Initial Environmental Examination

October 2022

India: Rajasthan State Highway Investment Program – Tranche 3
Volume 2 of 3, Appendix A-H

Prepared by PPP Division, Public Works Department, and Government of Rajasthan for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 21 October 2022)

Currency unit	–	Indian Rupee (₹)
INR1.00	=	$0.012
$1.00	=	₹82.83

ABBREVIATIONS

AE	–	Authority Engineer
ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
BIS	–	Bureau of Indian Standard
BOQ	–	Bill of Quantities
CBD	–	Convention on Biological Diversity
CCF	–	Chief Conservator Forest
CGM	–	Chief General Manager
CGWA	–	Central Ground Water Authority
CGWB	–	Central Ground Water Board
CPCB		Central Pollution Control Board
CTE	–	Consent to Establish
CTO	–	Consent to Operate
CFO	–	Certificate for Operation
COP 26	-	26TH UN Climate Change Conference of Parties
CSC	–	Construction Supervision Consultant
dBA	–	Decibel
DEIAA	–	District Environment Impact Assessment Authority
DFO	–	Divisional Forest Officer
DGM	–	Deputy General Manager
DPR	–	Detailed Project Report
EA	–	Executing Agency
EAC	–	Expert Appraisal Committee
EARF	–	Environmental Assessment and Review Framework
EFP	–	Environment Focal Person
EIA	–	Environmental Impact Assessment
EMP	–	Environmental management plan
EMOP	–	Environmental monitoring plan
ERDAS	–	Earth Resources Data Analysis System
FGD	–	Focused Group Discussion
FSO	–	Focal Safeguard Officer
FHWA	–	The Federal Highway Administration
GHG	–	Green House Gas
GIS	–	Geographic Information System
GM	–	General Manager
GOR	–	Government of Rajasthan
GOI	–	Government of India
GOR	–	Government of Rajasthan
GRC	–	Grievance Redress Committee
GRM	–	Grievance Redress Mechanism
GSDP	–	Goss State Domestic Product
IS	–	Indian Standard
IEE	–	Initial Environmental Examination
IMD	–	Indian Meteorological Department
IRC	–	Indian Road Congress
IUCN	–	International Union for Conservation of Nature
RPCB	–	Rajasthan Pollution Control Board
MDR	–	Major District Road
Leq	–	Equivalent Continuous Noise Level

MFF	–	Multi-tranche Financing Facility
MoEF&CC	–	Ministry of Environment, Forests and Climate Change
MORTH	–	Ministry of Roads Transport and Highway
NAAQS	–	National Ambient Air Quality Standard
NSDP	–	Net State Domestic Product
NH	–	National Highway
ODR	–	Ordinary District Road
PCR	–	Physical Cultural Resources
PCU	–	Passenger Car Unit
PF	–	Protected Forest
PM	–	Particulate Matter
PD	–	Project Director
PIU	–	Project Implementation Unit
PPP	–	Public-Private Partnership
PWD	-	Public Works Department
REA	–	Rapid Environmental Assessment
RF	–	Reserved Forest
RCD	–	Road Construction Department
ROB	–	Road Over Bridge
ROW	–	Right-of-Way
RR	–	Rural Roads
SE	–	Superintendent Engineer
SEIAA	–	State Environment Impact Assessment Authority
SH	–	State Highway
SOE	–	Safeguard Officer – Environment
SPS	–	ADB Safeguard Policy Statement, 2009
TEEMP	–	Transport Emissions Evaluation Model for Projects
TNM	–	Traffic Noise Model
UNESCO	–	United Nations Educational, Scientific and Cultural Organization
UNFCC	–	United Nations Framework Convention on Climate Change
USEPA		Unite States Environment Protection Agency
WLS	–	Wildlife Sanctuary
WPA	–	Wildlife Protection Act

Appendix-A

APPENDIX A: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Country/ Project Title: Rajasthan State Highways Improvement Program- Tranche3

Sector Division: SATC

Screening Questions	Yes	No	Remarks
A. Project siting Is the project area adjacent to or within any of the following environmentally sensitive areas?			
• Cultural heritage site		x	No cultural heritage site is located within the road ROW or vicinity.
• Protected area		x	None of the project roads is inside or adjacent to any notified protected area.
• Wetland		x	None.
• Mangrove		x	None
• Estuarine		x	None
• The buffer zone of the protected area		x	None
• Special area for protecting Biodiversity		x	No special biodiversity area is located within the Project area.
B. Potential environmental impacts will the project cause…			
• Encroachment on Historical/cultural areas; disfiguration of the landscape by road embankments, cuts, fills, and quarries?	x		No encroachment of historical places. However, some religious structures exist along anyone pf projects roads which may get partially impacted. Disfiguration of the landscape is not envisaged since it is an expansion/reconstruction of existing roads. Cut and fills are required only to improve the vertical profile of the road.
• Encroachment on precious ecology (e.g. sensitive or protected areas)?		x	No National Parks, wildlife sanctuaries, or similar eco-sensitive areas along with any one of the project's roads. Erratic and undefined movement of wild animals mainly that of Nilgai (Blue bull) is reported in most of the projects. This species is under Schedule-III of wildlife act and not assessed as per IUCN. Due to its large population causing heavy crop damage, MOEF& CC has issued an advisory to include it in the Vermin category of Schedule V so that killing/hunting of such animals is the outside purview of regulations. State govt. has nominated Tehsildar, Ranger officers, and other officials of the same level to be the competent authority for killing such animals. Adequate measures like conversion of existing pipe culverts to slab culverts, exclusively designed additional culverts, rumble strips, sign boards, speed restriction, etc. have been proposed to enable their free and safe movement.
• Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at the		x	There is one perennial waterway being crossed by the project roads. Non perennial Rivers are Luni and Mithri River Jojri, Golasmi, Guniamata and Bastua (Jodhpur) small parts of Shekhawati River Basin(Churu) Sabi and Ruparail, Chuhar Sidh and

construction site?			Landoha. (Alwar & Bharatpur), Mahi and its tributaries Anas, Chap, Haran, Kadgi, and Nal (Banswara). . 2 Major bridges have been proposed under project scope. Most of the minor bridges also have been retained. New minor bridges are proposed either on causeways or culverts with inadequate waterways. All culverts construction will be done during the lean flow period. There is no waterway or water bodies near cut and fill locations.
• Deterioration of surface water quality due to silt runoff and sanitary wastes from the worker-based camps and chemicals used in construction?		**x**	A temporary earthen bund or silt fencing will be provided around the construction site to avoid any sedimentation in nearby streams during rainfall. Adequate sanitary facilities and drainage in the worker's camps will help to avoid this possibility.
• Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	**x**		Air pollution level is likely to be increased for a short duration during the construction period. Appropriate distance from settlement area and wind direction may be taken into account to locate air polluting facility like stone crushing unit etc. use of environment- friendly equipment/machinery will help to reduce air pollution.
• Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation. Also due to COVID-19?	**x**		Workers may be exposed to dust and noise during construction activities. However, the exposure levels are likely to be short. Workers will be provided requisite PPEs to minimize such exposure and associated harmful occupational health effects. Traffic on roads is expected to be low and as such, no occupational health hazard is anticipated during the operation phase. SOPs of COSHP will be strictly implemented.
• Noise and vibration due to blasting and other civil works?	**x**		Blasting is not involved. The ambient noise level is expected to increase in the range of 70=80 DB (a) due to various construction activities, maintenance workshops, and earthmoving equipment. Although this level of noise exceeds national standards, their occurrence will be intermittent and co-terminus with the project construction. All stationary noise-making equipment will be installed with acoustic enclosures. Timings of noise construction activities will be regulated near sensitive receptors. Multi-layered plantation proposed. Quarry material will be procured from existing licensed quarries. Opening and operation of the new quarry, if needed will follow consent conditions of the Pollution Control Board and clearance from the State Environmental Impact Assessment Authority (SEIAA).
• Dislocation or involuntary • resettlement of people		**x**	Minimal since improvement work will mostly be accommodated within available ROW Except for a few bypasses.
• Dislocation and compulsory resettlement of people living in the right-of-way?		**x**	ROW encroachment in the project state is very uncommon.
• Disproportionate impacts on the		**x**	The extent of impact being assessed. Pls, refer

poor, women and children, indigenous peoples, or other vulnerable groups?			to RP an IPDP.
• Other social concerns relating to • inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress including those due to COCVID-19?	x		Deterioration in ambient air quality will be localized and temporarily during construction activity. Regular water sprinkling to reduce the dust emission up to negligible standard. Noise barriers at sensitive receptors and community places will be provided to avoid any stress. Extensive plantations along the highway and improved road conditions will improve the air quality of the area. SOPs of COSHP will be implemented**.**
• Hazardous driving conditions where construction interferes with pre-existing roads?	x		A suitable traffic management plan will be designed and implemented by the contractor to prevent any hazardous driving conditions in the above situations.
• Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable?	x		Proper provisions for sanitation, health care, and solid waste disposal facilities are included in the contract documents.
• diseases from workers to local populations?		x	
• Creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?		x	No such risk is anticipated. Borrow areas are mostly from upland and digging is minimal hence ponding of water is not envisaged.
• Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	x		All road improvement, except for limited by-passes to minimize resettlement, will be undertaken along existing roads currently being used.
• Increased noise and air pollution resulting from traffic volume?	x		An increase in noise and air pollution is expected during the construction phase from unpaved road travel, materials handling, earthmoving, and fumes from heavy equipment and processing plants. During operation, the increase in fumes from motor vehicles may increase.
• Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?		x	This is expected from accidental spillage. Adequate safety provisions have been proposed to avoid such situations.
• Social conflicts if workers from other regions or countries are hired?		x	Most of the workers will be from local areas and hence such conflict is not anticipated.
• Large population influx during project construction and operation that causes an increased burden on social infrastructure and services (such as water supply and sanitation systems)?		x	Workers will be mostly from local villages. Workers from remote places will be provided with the adequate facility.
• Risks to community health and safety, i.e. COVID-19 due to the transport, storage, use, and/or disposal of materials such as explosives, fuel, and other chemicals during construction and operation?	x		Road construction involves handling hazardous substances like fuel, lubricants, explosives, and bitumen which poses risk during transport and storage. SOPs of COSHP will be implemented.
• Community safety risks due to both accidental and natural causes including COVID-19, especially where the structural elements or	x		Adequate measures have been adopted to mitigate such risks. Adequate awareness will be created amongst

components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation, and decommissioning.			people and workers through information disclosure, safety signage and public consultation about safety aspects. SOPs of COSHP will be implemented

