Bihar State Road Development Corporation Limited

(A Govt. of Bihar Undertaking)

Registered Office:Central Mechanical Workshop Campus,Near Airport, Sheikhpura, Patna-800014, and

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Letter No. BSRDC Ltd. 3691/2021/Part-I/2022 - 741(we) Patna, Dated:- 28-03-2022

Addendum -2 to Bid Document

Bid Document for Improvement/Upgradation and Strengthening of Manjhway to Ch: 21.88 KM Section of Manjhway – Govindpur Road under BSHP III (Phase-2)/Pkg-6/SH-103 for financing from ADB.

1. The Environment Management Plan enclosed in Volume III, Section 6 from page 53 to 84 is hereby replaced with Modified Environment Management Plan as attached herewith.
2. Contractor shall employ at least 10% unskilled women labour in the project.

Encl:- Modified Environment Management Plan.

28.3.2022

(Sanjay Kumar)
Chief General Manager
Bihar State Road Development Corporation Ltd.

MODIFIED ENVIRONMENTAL MANAGEMENT PLAN

(MANJHWAY – GOVINDPUR SECTION OF SH-103 PACKAGE-6)

Km 0.000 to km 21.880

ENVIRONMENTAL MANAGEMENT PLAN

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 PHASE								
I. PRE-CONSTRUCTION ACTIVITIES BY PIU, BSRDCL								
1. Alignment/Pavement Design/Road Safety								
1.1 Alignment Design due considering risk of constricted sections, sharp curves, blind spot etc.	• Proposed design adopted in accordance with the provisions of the IRC Codes • Geometrical design standard features as follows • **Main Carriageway:** • Carriageway Width = 7.0m, • Earthen Shoulder Width= 2 x 2.5m or Variable width Paver Block Shoulder in Built-up area. • Footpath cum Drain = 2 x 1.0m (Built-up sections) • Roadway Width= 12.0m.	As per applicable IRC standards and guidelines	• Widening of whole section from Manjhway to Fatehpur with horizontal and vertical alignment improvements.	MI: Design Parameters compliance to Guideline. PT: Designs are in accordance with site needs	Review of detailed design documents &drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
1.2 Pavement Design considering traffic load, pavement damage, overtopping etc.	• Both Flexible and Rigid pavement has been proposed for the sub-project. • Rigid pavement design is based on IRC: 58-2011 and design of flexible pavement is based on IRC 37-2012. • Pavement Design life for cement concrete pavement has been performed for 30 years and 15 years for flexible pavements. • Proposed cement concrete Pavement has been proposed for 3.360 km and Flexible Pavement has been proposed for the remaining sections. • 40mm BC has been considered as surface course and 105mm DBM with VG-30 has been considered for Base/binder course of Flexible pavement.	Design requirement. IRC: 37-2012, IRC: 58-2011, IRC: SP:73-2007, SP:84-2009	• Rigid/ cement concrete pavement has been proposed in the heavily built-up stretch for 3.360 km (km 7.150 to km 7.800, km 10.380 to km 10.580, km 11.430 to km 11.600, km 12.450 to km 12.980, km 17.450 to km 17.730, km 18.680 to km 19.280 and km 20.950 to km 21.880) • Remaining section has been proposed with Flexible bituminous pavement.	MI: Design Parameters compliance to Guideline. PT: Designs are in accordance with site needs	Review of detail design documents &drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL

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	• Cement concrete pavement in built-up section with 300mm PQC, 150mm DLC, 150mm GSB and 500mm Stabilized Sub-grade.							
1.3 Drainage provisions considering inundation, water logging, overtopping due to inadequate drainage provisions.	• Embankment height raised above HFL. • Roadside footpath cum line drains to avoid water logging in built-up-sections proposed with suitable outfalls. • Prevention of waterlogging and overtopping due to intensive rainfall. • Heavily built-up and geometrically deficit sections have been avoided. • Increased vent size of existing cross drainage structures having inadequate waterways to control flooding. • Provision of additional cross drainages structures like culverts, bridges etc.	Design requirement IRC: SP: 19. IRC: 37-2012 IRC: SP:73 IRC-SP:50-1999.	• Lined drain of 6.720 km (both side) in urban areas(km 7.150 to km 7.800, km 10.380 to km 10.580, km 11.430 to km 11.600, km 12.450 to km 12.980, km 17.450 to km 17.730, km 18.680 to km 19.280 and km 20.950 to km 21.880). • Culverts- New construction of 1 Slab and 1 Pipe Box culverts, Reconstruction of 14 Slab and 58 Pipe culverts, Widening of 8 Slab and 8 Pipe culverts. • Minor bridge – Reconstruction of 1 minor bridge and replacement of 2 existing culverts to minor bridges.	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
1.4 Safety along the proposed alignment	• Geometric Improvements of curves • Provision of crash barriers at accident prone areas and bridges • Speed limitations near educational institutes, hospitals and other CPRs. • Provision of retro-reflective warning signboards near curves, school, hospital, religious places and other sensitive location • Provision of sidewalks in the built-up sections on covered drains • Signs and marking viz., delineators, object markers, hazard markers, safety	Design requirement IRC:SP:73-IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MORTH Specifications	• Speed Regulatory signage, in built-up/ sensitive locations. • Street lighting in built-up sections and at major junctions proposed. • 2 major junctions at km 0+000(with NH-82) and km 21+880(with NH-31) are to be improved with appropriate signages.	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

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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	barriers at hazardous locations, • Street Lighting in built-up sections and at major Junctions proposed • Major Junctions to be improved as per IRC/MORTH guidelines.	Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	• 34 minor junctions are also to be improved at places village roads, ODRs meets the project road. • Total 6 Bus-bays proposed for both side of the project road.	:				
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

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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2.3 Local Flooding/Water Logging	• Roadside footpath cum lined drains to avoid water logging in built-up-sections proposed with suitable outfalls. • Prevention of waterlogging and overtopping due to intensive rainfall. • Cross drainage structures designed for 50-year return period • Waterways of bridges and culverts have been increased.	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for	• Roadside footpath cum drains (both sides together) = 6.720km. • Culverts- New construction of 1 Slab and 1 Pipe Box culverts, Reconstruction of 14 Slab and 58 Pipe culverts, Widening of 8 Slab and 8 Pipe culverts. • Minor bridge – Reconstruction of 1 minor bridge and replacement of 2 existing culverts to minor bridges.	MI: Design and numbers of cross & Side drains, design and number of bridges PT: Design and numbers are in accordance with site needs	Reviewof 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	• 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. • The acquisition of land and private properties shall be carried out in accordance with the RAP and entitlement framework of the Project. • BSRDCL has to ascertain that acquisition of land in the post design phase are addressed and integrated into relevant contract documents. 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 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

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	• 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 Loss of forest flora/ Land use change/ deterioration in local climatic condition/ Increase in Green House effect	• All efforts shall be made to preserve trees including evaluation of minor design adjustments/alternatives (as applicable) to save trees. Specific attention shall be given for protecting oversize trees, green tunnels and locally important trees (religiously important etc.). • Only the bare minimum trees to be felled from the total affected trees. All attempts shall be taken to suitably translocate the treesaffected during construction as per the Tree translocation Plan. • Obtaining NOC for felling of trees on Forest Land prior to commencement of construction activities[1] • Tree felling is to proceed only after all the legal requirements including attaining of In-principle and Formal clearances form the Forest Dept. Particular species declared as "protected" by the State Forest Dept. in the private land shall be felled only after due clearance from the Forest Dept. • Trees shall be removed from the Corridor of Impact before the actual	Forest Conservation Act, 1980 MoRTH 201.2 and 301.5	• Total number of affected trees= 484[2] • Forest Area=Nil • Translocation of trees[3] = •	MI: location of geometric adjustments to minimize tree cutting, budget allocated for compensatory and additional plantation PT: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,	Review final design. Check budget provision for compensatory and additional plantation.	Covered under costs for DPR consultants	BSRDCL, Design consultants forest department	BSRDCL/Forest department

[1]NOC shall be obtained based on Guidebook on application & inspection procedure for obtaining NOC/Transit Permit for Tree felling/transportation of Environment and Forest Dept, Govt. of Bihar.

