, 38.825, 50.3, 52.625;; RHS Ch-km 31.2,36.3,38.825, 50.3,52.625)	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management	Review of design documents and site observations Compare site	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> and sides not steeper than 25%. Topsoil to be stockpiled and protected for use at the rehabilitation stage. Transportation of earth materials through covered vehicles. Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation Borrow areas not to be dug continuously. To the extent, borrow areas shall be sited away from habitated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 	Act, Air Act) +Clause 305.2.2 MORTH Specifications for Road and Bridge works Guidelines for Borrow Areas management	However contractor is free to select any other borrow area after consent from EA and securing all permits.	<p>practices. Number of accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by DEIAA in clearance letter. Zero accidents. Zero complaints.</p>	conditions with EC conditions by DEIAA			
3.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. Obtain environmental clearance from DEIAA in case of opening new quarry 	ClauseNo.111. 3MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	<p>Sand: Kiul River at a lead distance of 30 km.</p> <p>Stone: One stone quarry have been identified in project area at Seikhpura with lead distance of 100km.</p> <p>However, the contractor is free to choose the source after securing all permits</p>	<p>MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. 	Design requirement	Parking areas, Haulage roads and construction yards.	MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Land taken for construction camp and other temporary facility shall be restored to its original conditions 			<u>PT</u> : Zero occurrence of destroyed/compacted land and undestroyed land				
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MOEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area <u>PT</u> : Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC
4. Water Resources								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Groundwater Augmentation by converting borrow areas into ponds 	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	MI: Approval from competent authority Complaints from local people on water availability <u>PT</u> : Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local people	Included in civil works cost	Contractor	BSRDCL /CSC
4.2 Disposal of water during construction	<ul style="list-style-type: none"> Provision shall be made to connect roadside drains with existing nearby natural drains. 	ClauseNo.1010 EPAct1986MO RT&HSpecificationsforRoadand	Throughout the Project section	<u>MI</u> : Condition of drainage system in construction site. Presence/absence	Standards methods Site observation and review of	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
		Bridgeworks		of water logging in project area. <u>PT</u> : Existence of proper drainage system. No water logging in project area	documents			
4.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Rivers, canal, streams and nallah passing through the proposed road. Sakri River(29+550), Harkha River(48+800), KilltQu el(51+600), Dhamni River (37.17), Dumahar (39.8).	<u>MI</u> : Proper flow of water in existing streams and rivers <u>PT</u> : No complain of water shortage by downstream communities. No record of overtopping/ water logging	Review of design documents Site observation	Included in civil works cost	Contractor	BSRDCL /CSC
4.4 Siltation in water bodies due to construction activities/ earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge works Worldwide best practices	Rivers, canal, streams and nallah passing through the proposed road. Sakri River(29+550), Harkha River(48+800), Killt Que l(51+600), Kuel River (62+200), Dhamni River (37.17), Dumahar (39.8).	<u>MI</u> : Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels <u>PT</u> : No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit	Field observation	Included incivil works cost	Contractor	BSRDCL /CSC
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	<ul style="list-style-type: none"> Parking and refueling away from water bodies/waterways Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. All equipment operators, drivers, and 	The Water (Prevention and Control of Pollution) Act, 1974andamend mentsthereof.	Sakri River(29+550), Harkha River(48+800), KilltQu el(51+600), Dhamni River (37.17), Dumahar (39.8)..	<u>MI</u> : Water quality of ponds, streams, rivers and other water bodies in project Presence of oil floating in water	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors.</p> <ul style="list-style-type: none"> Construction camp to be sited away from water bodies. Wastes must be collected, stored and taken to approved disposal site only. Water quality shall be monitored 			<p>bodies in project area</p> <p>PT: Surface water quality meets freshwater quality standards prescribed by CPCB</p>				
5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior approval of competent authority. Mandatory compensatory plantation at 1:3 basis by Forestry Department Additional plantation @ 1:7 Employment preference to vulnerable Regular maintenance trees planted. Provision of LPG in construction camp Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. Controlled use of pesticides/ fertilizers 	Forest Conservation Act 1980 + IRC:SP:21 and IRC:SP:66	<p>Throughout project corridor</p> <p>Additional Plantation near Sensitive receptors, river banks, borrow areas</p>	<p>MI: ROW width</p> <p>Number of trees for felling</p> <p>Compensatory plantation plan</p> <p>Number of trees replanted.</p> <p>PT: Survival of Compensatory Plantation @ 70% and Additional plantation @ 80%</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan</p> <p>Field observations</p>	Additional plantation and compensatory plantation cost is included in project costs under BSRDCL.	Mandatory Compensatory plantation by forest Department and Additional plantation by contractor of forest department	BSRDCL /CSC
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	<ul style="list-style-type: none"> All camps should be established with prior permission from SPCB. Layout plan shall be recommended by CSC and approved by EA Camps to maintain minimum distance from following: <ul style="list-style-type: none"> # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible 	Design Requirement The Water (Prevention and Control of Pollution) Act, 1974 and its amendments thereof	All construction camps	<p>MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps</p> <p>PT: Distance of</p>	<p>On site observation</p> <p>Interaction with workers and local community</p>	Included in civil works cost	Contractor and EO	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	# 500 m from through traffic route			campsite is less than 500m from listed locations				
6.2 Worker's Health in construction camp/ construction sites	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „Engineer“. 	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Contractor	BSRDCL /CSC
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by 	Design Requirement,	At all Dumping/ Disposal Sites	MI: Location of dumping sites	Field survey and interaction	Included in civil	Contractor.	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	MORTH guidelines and General Conditions of Contract Document		Number of public complaints. PT: No public complaints. Consent letters for all dumping sites available with contractor	with local people. Review of consent letter	works cost.		
7.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORTH and General Conditions of Contract Document	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or CSC	Contractor records Field observation Interaction with local people	Included in civil works cost.		
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain 	Design requirement and IRC: SP: 27 - 1984, Report	Throughout the project corridor especially at intersections.	MI: Traffic management plan. Presence/ absence of safety signs,	Review traffic management plan Field observation	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road.</p> <ul style="list-style-type: none"> The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	<p>Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document</p>		<p>traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p>PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>			
8.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever cattle movement is expected. Large number of box and slab culverts has been proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals 	Same as above	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p>MI: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p>PT: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Contractor	BSRDCL /CSC
8.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at 	Same as above	Constructionsites	<p>MI: Availability of Safety gears to workers</p> <p>Safety signage</p>	<p>Site observation</p> <p>Review records on safety training and</p>	Included incivil works cost	Obligation ofContractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> the construction sites Training to workers on safety procedures and precautions. Appointment of a safety officer. All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. Provision of PPEs to workers. Provision of readily available first aid unit including an adequate supply of dressing materials. The contractor will not employ any person below the age of 18years Use of hazardous material should be minimized and/or restricted. Emergency plan (tobeapprovedbyengineersshallbeprep aredtorepondtoanyaccidentsoremer gencies. Accident Prevention Office must be appointed by the contractor. 			Training records on safety Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	accidents Interact with construction workers			
8.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. Provision of temporary diversions and awareness to locals before opening new construction fronts. Alternate access facility to common properties near construction zones Fencing and speed limitation wherever cattle movement is anticipated. 	Same as above	Construction sites and Accident Prone Area especially at sharp curve and junctions. 9 right hand curve, 11 left hand curve & 2 reverse curve.	MI: Safety signs and their location Incidents of accidents Complaints from local people PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Contractor	BSRDCL /CSC
9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations,	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 	Project requirement	Throughout the project corridor,	MI: Camp, Condition borrows	Site observation	Included in civil	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
Restoration and Rehabilitation	<div><div>'Engineer'.</div><div>The clean-up and restoration operations are to be implemented by the contractor prior to demobilization.</div><div>All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer.</div><div>All the opened borrow areas will be rehabilitated and 'Engineer' will certify</div></div>		construction camp sites and borrow areas	<div>areas and construction sites, Presence/absence of construction debris after construction works is over</div> <div>PT: Clean and tidy sites. No trash or debris left on site. Site restored/leveled.</div>	<div>Interaction with locals</div> <div>Issue completion certificate after restoration of all sites are found satisfactory</div>	works cost.		
Operation and Maintenance stage								
1. Wildlife Movement								
1.1 Anticipated risk of vehicle-wild animal collision and human-animal conflict	<div><div>Effectiveness of mitigative measures (rumble strips, informatory /cautionary signage, solar street lighting, solar dragon lights etc.) recommended in design stage shall be monitored.</div><div>Effectiveness of habitat enhancement measures shall be evaluated</div><div>BSRDCL to keep record of all accidents.</div><div>Fresh assessment in case of future widening</div></div>	Project Requirement	At identified crossing locations in IEE	<div>MI: No. of collision. Time location and causes of collision.</div> <div>PT: Zero vehicle collisions. Improvement in habitat coverage and quality</div>	<div>Site Observation</div> <div>Discussion with local People</div> <div>Collection of information from Forestry Department</div>	<div>Included in Operation / Maintenance cost</div>	BSRDCL field offices/Forest Department	
2. Air Quality								
1.1 Air pollution due to vehicular movement	<div><div>Compensatory tree plantations shall be maintained as prescribed by forest department.80% survival rate for additional plantation shall be maintained</div><div>Regular maintenance of the road will be done to ensure good surface condition</div><div>Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.</div><div>Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption.</div><div>Enforcement of vehicle emission rules in coordination with transport</div></div>	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<div>MI: Ambient air quality (PM₁₀, CO,SO₂ NO₂)</div> <div>PT: Levels are equal to or below baseline levels (Air Quality Standard, CPCB)</div>	<div>As per CPCB requirements</div> <div>Site inspection</div>	<div>Included in Operation/ Maintenance cost</div>	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	department or installing emission checking equipments							
3. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation and honking restrictions near sensitive receptors.Construction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution(Regulation and Control)Rules,2000andamendments thereof	Sensitive receptors as given in supplementary table to EMP	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites	Included in Operation/ Maintenance cost	BSRDCL	
4. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes (entire stretch) and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/ Maintenance cost	BSRDCL	
5. Siltation/Water-logging								
4.1 Siltation/ Contamination	<ul style="list-style-type: none">Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.Monitoring of surface water bodies	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation/Maintenance cost	BSRDCL	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/absence of water logging along the road <u>PT</u> : No record of overtopping/ Water	Site observation	Included in Operation/Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
				logging				
6. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	ForestConservati onAct1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>T</u> : Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance cost	BSRDCL/ADB	
7. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/ trimming of plantation along the roadsideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation/ Maintenance cost	BSRDCL	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be enforced strictly.Further encroachment of squatters within the ROW will be prevented.No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local lawMonitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling. Help lines for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.Tow-way facility for the breakdown vehicles if possible.	IRC:SP:55-2014	Accident Prone Area especially at sharp curve and junctions. 9 right hand curve, 11 left hand curve & 2 reverse curve	<u>MI</u> : Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law <u>PT</u> : Fatal and non fatal accident rate is reduced after improvement	Review accident records Site observations	Included in Operation/ Maintenance cost	BSRDCL	
6.3.Transport of Dangerous Goods	<ul style="list-style-type: none">Existence of spill prevention and control and emergency responsive systemEmergency plan for vehicles carrying hazardous material	-	Throughout the project stretch	<u>MI</u> : Status of emergency system – whether operational or not <u>PT</u> : Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	Included in Operation/ Maintenance cost	BSRDCL	

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan, BRPNN: Bihar Rajya PullNirman Nigam Limited.

The “Project engineer” or “the engineer” is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The “environmental officer” is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of “the engineer”.