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: Rajasthan State Highway Improvement Program
Sector: Transport
Subsector: Road
Division/Department: SATC/SARD

Screening Questions		Score	Remarks[37]
Location and Design of the project	Is sitting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?	1	The project areas have a history of drought but this has very little impact on the road upgrading. The study area does not have a flood problem. However, none of the 7 project districts lie in flood-prone regions.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed, etc)?	0	All cross-drainage structures have been designed for 50 yr return period. Major bridges were designed to a 100 yr return period flood on the designed structure. Embankment heights are proposed for raising for grade improvement and locations where overtopping was reported either due to local drainage problems or ponding due to overflow periods of rivers.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind, and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	Rajasthan is the largest state in India with two-thirds of its area as Thar desert. The Thar desert experiences low and erratic rainfall, high air and soil temperature, intense solar radiation, and high wind velocity. Based on the global climate model ensemble, the change in monthly future average high temperature from 2046-2065 at A2 scenario during peak summer months of April to June ranges from 2.4^{o}C to 3.8^{o}C from the historical monthly average of about 39^{o}C. Based on surveys, rutting of asphalt increase rapidly when the air temperature is higher than 38°C, and serious rutting of pavement will happen in several days if the air temperature is continually higher than 40°C. The project design coincidentally addresses the risk of accelerated rutting as maintenance contract requires asphalt overlay every 10 years which is far less than the period of climate prediction.
	Would weather, current, and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	1	The warmest predicted average monthly temperature of about 39^{o}C may increase the frequency of road repair due to rutting. However, this is minimal as this temperature is only breached during the month of April. Further, the 10-year asphalt overlay maintenance requirement to EPC Contractors ensures continued good road quality.
Performance	Would weather/climate	0	The predicted increase in temperature is at

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

of project outputs	conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design lifetime?		levels that may cause rutting but not at a scale that can jeopardize achieving the project objective of providing safe and efficient transport.

Options for answers and corresponding scores are provided below:

Response	Score
Not Likely	**0**
Likely	**1**
Very Likely	**2**

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

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

Other Comments:

Prepared by, Shakti Prakash, Environmental Specialist, PMC.

Appendix B: Baseline Air Quality Status in Project Areas)

Sl. No.	Name of Location	Particulate Matter ($PM_{2.5}$)	Particulate Matter (PM_{10})	Nitrogen Oxide (As NO_2)	Sulfur Dioxide (As SO_2)	Carbon monoxide (as CO)
	Unit	**µg/m3**				
Dantiwara-Pipar-Merta City Road						
1	0+13Km Near IOCL Vill. Indwar	48.12	90.53	25.47	10.65	0.62
2	0+38 Km Near Village Beetan	42.55	88.62	23.46	9.87	0.60
3	0+44Km Near Hotel Karni Place	40.58	90.36	23.8	9.9	0.63
4	0+60 Km Near Vill Naman	44.6	91.7	25.6	10.6	0.62
5	0+75 Km Near Village Bankaliya	39.45	87.21	22.55	10.48	0.61
6	0+91 Km Near Village Dantiwara	45.61	86.95	24.56	10.67	0.66
Churu-Taranagar-Nohar Road (Nohar To Taranagar)						
1	0 to 12 Km ESSAR Petrol Pump	49.20	92.48	26.16	9.08	0.63
2	0 to 23 Km Village Meghana	40.20	90.62	23.36	8.74	0.67
3	0 to 34 Km Near Sri Shiv Gorakha Bhojanalya	38.29	86.48	22.06	9.92	0.60
4	0 to 46 Village Dhriwas Bada	36.12	86.29	24.48	8.26	0.62
5	0 to 60 Nr. Baaichara Hotel	32.24	83.48	20.27	9.10	0.60
6	0 to 71 Km HP Petrol Pump	41.26	94.20	28.49	9.92	0.66
Churu-Taranagar-Nohar Road (Churau To Taranagar)						
1	0+9.5 Km Near Achanak Family Restaurant	46.30	89.50	23.20	8.12	0.59
2	0+15 Km Nr. Temple	36.40	87.20	21.50	7.68	0.56
3	0+23 Near ESSAR Petrol Pump	37.32	81.10	20.54	9.42	0.63
4	0+34 Khatiya Dhani	34.20	81.71	22.63	7.94	0.60
5	0+41 Nr Raghav Hotal	28.98	79.23	18.96	8.75	0.62
6	0+46 Nr. Taranagar	35.31	78.90	20.61	7.44	0.56
Kherli nadbai Kumher Road						
1	0+7 Km	51.26	94.80	27.72	10.16	0.64
2	0+15 Km Nr. IOCL Petrol Pump	44.16	94.28	26.19	9.16	0.62
3	0+19 Km Nr. ESSAR Petrol Pump	42.06	91.28	24.06	10.14	0.64
4	0+25Km Nr. ESSAR Petrol Pump	38.31	92.28	26.16	9.42	0.67
5	0+32 Km Nr. Baboraa Passion	36.28	85.62	22.44	10.16	0.62
6	0+39 Km Nr. Village Kumher	47.92	96.16	29.14	10.92	0.68
Paloda-Garhi-Anandpuri Rajya Seema Tak						
1	0+9 Km	44.24	90.16	25.48	10.93	0.61
2	0+18 Km	48.29	93.42	27.56	10.14	0.64
3	0+23 Km	51.06	96.48	29.34	11.57	0.66
4	0+34 Km	52.16	89.22	23.14	9.97	0.69
5	0+43 Km	39.18	90.26	26.07	11.34	0.65
6	0+51 Km	49.20	94.08	26.44	11.20	0.66

Appendix C: Noise Level in Project Area

Location Code	Location (Chain age)	Category	Leq (Day)	Leq (Night)
Dantiwara Pipar Merta City (SH-21)				
1	0+13 Km Nr. IOCL Vill Indawar	Commercial	62.54	48.78
2	0+38Km Near Village Beetan	Commercial	58.64	42.78
3	0+44 Km Near Hotal Karni Plance	Commercial	62.36	51.74
4	0+60 Km Near Village Nanan	Commercial	57.64	43.68
5	0+75 KM Near Village Bankaliya	Commercial	56.47	41.87
6	0+90Km Near Village Dantiwara	Commercial	62.65	52.97
Churu Taranagar Nohar (SH-36) (Nohar to Taranagar				
1	0 to 12 Km ESSAR Petrol Pump	Commercial	59.16	43.48
2	0 to 23 Km Village Meghana	Commercial	54.16	41.92
3	0 to 34 Km Near Sri Shiv Gorakha Bhojanalya	Commercial	61.26	51.48
4	0 to 46 Village Dhriwas Bada	Commercial	58.29	42.76
5	0 to 60 Nr. Baaichara Hotel	Commercial	63.49	43.56
6	0 to 71 Km HP Petrol Pump	Commercial	63.14	49.32
Churu Taranagar Nohar (SH-36) Churau To Taranagar				
1	0+9.5 Km Near Achanak Family Restaurant	Commercial	54.18	43.57
2	0+15 Km Nr. Temple	Commercial	49.02	38.62
3	0+23 Near ESSAR Petrol Pump	Commercial	63.28	52.75
4	0+34 Khatiya Dhani	Commercial	59.37	43.25
5	0+41 Nr Raghav Hotal	Commercial	61.28	43.58
6	0+46 Nr. Taranagar	Commercial	53.78	42.67
Khelri Nabai Kumher SH 44				
1	0+7 Km	Commercial	61.28	44.37
2	0+15 Km Nr. IOCL Petrol Pump	Commercial	63.36	44.29
3	0+19 Km Nr. ESSAR Petrol Pump	Commercial	62.26	48.14
4	0+25Km Nr. ESSAR Petrol Pump	Commercial	63.14	43.56
5	0+32 Km Nr. Baboraa Passion	Commercial	64.42	52.28
6	0+39 Km Nr. Village Kumher	Commercial	62.89	51.48
Paloda-Garhi- Anandpuri Rajya seema Tak				
1	0+9 Km	Commercial	61.56	42.87
2	0+18 Km	Commercial	57.61	41.95
3	0+23 Km	Commercial	62.78	43.67
4	0+34 Km	Commercial	60.28	42.57
5	0+43 Km	Commercial	56.24	41.68
6	0+51 Km	Commercial	63.54	44.61

Appendix D: Water Quality in Project Area

Dantiwara-Pipar-Merta City Road				
S. No	Parameters	unit	Result	
			0+26 Km Near Kanji Hotel	0+60 Km Near Bhaichara Hotel
1	Ph value @25^{0}C	-	7.98	7.82
2	Colour	Hazen	BDL(DL 1 Hazen)	BDL(DL 1 Hazen)
3	Turbidity	NTU	BDL (DL 1 NTU)	BDL (DL 1 NTU)
4	Odour	-	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable
6	Total Hardness as $CaCO_3$	mg/l	81.48	116.4
7	Calcium (as Ca)	mg/l	24.88	34.21
8	Alkalinity as $CaCO_3$	mg/l	77.76	97.2
9	Chloride (as Cl)	mg/l	41.46	51.1
10	Magnesium(as Mg)	mg/l	4.68	7.5
11	Total Dissolved solids	mg/l	120	150
12	Sulphate (as SO_4)	mg/l	10.35	7.13
13	Flouride (as F)	mg/l	BDL(DL 0.20 mg/l)	BDL(DL 0.20 mg/l)
14	Nitrate as NO_3	mg/l	5.4	3.91
15	Iron (as Fe)	mg/l	0.09	0.1
16	Zinc as Zn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
17	Copper as Cu	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
18	Manganese as Mn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
19	Cadmium as Cd	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
20	Lead as Pb	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
21	Total Coliform	MPN/10 0ml	Absent	Absent
22	E coli	Per 100 ml	Absent	Absent