[2]Figure mentioned is based on inventory prepared.

[3]Translocation of Trees shall be carried out as per Officer Order of Environment, Forest and Climate Change Division, Govt. of Bihar vide No. Forest Land-39/2012-974/E/PVJP, Patna 15 dated 26/07/2019.

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	commencement of the work after obtaining the permission from the state Forest Department. Tree felling shall not commence until the implementation of the project in that particular stretch is confirmed. • Stacking, transport and storage of the timber shall be done as per the relevant norms. • 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 and guided by Tirhut model (TOR Attached with this EMP) • Systematic corridor level documentation for the trees cut and those saved shall be maintained by BSRDCL.							
5. Shifting of Utilities								
5.1 Disruption of utility services to localcommunity	• Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. • All community utilities and properties i.e., hand pumps, open wells, water supply lines, sewer lines, telephone cables, buildings and health centers shall not be relocated before construction of sub-project road starts. • 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	Project requirement	Throughout the corridor	MI: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities PT: No. of complaints should be 0. Effective and timely notification.	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	
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	• Relocation of wells, hand pumps at suitable locations with consent from local community.			Minimal time for utility shifting				
5.2 Relocation of affected Cultural and Religious Properties	• All religious property resources such as shrines, temples and mosques within the project road shall be relocated. If there is any relocation of the religious structures may happen then it shall be identified in accordance with the choice of the community. BSRDCL in consultation with local people shall finalize those. • The entire process (i.e., selection of relocation sites and design) shall be under supervision of Environmental Specialist ofCSC during the construction stage by the Contractor. The relocation shall be completed before the construction starts in these sites.	MoRTH 110.7	Throughout the stretch especially nearby settlements	MI: Number of Religious structures within CoI. Finalization of relocation site in consultation with local community. PT: No. of complaints should be 0. Relocation of structures in consultation with local community at their preferred locations within shortest possible	Consultation with local community	Included under BSRDCL's costs	BSRDCL/ Contractor	CSC/ BSRDCL
II. **PRE-CONSTRUCTION ACTIVITIES BY THE CONTRACTOR/ENVIRONMENTAL SPECIALIST OF CSC**								
1.**Field Verification and Modification of the Contract Documents**								
1.1 Joint Field Verification	• Environmental Specialist of CSC and the Contractor shall carry out joint field verification to ascertain any possibilities of saving trees, environmental and community resources, and these activities are to be taken up by the construction contractor.	MoRTH 201.2	Throughout the stretch of project	MI: Joint verification of features at site PT Unnecessary tree felling to be avoided. Possibility of saving	Physical verification of features	Included under BSRDCL's costs	Contractor/ Environmental Specialist of CSC	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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				community features to be explored.				
1.2 Assessment of Impacts due to Changes/ Revisions/ additions in the Project Work	• The Environmental Specialist of CSC shall assess impacts and revise/modify the EMP and other required sections of the project document/s in the event of changes/revisions (including addition or deletion) in the project's scope of work.		Where ever changes are applicable	MI: Joint verification of features at site. PT Updation in impact and mitigation measures due to proposed change	Physical verification at changed location	Included under BSRDCL's costs	Contractor/ Environmental Specialist of CSC	BSRDCL
1.3 Crushers, Hot-mix plants and Batching Plants Location	• All construction plants shall be sited sufficiently away from settlements and agricultural operations or any commercial establishments. Such plants shall be located at least 1.0 km away from the nearest dwelling preferably in the downwind direction. • The Contractor shall submit a detailed layout plan for all such sites and approval of Environmental Specialist of CSC shall be necessary prior to the establishment. • Arrangements to control dust pollution through provision of windscreens, water sprinklers, and dust extraction systems shall have to be provided at all such sites. • Specifications for crushers, hot mix plants and batching plants shall comply with the requirements of the relevant emission control legislations. Consent for the Establishment and Operation from BSPCB shall be obtained before establishment and operation respectively and a copy should be submitted to the CSC and BSRDCL.	MoRTH 111.1, Air (prevention of control of pollution) Act, 1981 and Noise Rules	At all Crushers, Hot-mix plants and Batching Plants opened up for the construction of project road	MI: Siting criteria as per statutory provisions of Pollution Control Board. The agreement with the land owner for the land where the establishment of plant proposed by the contractor. PT: The siting of plants as per norms. Status of obtaining NOC (CtE & CtO) from state Pollution Control Boards	Checking of copy of valid NOC obtained from State Pollution Control Board and copy of agreement with land owner whose land will be utilized for establishment of plants	Incidental	Contractor/ Environmental Specialist of CSC	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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	• Wherever there is extremely water scarcity areas exist the Water sprinkling shall be limited to one time in the morning. To balance this deficient information boards shall be erected at appropriate locations with a message to "Dust prone area take precautions".							
1.4 Other Construction Vehicles, Equipment and Machinery	• All vehicles, equipment and machinery to be procured for construction shall confirm to the relevant Bureau of India Standard (BIS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 and Motor Vehicles Act, 1988 shall be strictly adhered to. • The silent/quiet equipment available in the market shall be used in the Project. The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period which shall be produced to EO, BSRDCL's verification whenever required.	Air pollution Control Act, and Noise Rules and Motor Vehicle Act, 1988	Applicable to all vehicles used in the construction	MI: verification of valid PUC PT: verification of valid PUC. Zero deviation/ complaints about pollution	Verification of PUC certificate	Part of Civil Cost	Contractor/ Environmental Specialist of CSC	BSRDCL
1.5 Construction Camp Locations - Selection, Design and Layout	• Siting of the construction camps shall be as per the guidelines and details of layout to be approved by CSC Resident Engineer and environment specialist. • Camps to maintain minimum distance from following: • # 500 m from nearest settlements to avoid conflicts • # 500 m from forest areas where possible • # 500 m from water bodies where possible • # 500 m from through traffic route • Construction camps shall not be proposed and stress over the infrastructure facilities with the local	As per IRC guidelines and contract documents.	Construction camps	MI: The agreement with the land owner for the land where the camp site is proposed by the contractor PT: The siting of camp as per norms. Status of agreement with the land owner. Zero complains and accidents at camp site.	Checking of copy of agreement with land owner whose land will be utilized for establishment of camp. Review of basic facilities and their conditions. Complaints of the	Part of Civil Cost	Contractor/ Environmental Specialist of CSC	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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	community. • Location for stockyards for construction materials shall be identified at least 300m away from watercourses. Contractor's camps shall be identified at least 1.5 km away from the Reserved/Protected Forest.			Provision of basic facilities and tier maintenance	residents staying in the camp			
2. Identification and Selection of Material Sources								
2.1 Borrow area Identification and Approvals	• Finalizing soil borrowing earth and all logistic arrangements as well as compliance to environmental requirements as applicable, shall be the sole responsibility of the Contractor. • Contractor shall not start borrowing earth from selected borrow area until the formal agreement is signed between landowner and Contractor and a copy is submitted to the CSC. • Locations finalized by the Contractor shall be reported to the Environmental Specialist of CSC and he shall submit the report to BSRDCL. • Planning of haul roads for accessing borrows areas shall be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as far as possible and shall use the existing village roads wherever available. • The environmental specialist of the CSC shall be required to inspect every borrow area location prior to its approval. CSC to include the Request for Inspection form for borrow area assessment and approval from the environmental perspective. • Non-productive,barrenlands, to be used for borrowing earth with the necessary	IRC Guidelines on borrow areas and quarries; EPA 1986 and MoRTH 111.2 and 305.2.2 Specifications for Road and Bridgeworks Guidelines for Borrow Areas management	Contractor is responsible for identifying the borrow area with all leads and lifts conforming Technical Specification after securing all permits as per Law of the Land.	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 the technical specification and air act. Zero accidents. Zero complaints.	Review of design documents and site observations Inspection of site for approval on environmental consideration	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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	permissions/ consents.							
2.2 Quarry operations	• Contractor shall finalize the quarry for procurement of construction materials after assessment of the availability of sufficient quantity of materials, quality and other logistic arrangements. • Contractor shall also work out haul road network and report to Environmental Specialist of CSC and CSC shall inspect and report to BSRDCL before approval. • 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. • Contractor will obtain environmental clearance (EC) from SEIAA/ DEIAA for identified quarry if intended to open new quarry site. • Comply to EC conditions of SEIAA/DEIAA. • The Contractor will obtain lease license from Department of Geology and Mines	ClauseNo.111.3MORT&H Specifications for Road and Bridgeworks Guidelines VI for Quarry Areas Management Environmental Protection Rules	Identified Quarry location. Contractor is responsible for identifying the source conforming Technical Specification after securing all permits as per Law of the Land.	MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit	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
2.3 Sand	• The Sand shall be procured from identified sand mines as far as possible. The Contractor shall obtain copy of the Lease Agreement of the supplier and submit to CSC before procuring the sand.	As per the contract document	Sand quarries being used for the construction. All riverbeds recommended for sand extraction for the project.	MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan PT: Quarry	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of	Included in civil works cost	Contractor	Environmental Specialist of 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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				license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit	opening new quarries			
B. CONSTRUCTION STAGE								
1. Air Quality								
1.1Dust Generation due to construction activities and transport, storage and handling of construction materials	• Contractor shall take every precaution to reduce the level of dust from construction plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source. • Contractor to submit location and layout plan for storage areas of construction materials approved by CSC. • Contractor shall erect the construction plants and machinery, which shall conform to the pollution control norms specified by MoEF&CC/CPCB • 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	MI: PM10 level measurements Complaints from locals due to dust PT: PM10 level< 100 g/m^3Number of complaints should be 0.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost/ Incidental to work	Contractor	BSRDCL /CSC
1.2 Emission of air pollutants (HC, SO_2, NO_X, COetc.)fromv	• Contractor shall ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant statutory requirements of	The Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and	Asphalt mixing plants, crushers, DG set's locations	MI: Levels of HC, SO_2, NO_2, and CO. Status of PUC certificates	Standards CPCB methods Review of monitoring	Included in civil works cost	Contractor	BSRDCL /CSC