**Supplementary Tables to EMP
Noise Sensitive Receptor**

Sl. No.	Chainage (in km)	Sensitive Noise Receptor	LHS/RHS	Distance from Center Line (in m)
1	29.2	High School Gorighat	RHS	7
2	29.6	Primary School	RHS	35
3	31.5	Girls Inter College	RHS	7
4	32.5	Private School	LHS	8
5	32.9	Residential Private School	RHS	7
6	38.4	Middle School	RHS	50
7	40.7	Private School	LHS	6
8	41.1	Primary School	RHS	6
9	49.4	Primary School	LHS	30
10	50.3	Primary School	RHS	7
11	53.2	Middle School	RHS	70

List of Other Common Properties

Sl. No.	Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
1	27.3	Temple	RHS	5
2	28.8	Brick Kiln	RHS	8
3	29.3	Temple	RHS	10
4	30	Brick Kiln	RHS	40
5	31.1	Temple	RHS	6
6	31.6	Temple	RHS	4
7	32.5	Temple	LHS	5
8	32.7	Temple	RHS	5
9	33.7	Temple	RHS	6
10	33.9	Brick Kiln	RHS	15
11	36.8	Temple	RHS	6
12	37.2	Brick Kiln	RHS	17
13	37.6	Temple	RHS	5
14	40.8	Temple	RHS	6
15	42	Temple	RHS	6
16	42.7	Temple	LHS	10
17	42.8	Brick Kiln	LHS	15
18	45.2	Temple	LHS	8
19	46	Temple	RHS	7
20	49.1	Temple	RHS	6
21	49.3	Temple	LHS	10
22	50.4	Temple	RHS	7
23	50.6	Panchayat Bhawan	RHS	12
24	53.2	Temple	RHS	12
25	53.8	Temple	LHS	20
26	54	Temple	RHS	6

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air Quality	Construction stage	PM 10 PM2.5 SO ₂ , NO _x , CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site, HMP site and representative sample for residential, commercial/Industrial and Sensitive Locations (Total 4 Locations)-	24 hr continuous, 3/year for 2.5 years	Air quality standard by CPCB	4x9000x3x2.5 = ₹2,70,000	Contractor through approved monitoring agency	BSRDC /CSC
	Operation stage			Representative sample 1 each for residential, commercial/Industrial and Sensitive Locations (Total 3 Locations)-	24 hr continuous, 3/year for 1 year	Air quality standard by CPCB	3X9000x3X1 = ₹ 81,000	BSRDC through approved monitoring agency	BSRDC
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential area and Surface water of Perennial Rivers/Ponds (4 Samples)	3/year for 2.5 years	Water quality standard by CPCB	4x 6000x3x2.5 = ₹ 1,80, 000	Contractor through approved monitoring agency	BSRDC /SC
	Operation stage			Groundwater at 2 locations and surface water at 1 locations and pond developed due to Borrows areas (Total 4 Samples)	3/year for 1 year	Water quality standard by CPCB	4X3x6000X1 = ₹ 72,000	BSRDC through approved monitoring agency	BSRDC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Construction sites, Construction Camp and 1 each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr continuous, 3*/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3000x3x2.5 = ₹1,12,500	Contractor through approved monitoring agency	BSRDC/CS C
	Operation stage			1 each at Sensitive and residential Commercial areas(3 Locations)	3 / year for 1 year		3x3000x3X1 = ₹ 27, 000	BSRDC through approved monitoring agency	BSRDC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3*2*5000*2.5 = ₹ 75,000	Contractor through approved monitoring agency	BSRDC/CS C
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location (2 Locations)	Twice for the first year of operation	CPCB standard	2*2*5000X1 = ₹ 20000	BSRDC through approved agency	BSRDC
Soil Erosion	Construction Stage			Throughout the Project Corridor especially at	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CS C

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
	Operation Stage	Visual check for Soil erosion and siltation		River banks, bridge locations and river training structures	Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CS C
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CS C
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Construction Sites and Labor Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CS C
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: BSRDC Additional Plantation: BSRDC Cost	Compensatory: BSRDC/Local Forest Departments Additional Plantation: BSRDC through contractor of forest dept.	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	IRC: SP:2009			The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period BSRDC will be responsible for monitoring additional plantation	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CS C
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	
Monitoring Costs: INR 8.38 Lakhs (0.838Million)									

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central Pollution Control Board, IS: Indian Standard

APPENDIX 19: ENVIRONMENTAL MANAGEMENT PLAN FOR BADALDIH-KHAIRA SECTION OF SH-82

Environmental Issue/ Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementatio n	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement/Road Safety								
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	<ul style="list-style-type: none">Embankment height raised, heavily built-up and geometrically deficit sections have been avoidedProvision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures.CBR value of sub grade adopted in consistent to MORTH guidelinesIncrease in waterway of cross drainsProvision of additional culvertsEmbankment height raisedAdequate side drains with suitable	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 IRC-SP: 50-1999 IRC:37-2001, chapter-4 (Para-d) IRC: 37-2001 (Para 5.2) IRC. S.P: 73-2007 (Para 4.2.7.7)	Heavily built-up stretch requiring rigid/concrete pavement Curve locations. Lined Drains Vent/waterway of culverts and major bridges to be increased	MI: Design and number of cross and side drains, PT: Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultan t	BSRDCL
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Geometric Improvements of curvesProvision of crash barriers at accident prone areas and bridgesChevron signs at 9 locations.Speed limitations near educational institutes, hospitals and other CPR.Provision of retro-reflective warning signboards near curves, school, hospital, religious places and other sensitive locationProvision of sidewalks in the built-up sections on covered drainsSigns and marking viz., delineators, object markers, hazard markers, safety barriers at hazardous locations,Major Junctions to be improved as per IRC/MORTH guidelines.	Design requirement IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MoRTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	Speed Regulatory signage, in built-up/ sensitive locations. Speed Restriction sign posts at all the built-up areas & junctions. Crash barriers at bridges	MI: number and location of crash barriers, informatory and cautionary sign boards, and street lighting as per design PT: numbers and location are in accordance with site needs :	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
2. Natural Hazard/Climate Change Risk								
2.1 Damage to pavement integrity like Rutting, embankment softening and migration of liquid	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening,	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.1 Deterioration in climatic condition. Increase in Green House effect/climate change impact	<ul style="list-style-type: none"> Geometric adjustments made to minimize tree cutting. Obtain tree cutting permission from forest department Obtain Forest Clearance under Forest Conservation Act Compensatory plantation (1:3) as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 Provision for additional plantation on 1: 7 basis to be implemented through contractor of forest department. 	Forest Conservation Act, 1980	<p>Total number of affected trees=4246 put together for entire length of SH-82 involving 3 construction packages</p> <p>Forest Area=27.695Ha for entire length of Sh-82 falling under Nawada forest Division. Remaining being assessed</p>	<p><u>MI</u>: location of geometric adjustments to minimize tree cutting, budget allocated for compensatory and additional plantation</p> <p><u>PT</u>: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,</p>	Review final design. Check budget provision for compensatory afforestation and additional plantation.	Covered under costs for DPR consultants	BSRDCL, Design consultants forest department	BSRDCL/ Forest department
5. Wildlife Movement								
5.1 Road design causing disruption in wildlife movement/ Vehicle- wild animals collision and	<ul style="list-style-type: none"> Provision for rumble strip, cautionary sign boards both ways for speed limits up to 30 Kmph Provision for habitat enhancement viz. plantation of fodder plants in forest areas and species to be selected as recommended in IEE report Creation of Water Bodies on both sides in the forest area to Existing slab culverts not catering to the perennial flow of water could also serve as animal crossings/pass. 	Project Requirement	Chanarwar (54.1) Kurwataand (66.4) Lal Diha (66.5) Baba Jakhraj (68.8)	<p><u>MI</u>: budget allocation for rumble strips, cautionary and informatory sign boards, habitat enhancement</p> <p><u>PT</u>: Budget amount is enough to fulfill proposed mitigations</p>	Review of bid documents and project budget plan	Covered under Design Cost	BSRDCL/ Design Consultant	BSRDC/ CSC in coordination with Forest Department
6. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. All telephone and electrical poles/wires and underground cables should be shifted before start of construction Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any Relocation of wells, hand pumps at 	Project requirement	Throughout the corridor	<p><u>MI</u>: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p><u>PT</u>: No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/ BSRDCL/utility company	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	suitable locations with consent from local community.							
B. Construction Stage								
1. Air Quality								
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Contractor to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<p>MI: PM10 level measurements Complaints from locals due to dust</p> <p>PT: PM10 level < 100 g/m³ Number of complaints should be 0.</p>	<p>Standards CPCB methods Observations Public consultation</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Contractor	BSRDCL /CSC
1.2 Emission of air pollutants (HC, SO ₂ , NO _x , CO etc) from vehicles due to traffic congestion and use of equipment and machinery	<ul style="list-style-type: none"> Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the SPCB shall be used DG sets with stacks of adequate height and use of low sulphur diesel as fuel. LPG should be used as fuel source in construction camps instead of wood Ambient air quality monitoring Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL 	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	<p>MI: Levels of HC, SO₂, NO₂, and CO. Status of PUC certificates</p> <p>PT: SO₂ and NO₂ levels are both less than 80ug/m³. PUC certificate of equipment and machinery is upto date</p>	<p>Standards CPCB methods</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during night time and weekend near schools, Implement noisy operations intermittently to reduce the total noise 	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6.	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	<p>MI: day and night Noise levels. Number of complaints from local people</p> <p>PT: Zero complaints or no repeated complaints by local people. Average day and night time</p>	<p>As per Noise rule, 2000</p> <p>Consultation with local people</p> <p>Review of noise level monitoring data maintained by contractor Observation of</p>	Included in civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential, built up and forest areas construction today light hours. Honking restrictions near sensitive areas PPEs to workers Noise monitoring as per EMOp. 	MORT&H Specifications for Road and Bridge works		noise levels are within permissible limits for work zone areas	construction site			
3. Land and Soil								
3.1 Landuse Change and Loss of productive/topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse 	Project requirement	<p>Throughout the project section and borrow areas (6 locations)</p> <p>Land to be identified for camp, storage areas etc.</p>	<p>MI: Borrow pit locations/Top soil storage area</p> <p>PT: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Contractor	BSRDCL /CSC
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. The earth stockpiles to be provided with gentle slopes to soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	<p>MI: Occurrence of slope failure or erosion issues</p> <p>PT: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC
3.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from DEIAA prior to opening any new borrow area. Comply to EC conditions of DEIAA Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. Depths of borrow pits to be regulated and sides not steeper than 25%. 	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause	Borrow site location (6 borrow area identified in DPR, LHS Ch- km 66.359, 77.2; RHS Ch- km 57.828, 66.359, 77.2, 86.201)	<p>MI: Existence of borrow areas in inappropriate unauthorized locations.</p> <p>Poor borrow area management practices.</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Topsoil to be stockpiled and protected for use at the rehabilitation stage. Transportation of earth materials through covered vehicles. Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation Borrow areas not to be dug continuously. To the extent, borrow areas shall be sited away from habitated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 	305.2.2MORTH Specifications for Road and Bridge works Guidelines for Borrow Areas management	However contractor is free to select any other borrow area after consent from EA and securing all permits.	<p>Number of accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by DEIAA in clearance letter. Zero accidents. Zero complaints.</p>	EC conditions by DEIAA			
3.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. Obtain environmental clearance from DEIAA in case of opening new quarry 	ClauseNo.111. 3MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	<p>Sand: Kiul River at a lead distance of 30 km.</p> <p>Stone: One stone quarry have been identified in project area at Seikhpura with lead distance of 100km.</p> <p>However, the contractor is free to choose the source after securing all permits</p>	<p>MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. 	Design requirement	Parking areas, Haulage roads and construction yards.	MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Land taken for construction camp and other temporary facility shall be restored to its original conditions 			<u>PT</u> : Zero occurrence of destroyed/compacted land and undestroyed land				
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MOEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area <u>PT</u> : Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC
4. Water Resources								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Groundwater Augmentation by converting borrow areas into ponds 	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	MI: Approval from competent authority Complaints from local people on water availability <u>PT</u> : Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local people	Included in civil works cost	Contractor	BSRDCL /CSC
4.2 Disposal of water during construction	<ul style="list-style-type: none"> Provisions shall be made to connect roadside drains with existing nearby natural drains. 	Clause No.1010 EPA Act 1986 MO RT & HS specifications for Road and Bridge works	Throughout the Project section	<u>MI</u> : Condition of drainage system in construction site. Presence/absence of water logging in	Standards methods Site observation and review of documents	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
				project area. <u>PT</u> : Existence of proper drainage system. No water logging in project area				
4.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Rivers, canal, streams and nallah passing through the proposed road. Kuel River 62+200).	<u>MI</u> : Proper flow of water in existing streams and rivers <u>PT</u> : No complain of water shortage by downstream communities. No record of overtopping/ water logging	Review of design documents Site observation	Included in civil works cost	Contractor	BSRDCL /CSC
4.4 Siltation in water bodies due to construction activities/earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	Design requirement, ClauseNo501.8.6.MORT&H Specifications for Road and Bridge works Worldwide best practices	Rivers, canal, streams and nallah passing through the proposed road. Kuel River (62+200)	<u>MI</u> : Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels <u>PT</u> : No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit	Field observation	Included incivil works cost	Contractor	BSRDCL /CSC
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	<ul style="list-style-type: none"> Parking and refueling away from water bodies/waterways Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. All equipment operators, drivers, and 	The Water (Prevention and Control of Pollution) Act, 1974andamendments thereof.	Kuel River (62+200).	<u>MI</u> : Water quality of ponds, streams, rivers and other water bodies in project Presence of oil floating in water bodies in project	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors.</p> <ul style="list-style-type: none"> Construction camp to be sited away from water bodies. Wastes must be collected, stored and taken to approved disposal site only. Water quality shall be monitored 			<p>area</p> <p>PT: Surface water quality meets freshwater quality standards prescribed by CPCB</p>				
5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior approval of competent authority. Mandatory compensatory plantation at 1:3 basis by Forestry Department Additional plantation @ 1:7 Employment preference to vulnerable Regular maintenance trees planted. Provision of LPG in construction camp Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. Controlled use of pesticides/fertilizers 	Forest Conservation Act 1980 + IRC:SP:21 and RC:SP:66	<p>Throughout project corridor</p> <p>Additional Plantation near Sensitive receptors, river banks, borrow areas</p>	<p>MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted.</p> <p>PT: Survival of Compensatory Plantation @ 70% and Additional plantation @ 80%</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan</p> <p>Field observations</p>	Additional plantation and compensatory plantation cost is included in project costs under BSRDCL.	Mandatory Compensatory plantation by forest Department and Additional plantation by Contractor of forest department	BSRDCL /CSC
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	<ul style="list-style-type: none"> All camps should be established with prior permission from SPCB. Layout plan shall be recommended by CSC and approved by EA Camps to maintain minimum distance from following: <ul style="list-style-type: none"> # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible 	Design Requirement The Water (Prevention and Control of Pollution) Act, 1974 and its amendments thereof	All construction camps	<p>MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps</p> <p>PT: Distance of</p>	<p>On site observation</p> <p>Interaction with workers and local community</p>	Included in civil works cost	Contractor and EO	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	# 500 m from through traffic route			campsite is less than 500m from listed locations				
6.2 Worker's Health in construction camp/ construction sites	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „ Engineer“. 	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Contractor	BSRDCL /CSC
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping	Contractor to submit a waste/spoil disposal plan and get it approved by	Design Requirement,	At all Dumping/ Disposal Sites	MI: Location of dumping sites	Field survey and interaction	Included in civil	Contractor.	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
Sites	<ul style="list-style-type: none"> CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	MORTH guidelines and General Conditions of Contract Document		Number of public complaints. PT: No public complaints. Consent letters for all dumping sites available with contractor	with local people. Review of consent letter	works cost.		
7.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or CSC	Contractor records Field observation Interaction with local people	Included in civil works cost.		
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain 	Design requirement and IRC: SP: 27 - 1984, Report	Throughout the project corridor especially at intersections.	MI: Traffic management plan. Presence/ absence of safety signs,	Review traffic management plan Field observation	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementatio n	Supervision
	<p>details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road.</p> <ul style="list-style-type: none"> The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	<p>Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document</p>		<p>traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p>PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>			
8.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever cattle movement is expected. Large number of box and slab culverts has been proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals 	Same as above	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p>MI: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p>PT: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Contractor	BSRDCL /CSC
8.3 Safety of Workers and accident risk from construction	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at 	Same as above	Construction sites	MI: Availability of Safety gears to workers	Site observation Review records on safety	Included in civil works cost	Obligation of Contractor	BSRDCL /CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
activities	<ul style="list-style-type: none"> the construction sites Training to workers on safety procedures and precautions. Appointment of a safety officer. All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. Provision of PPEs to workers. Provision of readily available first aid unit including an adequate supply of dressing materials. The contractor will not employ any person below the age of 18 years Use of hazardous material should be minimized and/or restricted. Emergency plan (to be approved by engineer shall be prepared to respond to any accidents or emergencies. Accident Prevention Officer must be appointed by the contractor. 			Safety signage Training records on safety Number of safety related accidents <u>PT</u> : Zero fatal accidents. Zero or minor non-fatal accidents.	training and accidents Interact with construction workers			
8.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. Provision of temporary diversions and awareness to locals before opening new construction fronts. Alternate access facility to common properties near construction zones Fencing and speed limitation wherever cattle movement is anticipated. 	Same as above	Construction sites and Accident Prone Area especially at sharp curve and junctions. Curve Locations	MI: Safety signs and their location Incidents of accidents Complaints from local people <u>PT</u> : Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Contractor	BSRDCL /CSC
9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations,	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 	Project requirement	Throughout the project corridor,	<u>MI</u> : Camp, Condition borrows	Site observation	Included in civil	Contractor	BSRDCL /CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementatio n	Supervision
Restoration and Rehabilitation	<ul style="list-style-type: none">'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization.All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer.All the opened borrow areas will be rehabilitated and 'Engineer' will certify		construction camp sites and borrow areas	areas and construction sites, Presence/absenc e of construction debris after construction works is over PT: Clean and tidy sites. No trash or debris left on site. Site restored/leveled.	Interaction with locals Issue completion certificate after restoration of all sites are found satisfactory	works cost.		
Operation and Maintenance stage								
1. Wildlife Movement								
1.1 Anticipated risk of vehicle-wild animal collision and human-animal conflict	<ul style="list-style-type: none">Effectiveness of mitigative measures (rumble strips, informatory /cautionary signage, solar street lighting, solar dragon lights etc.) recommended in design stage shall be monitored.Effectiveness of habitat enhancement measures shall be evaluatedBSRDCL to keep record of all accidents.Fresh assessment in case of future widening	Project Requirement	At identified crossing locations in IEE	MI: No. of collision. Time location and causes of collision. PT: Zero vehicle collisions. Improvement in habitat coverage and quality	Site Observation Discussion with local People Collection of information from Forestry Department	Included in Operation / Maintenance cost	BSRDCL field offices/Forest Department	
2. Air Quality								
1.1 Air pollution due to vehicular movement	<ul style="list-style-type: none">Compensatory tree plantations shall be maintained as prescribed by forest department.80% survival rate for additional plantation shall be maintained Regular maintenance of the road will be done to ensure good surface conditionAmbient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption.Enforcement of vehicle emission rules in coordination with transport department or installing emission	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	MI: Ambient air quality (PM ₁₀ , CO,SO ₂ NO ₂) PT: Levels are equal to or below baseline levels (Air Quality Standard, CPCB)	As per CPCB requirements Site inspection	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/ Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementatio n	Supervision
	checking equipments							
3. Noise								
2.1 Noise due to movemen t of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation and honking restrictions near sensitive receptors.Construction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof	Sensitive receptors as given in supplementary table to EMP	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites	Included in Operation/ Maintenance cost	BSRDCL	
4. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes (entire stretch) and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/ Maintenance cost	BSRDCL	
5. Siltation/Water-logging								
4.1 Siltation/ Contamination	<ul style="list-style-type: none">Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.Monitoring of surface water bodies	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation/Maintenance cost	BSRDCL	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation/Maintenance cost	BSRDCL	