Churu-Taranagar-Nohar Road				
S.No	Parameters	unit	Result	
			0+26 Km Near Kanji Hotel	0+60 Km Near Bhaichara Hotel
1	Ph value @25^{0}C	-	7.92	7.78
2	Colour	Hazen	BDL(DL 1 Hazen)	BDL(DL 1 Hazen)
3	Turbidity	NTU	BDL (DL 1 NTU)	BDL (DL 1 NTU)
4	Odour	-	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable
6	Total Hardness as $CaCO_3$	mg/l	1402.62	121.09
7	Calcium (as Ca)	mg/l	608.05	39.43
8	Alkalinity as $CaCO_3$	mg/l	1421.28	100.28
9	Chloride (as Cl)	mg/l	813.82	60.66
10	Magnesium(as Mg)	mg/l	321.47	5.47
11	Total Dissolved solids	mg/l	3390	380
12	Sulphate (as SO_4)	mg/l	384.69	10.74
13	Flouride (as F)	mg/l	BDL(DL 0.20 mg/l)	BDL(DL 0.20 mg/l)
14	Nitrate as NO_3	mg/l	366.75	4.05
15	Iron (as Fe)	mg/l	0.24	0.06
16	Zinc as Zn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
17	Copper as Cu	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
18	Manganese as Mn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
19	Cadmium as Cd	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
20	Lead as Pb	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
21	Total Coliform	MPN/10 0ml	Absent	Absent
22	E coli	Per 100 ml	Absent	Absent

Churu-Taranagar-Nohar Road

S.No	Parameters	unit	Result	
			0+15 Km Near Temple	0+41 Km Near Ragav Hotel
1	Ph value @25^{0}C	-	7.23	7.65
2	Colour	Hazen	BDL(DL 1 Hazen)	BDL(DL 1 Hazen)
3	Turbidity	NTU	BDL (DL 1 NTU)	BDL (DL 1 NTU)
4	Odour	-	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable
6	Total Hardness as $CaCO_3$	mg/l	2340.35	108.64
7	Calcium (as Ca)	mg/l	842.12	31.88
8	Alkalinity as $CaCO_3$	mg/l	1823	90.72
9	Chloride (as Cl)	mg/l	1824.34	46.28
10	Magnesium(as Mg)	mg/l	254.32	7.03
11	Total Dissolved solids	mg/l	5790	220
12	Sulphate (as SO_4)	mg/l	720.36	6.05
13	Flouride (as F)	mg/l	BDL(DL 0.20 mg/l)	BDL(DL 0.20 mg/l)
14	Nitrate as NO_3	mg/l	223.61	2.85
15	Iron (as Fe)	mg/l	0.26	0.1
16	Zinc as Zn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
17	Copper as Cu	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
18	Manganese as Mn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
19	Cadmium as Cd	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
20	Lead as Pb	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
21	Total Coliform	MPN/10 0ml	Absent	Absent
22	E coli	Per 100 ml	Absent	Absent

Khelri-Nabai-Kumher Road				
S.No	Parameters	unit	Result	
			0+32 Km Nr. Saboraa Passion	0+15 Km Near IOCL Petriol Pump
1	Ph value @250C	-	7.86	7.82
2	Colour	Hazen	BDL(DL 1 Hazen)	BDL(DL 1 Hazen)
3	Turbidity	NTU	BDL (DL 1 NTU)	BDL (DL 1 NTU)
4	Odour	-	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable
6	Total Hardness as CaCO3	mg/l	995.22	232.72
7	Calcium (as Ca)	mg/l	360.01	78.11
8	Alkalinity as $CaCO_3$	mg/l	909.36	106.82
9	Chloride (as Cl)	mg/l	520.69	68.49
10	Magnesium(as Mg)	mg/l	23.13	9.1
11	Total Dissolved solids	mg/l	2740	785
12	Sulphate (as SO_4)	mg/l	190.19	27.69
13	Flouride (as F)	mg/l	BDL(DL 0.20 mg/l)	BDL(DL 0.20 mg/l)
14	Nitrate as NO_3	mg/l	260.8	4.05
15	Iron (as Fe)	mg/l	0.26	0.21
16	Zinc as Zn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
17	Copper as Cu	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
18	Manganese as Mn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
19	Cadmium as Cd	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
20	Lead as Pb	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
21	Total Coliform	MPN/10 0ml	Absent	Absent
22	E coli	Per 100 ml	Absent	Absent

Paloda-Garhi-Anandpuri Road				
S.No	**Parameters**	**unit**	**Result**	
			Garhi Village @23	**Indian Oil Pump @43**
1	Ph value @250C	-	7.84	7.58
2	Colour	Hazen	BDL(DL 1 Hazen)	BDL(DL 1 Hazen)
3	Turbidity	NTU	BDL (DL 1 NTU)	BDL (DL 1 NTU)
4	Odour	-	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable
6	Total Hardness as CaCO3	mg/l	985.52	249.74
7	Calcium (as Ca)	mg/l	348.34	84.17
8	Alkalinity as $CaCO_3$	mg/l	892.08	119.9
9	Chloride (as Cl)	mg/l	610.36	74.36
10	Magnesium(as Mg)	mg/l	20.78	9.55
11	Total Dissolved solids	mg/l	2840	820
12	Sulphate (as SO_4)	mg/l	196.67	26.99
13	Flouride (as F)	mg/l	0.82	0.24
14	Nitrate as NO_3	mg/l	252.65	12.66
15	Iron (as Fe)	mg/l	0.27	0.08
16	Zinc as Zn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
17	Copper as Cu	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
18	Manganese as Mn	mg/l	BDL(DL 0.01 mg/l)	BDL(DL 0.01 mg/l)
19	Cadmium as Cd	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
20	Lead as Pb	mg/l	BDL(DL 0.002 mg/l)	BDL(DL 0.002 mg/l)
21	Total Coliform	MPN/10 0ml	Absent	Absent
22	E coli	Per 100 ml	Absent	Absent

APPENDIX-E: Soil Quality in Project Areas

Dantiwara-Pipar-Merta City Road				
S.No	Parameters	Unit	Location	
			0+28Km Near Village Beetan	0+75 Km Near Village Bankaliya
1	Ph value @25^{0}C	-	7.84	7.87
2	Electrical Conductivity	mS/cm	0.326	0.334
3	Colour	-	Brownish	Brownish
4	Water Holding Capacity	%	38.9	39.12
5	Bulk Density	gm/CC	1.32	1.43
6	Cloride	mg/Kg	151.46	118.64
7	Calcium (as Ca)	mg/Kg	246.87	236.59
8	Sodium (as Na)	mg/Kg	142.66	110.47
9	Potessium (as K)	Kg/Hec.	118.74	136.75
10	Organic Matter	%	0.54	0.58
11	Magnesium (as Mg)	mg/Kg	36.82	8467
12	available Nirogen (as N)	Kg/Hec.	292.59	268.12
13	Total Zink (as Zn)	mg/Kg	28.47	36.47
14	Total Manganese (as Mn)	mg/Kg	27.46	71.53
15	Total Chromium (as Cr)	mg/Kg	15.31	18.54
16	Total Lead (as Pb)	mg/Kg	1.84	3.21
17	Total Cadmium (as Cd)	mg/Kg	14.23	10.87
18	Total Copper (as Cu)	mg/Kg	16.28	16.98
19	Soil Texture	-	Sandy loam	Sandy Loam
Churu-Taranagar -Nohar Road				
S.No	Parameters	Unit	Location	
			0+26Km Near Kansi Hotel	0+60 Km Near Bhaichara Hotel
1	Ph value @25^{0}C	-	7.84	7.92
2	Electrical Conductivity	mS/cm	0.302	0.324
3	Colour	-	Brownish	Brownish
4	Water Holding Capacity	%	38.9	38.22
5	Bulk Density	gm/CC	1.38	1.42
6	Cloride	mg/Kg	143.16	114.75
7	Calcium (as Ca)	mg/Kg	264.35	236.59
8	Sodium (as Na)	mg/Kg	151.51	102.48
9	Potessium (as K)	Kg/Hec.	121.27	126.22
10	Organic Matter	%	0.57	0.59
11	Magnesium (as Mg)	mg/Kg	38.26	82.45
12	available Nirogen (as N)	Kg/Hec.	292.31	271.62
13	Total Zink (as Zn)	mg/Kg	32.84	36.54
14	Total Manganese (as Mn)	mg/Kg	28.22	68.22
15	Total Chromium (as Cr)	mg/Kg	12.64	14.89
16	Total Lead (as Pb)	mg/Kg	1.98	2.57
17	Total Cadmium (as Cd)	mg/Kg	14.57	9.25
18	Total Copper (as Cu)	mg/Kg	13.62	15.64
19	Soil Texture	-	Sandy loam	Sandy Loam