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ehiclesduetotrafficcongestionanduseofequipmentandmachinery	CPCB and/Motor Vehicles Rules 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. • Contractor shall submit PUC certificates for all vehicles/equipment/machinery used for the project. • LPG should be used as fuel source in construction camps instead of wood • Ambient air quality monitoring is to be conducted as per the monitoring plan • Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL	Rules 1982 Annexure 'A' to MoRTH 501 MoRTH:111.10 Contract Agreement		PT: SO_2 and NO_2 levels are both less than 80ug/m^3. PUC certificate of equipment and machinery is up to date	data maintained by contractor			
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 Construction plants and equipment used in construction shall strictly conform to the MoEF&CC/CPCB noise standards. • Construction equipment and machinery to be fitted with silencers and maintained properly. • All equipment to be timely serviced and properly maintained. • The equipment available in the market should be procured, if the Contractor plans to purchase new equipment. For the old equipment, necessary or possible alterations must be carried out to reduce the noise levels to the possible extent. • At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing,	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. Noise barriers at School, College and Hospitals as given in supplementary table to EMP (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

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	operation of DG sets, use of high noise generation equipment shall be stopped during the night time between 10.00 pm to 6.00 am. Working hours of the construction activities shall be restricted around educational institutions/Health Centers (silent zones) up to a distance of 100 m from the sensitive receptors i.e., School, Health Centers and Hospitals etc. during off hours only. • Implement noisy operations intermittently to reduce the overall noise exposure. • 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 shall be carried out at the locations specified in monitoring plan by the BSRDCL and the Engineer through the approved monitoring agency.							
3. Land and Soil								
3.1 Land use Change and Loss of productive/top soil	• Non-agricultural areas to be used as borrow areas to the extent possible. • In case agricultural and is used, 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 land use. • To prevent any compaction of soil in the	Project requirement	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area PT: Zero complaints or disputes registered against contractor by	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
	adjoining productive agricultural lands, the movement of construction vehicles, machinery and equipment's will be restricted to project corridor as much as possible.			land owner				
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	• After construction of road embankment, the side slopes shall be covered with grass and shrubs as per design specifications. • Slope protection by providing Grass turfing, stone pitching, masonry retaining walls, 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. • In borrow pits, the depth shall be so regulated that the sides of the excavation shall have a slope no steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. • Along sections abutting water bodies, pitching as per design specification shall protect slopes.	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	At bridge approaches; high embankment sections (Low lying areas) and borrow pits.	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	• No borrow area shall be opened without permission of the Environmental Specialist of CSC. The location, shape and size of the designated borrow areas shall be as approved by the Environmental Specialist of CSC and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC: 10: 1961).	IRC Guidelines on borrow areas and for quarries(EnvironmentalprotectionActandRules,1986;WaterAct,AirAct)+	Contractor is responsible for identifying the borrow area with all leads and lifts conforming Technical Specification after securing all permits as per Law of the Land.	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices.	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
	• Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. • The borrowing operations shall be carried out as specified in the guidelines for siting and operation of borrow areas. • The unpaved surfaces used for the haulage of borrow materials, if passing through the settlement areas or habitations; shall be maintained dust free by the Contractor. Sprinkling of water shall be carried out twice a day to control dust along such roads during their period of use. • During dry seasons (winter and summer) frequency of water sprinkling shall be increased in the settlement areas and Environmental Specialist of CSC shall decide the sprinkling time depending on the local requirements. • 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. • Borrow areas not to be dug continuously. • Contractor shall rehabilitate the borrow areas as soon as borrowing of soil is over from a particular borrow area in accordance with the approved Borrow Area Redevelopment Plan.	Clause305.2.2MORTH Specifications for Road and Bridgeworks Guidelines for Borrow Areas management		Number of accidents. Complaints from local people. PT: No case of non-compliance to statutory norms and technical specification Zero accidents. Zero complaints.	conditions with Land owner's agreement and statutory/ environmental approvals			
3.4 Quarry Operations	• Aggregates will be sourced from existing licensed quarries. • The Contractor shall obtain materials from quarries only after consent of the	ClauseNo.111.3MoRT&H Specifications for Road and	Contractor is responsible for identifying the source conforming Technical Specification after securing all permits as per Law of	MI: Existence of licenses quarry areas from which materials	Review of design documents, 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
	Department of Mines & Geology and District Administration. • Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. • Contractor will extract the materials as per approved mining plan. • Contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. • The Contractor will comply with the conditions stipulated in the Environmental clearances and mining lease. • In case blasting is required for extraction of stone from quarry, the contractor will follow the following guidelines: • Except as may be provided in the contract or ordered or authorized by the Engineer, the Contractor shall not use explosives. • Where the use of explosives is so provided or ordered or authorized, the Contractor shall comply with the requirements of the following Sub-Clauses of MoRTH 302 besides the law of the land as applicable. • Contractor shall at all times take every possible precaution and shall comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives. The contractor shall at all times when engaged in blasting operations, post sufficient warning	Bridgeworks Guidelines VI for Quarry Areas Management Environmental Protection Rules	the Land.	to be sourced and Existence of a quarry redevelopment plan PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit	documents and site observation Compliance to EC conditions in case of opening new quarries			