Environmental Issue/ Component	Remedial Measure	Reference to laws/ guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementatio n	Supervision
6. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>T</u> : Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance cost	BSRDCL/ADB	
7. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the roadsideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation/ Maintenance cost	BSRDCL	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be enforced strictly.Further encroachment of squatters within the ROW will be prevented.No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local lawMonitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling. Help lines for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.Tow-way facility for the breakdown vehicles if possible.	IRC:SP:55-2014	Accident Prone Area especially at sharp curve and junctions. Curve Locations	<u>MI</u> : Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law <u>PT</u> : Fatal and non fatal accident rate is reduced after improvement	Review accident records Site observations	Included in Operation/ Maintenance cost	BSRDCL	
6.3.Transport ofDangerous Goods	<ul style="list-style-type: none">Existence of spill prevention and control and emergency responsive systemEmergency plan for vehicles carrying hazardous material	-	Throughout the project stretch	<u>MI</u> : Status of emergency system – whether operational or not <u>PT</u> : Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	Included in Operation/ Maintenance cost	BSRDCL	

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment

Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan, BRPNN: Bihar Rajya PullNirman Nigam Limited.

The “Project engineer” or “the engineer” is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The “environmental officer” is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of “the engineer”.

**Supplementary Tables to EMP
Noise Sensitive Receptor**

Sl. No.	Chainage (in km)	Sensitive Noise Receptor	LHS/RHS	Distance from Center Line (in m)
1	55.1	Primary School	LHS	6
2	57	Middle School	LHS	8
3	57.6	Madrassa School	RHS	6
4	59.5	Anganbadi	LHS	20
5	59.9	Madrassa School	LHS	12
6	62.2	Primary School	RHS	5
7	63.8	Middle School	RHS	8
8	65.6	Middle School	LHS	4
9	67.4	Anganbadi	LHS	7
10	67.4	Primary School	LHS	10
11	73.4	Private School	LHS	6
12	4.5	KabirBigyan Ashram	RHS	6

List of Other Common Properties

Sl. No.	Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
1	54	Temple	RHS	6
2	54.6	Temple	RHS	5
3	58.5	Graveyard	RHS	8
4	59.5	Mosque	RHS	6
5	60.2	Police Camp	LHS	8
6	63.1	Temple	LHS	5
7	63.3	Temple	LHS	5
8	65.6	Temple	LHS	10
9	66	Temple	LHS	6
10	66.1	Temple	LHS	5
11	66.2	Temple	RHS	4
12	66.5	Temple	RHS	7
13	67.1	Temple	LHS	4
14	67.4	Temple	LHS	6
15	70.2	Temple	LHS	6
16	70.3	Temple	LHS	5
17	70.5	Temple	LHS	5
18	71.1	Temple	LHS	4.5
19	71.85	Temple	RHS	4
20	71.9	Temple	RHS	4
21	73.2	Temple	LHS	5
22	73.2	Khaira Block office	LHS	6

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air Quality	Construction stage	PM 10 PM2.5 SO2, NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site, HMP site and representative sample for residential, commercial/Industrial and Sensitive Locations (Total 4 Locations)-	24 hr continuous, 3/year for 2.5 years	Air quality standard by CPCB	4x9000x3x2.5 = ₹2,70,000	Contractor through approved monitoring agency	BSRDC /CSC
	Operation stage			Representative sample 1 each for residential, commercial/Industrial and Sensitive Locations (Total 3 Locations)-	24 hr continuous, 3/year for 1 year	Air quality standard by CPCB	3X9000x3X1 = ₹ 81,000	BSRDC through approved monitoring agency	BSRDC
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential area and Surface water of Perennial Rivers/Ponds (3 Samples)	3/year for 2.5 years	Water quality standard by CPCB	3x 6000x3x2.5 = ₹ 1,35, 000	Contractor through approved monitoring agency	BSRDC /SC
	Operation stage			Groundwater at 1 locations and surface water at 1 locations and pond developed due to Borrows areas (Total 3 Samples)	3/year for 1 year	Water quality standard by CPCB	3X3x6000X1 = ₹ 54,000	BSRDC through approved monitoring agency	BSRDC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Construction sites, Construction Camp and 1 each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr continuous, 3*/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3000x3x2.5 = ₹1,12,500	Contractor through approved monitoring agency	BSRDC/CS C
	Operation stage			1 each at Sensitive and residential Commercial areas(3 Locations)	3 / year for 1 year		3x3000x3X1 = ₹ 27, 000	BSRDC through approved monitoring agency	BSRDC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3*2*5000*2.5 = ₹ 75,000	Contractor through approved monitoring agency	BSRDC/CS C
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location (2 Locations)	Twice for the first year of operation	CPCB standard	2*2*5000X1 = ₹ 30000	BSRDC through approved agency	BSRDC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		Throughout the Project Corridor especially at River banks, bridge locations and river training structures	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CS C
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CS C
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CS C
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Construction Sites and Labor Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CS C
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: BSRDC Additional Plantation: BSRDC Cost	Compensatory: BSRDC/Local Forest Departments Additional Plantation: BSRDC through contractor of Forest Dept.	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	IRC: SP: 2009			The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period BSRDC will be responsible for monitoring additional plantation	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CS C
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	
Monitoring Costs: INR 7.75 Lakhs (0.775 Million)									