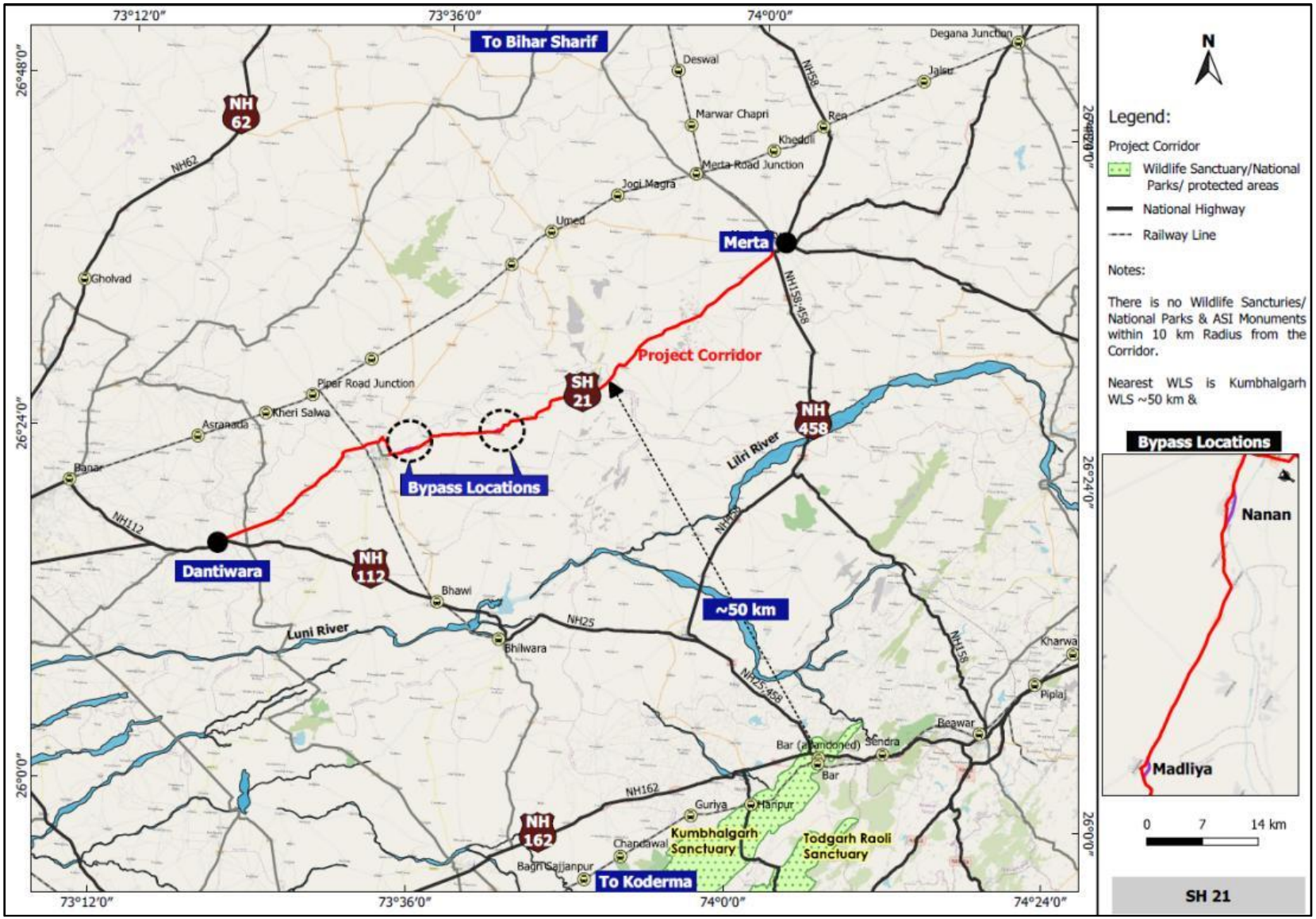
Churu-Taranagar- Nohar Road				
S.No	Parameters	Unit	Location	
			0+15 Km Near Temple	0+14 Km Near Raghav Hotel
1	Ph value @25^{0}C	-	7.75	7.98
2	Electrical Conductivity	mS/cm	0.298	0.346
3	Colour	-	Brownish	Brownish
4	Water Holding Capacity	%	38.5	36.5
5	Bulk Density	gm/CC	1.36	1.4
6	Cloride	mg/Kg	140.31	110.61
7	Calcium (as Ca)	mg/Kg	260.27	232.48
8	Sodium (as Na)	mg/Kg	146.5	96.9
9	Potessium (as K)	Kg/Hec.	128.33	124.14
10	Organic Matter	%	0.59	0.6
11	Magnesium (as Mg)	mg/Kg	36.42	74.35
12	available Nirogen (as N)	Kg/Hec.	297.23	264.24
13	Total Zink (as Zn)	mg/Kg	34.41	34.62
14	Total Manganese (as Mn)	mg/Kg	32.16	63.27
15	Total Chromium (as Cr)	mg/Kg	14.31	14.22
16	Total Lead (as Pb)	mg/Kg	2	2.34
17	Total Cadmium (as Cd)	mg/Kg	16.11	8.61
18	Total Copper (as Cu)	mg/Kg	16.98	13.63
19	Soil Texture	-	Sandy loam	Sandy Loam

Khelri-Nabai-Kumher Road				
S.No	Parameters	Unit	Location	
			0+32Km Near Sabora Passion	0+15 Km Near Nr. IOCL Petrol Pump
1	Ph value @250C	-	7.92	7.86
2	Electrical Conductivity	mS/cm	0.314	0.328
3	Colour	-	Brownish	Brownish
4	Water Holding Capacity	%	37.6	38.45
5	Bulk Density	gm/CC	1.34	1.4
6	Cloride	mg/Kg	146.37	112.61
7	Calcium (as Ca)	mg/Kg	261.85	232.84
8	Sodium (as Na)	mg/Kg	146.21	104.68
9	Potessium (as K)	Kg/Hec.	123.55	128.46
10	Organic Matter	%	0.55	0.68
11	Magnesium (as Mg)	mg/Kg	34.62	81.62
12	available Nirogen (as N)	Kg/Hec.	298.51	270.57
13	Total Zink (as Zn)	mg/Kg	31.47	35.69
14	Total Manganese (as Mn)	mg/Kg	26.89	67.38
15	Total Chromium (as Cr)	mg/Kg	14.55	16.24
16	Total Lead (as Pb)	mg/Kg	1.85	2.97
17	Total Cadmium (as Cd)	mg/Kg	13.56	10.37
18	Total Copper (as Cu)	mg/Kg	12.84	16.5
19	Soil Texture	-	Sandy loam	Sandy Loam

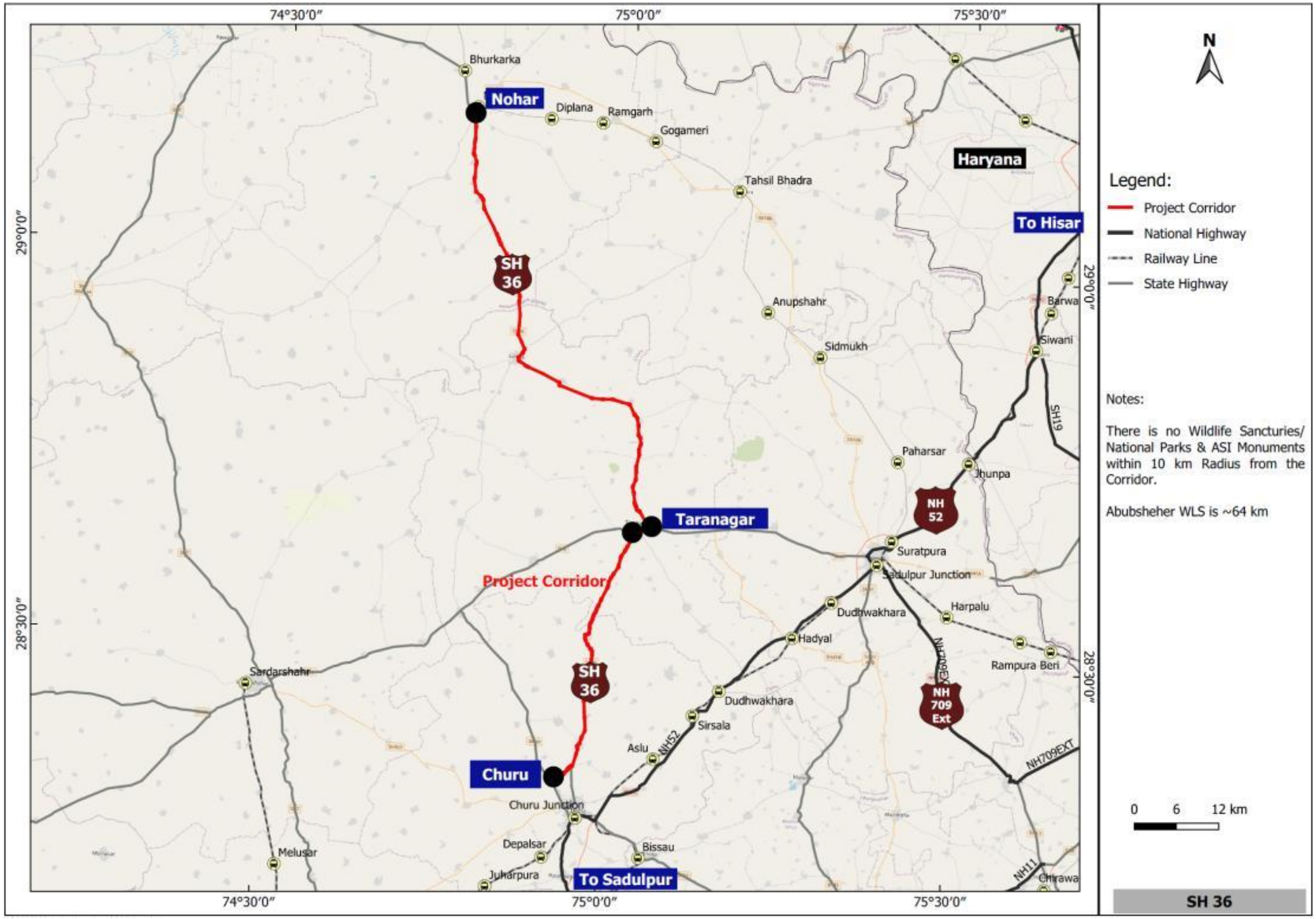
Paloda-Garhi-Anandpuri (Rajya seema Tak)				
S.No	Parameters	Unit	Location	
			Garhi Village @ 23	Indian Oil Pump @43
1	Ph value @250C	-	7.86	7.72
2	Electrical Conductivity	mS/cm	0.318	0.322
3	Colour	-	Brownish	Brownish
4	Water Holding Capacity	%	38.2	36.14
5	Bulk Density	gm/CC	1.36	1.38
6	Cloride	mg/Kg	142.29	108.19
7	Calcium (as Ca)	mg/Kg	248.14	316.61
8	Sodium (as Na)	mg/Kg	142.18	98.27
9	Potessium (as K)	Kg/Hec.	118.36	122.18
10	Organic Matter	%	0.56	0.59
11	Magnesium (as Mg)	mg/Kg	36.22	78.38
12	available Nirogen (as N)	Kg/Hec.	286.08	259.22
13	Total Zink (as Zn)	mg/Kg	27.56	32.56
14	Total Manganese (as Mn)	mg/Kg	25.19	64.12
15	Total Chromium (as Cr)	mg/Kg	13.28	15.28
16	Total Lead (as Pb)	mg/Kg	1.82	2.56
17	Total Cadmium (as Cd)	mg/Kg	12.29	9.27
18	Total Copper (as Cu)	mg/Kg	11.16	18.18
19	Soil Texture	-	Sandy loam	Sandy Loam