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
	flagmen, to the full satisfaction of the Engineer. • Contractor shall at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government Authorities, public bodies and private parties whomsoever concerned or affected or likely to be concerned or affected by blasting operations. • Blasting shall be carried out only with permission of the Engineer. All the statutory laws, regulations, rules etc., pertaining to acquisition, transport, storage, handling and use of explosives shall be strictly followed. • Blasting shall be carried out during fixed hours (preferably during mid-day) or as permitted by the Engineer. The timing should be made known to all the people within 1000 m (200 m for pre-splitting) from the blasting site in all directions.							
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	• 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.	MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not been restored to its original condition PT: Zero occurrence of destroyed/comp	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
				acted 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	• 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&CC/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 SPCB.	Design requirement	Fueling 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	• Water availability and supply to nearby communities unaffected. • 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 thatthe water availability and supply to nearby communities remain unaffected. • Water intensive activities not to be undertaken during summer season.	CGWA Guidelines	Throughout the Project section andenhancement of existing roadside water harvesting structures being used by local peoples.	MI: Approval from competent authority. Complaints from local people on water availability PT: Valid approval from competent authority. Zero	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	
							Implementation	Supervision
	• Groundwater Augmentation by converting borrow areas into ponds • Enhancement of community ponds.			complaints from local people.				
4.2 Disposal of water during construction	• Provisionsshallbemadetoconnectroadsidedrainswithexistingnearbynatural drains.	ClauseNo.1010EPAct1986MoRTH Specifications for Road and Bridgeworks	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	• Existing drainage system to be maintained and further enhanced. • Provision shall be made for adequate size and number of cross drainage structures especially 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. • Temporary water diversions after approval of CSC shall be provided on requirement at bridge and culverts construction locations to maintain the natural flow unobstructed.	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Rivers, canal, streams and nallah passing through the proposed road.	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
4.4 Siltation in water bodies due to construction activities/earthwork	• 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 work 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 Bridgeworks Worldwide best practices	Rivers, canal, streams and nallah passing through the proposed road. List of water bodies and locations are given in supplementary table to EMP (Please refer Supplementary tables for list of water bodies likely to be affected)	MI: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels PT: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit	Field observation	Included in civil works cost	Contractor	BSRDCL /CSC
4.5Deterioration in Surface water quality due to leakage from vehicles and equipment's and waste from construction camps.	• Parking and refueling away from water bodies/waterways • Oil/ grease trap and fueling platforms to be provided at re-fueling 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 forspill 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	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	List of water bodies and locations are given in supplementary table to EMP (Please referSupplementary tables for list of water bodies likely to be affected)	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	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
	taken to approve disposal site only. • Water quality shall be monitored			CPCB				
5. Flora and Fauna								
5.1 Road side Plantation Strategy	• The Contractor shall do turfing on embankment slopes, plantation of shrubs as specified in the Contract. • The compensatory plantation shall be carried out by the State Forest Department. Minimum 80 percent survival rate of the saplings shall be acceptable otherwise the Contractor/Forest Department shall replace dead plants at his own cost. The Environmental Specialist of CSC shall inspect regularly the survival rate of the trees planted by the Contractor in accordance with the plantation strategy suggested.	As per the contract document and MoRTH 301.3.3	Throughout the length of project corridor	MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. PT: Survival of Compensatory Plantation @ 80% and Additional plantation @ 80% done on Tirhut model	Review of relevant documents – tree cutting permit, compensatory plantation plan and key informants on Tirhut model of plantation Field observations	Additional plantation and compensatory plantation cost is included in project costs under BSRDCL.	Contractor	Environmental Specialist of CSC, BSRDCL
5.2 Damage to Flora and chance found Fauna	• The Contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any animal is found near the construction site at any point of time, the contractor shall immediately upon discovery thereof acquaint in the Environmental Specialist of CSC and carry out his instructions for dealing with the same. • Environmental Specialist of CSC shall report to the nearby forest office (Range office or Divisional office) and shall take appropriate steps/measures,	Wildlife Protection, Act and EMP and Bid	Throughout project corridor especially near forest stretches including surface water bodies	MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. PT: Survival of Compensatory Plantation @ 80% and Additional plantation @ 80% done on Tirhut model	Visual observation and record checking	Included in civil works cost	Contractor	Environmental Specialist of CSC, 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
	if required in consultation with the forest officials.							
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	• Contractor shall follow all relevant provisions of the Building and the other Construction Workers (Regulations of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. • The location, layout and basic facility provision of each labour camp shall be submitted to CSC and BSRDCL prior to their construction. • The Construction shall commence only upon the written approval of the Environmental Specialist of CSC. The Contractor shall maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the CSC.	The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act, 1996	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 Potable Water	• The Contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. • The Contractor shall also provide potable water facilities within the premises of every camp at an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. • The Contractor shall also guarantee the following: • Supply of sufficient quantity of Potable Water (as per IS) in every workplace/labour camp (Site at suitable and easily accessible places and	The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act, 1996	Construction site, Labour camp	MI: Provision of potable water PT: Storage of water having sufficient capacity. Complaints of bad water quality by workers	Visual observation of maintenance of the facilities. Water quality test report	Included in civil works cost	Contractor	Environmental Specialist of CSC, 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
	regular maintenance of such facilities. • If any water storage tank is provided that shall be kept such that the bottom of the tank at least 1 m above the surrounding ground level. • If water is drawn from any existing well, which is within 30 m proximity of any toilet, drain or other source of pollution, the well shall be disinfected before water is used for drinking. • All such wells shall be entirely covered and provided with a trap door, which shall be dust proof and water proof. • A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once in a month. • Analysis of water shall be done every month as per parameters prescribed in IS 10500-1991. • Environmental Specialist of CSC shall be required to inspect the labour camp once in a week to ensure the compliance of the EMP.							
6.3 Sanitation and Sewage System	The Contractor shall ensure that – • The Sewage system for the camp is designed, built and operated in such a manner that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place • Separate toilets/ bathrooms, wherever required, screened from those form men (marked in vernacular) are to be provided for women • Adequate water supply is to be provided in all toilets and urinals • Night soil can be disposed of with the	The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act, 1996 MoRTH:114.14	Labour camps	MI: Provision toilets and bathroom units and septic tank with soak pits and drainage networks PT: No discharge outside the camp area. Zero complaints from surrounding	Visual observation od site.	Included in civil works cost	Contractor	Environmental Specialist of CSC, 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
	help of local municipal extractor or disposed of by putting layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15 cm layer of waste or refuse and then covered with a layer of earth for fortnight.			population. Zero water borne diseases in camp site				
6.4 Waste Disposal	• The Contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Specialist of CSC.	Annexure 'A' to MoRTH Clause 501 and The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act, 1996	Camp site	MI: Number and capacity of Dust bins PT: No disposal outside the camp area. Zero complaints from surrounding population.	Visual observation at site.	Included in civil works cost	Contractor	Environmental Specialist of CSC, BSRDCL
6.5 Worker's Health in construction camp/construction sites	• The Contractor will provide 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. • All necessary fencing and lights will be	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act1996 and The Water (Prevention and Control of Pollution)Act, 1974andamendments 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	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
	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". • Readily available First Aid Kits will all the essential first aid items will be maintained at camp site, construction site, plant site and other site of activities			conditions.				
7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	• 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	MI: Location of dumping sites Number of public complaints. PT: No public complaints. Consent letters for all dumping sites available with contractor	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	• 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.	Design Requirement, MORT&H guidelines and General Conditions of	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and	Contractor records 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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waste	• 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. • The disposable debris may be utilized for following purposes: • For filling and leveling of School grounds and proposed parking areas. • The sub-grade of the existing pavement shall be used as embankment fill material. • Existing base and sub-base material shall be recycled as sub-base of the haul road or access roads. • The existing bitumen surface may be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes etc. • The Contractor shall suitably dispose off unutilized debris materials either through filling up of borrows areas	Contract Document		location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or CSC	Interaction with local people			