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central Pollution Control Board, IS: Indian Standard

APPENDIX 20: ENVIRONMENTAL MANAGEMENT PLAN FOR BIHIA-UJBALIYA SECTION OF SH-102

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement/Road Safety								
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	<ul style="list-style-type: none">Heavily built-up and geometrically deficit sections have been avoidedProvision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures.CBR value of sub grade adopted in consistent to MORTH guidelinesOverloading to be checked at weigh stationIncrease in vent size/waterway of cross drainsProvision of additional culvertsProvision of adequate side drains	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 IRC-SP:50-1999.	Realignment/speed limitations/geometric improvements at Km-27.5 to 28.050 Heavily built-up stretch requiring rigid pavement with drain=0.97 Km Flexible Pavement stretch with side drain Weigh bridge near Bihia at Km:1.5 Most of the culverts widened	MI: Design and number of cross and side drains, PT: Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Geometric Improvements of curvesROB for level crossingsProvision of crash barriers at accident prone areas and bridgesSpeed limitations near educational institutes, hospitals and other CPR.Provision of warning signs near curves/ sensitive locations.Provision of sidewalks in the built-up sections, on both sides.Signage at hazardous locations,Service roads in densely habitated areas (beneath ROB)Street Lighting in built-up sections and bridge locations proposedMajor Junctions to be improved.	Design requirement IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MORTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	straightening of curve at Km-27.5 to 28.050 Crash barrier: 800m Speed Regulatory signage, in built-up sections/sensitive locations. Service Road at Km 2.67-3.045 & 3.14-3.48 in both side as per the DPR 2 major Junctions (Bihia &Arrah-Mohania Chowk) to be improved	MI: number and location of crash barriers, informatory and cautionary sign boards, service roads and street lighting as per design PT: numbers and location are in accordance with site needs : 	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
2. Natural Hazard/Climate Change Risk								
2.1 Damage to pavement integrity like Rutting, embankment softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening, rutting, asphalt	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
and paved surfaces				migration/thermal expansion of joint				
2.2 Earthquake	<ul style="list-style-type: none"> Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area 	Dislodgement of superstructure shall be taken as per Clause 222 of IRC: 6.	Entire Stretch	<u>MI: Stability of Bridges, Culverts and ROB</u> <u>PT: Design conforms BIS and IRC guidelines</u>	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
2.3 Flooding/Water-Logging	<ul style="list-style-type: none"> New culverts proposed along with reconstruction of existing culverts CD structures designed for 50year return period Waterways of bridges and culverts have been increased. Roadside drains to be provided (lined/covered in urban areas and open in rural sections) 	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for	Entire Stretch.	<u>MI: Design and numbers of cross & side drains, design and number of bridges</u> <u>PT: Design and numbers are in accordance with site needs</u>	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none"> Road improvement work to be accommodated within available ROW to the extent possible. Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. Complete all necessary land and property acquisition procedures prior to the commencement of civil work. Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. Compensation and assistance as per project Resettlement Plan Implementation of Income restoration plan as per approved RP Preference in employment and petty contracts during construction to APs Constitute Grievance Redress Committee as per approved RP 	<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.</p> <p>Contract Clause for preference to local people during employment.</p>	Throughout the corridor	<u>MI: Payment of compensation and assistance to DPs as per entitlement matrix of RP</u> Number of complaints/grievances related to compensation and resettlement <u>PT: Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case referred to arbitrator/court.</u>	Check LA records; design drawings vs land plans; Interview with affected persons Check status of employment given to local people during construction	Part of administrative and resettlement costs	BSRDCL and implementing NGO	BSRDCL
4. Diversion of Forest Land and Cutting of Trees								
4.1 Deterioration in climatic condition. Increase in Green House effect/climate	<ul style="list-style-type: none"> Geometric adjustments made to minimize tree cutting. Obtain tree cutting permission from forest department 	Forest Conservation Act, 1980	Total number of affected trees=2503 put	<u>MI: location of geometric adjustments to minimize tree</u>	Review final design. Check budget provision for compensatory	Covered under costs for DPR	BSRDCL, Design consultants forest department	BSRDCL/Forest department

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
change impact	<ul style="list-style-type: none"> Obtain Forest Clearance under Forest Conservation Act Compensatory plantation (1:3) as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 Provision for additional plantation on 1: 7 basis to be implemented by contractor of Forest Department 		<p>together for entire stretch of SH-102</p> <p>Forest Area=55.46 Ha put together for entire stretch of Sh-102</p>	<p>cutting, budget allocated for compensatory and additional plantation</p> <p>PT: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,</p>	plantation and additional plantation.	consultants		
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. All telephone and electrical poles/wires and underground cables should be shifted before start of construction Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any Relocation of wells, hand pumps at suitable locations with consent from local community. 	Project requirement	Throughout the corridor	<p>MI: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p>PT: No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/ BSRDCL/utility company	BSRDCL /CSC
B. Construction Stage								
1. Air Quality								
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Contractor to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, 	MORTH Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<p>MI: PM₁₀ level measurements Complaints from locals due to dust</p> <p>PT: PM₁₀ level < 100 g/m³ number of complaints should be 0.</p>	Standards CPCB methods Observations Public consultation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	unpaved haulage roads and other dust prone areas. Provision of PPEs to workers.							
1.2 Emission of air pollutants(HC,SO ₂ , NO _x ,CO etc) from vehicles due to traffic congestion and use of equipment and machinery	<ul style="list-style-type: none"> Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the SPCB shall be used DG sets with stacks of adequate height and use of low sulphur diesel as fuel. LPG should be used as fuel source in construction camps instead of wood Ambient air quality monitoring Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL 	The Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG set locations	MI: Levels of HC, SO ₂ , NO ₂ , and CO. Status of PUC certificates PT: SO ₂ and NO ₂ levels are both less than 80ug/m ³ . PUC certificate of equipment and machinery is upto date	Standards CPCB methods Review of monitoring data maintained by contractor	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during night time and weekend near schools, Implement noisy operations intermittently to reduce the total noise generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential/ built up areas to daylight hours. Honking restriction near sensitive areas like school, college, hospitals PPEs to workers Noise monitoring as per EMoP. 	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	MI: day and night Noise levels. Number of complaints from local people PT: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas	As per Noise rule, 2000 Consultation with local people Review of noise level monitoring data maintained by contractor Observation of construction site	Included in civil works costs	Contractor	BSRDCL /CSC
3. Land and Soil								
3.1 Landuse Change and Loss of productive/topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to 	Project requirement	Throughout the project section and borrow areas	MI: Selection of Borrow pit locations/Top	Review borrow area plan site visits, check	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion.</p> <ul style="list-style-type: none"> Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original land use Requisite permissions for Borrow areas from DEIAA/ mines department and consent of Panchayats. 		Land to be identified for camp, storage areas etc.	<p>soil storage area</p> <p>Permission from DEIAA/Mines</p> <p>PT: Zero complaints or disputes registered against contractor by land owner</p> <p>Compliance to all conditions of DEIAA/Mines Dept.</p>	compliance conditions			
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Slope gradient shall not be greater than 2:1. The earth stockpiles to be provided with gentle slopes to soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORTH Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	<p>MI: Occurrence of slope failure or erosion issues</p> <p>PT: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC
3.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from DEIAA prior to opening any new borrow area. Comply to EC conditions of DEIAA Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. Depths of borrow pits to be regulated and sides not steeper than 25%. Topsoil to be stockpiled and protected for use at the rehabilitation stage. Transportation of earth materials through covered vehicles. Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation Borrow areas not to be dug continuously. To the extent, borrow areas shall be 	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause 305.2.2 MORTH Specifications for Road and Bridge works Guidelines for Borrow Areas management	<p>Borrow sites location (6)/ borrow area identified in DPR, 6.70 Km, 11.8 Km, 18.6 Km, 19.5 Km, 21.9 Km & 28.0 Km.</p> <p>However contractor is free to select any other borrow area after consent from EA and secure permits.</p>	<p>MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p>PT: No case of non-compliance to conditions stipulated by DEIAA in clearance letter.</p>	Review of design documents and site observations	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>sited away from habitated areas.</p> <ul style="list-style-type: none"> Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 			<p>Zero accidents.</p> <p>Zero complaints.</p>				
3.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. Obtain environmental clearance from DEIAA in case of opening new quarry 	ClauseNo.111.3 MORTH Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	As per DPR, sand shall be collected from Son River with lead distance of 1km from Ch-54.519km in right hand side of the project road while the stone shall be collected from crusher at Domchanch is taken as stone quarry in the DPR. However, the contractor is free to choose the source after securing all permit	<p>MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p>PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p>MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p>PT: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non bituminous debris	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not 	Design requirement	Fuelling station, construction sites, and construction camps and	<p>MI: Quality of soil near storage area Presence of</p>	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
generated from demolition and road construction	<ul style="list-style-type: none"> contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEFCC/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 		disposal location.	<p>spilled oil or bitumen in project area</p> <p>PT: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>				
4. Water Resources								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Groundwater Augmentation by converting borrow areas into ponds 	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	<p>MI: Approval from competent authority</p> <p>Complaints from local people on water availability</p> <p>PT: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil works cost	Contractor	BSRDCL /CSC
4.2 Disposal of water during construction	<ul style="list-style-type: none"> Provision shall be made to connect roadsides drains with existing nearby natural drains. 	Clause No. 1010E P Act 1986 MORTH Specifications for Road and Bridge works	Throughout the Project section	<p>MI: Condition of drainage system in construction site.</p> <p>Presence/absence of water logging in project area.</p> <p>PT: Existence of proper drainage system. No</p>	<p>Standards methods</p> <p>Site observation and review of documents</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Rivers, canal, streams and nallah passing through the proposed road.	<p>water logging</p> <p>MI: Proper flow of water in existing streams and rivers</p> <p>PT: No complain of water shortage by downstream communities. No record of overtopping/ water logging</p>	<p>Review of design documents</p> <p>Site observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC
4.4 Siltation in water bodies due to construction activities/ earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridgeworks</p> <p>Worldwide best practices</p>	Rivers, canal, streams and nallah passing through the proposed road. Especially at ponds (Ch—14, 16.9, 19.5, 21.1, 22.9 km)	<p>MI: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p>PT: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included incivil works cost	Contractor	BSRDCL /CSC
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	<ul style="list-style-type: none"> Parking and refueling away from water bodies/waterways Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Rivers, canal, streams and nallah passing through the proposed road. Especially at ponds (Ch—14, 16.9, 19.5, 21.1, 22.9 km)	<p>MI: Water quality of ponds, streams, rivers and other water bodies in project</p> <p>Presence of oil floating in water bodies in project area</p> <p>PT: Surface water</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>Readily available, simple to understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors.</p> <ul style="list-style-type: none"> Construction camp to be sited away from water bodies. Wastes must be collected, stored and taken to approved disposal site only. Water quality shall be monitored 			quality meets freshwater quality standards prescribed by CPCB				
5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior approval of competent authority. Mandatory compensatory plantation at 1:3 basis by Forestry Department Additional plantation @1:7 Employment preference to vulnerable Regular maintenance trees planted. Provision of LPG in construction camp Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. Controlled use of pesticides/fertilizers 	Forest Conservation Act1980 + IRC:SP:21 and IRC:SP:66	<p>Throughout project corridor</p> <p>Total number of affected trees=2503 put together for entire stretch of SH-102</p> <p>Additional Plantation near Sensitive receptors, river banks, borrow areas</p>	<p>MI: ROW width</p> <p>Number of trees for felling</p> <p>Compensatory plantation plan</p> <p>Number of trees replanted.</p> <p>PT: Survival of Compensatory Plantation @ 70% and Additional plantation @ 80% done</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan</p> <p>Field observations</p>	Additional plantation and compensatory plantation cost is included in project costs under BSRDCL.	Mandatory Compensatory plantation by forest Department and Additional plantation by Contractor of forest department	BSRDCL /CSC
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	<ul style="list-style-type: none"> All camps should be established with prior permission from SPCB. Layout plan shall be recommended by CSC and approved by EA Camps to maintain minimum distance from following: <ul style="list-style-type: none"> # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from through traffic route 	Design Requirement The Water (Prevention and Control of Pollution) Act, 1974 and its amendments thereof	All construction camps	<p>MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps</p> <p>PT: Distance of campsite is less than 500m from listed locations</p>	<p>On site observation</p> <p>Interaction with workers and local community</p>	Included in civil works cost	Contractor and EO	BSRDCL /CSC
6.2 Worker's Health in	The location, layout and basic facility	The Building and	Construction	MI: Camp health	Camp records	Part of the	Contractor	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
construction camp/ construction sites	<p>provision of each labor camp will be submitted to CSC and approved by EA.</p> <ul style="list-style-type: none"> The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „ Engineer“. 	Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	camps	<p>records</p> <p>Existence of proper first aid kit in camp site</p> <p>Complaints from workers.</p> <p>PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.</p>	<p>Site observation</p> <p>Consultation with contractor workers and local people living nearby</p>	civil works costs		/CSC
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in 	Design Requirement, MORTH guidelines and General	At all Dumping/ Disposal Sites	MI: Location of dumping sites Number of public complaints.	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Contractor.	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	the pit design to avoid leachate seepage into the soil, which may later affect ground water quality <ul style="list-style-type: none"> Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Conditions of Contract Document		PT: No public complaints. Consent letters for all dumping sites available with contractor				
7.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or CSC	Contractor records Field observation Interaction with local people	Included in civil works cost.		
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of 	Design requirement and IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional Workshops on	Throughout the project corridor especially in built-up sections and major Junctions/ intersections.	MI: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints	Review traffic management plan Field observation of traffic management and safety system Interaction with	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road.</p> <ul style="list-style-type: none"> The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	<p>Highway Safety IRC:SP: 32 -1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document</p>		<p>from road users. No of accidents PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	people in vehicles using the road			
8.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever cattle movement is expected. Large number of box culverts has been proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals 	Same as above	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p>MI: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p>PT: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Contractor	BSRDCL /CSC
8.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 	Same as above	Construction sites	<p>MI: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction</p>	Included in civil works cost	Obligation of Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> Appointment of a safety officer. All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. Provision of PPEs to workers. Provision of a readily available first aid unit including an adequate supply of dressing materials. The contractor will not employ any persons below the age of 18 years Use of hazardous material should be minimized and/or restricted. Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. Safety Officer must be appointed by the contractor. 			Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	workers			
8.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. Provision of temporary diversions and awareness to locals before opening new construction fronts. Alternate access facility to common properties near construction zones Fencing and speed limitation wherever cattle movement is anticipated.. 	Same as above	Construction sites and Accident Prone Areas. There is an accident prone sub-standard reverse curves in between Ch-27.5km to 31km (length-3.5km).	MI: Safety signs and their location Incidents of accidents Complaints from local people PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Contractor	BSRDCL /CSC
9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	MI: camp, Condition borrows areas and construction sites, Presence/absen	Site observation Interaction with locals Issue completion	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none">All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer.All the opened borrow areas will be rehabilitated and 'Engineer' will certify			ce of construction debris after construction works is over PT: Clean and tidy sites. No trash or debris left on site. Site restored/leveled.	certificate after restoration of all sites are found satisfactory			
Operation and Maintenance stage								
1. Air Quality								
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none">Compensatory tree plantations shall be maintained as prescribed by forest department.80% survival rate for additional plantation shall be maintainedRegular maintenance of the road will be done to ensure good surface conditionAmbient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption.Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipments	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	MI: Ambient air quality (PM ₁₀ , CO,SO ₂ NO ₂) PT: Levels are equal to or below baseline levels (Air Quality Standard, CPCB)	As per CPCB requirements Site inspection	Included in Operation/ Maintenance cost	BSRDCL	
2. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation and honking restrictions near sensitive receptors and elephant movement areasConstruction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.	Noise Pollution(Regulation and Control)Rules,2000andamendments thereof	Sensitive receptors as given in supplementary table to EMP locations.	MI: Noise levels PT: Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none">Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.							
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/ Maintenance cost	BSRDCL	
4. Siltation/Water-logging								
4.1 Siltation/ Contamination	<ul style="list-style-type: none">Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.Monitoring of surface water bodies	Project requirement	Near surface Water bodies	MI: Water quality PT: No turbidity of surface water bodies due to the road	Site observation	Included in Operation/ Maintenance cost	BSRDCL	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging	Site observation	Included in Operation/ Maintenance cost	BSRDCL	
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	MI: Tree/plants survival rate T: Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance cost	BSRDCL/ADB	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the roadsideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	MI: Presence and extent of vegetation growth on either side of road. Number of accidents. PT: No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures, including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented. No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local law Monitor/ensure that all safety provisions included in design and construction phases are properly maintained Highway patrol unit(s) for round the clock patrolling. Help lines for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. Tow-way facility for the break down vehicles if possible. 	IRC:SP:55-2014	Accident Prone Areas. There is an accident prone sub-standard reverse curves in between Ch-27.5km to 31km (length-3.5km).	<p>MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law</p> <p>PT: Fatal and non fatal accident rate is reduced after improvement</p>	<p>Review accident records</p> <p>Site observations</p>	Included in Operation/ Maintenance cost	BSRDCL	
6.3. Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	-	Throughout the corridor	<p>MI: Status of emergency system – whether operational or not</p> <p>PT: Fully functional emergency system</p>	<p>Review of spill prevention and emergency response plan</p> <p>Spill accident records</p>	Included in Operation/ Maintenance cost	BSRDCL	