Appendix F: Road Maps

SH 21



SH 36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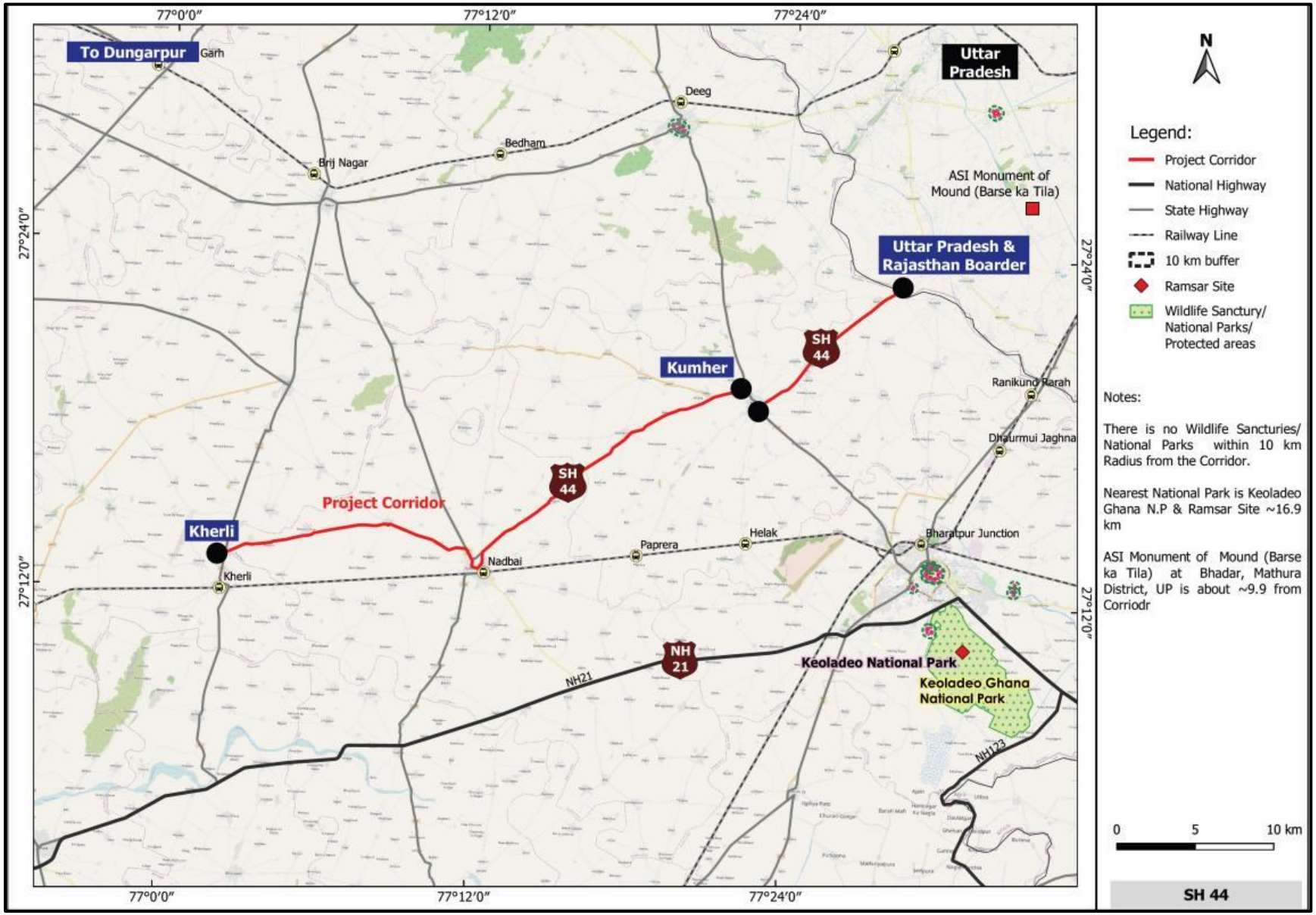
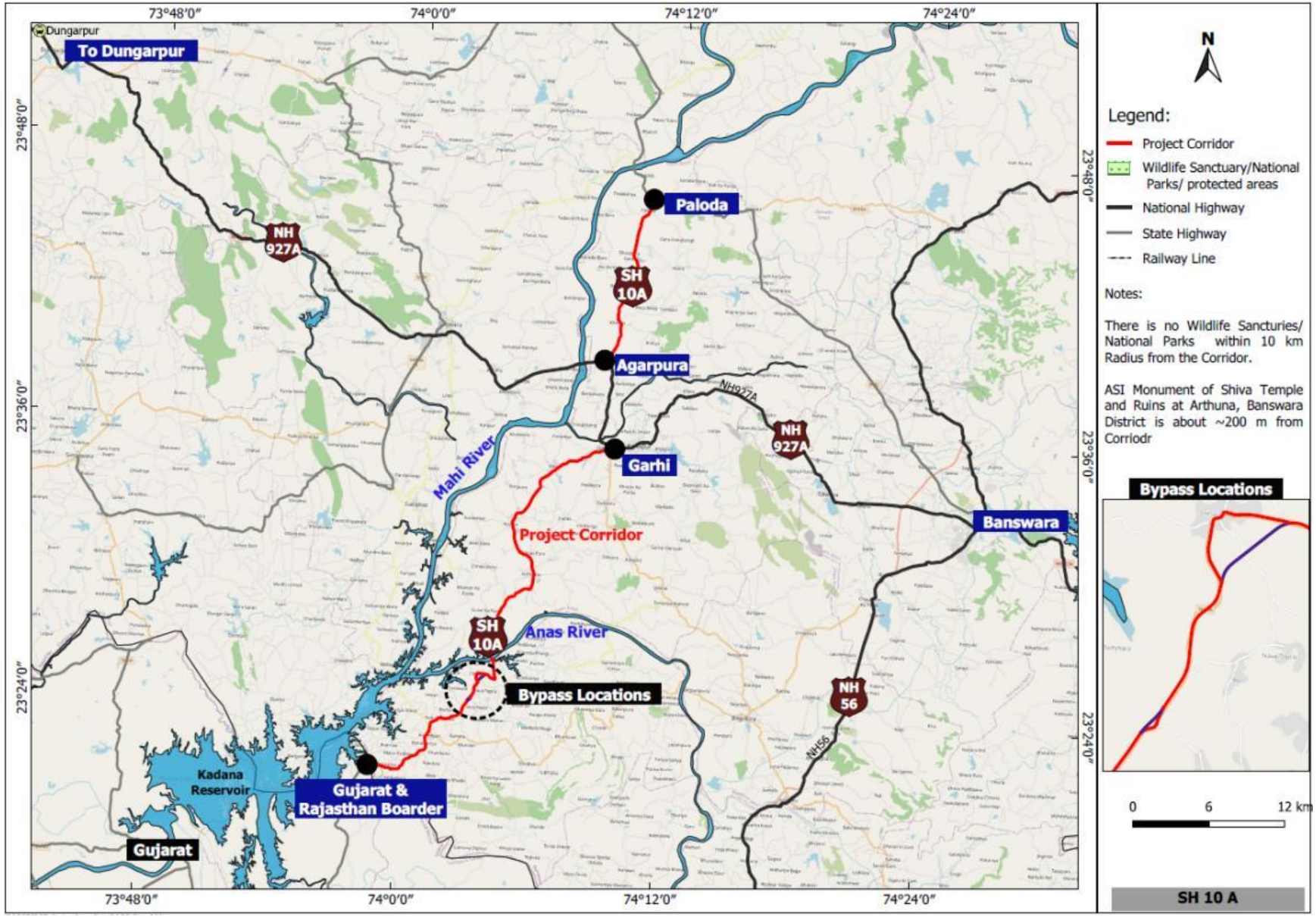
75°0'0"
75°30'0"
29°0'0"
28°30'0"
Bhurkarka
Nohar
Diplana
Ramgarh
Gogameri
Tahsil Bhadra
Haryana
To Hisar
SH 36
Anupshahr
Sidmukh
Barwa
Siwani
SH19
Paharsar
Jhunpa
NH 52
Taranagar
Suratpura
Sadulpur Junction
Project Corridor
Dudhwakhara
Harpalu
Hadyal
Rampura Beri
NH709EXT
NH 709 Ext
Sardarshahr
SH 36
Dudhwakhara
Sirsala
Aslu
NH52
Churu
Churu Junction
Depalsar
Bissau
Melusar
Juharpura
To Sadulpur
Chirawa
NH11
N
Legend:
Project Corridor
National Highway
Railway Line
State Highway
Notes:
There is no Wildlife Sancturies/ National Parks & ASI Monuments within 10 km Radius from the Corridor.
Abubsheher WLS is ~64 km
0 6 12 km
SH 36