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
	located in wasteland or at pre-designated disposal locations, subject to the approval of the Environmental Expert of CSC. • At locations identified for disposal of bituminous wastes, the disposal shall be carried out over a 30 mm thick layer of rammed clay so as to eliminate the possibility of scarified percolation of leachate into the ground water. The Contractor shall ensure that the surface area of such disposal pits is covered with a layer of soil and subsequent turfing. • All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, shall be considered incidental to the work and shall be planned and implemented by the Contractor as approved and directed by the Environmental Expert of CSC. • The pre-designed disposal locations shall be a part of Waste Disposal Plan in consultation and with approval of Environmental Expert of CSC. • Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or for mud puddles in the area. • All waste materials shall be completely disposed and the site shall be completely cleaned and certified by Environmental Specialist of CSC before handing over. • The Contractor at his cost shall resolve any claim, arising out of waste disposal or any non-compliance that may arise							

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
	on account of lack of action on his part.							
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	• 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 shall take all necessary measures for the safety of traffic during construction and provide erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Environmental Expert of CSC for the information and protection on traffic approaching or passing through the section of any existing cross roads. • The Contractor shall ensure that all signs, barricades, pavement markings are provided as per the MoRTH specifications. • 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	Design requirement and IRC: SP: 27 - MoRTH: 112.4 MoRTH: 112.1 IRC: SP:55-2014 Bid Document	Throughout the project corridor especially at intersections and settlements.	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
	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.							
8.2Pedestrian, animal movement	• 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.	MI: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people PT: Easy access to schools, temples and public places. Zero complaints	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	• Contractors to adopt and maintain safe working practices. • Contractor shall provide: • Protective footwear, protective goggles and nose masks to the workers employed in asphalt works, concrete works, crusher etc. • Welder's protective eye-shields to workers who are engaged in welding works • Earplugs to workers exposed to loud noise, and workers working in crushing	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents	Site observation Review records on safety training and accidents Interact with construction workers	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
	or compaction • The Contractor shall comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. • The Contractor shall comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract. • The Contractor shall make sure that during the construction work all relevant provisions of Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. • The Contractor shall not employ any person below the age of 18 years for any work and no woman shall be employed on the work of painting with products containing lead in any form • The Contractor shall also ensure that paint containing lead or lead products is used except in the form of paste or readymade paint. • Usage of fluorescent and retro refectory signage, in local language at the construction sites • Training to workers on safety procedures and precautions. • Appointment of a safety officer. • Allregulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied			PT: Zero fatal accidents. Zero or minor non-fatal accidents.				

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
	with. • Provision of readily available first aid unit including an adequate supply of dressing materials. • 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.							
8.4 Risk from electrical equipment's	• The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that: • No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public. • All necessary fencing and lights shall be provided to protect the public in construction zones. • All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, shall be free from patent defect, shall be kept in good working order, shall be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Environmental Expert of CSC.	Contract Agreement and Annexure 'A' to MoRTH Clause 501, The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act, 1996 and Factories Act, 1948	Throughout construction zones, plant sites and camp site and storage areas, DG sets	MI: Electric connections/ wiring system Number of safety related accidents PT: Zero accidents.	Visual observation of electric connections	Included in civil works cost	Contractor	Environmental Specialist of CSC, BSRDCL
8.5 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	Same as above	Construction sites and Accident-Prone Area especially at km 0.000 (Manjhway) and km21.880 (Junction with NH-31).	MI: Safety signs and their location Incidents of accidents Complaints from local	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
	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.			people PT: Zero incident of accidents. Zero complaints.				
8.6 Risk force measure	• Contractor shall take all reasonable precautions to prevent danger to the workers and public from fire, flood etc. resulting due to construction activities. • Contractor shall make required arrangements so that in case of any mishap all necessary steps can be taken for prompt first aid treatment. Construction Safety Plan prepared by the Contractor shall identify necessary actions in the event of an emergency.	Contract Agreement and Annexure 'A' to MoRTH Clause 501	At all activities areas Throughout the construction phase	MI: Development of Emergency Response system and emergency preparedness Complaints from local people PT: Zero incidents	Documents on Emergency Response System/ Record of Mock Drilling record of regular checking's	Included in civil works cost	Contractor	CSC/ BSRDCL
9. 9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations, Restoration and Rehabilitation	• Contractor shall prepare site restoration plans, which shall be approved by the Environmental Specialist of CSC. • The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization. The Contractor shall clear all temporary structures; dispose all garbage, night soils and POL (Petroleum, Oil and Lubricants) wastes as per Comprehensive Waste Management Plan and as approved by CSC. • All disposal pits or trenches shall be filled in and effectively sealed off.	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	Site observation Interaction with locals Issue completion certificate after restoration of all sites is found satisfactory	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
	Residual topsoil, if any shall be distributed on adjoining/proximate barren land or areas identified by the Contractor and approved by the Environmental Specialist of CSC in a layer of thickness of 75 mm – 150 mm. • All construction zones and facilities including culverts, road side areas, camps, Hot Mix plant sites, Crushers, batching plant sites and any other area used/affected due to the project operations shall be left clean and tidy at the Contractor's expense, to the entire satisfaction to the Environmental Specialist of CSC.			tidy sites. No trash or debris left on site. Site restored/leveled.				
10. Impact on Cultural and Archaeological Features								
10.1 Chance Found Archaeological Property	• All fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. • The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He shall, immediately upon discovery thereof and before removal acquaint the Environmental Specialist of CSC of such discovery and carry out the CSC's instructions for dealing with the same, waiting which all work shall be stopped. The CSC shall seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site. The Archaeological structures identified	The Ancient Monuments and Archaeological Sites and Remains Act, 1958	Throughout project corridor	MI: Identification of Archaeological features during excavation activities PT: Intimation to CSC and Respective Department.	Photographic recordsand visual observation at 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
	along the road sides should be protected/ preserved or enhanced as per the law.							
C. OPERATION AND MAINTENANCE STAGE								
1. Performance Monitoring of Proposed Development								
1.1 Monitoring Operation Performance	• The BSRDCL shall monitor the operational performance of the various mitigation/enhancement measures carried out as a part of the project. • The indicators selected for monitoring include the survival rate of trees; utility of enhancement provision made under the project; status of rehabilitation of borrow areas and effectiveness of noise barriers.	As per the contract document	Throughout the project corridor				BSRDCL	BSRDCL
2. Pollution Monitoring								
2.1 Pollution Monitoring	• The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil quality in the selected locations as suggested in pollution monitoring plan through the BSPCB or its approved monitoring agency.	Environmental Protection Act, 1986 and The noise pollution (regulation and control) rules, 2000	At representative locations as per the instructions of Env. Engineer	MI: Test results of environmental attributes of air, water, noise and soil PT: No parameters exceed the standard limits and levels are equal or below the baseline data	Environmental monitoring and test reports	As per Environmental Monitoring Cost Included in Operation/Maintenance cost	Pollution Monitoring Agency	BSRDCL
1. **3. Air Quality**								
3.1 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 as per Tirhut model	Environmental Protection Act, 1986; The Air (Prevention	Throughout the Corridor	MI: Ambient air quality (PM_{10}, CO,SO_2 NO_2)	As per CPCB requirements	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
	• 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 equipment's	and Control of Pollution) Act, 1981		PT: Levels are equal to or below baseline levels (Air Quality Standard, CPCB)	Site inspection			
2. 4. Noise Pollution								
4.1 Noise due to movement of traffic	• 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,2000 and amendments thereof	Noise barriers at School, College and Hospitals as given in supplementary table to EMP (Refer supplementary tables to EMP for information on sensitive receptors).	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	
5.Land and Soil								
5.1 Soil Erosion and Monitoring of Borrow Areas	• Visual Monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankments and other places expected to be affected, shall be	MoRTH 305.2.2.2 and 306. Project requirement	Borrow areas and embankment slopes	MI: observed Erosion PT: No erosion. suitable erosion	Visual observation especially after monsoon	As per Environmental Monitoring Cost	BSRDCL	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
	carried out once in every three months as suggested in monitoring plan. 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 • Necessary measures to be followed wherever there are failures			control measures to be provided immediately once it is noticed	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	Included in Operation/Maintenance cost		
6. Siltation/Water-logging								
6.1 Siltation/ Contamination	• 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	BSRDCL
6.2 Water logging due to blockage of drains, culverts or streams	• BSRDCL shall ensure that all drains (side drains, median drain and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding • 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	All the CD structures 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	BSRDCL
7. Flora								
7.1 Vegetation	• Planted trees, shrubs, and grasses to be properly maintained. • The tree survival audit to be conducted	ForestConservationAct1980	Project tree plantation sites	MI: Tree/plants survival rate T: Minimum	Records and field observation	Included in Operation/Maintenance	BSRDCL/NGO/ADB	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
	at least once in a year to assess the effectiveness			rate of 80% tree survival	s. Information from Forestry Department	cost		
8. Maintenance of Right of Way and Safety								
8.1 Accident Risk due to uncontrolled growth of vegetation	• Maintain shoulder completely clear of vegetation. • Minimum offset as prescribed in IRC:SP:21-2009 to be maintained • Regular maintenance/trimming of plantation along the roadside • No 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	BSRDCL
8.2 Accident risks associated with traffic movement.	• 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/ensurethatallsafetyprovisionsincludedindesignandconstructionphasearepropерlymaintained • 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 breakdown vehicles if possible.	IRC:SP:55-2014. IRC:67-2010 Project Design	Accident Prone Areas	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	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
8.3.Transport of Dangerous Goods	• 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	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: IndianRoadCongress, 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 Receptors and Proposed Noise Barriers