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan

The “Project engineer” or “the engineer” is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The “environmental officer” is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of “the engineer”.

**Supplementary Tables to EMP
Noise Sensitive Receptor**

Sl. No.	Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
1	0.4	Private School	LHS	6
2	2.1	Private School	RHS	14
3	2.3	Private School	RHS	13
4	2.5	Private School	LHS	15
5	3.9	Private College	RHS	6
6	3.9	Private College	RHS	7
7	4.1	Private School	RHS	8
8	4.5	ITI (Private)	LHS	10
9	4.9	ITI (Private)	RHS	8
10	6.1	Private School	RHS	8
11	8.8	Private School	LHS	8
12	11.1	Middle School	RHS	7
13	12	Primary School	RHS	12
14	12.3	ITI (Private)	LHS	15
15	12.4	Private School	RHS	7
16	12.45	ITI (Private)	LHS	6
17	12.6	ITI (Private)	RHS	7
18	12.9	ITI (Private)	LHS	7
19	13.3	Private School	RHS	8
20	13.6	Residential School	RHS	15
21	14.3	Mission School	RHS	7
22	14.4	Mission Hospital	RHS	7
23	18	Middle School	RHS	8
24	18.3	Play School	LHS	6
25	21.1	Middle School	LHS	15
26	21.8	Primary School	LHS	7
27	24.1	Private School	LHS	20
28	25	Primary School	RHS	8
29	25.4	Govt. PHC	RHS	7
30	25.9	Middle School	LHS	3

List of Other Common Properties

Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
0.5	Petrol Pump	RHS	10
0.6	Temple	RHS	6
1.8	Temple	LHS	10
2.4	Temple	LHS	15
2.5	Temple	RHS	5
3.8	Petrol Pump	RHS	10
3.8	Temple	RHS	7
5.3	Temple	LHS	6
6.1	Crusher Plant	LHS	15
6.7	Temple	RHS	3
6.7	Temple	LHS	3
7.5	Brick Kiln	RHS	6
7.9	Temple	RHS	6
8.7	Temple	LHS	6
9.3	Temple	LHS	6
9.5	Temple	LHS	8
10.1	Temple	RHS	7
10.2	Petrol Pump	RHS	7

Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
10.7	Temple	LHS	8
11.1	Panchayat Bhawan	LHS	6
11.8	Temple	RHS	5
12.8	Temple	LHS	5
14	Temple	LHS	8
14	Pond	LHS	12
14.3	Church	RHS	7
16.2	Graveyard	LHS	10
16.4	Temple	RHS	6
16.9	Petrol Pump	RHS	8
16.9	Temple	LHS	15
16.9	Pond	LHS	15
19.5	Pond	RHS	6
20.9	Temple	LHS	6
21.1	Pond	LHS	20
22	Brick Kiln	LHS	10
22.5	Temple	LHS	5
22.9	Pond	RHS	6
23.1	Temple	RHS	6
23.2	Temple	LHS	6
23.3	Temple	RHS	6
23.9	Temple	LHS	6
24.6	Temple	RHS	6
24.65	Temple	RHS	5
25.6	Temple	RHS	6
25.7	Temple	LHS	5
26.5	Temple	LHS	8
26.5	Temple	LHS	5
27.2	Temple	LHS	6

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air Quality	Construction stage	PM ₁₀ , PM _{2.5} , SO ₂ , NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site/ HMP site and representative sample, 1 each for residential, commercial/Industrial and Sensitive Locations (Total 4 Locations)-	24 hr continuous, 3/year for 2.5 years	Air quality standard by CPCB	4x9000x3x2.5 = ₹2,70,000	Contractor through approved monitoring agency	BSRDC /CSC
	Operation stage			Representative sample 1 each for residential, commercial and industrial area (3 Locations)-	24 hr continuous, 3/year for 1 year	Air quality standard by CPCB	3X9000x3X1 = ₹ 81,000	BSRDC through approved monitoring agency	BSRDC
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential area and Surface water of Perennial Rivers/Ponds (4 Samples)	3/year for 2.5 years	Water quality standard by CPCB	4x 6000x3X2.5 = ₹ 1,80, 000	Contractor through approved monitoring agency	BSRDC /SC
	Operation stage			Groundwater at 2 locations and 1 location each at surface water and pond developed due to Borrows areas (Total 4 Samples)	3/year for 1 year	Water quality standard by CPCB	4X3x6000X1 = ₹ 72,000	BSRDC through approved monitoring agency	BSRDC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Construction sites, Construction Camp and 1 each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr continuous, 3/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3000x3x2.5 = ₹1,12,500	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage			Near Sensitive locations and residential/Commercial areas (3 Locations)	3 / year for 1 year		3x3000x3X1 = ₹ 27, 000	BSRDC through approved monitoring agency	BSRDC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3x2x5000x2.5= ₹ 75,000	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location (2 Locations)	Twice for the first year of operation	CPCB standard	2x2x5000X1= ₹ 20,000	BSRDC through approved agency	BSRDC
Soil Erosion	Construction Stage			Throughout the Project Corridor especially at	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
	Operation Stage	Visual check for Soil erosion and siltation		River banks, bridge locations and river training structures	Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CSC
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Construction Sites and Labor Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: BSRDC	Compensatory: BSRDC/Local Forest Departments	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	IRC: SP:2009		Additional Plantation: BSRDC Cost	Additional Plantation: BSRDC through contractor of Forest Dept.	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	
Monitoring Costs: INR (₹)8.38 Lakhs (0.838 Million)									

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central Pollution Control Board, IS: Indian Standard