SH 44



SH 10A


73°48'0"
74°0'0"
74°12'0"
74°24'0"
23°48'0"
23°36'0"
23°24'0"
Dungarpur
To Dungarpur
NH 927A
Paloda
SH 10A
Agarpura
NH927A
NH 927A
Mahi River
Garhi
Banswara
Project Corridor
SH 10A
Anas River
Bypass Locations
NH 56
NH56
Kadana Reservoir
Gujarat & Rajasthan Boarder
Gujarat
N
Legend:
Project Corridor
Wildlife Sanctuary/National Parks/ protected areas
National Highway
State Highway
Railway Line
Notes:
There is no Wildlife Sancturies/ National Parks within 10 km Radius from the Corridor.
ASI Monument of Shiva Temple and Ruins at Arthuna, Banswara District is about ~200 m from Corriodr
Bypass Locations
0
6
12 km
SH 10 A

Appendix G: Each Road Specific EMP and EMoP

ENVIRONMENT MANAGEMENT PLAN FOR DANTIWARA-MERTA CITY ROAD

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
A. Design and Pre-construction Stage								
1. Alignment/ Pavement/ Drainage								
1.1. Alignment Design	Proposed design adopted in accordance with the provisions of the following IRC and BIS Codes/ MoRTH guidelines/ AASHTO specifications. Geometrical design standards will mostly follow. **2-Lane Plus Carriageway:** • Carriageway Width = 7.0m, • Paved Shoulder Width = 2 x 1.5m, • Earthen/ Granular/ Paver block Shoulder Width= 2 x 2.0m or varying width shoulder. • Side Drain = 2 x 1.5m footpath drain • Roadway Width = 14.0m (Minimum) • Roadway Length = 68.130 km **4-Lane Divided Carriageway:**	Section 2 of the Manual of Specifications and Standards for Two Lanning of Highways with Paved Shoulder (IRC: SP:73-2018)	Widening of whole project road from km 0/000 to 86/700 (Length 86.700 km) shall follow the existing alignment unless geometric deficiencies with horizontal and vertical profiles which shall be corrected within available RoW as per prescribed standards. Raising and reconstruction of embankment at location where road top level is equal to less than HFL or Bypass/ Realignment sections. Bypasses=2 Nos. (Sections from km 29.600 to 31.400 and km 41.950 to km 42.950) Realignments = 5 sections (km 15.860 to km 16.270, km 43.300 to km 43.800, km 53.450 to km 54.300, km 55.150 to km 55.850 & km 69.025 to km 69.255)	MI: Recording of near miss, incident, accident, safety parameters etc w.r.t to designed alignment. PT: Design in compliance to prescribed Standards. MI: Design Parameter's compliance to prescribed Standards. PT: Designs are in accordance with site requirements	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• Carriageway Width = 7.5m each with 1.5m Median. • Paved Shoulder Width = 2 x 1.5m, • Paver Block Shoulder Width = 2 x 2.0m or varying width shoulder. • Side Drain = 2 x 1.5m footpath drain • Roadway Width = 30.0m (Approx.) • Roadway Length = 18.570 km							
1.2. Pavement Design	• Bottom of crust shall be at least 600mm above HFL to prevent any capillary action due to black cotton/ expansive/ cohesive soil. • Flexible Pavement Thickness is proposed for almost entire length with minimum design period of 20 years. • CBR value of sub grade as per IRC guidelines. • 40mm BC with PMB-70 has been considered as surface course and 60mm DBM with VG-30 has	Section 5 of the Manual of Specifications and Standards and IRC:37 & IRC:58.	Flexible pavement is proposed for a minimum design period of 20 years for the carriageway and paved shoulders of entire project stretch, except Toll Plaza Sections where Rigid Pavement shall be provided for a design period of 30 years.	MI: Monitoring of wearing and damaging of pavement condition. PT: Design Parameter's compliance to prescribed Standards.	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	been considered for Base/ binder course. • Also, Rigid Pavement thickness for small section for a design period of 30 years with PQC-M40 Grade of 300m, Dry Lean Concrete of 150mm and Granular Sub Base of 250mm.							
1.3. Drainage provisions	• Raised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also inconvenience caused to nearby community. • Provision of adequate nos. of cross drainage structures. • Increased (vent and height) in waterway of existing structures. • Roadside drains have been proposed with suitable outfalls. • Additional culverts and bridges • Causeway and submerged bridges to be replaced with high level bridges • Roadside longitudinal drains to avoid water logging in built-up-	Provision of lined drain as per IRC: SP:42-2014 & IRC: SP:50-2013. IRC SP: 42-2014 and IRC SP: 50-2013. MORTH Specifications for Road and Bridge Works 5th Revision 2013	**<u>Cross-Drainages</u>** **Culverts** Reconstruction (9 nos. slab culverts to Box culverts, 6 nos. HPC to HPC/Box culverts) and 41 nos. of additional new HPC/ Box culverts. **Bridges** Reconstruction of 6 existing minor bridges at km 25.605, km 25.856, km 26.520, km 45.831, km 47.042 and km 47.603. 1 no. each New major bridge and new minor bridge at km 27.124 and km 30.954 respectively. Longitudinal drains (B/S together) Footpath cum covered drains in built-up sections = 41.66 km (B/S).	MI: Monitoring of the function of cross drainage, longitudinal drainages and climate adaptation during exigencies. PT: Standard Design and required numbers of cross and side drains, slab/ box culverts, and Hume pipes	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	sections and rural sections proposed with suitable outfalls. • Prevention of waterlogging and overtopping due to intensive rainfall.		RWH at every 2km in a staggered manner on LHS and EHS in the entire project length.					
1.4. Safety along the proposed alignment	• Vertical and horizontal geometrics in consistent to adequate numbers of road signs and pavement markings IRC/MORTH guidelines. • Provision of crash barriers at high embankments. • Speed breakers in habitat areas, schools, junction and curves to regulate speed. • Provision retro-reflective warning signboards, LED traffic beacons near school, hospital, religious places and forests • Safety kerb at all bridges • Informatory traffic signage/ Road markings on approach to built-up sections on	Design requirement IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC: 79, IRC: 99 IRC 119, and Section 800 of MoRTH Specifications	Curve locations Speed Breakers and signages, LED traffic beacons, Pedestrian facilities near built-up areas and toll plaza and near school, hospitals and other sensitive areas. Road Studs, Road signs, markings, object Markers etc shall be finalized in consultation with Authority's Engineer. Metal beam crash barriers provided at embankment above 3m, at sharp curve and along retaining wall locations and on approaches to structures, bridges, and culverts in consultation with Authority Engineer. Roadside & Median Safety barriers shall be provided finalized in consultation with Authority's Engineer.	MI: Monitoring of the functioning/ performance of proposed safety measures, w.r.t proposed numbers, location and site-specific needs and maintenance. PT: Required numbers and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	Ambulance and medical aid posts • Checking for overloading at toll plazas. • Speed restrictions in built up sections curve locations etc. • Roadside Safety Barriers near culverts, bridges. • Pedestrian Guard Rails / Footpath Facilities at Schools. • Other road safety furniture comprising road signs, road markings, object markers, hazard marker, studs, delineators, attenuators, safety barriers, pedestrian guard rails, boundary stones, kilometre stone etc.		Toll Plaza = 2 Nos. at km 10.200 (Buchkallan) and at km 66.400 (Near Beetan)					
2. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. and paved surfaces	• Flexible Pavement Thickness is proposed for almost entire length with minimum design period of 20 years. • CBR value of sub grade as per IRC guidelines. • 40mm BC with PMB-70 has been	IRC:37 & IRC:58 for flexible pavement design.	Entire stretch	MI: Monitoring pavement surface quality interms of roughness, cracking, rutting, softening etc. PI:No softening, rutting, asphalt	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design cost of F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	considered as surface course and 60mm DBM with VG-30 has been considered for Base/ binder course.			migration/ thermal expansion of joint				
2.2 Flooding/ Water-Logging	• Adequate number of CD structures. Additional culverts also proposed. • CD structures designed for 50year return period. • Water ways of bridges and culverts have been increased. • Roadside drains also provided • Embankment height raised along low lying/ potential water-logged areas. • Improvement in existing culverts through increase in vent size or retrofitting's. • Longitudinal Drains designed so that runoff resulting from storms to a specified frequency of occurrence can be drained off immediately without overflowing or not being impounded in lower level of the	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	Reconstruction (9 nos. slab culverts to Box culverts, 6 nos. HPC to HPC/ Box culverts) and 41 nos. of additional new HPC/ Box culverts. Reconstruction of 6 existing minor bridges at km 25.605, km 25.856, km 26.520, km 45.831, km 47.042 and km 47.603. 1 no. each New major bridge and new minor bridge at km 27.124 and km 30.954 respectively. Footpath cum covered drains in built-up sections = 41.66 km (B/S). RWH at every 500m in the entire project length.	MI: Monitoring overtopping/ flooding w.r.t design, functioning and numbers in accordance with site needs. PT: Standard Design and required numbers of cross & side drains, slab/ box culverts Hume pipes, road embankment height, design and number of bridges. Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	Project Area and market areas.							
2.3 Earthquake	• Relevant IS codes shall be 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: Integrity of proposed structures like bridges, culverts and others. PT: Design conforms BIS and IRC guidelines.	Review of design documents and drawings and comparison with site conditions	F/S consultant, Detailed design cost to be borne by concessionaire	Design Consultant	PMC/RPWD-PIU-PPP
2.4 Drought	• Ensure water availability for compaction work and consolidation of sub-structure	IRC:78-2000 Standard Specifications and Code of Practice for Road Bridges	Entire Stretch	MI: Monitoring GW levels, public consultations with local communities. PT: Water availability and scarcity in the region and d/s of waterways.	Design and drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	Design Consultant	PMC/RPWD-PIU-PPP
2.5 Forest Fires	• Measures to avoid accident followed by fuel spills. • Removal of maintenance slash or management by controlled burning. • Plant fire-resistant species in RoW • Thinning slashing during non-dry season.	Design requirement	There is no forest along proposed road.	MI: Monitoring of likely damage to roadside flora and spillage/ fuel accumulation induced accident. PT: Zero incidence of forest fires.		Covered under F/S consultant cost	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• No construction camp within 500m of Notified Forest Areas.							
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. • Minimize resettlement impact due to heavily congested built-up section • Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. • Complete all necessary land and property acquisition procedures prior to the commencement of civil work. • Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. • Compensation and assistance as per project Resettlement Plan • Income restoration as per 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.	Refer SIA/ RAP for more details.	MI: Monitoring payment of compensation and assistance to DPs as per RP. PT: Minimal number of complaints/ grievances. No case referred to arbitrator/ court. Payment in compliance of compensation entitlement matrix of RPs.	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	RPWD and implementing NGO	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• Preference in employment and petty contracts during construction to APs • Constitute GRC as per RP							
4. Diversion of Forest Land and Cutting of Trees								
4.1 Need for cutting of trees and diversion of forest land	• Geometric adjustments to minimize tree cutting and diversion of forest land • Obtain tree cutting permission from forest department • Provision for mandatory compensatory afforestation (1:3) for deposit of payment to Forestry Department • Provision for additional compensatory plantation on 1:3 bases to be implemented by concessionaire	Forest Conservation Act, 1980	Forest Diversion = Nil Total number of affected trees= 1, 075 Nos. Mandatory compensatory plantation in 1:3 ratio = 3, 225 saplings Overall, Contractor shall plant at least 8, 000 saplings as compensatory afforestation.	MI: Monitoring number and location of geometric adjustments made to avoid forestland and tree cutting, budget amount allocated for compensatory afforestation and additional plantation. PT: Avoiding or bare minimum tree felling on Govt. land/ forest/ private land.	Review final design. Check budget provision for compensatory afforestation Onsite validations of plantations carried out.	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	RPWD, Design cousulant	PMC/RPWD-PIU
5. Shifting of Utilities								
5.1. Disruption of utility services to local community	• All telephone and electrical poles/wires and underground cables should be shifted before start of construction • Necessary permission and payments should	Project requirement	Throughout the corridor	MI: Monitoring number of complaints from local people, number, timing and type of notifications	Interaction with concerned utility authorities and local public	Included under RPWD's costs	EPC Contractor/ RPWD/utility company	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	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			issued to local people, time taken to shift utilities PT: Nos. of complaints should be bare minimum or. Minimal time for utility shifting.				
B. Construction Stage								
1. Preparatory activities								
1.1 Preparatory activities	• Submit appointment letter and resume of the EPC Contractor's Environmental Focal Person (EFP) to PMU • EFP will engage PMC Environment Specialist and PMU Safeguard Officer-Environment to a meeting to discuss in detail the EMP, seek clarification and recommend corresponding revisions if necessary • EFP will prepare implementation schedule of the approved EMP, EMoP, and agreements reached during the meeting	Project requirement	Project Office, EPC Contractor's construction camp	MI: Check the Contract document, EMP and construction Method for proper addressing all environmental management plans. PT: Compliance of EMP during construction activities.Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	with PMC-ES and PMU-SOE • EFP will consult Environmental Safeguard Implementation Manual and will apply monthly monitoring formats (Checklists) and establish deadlines for submission in consultations with ES (PMC) and ES (AE). • EFP will submit for PMC-ES approval an action plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g., fuel, lubricants, explosives), iii) waste disposal sites, iv) temporary storage location, iv) water use, and v) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation,							