S. No	From Ch.	To Ch.	Name of Noise Receptors	Dist. of Boundary wall from PCL (m)	Dist. of Main structure from PCL (m)	Side	Proposed Noise Barriers (m)
1.	5+600	5+700	Navshrijit Primary School, Gandhinagar	No wall	12	LHS	N/A
2.	8+500	8+600	Utkarmit Middle School, Jalalpur	5	6	LHS	60
3.	10+600	10+700	Navshrijit Primary School, Mohan Nagar	No wall	61	LHS	50
4.	11+100	11+200	Brilliant Mind International School, Narhat	No wall	46	LHS	N/A
5.	12+900	13000	Prathamik Vidyalaya, Baniya Bigha	No wall	25	LHS	15
6.	20+100	20+200	Prathamik Vidyalaya, Laxmi Bigha	60	60	LHS	55
7.	21+300	21+400	Middle School, Fatehpur	35	37	LHS	70
Total proposed Noise Barrier (Running Meter)							**250**

Water Bodies likely to be Affected along Project Road

S. No.	Chainage (km)	Dist. of from PCL (m)	Name of water bodies	Type	Side	Nature	Usage
1.	0+400	0	Canal, Manjhway	Canal	L-1	Non-Perrenial	Agriculture
2.	0+800	60	Pond, Manjhway	Pond	L-2	Perrenial	Fishing
3.	0+900	45	Pond, Manjhway	Pond	L-3	Perrenial	Fishing
4.	2+500	0	Canal, Beldari	Canal	L-4	Non-Perrenial	Agriculture
5.	2+800	0	Canal, Milki	Canal	L-5	Non-Perrenial	Agriculture
6.	5+900	8	Pond, Gandhinagar	Pond	L-7	Perrenial	Fishing
7.	8+300	0	Telaiya River, Jalalpur	River	L-9	Perrenial	Agriculture, cattle
8.	9+100	0	Nala, Abgil	Nala	L-12	Non-Perrenial	Agriculture
9.	12+800	0	Nala, Ibrahimpur	Nala	L-15	Non-Perrenial	Agriculture
10.	15+500	0	Nala, Govasa	Nala	L-17	Non-Perrenial	Agriculture
11.	17+700	0	Nala, Patrang	Nala	L-18	Non-Perrenial	Agriculture
12.	20+200	4	Canal, Laxmi Bigha	Canal	L-19	Perrenial	Agriculture, cattle

S. No.	Chainage (km)	Dist. of from PCL (m)	Name of water bodies	Type	Side	Nature	Usage
13.	21+500	0	Nala, Fatehpur	Nala	L-24	Perrenial	Agriculture
14.	2+500	12	Pond, Beldari	Pond	R-1	Non-Perrenial	Agriculture
15.	4+300	25	Pond, Murheta Chowk	Pond	R-2	Perrenial	Fishing
16.	6+700	0	Canal, Mahugai	Canal	R-3	Non-Perrenial	Agriculture
17.	7+300	0	Nala, Shankar Bigha	Nala	R-4	Non-Perrenial	Agriculture
18.	9+000	0	Canal, Jalalpur	Canal	R-6	Non-Perrenial	Agriculture
19.	9+800	0	Canal, Raja Bigha	Canal	R-7	Non-Perrenial	Agriculture
20.	10+700	0	Canal, Mohan Nagar	Canal	R-8	Non-Perrenial	Agriculture
21.	12+200	0	Nala, Ibrahimpur	Nala	R-9	Non-Perrenial	Agriculture
22.	13+000	0	Nala, Baniya Bigha	Nala	R-10	Non-Perrenial	Agriculture
23.	13+400	0	Dhanarjay River, Baniya Bigha	River	R-11	Perrenial	Domestic, cattle bathing, fishing, agriculture
24.	14+100	0	Canal, Daulatpur	Canal	R-12	Perrenial	Agriculture
25.	15+100	0	Nala, Govasa	Nala	R-13	Non-Perrenial	Agriculture
26.	20+700	0	Canal, Fatehpur	Canal	R-16	Non-Perrenial	Agriculture

Performance Indicators

Environmental components identified of a particular significance in affecting the environment at critical locations have been suggested as performance indicators (PIs) and is given in **following Table:**

Performance Indicators and Monitoring Plan

S. No	Monitoring plan/ Performance Indicators	Description of Item	Indicator	Stage	Responsibility
1	Monitoring plan	• No. of trees planted (Total) • No. of trees under Compensatory Afforestation • No. of Trees planted along Road sides	Road side and other plantation areas	Post construction stage	Forest Department and BSRDCL
3	Performance indicators	• No. of Borrow Areas identified and verified • No. of sites for which restoration plans have been prepared • No. of Sites restored and rehabilitated • No. of sites handed over	Borrow Area	Pre -Construction and Post- Construction	Contractor & BSRDCL
4	Performance indicators	• No. of Quarry Areas identified and verified • No. of sites for which restoration plans have been prepared • No. of sites restored and rehabilitated • No. of sites handed over	Quarry	Pre –Construction and Post Construction	Contractor & BSRDCL
5	Performance indicators	• Quantity of Debris and spoils to be disposed off • No. of locations finalized for Debris disposal • Quantity of Debris and spoils disposed off • No. of locations for which Rehabilitation works have been completed	Disposal sites	Construction and Post Construction	Contractor & BSRDCL
6	Performance indicators	• No. of locations identified for the construction camp and construction plant sites • No. of locations approved • Lay-outs approved • No. of sites for which site Restoration and Rehabilitation has been completed	Construction camps and plant sites	Pre- construction and Post Construction	Contractor & BSRDCL