APPENDIX 21: ENVIRONMENTAL MANAGEMENT PLAN FOR UJBALIYA-BIHTA SECTION OF SH-102

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement/Road Safety								
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	<ul style="list-style-type: none">Heavily built-up and geometrically deficit sections have been avoidedProvision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures.CBR value of sub grade adopted in consistent to MORTH guidelinesOverloading to be checked at weigh stationIncrease in vent size/waterway of cross drainsProvision of additional culvertsProvision of adequate side drains	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 IRC-SP:50-1999.	Realignment/speed limitations/geometric improvement at Km 47.8 to 48.050 and km 47.950 Heavily built-up stretch requiring rigid pavement new culverts waterways of CD increased along with reconstruction	MI: Design and number of cross and side drains, PT: Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Geometric Improvements of curvesROB for level crossingsProvision of crash barriers at accident prone areas and bridgesSpeed limitations near educational institutes, hospitals and other CPR.Provision of warning signs near curves, and sensitive locations.Provision of sidewalks in the built-up sections, on both sides.Signs and marking viz., delineators, object markers, hazard markers, safety barriers at hazardous locations,Service roads in densely habitated areas (beneath ROB)Street Lighting in built-up sections and bridge locations proposedMajor Junctions to be improved as per IRC/MORTH guidelines.	Design requirement IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MORTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	Straightening of curve atKm 47.8 to 48.050 and km 47.950 Speed Regulatory signage ,in built-up sections/sensitive locations (Refer Supplementary Tables to EMP) ROB at km 33.375 Service Road-(33-33.2, 33.5-33.82) in both side &0.288 km(km 33.2-33.369, 33.38-33.5) in single side as mentioned in the DPR. 4 major Junctions to be improved	MI: number and location of crash barriers, informatory and cautionary sign boards, service roads and street lighting as per design PT: numbers and location are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
2. Natural Hazard/Climate Change Risk								
2.1 Damage to pavement integrity like Rutting,	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS	IRC 37 2012 for flexible pavement design, IRC 81	Entire stretch	MI: Pavement Surface and bridge expansion	Review of design documents and drawings and	Covered under costs for DPR	Contractor	BSRDC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
embankment softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	15462 2004 for rubber modified binder and polymer modified binders.	1997 for strengthening of flexible pavement		joints during extreme heat PI: No softening, rutting, asphalt migration/thermal expansion of joint	comparison with site conditions	consultant		
2.2 Earthquake	<ul style="list-style-type: none"> Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area 	Dislodgement of superstructure shall be taken as per Clause 222 of IRC: 6.	Entire Stretch	<u>MI: Stability of Bridges, Culverts and ROB</u> <u>PT: Design conforms BIS and IRC guidelines</u>	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
2.3 Flooding/Water-Logging	<ul style="list-style-type: none"> New culvert proposed along with reconstruction of CD structures. CD structures designed for 50year return period Waterways of bridges and culverts have been increased. Roadside drains to be provided (lined/covered in urban areas and open in rural sections) 	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for	Potential water logging sections	<u>MI: Design and numbers of cross & side drains, design and number of bridges</u> <u>PT: Design and numbers are in accordance with site needs</u>	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDC
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none"> Road improvement work to be accommodated within available ROW to the extent possible. Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. Complete all necessary land and property acquisition procedures prior to the commencement of civil work. Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. Compensation and assistance as per project Resettlement Plan Implementation of Income restoration plan as per approved RP Preference in employment and petty contracts during construction to APs Constitute Grievance Redress 	<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.</p> <p>Contract Clause for preference to local people during employment.</p>	Throughout the corridor	<u>MI: Payment of compensation and assistance to DPs as per entitlement matrix of RP</u> Number of complaints/grievances related to compensation and resettlement <u>PT: Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case</u>	Check LA records; design drawings vs. land plans; Interview with affected persons Check status of employment given to local people during construction	Part of administrative and resettlement costs	BSRDCL and implementing NGO	BSRDCL

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	Committee as per approved RP			referred to arbitrator/court.				
4. Diversion of Forest Land and Cutting of Trees								
4.1 Deterioration in climatic condition. Increase in Green House effect/climate change impact	<ul style="list-style-type: none"> Geometric adjustments made to minimize tree cutting. Obtain tree cutting permission from forest department Obtain Forest Clearance under Forest Conservation Act Compensatory plantation (1:3) as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 Provision for additional plantation on 1: 7 basis to be implemented by contractor of forest department 	Forest Conservation Act, 1980	<p>Total number of affected trees=2503 put together for entire stretch of SH-102</p> <p>Forest Area=55.46 Ha put together for entire stretch of Sh-102</p>	<p><u>MI:</u> location of geometric adjustments to minimize tree cutting, budget allocated for compensatory and additional plantation</p> <p><u>PT:</u> Unnecessary tree felling on forest land avoided. Budget allocation is adequate,</p>	Review final design. Check budget provision for compensatory plantation and additional plantation.	Covered under costs for DPR consultants	BSRDCL, Design consultants forest department	BSRDCL/Forest department
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. All telephone and electrical poles/wires and underground cables should be shifted before start of construction Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any Relocation of wells, hand pumps at suitable locations with consent from local community. 	Project requirement	Throughout the corridor	<p><u>MI:</u> Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p><u>PT:</u> No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/BSRDCL/utility company	BSRDCL/CSC
B. Construction Stage								
1. Air Quality								
1.1 Dust Generation due to construction	<ul style="list-style-type: none"> Contractor to submit location and layout plan for storage areas of construction materials approved by 	MORTH Specifications for Road and Bridge	Throughout project corridor	<u>MI:</u> PM10 level measurements Complaints from	Standards CPCB methods Observations	Included in civil works cost	Contractor	BSRDCL/CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document		<p>locals due to dust</p> <p>PT: PM10 level< 100 g/m³Number of complaints should be 0.</p>	<p>Public consultation</p> <p>Review of monitoring data maintained by contractor</p>			
1.2 Emission of air pollutants (HC,SO ₂ ,NO _x ,CO etc) from vehicles due to traffic congestion and use of equipment and machinery	<ul style="list-style-type: none"> Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the SPCB shall be used DG sets with stacks of adequate height and use of low sulphur diesel as fuel. LPG should be used as fuel source in construction camps instead of wood Ambient air quality monitoring Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL 	The Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG set locations	<p>MI: Levels of HC, SO₂, NO₂, and CO. Status of PUC certificates</p> <p>PT: SO₂ and NO₂ levels are both less than 80ug/m³. PUC certificate of equipment and machinery is upto date</p>	<p>Standards CPCB methods</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during night time and weekend near schools, Implement noisy operations intermittently to reduce the total noise generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential/ 	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	<p>MI: day and night Noise levels. Number of complaints from local people</p> <p>PT: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas</p>	<p>As per Noise rule, 2000</p> <p>Consultation with local people</p> <p>Review of noise level monitoring data maintained by contractor</p> <p>Observation of construction site</p>	Included in civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> built up areas today light hours. Honking restriction near sensitive areas like school, college, hospitals PPEs to workers Noise monitoring as per EMoP. 							
3. Land and Soil								
3.1 Landuse Change and Loss of productive/topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse Requisite permissions for Borrow areas from DEIAA/ mines department and consent of Panchayats. 	Project requirement	<p>Throughout the project section and borrow areas</p> <p>Land to be identified for camp, storage areas etc.</p>	<p>MI: Selection of Borrow pit locations/Top soil storage area Permission from DEIAA/Mines</p> <p>PT: Zero complaints or disputes registered against contractor by land owner</p> <p>Compliance to all conditions of DEIAA/Mines Dept.</p>	Review borrow area plan site visits, check compliance conditions	Included in civil works cost	Contractor	BSRDCL /CSC
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Slope gradient shall not be greater than 2:1. The earth stockpiles to be provided with gentle slopes to soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORTH Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	<p>MI: Occurrence of slope failure or erosion issues</p> <p>PT: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC
3.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from DEIAA prior to opening any new borrow area. Comply to EC conditions of DEIAA Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. Depths of borrow pits to be regulated and sides not steeper than 25%. Topsoil to be stockpiled and protected 	IRC Guidelines on borrow areas and for quarries(Environmentalprotection ActandRules,1986;WaterAct,AirAct)+Clause305.2.2 MORTH Specifications for	Borrow sites location (5). borrow area identified in DPR, 33.5 Km,39.96Km, 45.6 Km, 51.25Km and 54.25 Km.	<p>MI: Existence of borrow areas in inappropriate unauthorized locations.</p> <p>Poor borrow area management practices.</p> <p>Number of</p>	Review of design documents and site observations	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> for use at the rehabilitation stage. Transportation of earth materials through covered vehicles. Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation Borrow areas not to be dug continuously. To the extent, borrow areas shall be sited away from habitated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 	Road and Bridgeworks Guidelines for Borrow Areas management	However contractor is free to select any other borrow area after consent from EA and securing all permits.	<p>accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by DEIAA in clearance letter. Zero accidents. Zero complaints.</p>				
3.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. Obtain environmental clearance from DEIAA in case of opening new quarry 	Clause No. 111.3 MORTH Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	As identified in DPR However, the contractor is free to choose the source after securing all permit	<p>MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent 	Design requirement	Parking areas, Haulage roads and construction yards.	MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 			condition <u>PT</u> : Zero occurrence of destroyed/compacted land and undestroyed land				
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area <u>PT</u> : Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC
4. Water Resources								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Groundwater Augmentation by 	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	MI: Approval from competent authority Complaints from local people on water availability <u>PT</u> : Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local people	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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4.2 Disposal of water during construction	<p>converting borrow areas into ponds</p> <ul style="list-style-type: none"> Provisions shall be made to connect roadside drains with existing nearby natural drains. 	Clause No. 1010E PACT 1986 MORTH Specifications for Road and Bridgeworks	Throughout the Project section	<p><u>MI</u>: Condition of drainage system in construction site. Presence/absence of water logging in project area.</p> <p><u>PT</u>: Existence of proper drainage system. No water logging</p>	Standards methods Site observation and review of documents	Included in civil works cost	Contractor	BSRDCL /CSC
4.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be brought back to its original course immediately after construction. 	Design requirement, Clause No 501.8.6. MORTH Specifications for Road and Bridge	Rivers, canal, streams and nallah passing through the proposed road. Especially	<p><u>MI</u>: Proper flow of water in existing streams and rivers</p> <p><u>PT</u>: No complaint of water shortage by downstream communities. No record of overtopping/ water logging</p>	Review of design documents Site observation	Included in civil works cost	Contractor	BSRDCL /CSC
4.4 Siltation in water bodies due to construction activities/earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	Design requirement, Clause No 501.8.6. MORTH Specifications for Road and Bridgeworks Worldwide best practices	Rivers, canal, streams and nallah passing through the proposed road.	<p><u>MI</u>: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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4.5 Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	<ul style="list-style-type: none"> Parking and refueling away from water bodies/waterways Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors. Construction camp to be sited away from water bodies. Wastes must be collected, stored and taken to approved disposal site only. Water quality shall be monitored 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Rivers, canal, streams and nallah passing through the proposed road.	<p>MI: Water quality of ponds, streams, rivers and other water bodies in project</p> <p>Presence of oil floating in water bodies in project area</p> <p>PT: Surface water quality meets freshwater quality standards prescribed by CPCB</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Contractor	BSRDCL /CSC
5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior approval of competent authority. Mandatory compensatory plantation at 1:3 basis by Forestry Department Additional compensatory plantation 1:7 guided by forest department contractor Employment preference to vulnerable Regular maintenance trees planted. Provision of LPG in construction camp Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. Controlled use of pesticides/fertilizers 	Forest Conservation Act 1980 + IRC:SP:21 and IRC:SP:66	<p>Throughout project corridor</p> <p>Additional Plantation near Sensitive receptors, river banks, borrow areas</p>	<p>MI: ROW width</p> <p>Number of trees for felling</p> <p>Compensatory plantation plan</p> <p>Number of trees replanted.</p> <p>PT: Survival of Compensatory Plantation @ 70% and Additional plantation @ 80%</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan</p> <p>Field observations</p>	Additional plantation and compensatory plantation cost is included in project costs under BSRDCL.	Mandatory Compensatory plantation by forest Department and Additional plantation by contractors of forest department	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	<ul style="list-style-type: none">All camps should be established with prior permission from SPCB.Layout plant shall be recommended by CSC and approved by EACamps to maintain minimum distance from following: # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from through traffic route	Design Requirement The Water (Prevention and Control of Pollution)Act,197 4 and its amendments thereof	All construction camps	MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included in civil works cost	Contractor and EO	BSRDCL /CSC
6.2 Worker's Health in construction camp/ construction sites	<ul style="list-style-type: none">The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA.The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner.Adequate water and sanitary latrines with septic tanks with soak pits shall be provided.Preventive medical facilities in campWaste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations.No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community.Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases.No material will be so stacked or placed as to cause danger or inconvenience to any person or the public.	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act,1974 and amendments thereof	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „ Engineer”. 							
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORTH guidelines and General Conditions of Contract Document	At all Dumping/ Disposal Sites	<p><u>MI</u>: Location of dumping sites Number of public complaints.</p> <p><u>PT</u>: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Contractor.	BSRDCL /CSC
7.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. 	Design Requirement, MORTH guidelines and General Conditions of Contract Document	Throughout the project corridor	<p><u>MI</u>: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p><u>PT</u>: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.		