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	and prevention of communicable diseases will also be included in the action plan. • EFP will submit for approval of PMC-ES the construction camp layout before its establishment.							
1.2 Site induction	• No works will be initiated by the EPC contractor until the site induction training is carried out by the PMC • Site induction training includes but not limited to: i) discussion and review of EMP and EMoP detailing how specific environmental risks associated with their Scope of Work will be managed legal compliance, inspection and audits, and progress tracking and reporting; ii) environmental training and awareness needs shall be determined and documented via a training needs analysis prior to commencement; iii) Health and Safety Awareness Course,	Project requirement	Conference/ Meeting Room in construction camp of EPC Contractor or any other suitable place, adequately big enough in areal size for observed required social distancing, where Audio-visual facilities for delivering training programmes, can be installed.	MI: Check Training modules, participants list and number of trainings PT: Participants adhere the Compliance of EMP during construction activities.	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	which details general environmental awareness and specific performance requirements expected on site; and iv) GRM and v) compliances to implementation of Community Occupational Safety & Health Plan (COSHP) for prevention and control of spread of COVID-19..							
1.3 Poor siting and layout of workers camp and other infrastructure facilities	• The location, layout and basic facility provision of each labour camp and others will be submitted to (Supervision Consultant) and Project Implementing Unit (PIU) prior to their construction. • Ensure solid waste and liquid management plan subject to the review and approval of the Supervision Consultant • Camps sitting to maintain minimum distance from following: # 500m from habitations # 500m from water bodies	Project requirement. General Condition of the Bid Document	All contractors and sub-contractors	MI: Review the design Check compliance with design sitting. PT: Confirms Camps site not disturbs the nearby habitation and main road traffic. Not to pollute receiving waterbodies.	Observations on the site location	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	# 500m from main traffic routes • Land agreement with land owner for establishment of construction/ labour camps • Submit CTE/ CTO from PCB for establishment of camps, crushers, HMP, WMM, batching plants etc.							
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	• Concessionaire to submit location and layout plan for storage areas of construction materials agreed by PD-PPP-PIU-RPWD and TL (AE). • 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- Sunsequent Amendments and Central Motor and Vehicle Act 1988 General Conditions of Bid Document,	Throughout project corridor as required during construction activities, Human Habitation during commencement of construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City.	MI: NAAQS Limits, Complaints from locals due to dust. PT: Compliances to NAAAQS Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by EPC contractor	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
2.2 Emission of air pollutants (HC, SO_2, NO_X, CO etc) from vehicles due to traffic congestion and use of equipment and machinery	• Regular maintenance of machinery and equipment. • Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. • Only crushers licensed by the PCB shall be used. • DG sets with stacks of adequate height and use of low Sulphur diesel as fuel. • LPG should be used as fuel source in construction camps instead of wood • Ambient air quality monitoring. • Contractor to prepare traffic management and dust suppression plan duly approved by PD-PIU-PPP-RPWD after review by TL (AE). • Periodic pollution checking of all vehicles and obtaining of Pollution Under Control Certificates (PUCs) and their renewal at required periods of time.	The Air (Prevention and Control of Pollution) Act, 1981 and applicable subsequent Amendments.	Asphalt mixing plants, crushers, DG set's locations, Human Habitation during construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City.	MI: Levels of HC, SO_2, NO_2, and CO. Status of PUC certificates PT: Compliances to NAAQS. PUC certificates of equipment and machinery's is up to date.	Standards CPCB methods Review of monitoring data maintained by EPC contractor	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
3. Noise and Vibration								
3.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	• All equipment to be timely serviced and properly maintained. • Construction equipment and machinery to be fitted with silencers and maintained properly. • Only IS approved equipment shall be used for construction activities. • Timing of noisy construction activities shall be done during night time and weekend near schools, • Implement noisy operations intermittently to reduce the total noise generated • Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. • Restrict construction near residential, built up and forest areas construction to day light hours. • Conduct condition surveys of all properties within 25	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 DIN 4150 and BS 7385.	Throughout project section especially at construction sites and residential and sensitive locations as near schools viz; km 8.040 (LHS), km 8.199 (LHS), km 8.689 (RHS), km 13.550 (LHS), km 13.700 (RHS), km 14.201 (RHS), km 17.152 (RHS), km 20.000 (LHS), km 29.200 (LHS), km 41.894 (RHS), km 47.399 (RHS), km 50.900 (RHS), km 51.800 (RHS), km 55.096 (LHS), km 62.300 (RHS), km & 84.399 (LHS). Human Habitation during construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City.	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 UNI 9916 "Criteria for measuring and assessing the effects of vibration on buildings" DIN 4150 BS 7385 Consultation with local people Review of noise level monitoring data maintained by contractor Observation of construction site	Included in civil works costs	EPC Contractor	AE/PMC/RP WD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	meters from road edge • Vibration monitoring during heavy machinery/ equipment operation • Honking restrictions near sensitive areas. • PPEs to workers • Noise monitoring as per EMoP.							
4. Land and Soil								
4.1 Land use Change and Loss of productive / topsoil	• Non-agricultural areas to be used as borrow areas to the extent possible. • If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. • Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original land use	Project requirement, applicable ADB and IRC Guidelines	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area, Compliances with applicable ADB and IRC Guidelines. PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits	Included in civil works cost	EPC Contractor	AE/PMC/RP WD-PIU-PPP
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and	• Bio-turfing of embankments to protect slopes. • Slope protection by providing • frames, dry stone pitching, masonry retaining walls,	IRC: 56 - 1974 recommended practice for treatment of embankment slopes	Throughout the entire project road for example retaining walls/ toe walls are proposed for 1.1 km at 3 ponds sections from km 40.850 to km 41.050 (RHS), km 42.900 to km 43.250 (B/S) and km 52.710 to km 52.910 (RHS).	MI: Occurrence of slope failure or erosion issues. PT: No slope failures.	Review of design documents and site observation	Included in civil works cost	EPC Contractor	AE/PMC/RP WD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
fill, stockpiles etc.	planting of grass and trees. • Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. • The earth stockpiles to be provided with gentle slopes to soil erosion.	for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Slope protection events has been proposed with stone pitching at various near bridge approach locations.	Minimal erosion issues				
4.3 Borrow area management	• Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/consents. • Depths of borrow pits to be regulated and sides not steeper than 25%. • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Transportation of earth materials through covered vehicles. • Follow IRC recommended	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause 305.2.2 MORTH Specifications for Road and Bridgeworks, Applicable	Borrow Area sites	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Numtestesber of accidents. Complaints from local people. PT: No case of non-compliance with applicable ADB and IRC Guidelines.	Review of design documents and site observations	Included in civil works cost	EPC Contractor	AE/PMC/RP WD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation • Borrow areas not to be dug continuously. • To the extent borrow areas shall be sited away from habitat areas. • Borrow areas shall be levelled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fish pond. • EPC Contractor to submit copies of STPs/ Land Owners Consent Letters.	ADB and IRC Guidelines for Borrow Areas management		Zero accidents. Zero complaints No use of black cotton soil				
4.4 Quarry Operations	• Aggregates will be sourced from existing licensed quarries. • Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to RPWD. • The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and	Clause No.111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental	New Quarry if needed and existing Quarries	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	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	submit a copy of the approval to EA. • Obtain environmental clearance from SEIAA /DEIAA in case of opening new quarry.	Protection Rules		consent conditions and air quality meets the prescribed limit				
4.5 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 demolished/ compacted land and undemolished land.	Site observation	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
4.6 Contamination of soil due to leakage/ spillage of	• Construction vehicles and equipment will be maintained and	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	MI: Quality of soil near storage area	Site observation	Included in civil work cost.	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
oil, bituminous and non-bituminous debris generated from demolition and road construction	refuelled in such a fashion that oil/diesel spillage does not contaminate the soil. • Fuel storage and refuelling 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 refuelling areas. • Waste oil and oil-soaked cotton/ cloth shall be stored in containers labelled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors • Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. • Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board.		2 Nos. of Oil interceptors are proposed at the proposed two Truck-lay-by locations at km 20.450 and km 58.100.	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.				