S. No	Monitoring plan/ Performance Indicators	Description of Item	Indicator	Stage	Responsibility
7	Performance indicators	• No. of Trees to be cut • No. of Trees cut • % Progress on the tree removal	Tree cutting	Pre construction	BSRDCL
8	Performance indicators	• No. of locations identified for temporary storage of the excavated materials to be used in embankment and sub grade	Storage of excavated materials	Pre construction and construction	Contractor
9	Monitoring plan	• Statutory environmental monitoring as per the conditions stipulated in the consents/ permission issued by PCB	Environmental status at construction Sites	Construction	Contractor
10	Monitoring plan	• Environmental parameter monitoring in accordance with the frequency and duration of monitoring as well as the locations as per the Monitoring plan.	Air, Noise, Soil and Water quality	Construction and Operation	Contractor/ BSRDCL through external agency
11	Monitoring plan	• Before the onset of monsoon all the debris/excavated materials shall be cleaned from the work sites and disposed of at the pre –identified approved locations	Silting of water bodies	Construction	Contractor supervised by the Environmental specialist of CSC
12	Performance indicators	• Implementation of enhancement measures for • Parking areas • Cultural properties • Religious properties	Enhancements	Construction	Contractor
13	Performance indicators	No. of Training sessions organized for • Department staff • Contractors • Combined • No. of people trained • Department staff • Contractors	Training Imparted	Construction and Operational Phase	BSRDCL
14	Performance indicators	Slope protection measures • Length (by type) • No. of Locations	Work sites	Construction	Contractor
15	Performance indicators	Drainage • Length • No. of Locations	Work sites	Construction	Contractor
16	Performance indicators	Safety provisions • Signage (by type and No.)	Work sites	Construction	Contractor

S. No	Monitoring plan/ Performance Indicators	Description of Item	Indicator	Stage	Responsibility
		• Guard Rails • Guide Rails			
17	Performance indicators	No. of chute drains provided	Work sites	Construction	Contractor
18	Performance indicators	Soil erosion prevention measures • Silt fencing (No. of locations and quantity) • Stone pitching (No. of locations and quantity) • Any other (Grass seeding etc.,)	Work sites	Construction	Contractor
19	Performance indicators	Utility ducts • Length provided • No. of Locations	Utility ducts	Construction	Contractor
20	Performance indicators	Water sources • No. of sources protected • No. of sources relocated	Work sites	Construction	Contractor
21	Performance indicators	No. of HIV awareness sessions conducted	Labours	Construction Stage	BSRDCL
22	Performance indicators	No. Safety awareness sessions conducted	Labours	Construction Stage	BSRDCL
23	Monitoring plan	No. of awareness sessions for educating the public about road safety and other environmental aspects (such as waste dumping, preservation of enhanced sites, pollution and health impacts etc.)	Public in the vicinity of project road.	Construction Stage	BSRDCL

ENVIRONNEMENTAL MONITORING PLAN

Environmental Monitoring of Ambient Air, Water, Noise and Soil along the Project Road

Environment Component	Project Stage		Regular Monitoring Parameters				Institutional Responsibilities			
		Parameters	**Standards**	**Method/ Guidelines**	**Locations**	**Frequency**	**Duration**	**Action Plan in case criteria exceeds**	**Implementation**	**Supervision**
Ambient Air	**Construction**	PM_{10} µg/m^3, $PM_{2.5}$ µg/m^3, SO_2, NOx, CO	National Ambient Air Quality Standard (CPCB, 18th Nov, 2009)	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Plant site/ HMP/Stone Crusher/ (construction site)- *Total 2 locations*	Once in 3 month for 2 years excluding monsoon period) **(No. of Samples = 3x2x2 =12)**	Continuous 24 hours	Check and modify control device like bag filter/cyclones of hot mix plant	Contractor through approved NABL monitoring agency	EO of CSC and BSRDCL
		PM_{10} µg/m^3, $PM_{2.5}$ µg/m^3, 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	Along the project roads at 2 locations in consultation with CSC.	Once in a season excluding the monsoon for 2 years **(No. of Samples = 3x2x2 =12)**	Continuous 24 hours	-	Contractor through approved NABL monitoring agency	EO of CSC and BSRDCL
	Operation	PM_{10} µg/m^3, $PM_{2.5}$ µg/m^3, 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	Along the project road at 2 locations in consultation with BSRDCL	In the interval of 4 months for 1 Year **(No, of Samples = 3x2x1= 6)**	Continuous 24 hours	-	BSRDCL through approvedNABL monitoring agency	BSRDCL

Environment Component	Project Stage	Regular Monitoring Parameters					Institutional Responsibilities			
		Parameters	Standards	Method/ Guidelines	Locations	Frequency	Duration	Action Plan in case criteria exceeds	Implementation	Supervision
Surface Water Quality	**Construction**	pH, Temperature, DO, BOD, COD, Oil & Grease, Total Suspended Solid, turbidity, Total Hardness, Chlorine, Iron, Total Coliform	Freshwater Classification Criteria by CPCB for Propagation of Aquatic life	Grab sample collected from source and analyze as per Standard Methods for Examination of Water and Wastewater	2 locations along the project road	Once in 3 month for 2 years excluding monsoon period) **(No. of Samples = 3x2x2 = 12)**	Grab Sampling	Check and modify petrol interceptors, silt fencing devices	Contractor through approved NABL monitoring agency	EO of CSC and BSRDCL
	Operation	pH, Temperature, DO, BOD, COD, Oil & Grease, Total Suspended Solid, turbidity, Total Hardness, Chlorine, Iron, Total Coliform		Grab sample collected from source and analyze as per Standard Methods for Examination of Water and Wastewater	2 locations identified by BSRDCL along the project roads	In the interval of 4 months for 1 Year **(No. of Samples = 3x2x1 = 6)**	Grab Sampling	Check and modify petrol interceptors, silt fencing devices	BSRDCL through approved NABL monitoring agency	BSRDCL
Ground Water Quality	**Construction**	pH, Temperature, TSS, Total hardness, Suspended Solid, Chlorine, Iron, Sulphate, Nitrate	Ground Water Quality Standard as per IS: 10500, 1991	Grab sample collected from source and analyze as per Standard Methods for Examination of Water and Wastewater	Plant, Camp site & Construction site (2 location)	Once in 3 month for 2 years excluding monsoon period) **(No. of Samples = 3x2x2 = 12)**	Grab Sampling	Check and modify petrol interceptors, silt fencing devices	Contractor through approved NABL monitoring agency	EO of CSC and BSRDCL
	Ope ratio	pH, Temperature, TSS, Total		Grab sample collected from source and	1 location identified by BSRDCL along the	In the interval of 4 months for 1 Year	Grab Sampling	Check and modify petrol interceptors, silt	BSRDCL through approved NABL monitoring agency	BSRDCL