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	<ul style="list-style-type: none"> The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 							
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	<p>Design requirement and IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document</p>	Throughout the project corridor especially in built-up sections and major Junctions/ intersections.	<p><u>MI</u>: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p><u>PT</u>: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Contractor	BSRDCL /CSC
8.2 Pedestria	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. 	Same as above	Near habitation on both sides of	<u>MI</u> : Presence/ absence of	Field observation with Interaction with	Included in civil works	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
ns, animal movement	<ul style="list-style-type: none"> Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever cattle movement is expected. Large number of box culverts has been proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals 		schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p>access routes for pedestrians. Road signage</p> <p>Number of complaints from local people</p> <p>PT: Easy access to schools, temples and public places. Zero complaints</p>	local people	cost.		
8.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. Appointment of a safety officer. All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. Provision of PPEs to workers. Provision of a readily available first aid unit including an adequate supply of dressing materials. The contractor will not employ any persons below the age of 18 years Use of hazardous material should be minimized and/or restricted. Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. Safety Officer must be appointed by the contractor. 	Same as above	Construction sites	<p>MI: Availability of Safety gears to workers</p> <p>Safety signage</p> <p>Training records on safety</p> <p>Number of safety related accidents</p> <p>PT: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost.	Obligation of Contractor	BSRDCL /CSC
8.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 	Same as above	Construction sites and Accident Prone Areas especially at (Ch. 50.1km, 53.8km).	MI: Safety signs and their location Incidents of accidents	<p>Site inspection</p> <p>Consultation with local people</p>	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. Provision of temporary diversions and awareness to locals before opening new construction fronts. Alternate access facility to common properties near construction zones Fencing and speed limitation wherever cattle movement is anticipated.. 		There are accident prone sub-standard reverse curves in between Ch-29km to 31km.	Complaints from local people PT: Zero incident of accidents. Zero complaints.				
9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<p>MI: camp, Condition borrows areas and construction sites, Presence/absence of construction debris after construction works is over</p> <p>PT: Clean and tidy sites. No trash or debris left on site. Site restored/leveled.</p>	<p>Site observation</p> <p>Interaction with locals</p> <p>Issue completion certificate after restoration of all sites are found satisfactory</p>	Included in civil works cost.	Contractor	BSRDCL /CSC
Operation and Maintenance stage								
1. Air Quality								
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none"> Compensatory tree plantations shall be maintained as prescribed by forest department.80% survival rate for additional plantation shall be maintained Regular maintenance of the road will be done to ensure good surface condition Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken. Signages shall be provided 	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<p>MI: Ambient air quality (PM₁₀, CO,SO₂ NO₂)</p> <p>PT: Levels are equal to or below baseline levels (Air Quality Standard, CPCB)</p>	<p>As per CPCB requirements</p> <p>Site inspection</p>	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption. <ul style="list-style-type: none">Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipments							
2. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation and honking restrictions near sensitive receptors and elephant movement areasConstruction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution(Regulation and Control)Rules,2000andamendments thereof	Sensitive receptors as given in supplementary table to EMP locations.	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites	Included in Operation/ Maintenance cost	BSRDCL	
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/ Maintenance cost	BSRDCL	
4. Siltation/Water-logging								
4.1 Siltation/ Contamination	<ul style="list-style-type: none">Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.Monitoring of surface water bodies	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation/	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Maintenance cost	BSRDCL	
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>T</u> : Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance cost	BSRDCL/ADB	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the roadsideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation/ Maintenance cost	BSRDCL	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be forced strictly.Further encroachment of squatters within the ROW will be prevented.No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local lawMonitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling.Help lines for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.Tow-way facility for the breakdown vehicles if possible.	IRC:SP:55-2014	Accident Prone Areas especially at (Ch. 50.1km, 53.8km). There are two accident prone sub-standard reverse curves in between Ch-27.5km to 31km (length-3.5km).	<u>MI</u> : Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law <u>PT</u> : Fatal and non fatal accident rate is reduced after improvement	Review accident records Site observations	Included in Operation/ Maintenance cost	BSRDCL	
6.3. Transport of Dangerous Goods	<ul style="list-style-type: none">Existence of spill prevention and control and emergency responsive systemEmergency plan for vehicles carrying	-	Included in Operation/ Maintenance cost	<u>MI</u> : Status of emergency system – whether operational or not	Review of spill prevention and emergency response plan	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	hazardous material			PT: Fully functional emergency system	Spill accident records			

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan

The "Project engineer" or "the engineer" is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The "environmental officer" is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of "the engineer".

**Supplementary Tables to EMP
Noise Sensitive Receptor**

Sl. No.	Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
1	29.7	Primary School	RHS	6
2	30.7	Primary School	LHS	7
3	32	Private School	LHS	6
4	32.5	ITI (Private)	RHS	6
5	32.9	Library	RHS	8
6	33.15	Private School	RHS	8
7	36.4	Primary School	LHS	5
8	38.6	Private School	LHS	8
9	38.8	Private School	RHS	10
10	41.6	Primary School	LHS	12
11	45.6	Madrassa School	LHS	6
12	46.9	Middle School	RHS	8
13	47.1	Private School	LHS	8
14	53.3	Govt. PHC Vishanpura	LHS	8
15	53.5	Middle School	RHS	8

List of Other Common Properties

Chainage (in km)	Particulars	LHS/RHS	Distance from Center Line (in m)
29.3	Temple	LHS	5.5
32.5	Temple	RHS	5
32.5	Temple	LHS	6
32.9	Temple	RHS	6
33.1	Temple	RHS	6
36.5	Temple	LHS	6
37.7	Petrol Pump	RHS	12
39.2	Temple	LHS	6
39.4	Temple	RHS	6
39.5	Temple	RHS	6
39.6	Temple	RHS	6
40.7	Temple with Banyon Tree	LHS	6
44.4	Temple	RHS	6
44.5	Temple	LHS	6
44.5	Temple	LHS	5
44.9	Mazhar	LHS	7
45.5	Mosque	RHS	6
46.2	Petrol Pump	RHS	10
46.5	Petrol Pump	RHS	10
47.3	Temple	RHS	7
47.8	Temple	RHS	6
48.2	Temple	RHS	8
50.1	Temple	RHS	7
50.5	Temple	RHS	5
50.9	Temple	RHS	6
52.8	Temple	RHS	5
53.5	Police Station Itmadpur	RHS	8

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air Quality	Construction stage	PM 10 PM2.5 SO2, NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site/ HMP site and representative sample, 1 each for residential, commercial/Industrial and Sensitive Locations (Total 4 Locations)-	24 hr continuous, 3/year for 2.5 years	Air quality standard by CPCB	5x9000x3x2.5 = ₹2,70,000	Contractor through approved monitoring agency	BSRDC /CSC
	Operation stage			Representative sample 1 each for residential, commercial and industrial area (3 Locations)-	24 hr continuous, 3/year for 1 year	Air quality standard by CPCB	3X9000x3X1 = ₹ 81,000	BSRDC through approved monitoring agency	BSRDC
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential area and Surface water of Perennial Rivers/Ponds (4 Samples)	3/year for 2.5 years	Water quality standard by CPCB	4x 6000x3X2.5 = ₹ 1,80, 000	Contractor through approved monitoring agency	BSRDC /SC
	Operation stage			Groundwater at 2 locations and 1 location each at surface water and pond developed due to Borrows areas (Total 4 Samples)	3/year for 1 year	Water quality standard by CPCB	4X3x6000X1 = ₹ 72,000	BSRDC through approved monitoring agency	BSRDC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Construction sites, Construction Camp and 1 each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr continuous, 3*/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3000x3x2.5 = ₹1,12,500	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage			Near Sensitive locations and residential/Commercial areas (3 Locations)	3 / year for 1 year		3x3000x3X1 = ₹ 27, 000	BSRDC through approved monitoring agency	BSRDC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3x2x5000x2.5= ₹ 75,000	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location (2 Locations)	Twice for the first year of operation	CPCB standard	2x2x5000X1= ₹ 20,000	BSRDC through approved agency	BSRDC
Soil Erosion	Construction Stage			Throughout the Project Corridor especially at	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
	Operation Stage	Visual check for Soil erosion and siltation		River banks, bridge locations and river training structures	Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CSC
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Construction Sites and Labor Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: BSRDC	Compensatory: BSRDC/Local Forest Departments Additional Plantation: BSRDC through contractor of Forest department The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period BSRDC will be responsible for monitoring additional plantation	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	IRC: SP:2009		Additional Plantation: BSRDC Cost		
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	
Monitoring Costs: INR(₹)8.38 Lakhs (0.838 Million)									

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central Pollution Control Board, IS: Indian Standard

APPENDIX 22: GENERIC ENVIRONMENTAL MANAGEMENT PLAN FOR PROPOSED BRRI BUILDING

Environmental Issues	Mitigative Measures	Location	Time frame: when to be under-taken	Implementing Organization/	Supervision
Design and Construction Stage					
Soil Erosion	<ul style="list-style-type: none"> Turfing shall be done prior to onset of monsoon. Other shrubs and trees shall also be planted at the earliest possible. Provide drains and detention basins to stabilise slopes and collect runoff/ sediments Preserve vegetative cover as much as practicable Land clearing activities should be kept to the absolute minimum and use crushed stone rather than asphalt or concrete for surfacing parking 	Exposed soil surface	Site Clearing Soil excavation	Contractor	BSRDCL
Soil Compaction	<ul style="list-style-type: none"> Only identified haulage roads shall be used for transportation. (transportation routes has to be identified for transportation of material and same to be marked on the site plan.) Vehicle parking shall not be done on the sides of the road over green areas 	Along the route and parking spaces	Transportation of construction material	Contractor	BSRDCL
Loss of top soil	<ul style="list-style-type: none"> Clearing of ground vegetation should be done post monsoon and turfing to be undertaken as per the plans/ drawings simultaneously along with other constructional activities Regular watering and maintenance of the areas are to be done to ensure that green cover (especially grasses) is restored at the earliest. (Quantification of excavated soil is required and quantity of earth to be used to be clearly stated.) Topsoil should be stripped to a depth of 20 cm from the areas proposed for buildings, roads, paved areas, It should be stockpiled in designated areas and reapplied during plantation of the proposed vegetation on site. 	Project Site	Construction Period	Contractor	BSRDCL
Contamination of soil from oil and lubricants	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil Any minor spill shall be wiped with cloth Fuel storage and refueling sites will be kept away from storm water drains and the ponds. (Parking arrangement to be done away from water storage tanks and storm water drains.) 	Maintenance and Fueling station for vehicles	Construction Period	Contractor	BSRDCL
Contamination of soil from constructional wastes etc	<ul style="list-style-type: none"> All constructional wastes shall be collected and stored at designated places, preferable on cemented land Constructional wastes shall be used in constructional activities and landscaping as much as possible. Remaining wastes are to be disposed away with garbage. Quantity of construction waste to be assessed and the proposal for its disposal/reuse within the site shall be prepared 	Project Site	Construction period	Contractor	BSRDCL

Environmental Issues	Mitigative Measures	Location	Time frame: when to be under-taken	Implementing Organization/	Supervision
Changes in natural landscape	<ul style="list-style-type: none"> The constructional debris should be mainly used as borrow material. For any extra borrow pit required, it shall be dug within the site premises and after removing and preserving the top soil. On closure of the borrow area, the same shall be layered on the surface and turfing done. Constructional material shall be used only from approved quarry contractors 	<p>Borrow areas (within the site)</p> <p>Quarries outside the project site</p>	<p>Borrow Areas</p> <p>During procurement of constructional material</p>	Contractor	BSRDCL
Loss of vegetation	<ul style="list-style-type: none"> Minimise clearance of trees in final designs Plantation trees should comprise largely from local species Plantation activities should be initiated as early as possible 	Project Site Landscaped area, Grassland , Park		Contractor	BSRDCL
Air Pollution due to Dust and emission	<ul style="list-style-type: none"> All the materials that are likely to produce dust, like cement, should be delivered at site with proper cover Water will be sprayed in the lime/ cement and earth mixing sites. Dust suppression foam may also be used to minimize use of water. After compacting, water will be sprayed on the earthwork regularly to prevent dust. In high dust area, masks for workers to be provided Concrete mixing plants to be located in the downwind of residential areas or alternatively cover the entire area Periodic emission check for equipment/ machinery Regular maintenance of equipment to be ensured Ensure use of good fuel for vehicles/ DG sets complying emission norms notified by MoEF. All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the standards prescribed in Central Motor Vehicles Rules, 1989. Material storages / warehouses – Care should be taken to keep all material storages adequately covered and contained so that they are not exposed to situations where winds on site could lead to dust / particulate emissions. Fabrics and plastics for covering piles of soils and debris is an effective means to reduce fugitive dust. Dust interception can be achieved by a 30 m belt of trees. Even a single row of trees may bring about 25 percent reductions in airborne particulate. The species chosen must be resistant to pollutants, particularly in the early stages of their growth. Sprinkling of water and fine spray from nozzles to suppress the dust. On-Road- Inspection should be done for black smoke generating machinery. Only vehicles having pollution under control certificate may be allowed to ply. 	Project site	Constructional activities	Contractor	BSRDCL

Environmental Issues	Mitigative Measures	Location	Time frame: when to be under-taken	Implementing Organization/	Supervision
	<ul style="list-style-type: none"> Air Quality monitoring shall be carried out 				
Water resource exploitation	<ul style="list-style-type: none"> Any leakages, opened sources of water or cracks on pipe are to be fixed on priority. Drip irrigation facility may be provided in the. Supplied water from Municipal Corporation for domestic usage shall not be used for constructional activities. The workers to be made aware of the need to conserve or water and be discouraged from wasting the same. Quantity of water required from borewells and its yield must be correlated Curing water should be sprayed on concrete structures; free flow of water should not be allowed for curing. The local bye-law provisions on rain water harvesting should be followed. If local bye-law provision is not available, adequate provision for storage and recharge should be followed as per the Ministry of Urban Development Model Building Bye- laws, 2016. Requisite permission from CGWA for new bore wells 	<p>At groundwater withdrawal points</p> <p>Construction camps</p>	<p>Constructional activities</p> <p>Domestic requirements of workers during construction period</p>	Contractor	BSRDCL
Groundwater contamination	<ul style="list-style-type: none"> Minimise the use of inorganic pesticides. groundwater monitoring shall be carried out periodically 	Project Site	Construction Period		BSRDCL
Sanitation and waste disposal in construction camps	<ul style="list-style-type: none"> Provisions for adequate septic tanks shall be made for collection of domestic sewage Garbage shall be collected from all dwelling units of the workers and disposed with the municipality collection Burning of garbage shall not be allowed within the campus 	Near the construction camps and site office	Sanitation of construction camps	Contractor / Proponent	BSRDCL
Generation of Noise	<ul style="list-style-type: none"> Construction activities shall be carried out at the day time only Equipments with lower noise generation levels to be used Monitoring of Day and Night noise levels shall be undertaken as per the Noise Monitoring Plan. 		Site Clear construction activi	Contractor	BSRDCL
Traffic management within the site	<ul style="list-style-type: none"> A comprehensive mobility plan, shall be prepared Road should be designed with due consideration for environment, and safety of users. The road system can be designed with these basic criteria. <ul style="list-style-type: none"> Hierarchy of roads with proper segregation of vehicular and pedestrian traffic. Traffic calming measures. Proper design of entry and exit points. Parking norms as per local regulation. Traffic rules should be followed Speed levels shall be set Honking shall be discouraged 	Transport route	Transportation of construction material	Contractor	BSRDCL

Environmental Issues	Mitigative Measures	Location	Time frame: when to be under-taken	Implementing Organization/	Supervision
Health and Safety of Workers	<ul style="list-style-type: none"> Comply with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7 Constructional practices and safety, 2005, National Building code of India, Bureau of Indian Standards Provide clean drinking water to all workers Provide adequate number of decentralized latrines and urinals to construction workers. Guarding all parts of dangerous machinery. Precautions for working on machinery. Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles in good condition. Durable and reusable formwork systems to replace timber formwork and ensure that formwork where used is properly maintained. Ensuring that walking surfaces or boards at height are of sound construction and are provided with safety rails or belts. Provide protective equipment; helmets etc. Provide measures to prevent fires. Fire extinguishers and buckets of sand to be provided in the fire-prone area Provide sufficient light for working during night time. Dangers, health hazards, and measures to protect workers from materials of construction, transportation, storage etc. 				
Seismicity and High winds	<ul style="list-style-type: none"> IS 4326:1993 'Earthquake Resistant Design and Construction of Buildings – Code of Practice' IS 13920: 1993 'Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces-Code of Practice' Use of "floating" foundations and height restrictions in earthquake zones and increased foundation height, wall strength, and roof support in areas periodically subject to cyclones can reduce the hazards. 			Contractor	BSRDCL
Operation Stage					
Soil contamination	<ul style="list-style-type: none"> Spilled pesticides and fertilizers shall be applied to the grass-land and parks and not discarded. Storage and mixing of pesticides, fuel, fertilizer and solvents etc shall be done on cemented/ impermeable surface, which is adequately shaded from rains. Mixing of pesticides and fertilizers etc shall also be done away from any cemented/ impermeable surface. Chemicals, fertilizers and pesticides container washwater shall be applied to the golf and parks after adjustment with the application required. Garbage shall not be dumped in the open but only in the designated storage areas 	Grassland , lawns and parks	Operation Period	BSRDCL	BSRDCL

Environmental Issues	Mitigative Measures	Location	Time frame: when to be under-taken	Implementing Organization/	Supervision
Groundwater replenishment	<ul style="list-style-type: none"> All storm water to be allowed to existing drainage system Drip irrigation method should be adopted to reduce water usage for parks and lawn maintenance. 		Operation Period	BSRDCL	BSRDCL
Groundwater contamination	<ul style="list-style-type: none"> Use of organic fertilizer to be increased and gradually to replace the use of inorganic fertilizer. Pesticides shall be applied only as per requirement Storage of pesticides, fuel, fertilizer and solvents etc and the equipments used for their application shall be away from any stormwater drain. Minimize irrigation, fertilizer and pesticide requirements through use of integrated Pest Management and native or naturalized vegetation 	Grassland , lawns and parks	Operation Period	BSRDCL	BSRDCL
Management of storm water	<ul style="list-style-type: none"> The storm water drains are so designed that they drain into the lake. All the drains shall be underground and covered. Excess water shall be drained into the main outfall drain. Water quality monitoring should be carried out during operation phase. If monitored parameters are above the prescribed limit, suitable control measures must be taken Pretreatment proposal for storm water (roof top) 	Project Site	Operation Period	BSRDCL	BSRDCL
Management of wastewater generated	<ul style="list-style-type: none"> Underground lined drainage system shall be provided for draining the sewage into city sewers. 	Project Site Grassland , lawns and parks	Operation Period	BSRDCL	BSRDCL
Air Pollution Control	<ul style="list-style-type: none"> A dense and multilayered plantation may be taken up to attenuate the vehicular pollution. Good road condition to be maintained within the project site. Vehicle speed shall be regulated within the project site Air monitoring shall be undertaken as per the Air Pollution Monitoring Plan PUC camps may be organised within the proposed project every 3 months 	Along the boundary walls of the project site Roads within the project	Operation Period	BSRDCL	BSRDCL
Noise pollution control	<ul style="list-style-type: none"> Green belt development may be provided. DG sets shall be provided with acoustic enclosure ensuring a minimum 25 dB (A) Insertion loss or ambient noise standard whichever is higher. The DG sets shall also be provided with exhaust muffler with insertion loss of minimum 25 dB (A). Honking of vehicles may be discouraged within the residential areas. Noise monitoring shall be undertaken as per the Noise Pollution Monitoring Plan. 	Along the boundary of the project site and entry gates DG Sets Roads within the project site	Operation Period	BSRDCL	BSRDCL

Environmental Issues	Mitigative Measures	Location	Time frame: when to be under-taken	Implementing Organization/	Supervision
Management of solid waste	<ul style="list-style-type: none"> Waste shall be segregated; bio degradable and non-biodegradable. Twin bins are to be provided. Blue bins for non-biodegradable wastes, while Green coloured bins are to be provided for biodegradable wastes. To ensure waste is collected on a daily basis Clearing of the wastes shall also be ensured on a daily basis Grass clippings from the mowing of the lawns shall be collected separately and sold to local cattle owners. 	<p>At waste collection points</p> <p>Grassland , Lawns and Parks</p>	Operation Period	BSRDCL	BSRDCL
Hazardous Waste Management	<ul style="list-style-type: none"> Waste oil shall be collected and stored and periodically sold off to MoEF/ SBCB authorized dealers. Buy back arrangement shall be made with the authorized dealer of Lead acid storage batteries used in the Grassland carts and DG sets etc. 	Project Site	Maintenance work etc. During procurement of new batteries	BSRDCL	BSRDCL
Conservation of electricity	<ul style="list-style-type: none"> Street lighting may be provided with conservation bulbs, timers for operation etc. Awareness may be created amongst the residents for conservation of electricity. 	Street light	Operation Period	BSRDCL	BSRDCL
Health Care	<ul style="list-style-type: none"> Insecticides spraying shall be done in regular intervals, but only requisite quantities shall be sprayed Cleanliness shall be maintained in the entire project area Regular street sweeping shall be undertaken. This shall also keep SPM Levels low. Drainage shall be provided for any identified location of waterlogging 	Project site	Operation period	BSRDCL	BSRDCL

ENVIRONMENTAL MONITORING PLAN

Construction Phase:

Source	Monitoring Location	Parameters to be Monitored	Frequency
Ambient Air Quality	2 locations on the periphery of site covering surrounding residential area and/or consent conditions of SPCB	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ and/or Consent conditions of SPCB	Once in 3 months and or Consent conditions of SPCB
Noise	2 locations on the periphery of site covering surrounding residential area and/or consent conditions of SPCB	Day and night equivalent noise level	Once in 3 months
Ground Water	At 1 location nearest to the Project site.	As per Drinking Water Standard (IS: 10500-91)	Once in 3 months
Soil	At 1 location each within and outside the project site	As per ICAR Standard	Once in 3 months

Post- Construction Phase:

Source	Monitoring Location	Parameters to be Monitored	Frequency
DG Set Emission	DG Stack	PM, SO ₂ , NO ₂ , CO, HC	Twice in a year or as per requirement of SPCB
DG Set	At 0.5 m distance from enclosure	Noise Level	Twice in a year or as per requirement of SPCB

Source	Monitoring Location	Parameters to be Monitored	Frequency
Sewage Treatment Plant If proposed	Inlet and Outlet	pH, BOD, Suspended Solid, Oil & Grease	Twice in a year or as per requirement of SPCB
Ambient Air Quality	At 1 location at boundary of the project site.	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂	Once in each non-monsoon season or as per requirement of SPCB
Noise Level	At 1 location at the boundary of the project	Day and night equivalent noise level	Once in each non-monsoon season or as per requirement of SPCB.
Ground Water	At 1 location nearest to the Project site.	As per standards	Once in a season or as per requirement of SPCB.