Environment Component	Project Stage		Regular Monitoring Parameters				Institutional Responsibilities			
		Parameters	Standards	Method/ Guidelines	Locations	Frequency	Duration	Action Plan in case criteria exceeds	Implementation	Supervision
		hardness, Suspended Solid, Chlorine, Iron, Sulphate, Nitrate		analyze as per Standard Methods for Examination of Water and Wastewater	roads (1 location)	**(No. of Samples = 3x1x1 = 3)**		fencing devices		
Drinking water Quality	**Construction**	pH, Temperature, TSS, Total hardness, Suspended Solid, Chlorine, Iron, Sulphate, Nitrate Total coliform Faecal coliform	Drinking Water quality standard by CPCB/IS:10500	Grab sample collected from drinking water source at camp site and construction site	2 location camp site and construction site	In the interval of 3 months for 2 Year **(No. of Samples = 2x4x2 = 16)**	Grab Sampling	Treatment of water/identification of alternate source	Contractor through approved NABL monitoring agency	BSRDCL
Noise Level	**Construction**	Leq dB (A) (Day and Night) Average and Peak values	Ambient Noise Standard (CPCB, 2000)	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968Using Noise level meter	1 location at plant site and 3 sensitive locations (school/ college/ hospital along the project road) during construction stage of the project road	Once in 3 month for 2 years excluding monsoon period) (**No. of Samples = 4x3x2= 24)**	Readings to be taken at 60 seconds interval for every hour and then Leq are to be obtained for Day time and Night time	Check and modify equipment and devices used to attenuate noise level	Contractor through approved NABL monitoring agency	EO of CSC and BSRDCL
	Operation	Leq dB (A) (Day and Night) Average and Peak values		IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968Using Noise level meter	2 Location as identified by BSRDCL	In the interval of 4 months for 1 Year **(No. of Samples = 2x3x1= 6)**	Readings to be taken at 60 seconds interval for every hour and then Leq are to be obtained for Day time and	-	BSRDCL through approved NABL monitoring agency	BSRDCL

Environment Component	Project Stage		Regular Monitoring Parameters				Institutional Responsibilities			
		Parameters	Standards	Method/ Guidelines	Locations	Frequency	Duration	Action Plan in case criteria exceeds	Implementation	Supervision
							Night time			
Soil	Construction	Physical Parameter: Texture, Grain Size, Gravel, Sand, Silt, Clay; Chemical Parameter: pH, Conductivity, Calcium, Magnesium, Sodium, Nitrogen, Absorption Ratio	-	As specified by the site engineer BSRDC / CSC	Near Construction sites along the road as identified by the EO, CSC (2 location)	Once in 3 month for 2 years excluding monsoon period) (**No. of Samples = 2x3x2= 12)**	Grab sampling	-	Contractor through approved NABL monitoring agency	EO of CSC and BSRDCL
Tree Plantation/ Green belt Development	Construction	Tree Survival rate	90% Tree Survival Rate	Visual checks and tree enumeration	Throughout the Project in substantially completed section	Once in a month	2 Years	Replacement of Dead tree with healthy saplings of same species, repairing of tree guards, fencing	Contractor/Forest Department	EO of CSC and BSRDCL
	Operation	Tree Survival rate	90% Tree Survival Rate	Visual checks and tree enumeration	Throughout the Project stretch	Once in three months	3 years	Replacement of Dead tree with healthy saplings of same species	BSRDCL	BSRDCL

Environment Component	Project Stage	Regular Monitoring Parameters					Institutional Responsibilities			
		Parameters	Standards	Method/ Guidelines	Locations	Frequency	Duration	Action Plan in case criteria exceeds	Implementation	Supervision
Water Bodies	Construction	Turbidity in Storm water Silt load in ponds/Rivers	As specified by the engineer Water quality standards	Visual Checks	At the drains, Ponds, Water reservoir and River along the project road	Pre-monsoon and post monsoon seasons for 2 years	2 years	Inspection and modification of silt fencing/ any leakage of drains to these surface water bodies	Contractor	EO of CSC and BSRDCL
	Operation	Turbidity in Storm water Silt load in ponds	As specified by the engineer/ Water quality standards	Visual Checks	At major water bodies (Pond, within the Proposed ROW and those located at immediate vicinity of the Proposed ROW.	1 Years before onset of monsoon	2 Years	Check and repair catch drains, storm water drains and silt trap	BSRDCL	BSRDCL

**Accidental spillage of hazardous and non-hazardous substances needs to be dealt with as special cases largely depends on the circumstances including state of the substance (liquid or solid). Monitoring shall be carried out at all locations used for collection of primary data in the study.*

EMP SH- 103 Pkg- 6 (Km 0.000 to Km 21.880)

	Description	Unit	Quantity	Remarks
A.	Environmental Pollution Monitoring			
	Environmental Monitoring for air, water, noise and soil attributes			
1	Ambient air quality monitoring along the project road for particulate matter ($PM_{2.5}$ and PM_{10}), sulphur dioxide (SO_2), oxides of nitrogen (NO_x); and carbon monoxides (CO) using standard analysis technique in accordance with the National Ambient Air Quality Standards formulated by MoEF&CC and the World Bank (IFC) Air Quality Standards	Nos.	30	
2	Sound Pressure Level (SPL) measurements along the project road using standard analysis technique in accordance with the National Ambient Air Quality Standards in respect of noise formulated by MoEF&CC and the World Bank (IFC) Air Quality Standards	Nos.	30	It has already been included in BOQ item no 10.08
3	Soil Quality Testing along the project road in accordance with CPCB norms	Nos.	12	
4	Water Quality Testing for parameters as per IS: 10500-2012 along the road in accordance with CPCB norms (ground water and surface water samples)	Nos.	49	
	Sub-Total A			
B.	Environmental Mitigation Measures			
1	Dust suppression in haul roads, material storage location and all active locations @ 3 tanker per day for 200 days	Nos.	600	
2	Bio Toilets in Construction Camp			
	Supply of D.R.D.O Technology Bio-Digester tanks Rota-molded double wall manufactured in automatic Rota-molding machines using superior grade Virgin LLDPE (Polymer) with 2.5% Carbon Black, UV Resistant Polymer leading to highest quality consistency. Thickness of the outer shell of minimum 6mm, partitions made from HDPE Polymer of 8mm thick. Immobilization Matrices of Heavy Duty Poly Grass PVC Matting lining along the partitions on both sides. Heavy duty pipes & fitting shall be used in these tanks of Finolex or equivalent make. Fasteners made of Brass shall be used inside the tank with manufacturer's test certificate and including AMI (Bacteria) of 600 liters per tank. Size of Tank: 2000 Litres capacity upto 20-30 users per day; Tank Diameter of 1425mm; Tank Height of 1600mm; Outlet pipe diameter 75mm; inlet pipe diameter 110mm.	Nos.	2	As per MORT&H Technical spesification (Fifth Revision) clause 111 it is incidental to the work. No separate payment to the Contractor is required.
	FRP Toilet Cabin IWC (Ceramic Pan) type of size 1250mm X 915mm X 2400mm with ± 5% tolerance.	Nos.	4	
	Installation Charges			
	i) Plumber (Skilled)	Nos.	1	
	ii) Plumber (Unskilled)	Nos.	1	
3	Providing solid waste management facility in construction camp, HDPE Garbage Container, Size: 940 X 480 X 550mm(LxWxD)	Nos.	6	
5	Oil trap/ interceptor at parking/ servicing of construction vehicles	Nos.	2	Responsibility of Contractor, Incidental to the Work
6	Occupational safety appliances and PPEs for Covid-19	Month	24	Responsibility of Contractor, Incidental to the Work (Already included in Section-6 of the Bid document)
7	Silt Fencing near water bodies adjacent to road	Rm	830	As per MORT&H clause 111.8.3 it is incidental to work. No separate payment to the Contractor is required.
8	Rainwater Harvesting Structures complete in all respect and confirming to the relevant specifications	Nos.	40	This item shall be impleted as variation to the contract
9	Noise Barrier with hollow brick compound wall to 3.5m height using mortar, plastering and intermediate brick pillars viz at Schools and hospitals	Rm	250	This item shall be impleted as variation to the contract
13	Informatory Signage for safety near noise sensitive locations and all built-up sections	Nos.		Already included in BOQ. In addition to that whreever wild life or any other inforamatory/ cautionary signboard is required, it will be imlemented through variation.
14	Slope / Embankment protection with Turfing of embankment and Stone pitching	Sqm	-	As per requirement already included in BOQ
	Sub-Total B			
C	Environmental Enhancement Measures			
1	Provision for Solar Lighting in important major Junctions and bus bays.	Nos.	8	This item shall be impleted as variation to the contract