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
5. Water Resources								
5.1 Sourcing of water during Construction	• Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. • Arrangements shall be made by EPC contractor that the water availability and supply to nearby communities remain unaffected. • Water intensive activities not to be undertaken during summer season. • Provision of water harvesting structure to augment recharging of groundwater conditions (aquifers) in the project area. • Permissions from Local Irrigation Department, in case using canal water. • Agreement letters with local level water suppliers.	CGWA Guidelines	Throughout the Project section All water harvesting structures and at toll plazas.	MI: Approval from competent authority Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people.	Checking of documentation. Talk to local people	Included in civil work cost	EPC Contractor	AE/PMC/RP WD-PIU-PPP
5.2 Disposal of water during construction	• Provisions shall be made to connect road side drains with existing nearby natural drains.	Clause No.1010 EP Act, 1986 MORT&H Specificatio	Throughout the Project section.	MI: Condition of drainage system in construction site. Presence /absence of	Standards methods Site observation and review of	Included in civil work cost	EPC Contractor	AE/PMC/RP WD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
		ns for Road and Bridgeworks		water logging in project area. PT: Existence of proper drainage system. No water logging in project area	documents			
5.3 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 esp. in the areas where land is sloping towards road alignment. • Road level shall be raised above HFL level wherever road level is lesser than HFL. • Culverts reconstruction shall not be done during lean flow period. In some cases, these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction.	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc near waterways at km 27.124, km 30.954, km 25.605, km 25.856, km 26.520, km 45.831, km 47.042, km 47.603 and ponds at section from km 40.850 to km 41.050 (RHS), km 42.900 to km 43.250 (B/S) and km 52.710 to km 52.910 (RHS).	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 observations	Included in civil works cost	EPC Contractor	AE/PMC/RP WD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
5.4 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, Clause No 501.8.6. MORT&H Specifications for Road and Bridgeworks Worldwide best practices	Near all waterbodies/ waterway at km 27.124, km 30.954, km 25.605, km 25.856, km 26.520, km 45.831, km 47.042, km 47.603 and ponds at km 40.850, km 42.900, km 52.710.	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	EPC Contractor	AE/PMC/RP WD-PIU-PPP
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment	• No vehicles or equipment should be parked or refuelled near water-bodies, so as to avoid contamination from fuel and lubricants. • Oil and grease traps and fuelling platforms	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof. / as well as IS-	All water bodies like rivers, waterways at km 27.124, km 30.954, km 25.605, km 25.856, km 26.520, km 45.831, km 47.042, km 47.603 and ponds at section from km 40.850 to km 41.050 (RHS), km 42.900 to km 43.250 (B/S) and km 52.710 to km 52.910 (RHS), refuelling stations,	MI: Water quality of ponds, streams, rivers and other water bodies in project. Presence of oil floating in water bodies in project area	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	EPC Contractor	AE/PMC/RP WD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
and waste from construction camps.	to be provided at refuelling locations. • All chemicals and oil shall be stored away from water and concreted platform with catchment pit for spills collection. • All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors. • Construction camp to be sited away from water bodies. • Wastes must be collected, stored and taken to approve disposal site only. • Water quality shall be monitored.	10500:2012	construction camps, proposed Truck-lay-bye locations at km 20.450 and km 58.100.	PT: Surface water quality meets freshwater quality standards prescribed by CPCB.				
6. Flora and Fauna								
6.1 Vegetation loss due to site	• Restrict tree cutting up to toe line considering safety to road users.	Forest Conservation Act 1980 +	Throughout project corridor. Estimated No. of affected tree = 1, 075 Nos.	MI: ROW width. Number of trees for felling.	Review of relevant documents of tree	Mandatory Compensatory afforestation	Mandatory Compensatory plantation	AE/PMC/RP WD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
preparation and construction activities	• Roadside trees to be removed with prior approval of competent authority. • Mandatory compensatory plantation at 1:3 basis by Forestry Department • Additional plantation on 1:3 basis as per the IRC guidelines to be carried out by concessionaire • Regular maintenance trees planted. • Provision of LPG in construction camp as fuel source to avoid tree cutting. • Plantation of trees on both sides of the road where technically feasible. Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and provide adequate sight distance. • Integrate vegetation management (IVM) with the carriage way completely clear of vegetation. • Controlled use of pesticides/ fertilize	IRC: SP:21 and IRC: SP:66	Mandatory compensatory plantation in 1:3 ratio = 3, 225 saplings Overall, Contractor shall plant at least 8, 000 saplings as compensatory afforestation.	Compensatory plantation plan. Number of trees replanted. PT: Compensatory afforestation done on a 1:3 basis by concessionaire.	cutting permit, compensatory plantation plan. and additional plantation strategy. Field observations	cost is included in project costs under RPWD. Additional compensatory afforestation, if required, costs included in civil works costs	by forest Department and additional plantation by EPC Contractor	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
7. Construction Camps								
7.1 Impact associated with location	• All camps should be established with prior permission from PCB. Camps to maintain minimum distance from following: • #500m from habitation • #500m from forest areas where possible • #500 m from water bodies where possible • #500m from through traffic route • #500m from identified wildlife crossing areas	Design Requirement As identified in IEE, all applicable laws, rules and regulations including Contract Labour laws as well as, EHS policy and rules.	Construction camp	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	EPC Contractor	AE/PMC/RPWD-PIU-PPP
7.2 Worker's Health in construction camp	• The location, layout and basic facility provision of each labour camp will be submitted to AE and approved by PD-PIU-PPP-RPWD. The EPC contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. • Adequate water and sanitary latrines with septic tanks with soak pits shall be provided.	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and	All construction camps.	MI: Camp health records, Compliance to SOPs of COSHP for COVID-19 Protection. Existence of proper first aid kit in camp site. Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• Preventive medical facilities in camp • Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste. • The EPC 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. • Compliance to SOPs of COSHP for COVID-19 Protection.	amendments thereof		cases of STD. Clean and tidy camp site conditions. Compliance to SOPs of COSHP for COVID-19 Protection.				
8. Management of Construction Waste/Debris								

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
8.1 Selection of Dumping Sites	• Contractor to submit a waste/spoil disposal plan and get it approved by AE and PD-PIU-PPP-RPWD. • 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 quantity 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, Construction and Demolition Waste Management Rules-2016 and subsequent Amendments.	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.	EPC Contractor.	AE/PMC/RPWD-PIU-PPP
8.2 Reuse and disposal of construction and	• The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps,	Design Requirement, MORT&H guidelines and General	Throughout the project corridor	MI: Percentage of reuse of existing surface material	Contractor records Field observation	Included in civil works cost.	EPC Contractor.	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
dismantled waste	temporary traffic diversions, and haulage routes. • All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. • Unusable and non-bituminous debris materials should be suitably disposed of 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.	Conditions of Contract Document Construction and Demolition Waste Management Rules 2016 and subsequent Amendments.		Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or AE.	Interaction with local people			
9. Traffic Management and Safety								

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
9.1 Management of existing traffic and safety	• Traffic Management Plan shall be submitted by the contractor and approved by the AE • The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. • The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. • On stretches where it is not possible to pass the traffic on the part width of existing carriageway,	Design requirement and IRC: SP: 27 -1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC: SP: 32 -1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC: SP:55-2014 The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948 + Section 6 of Employer's Requireme	Throughout the project corridor especially at built-up areas, major/ minor intersections and accident-prone areas at sharp curves and sensitive areas like school, hospitals and religious places.	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 Checklists based monitoring Interaction with people in vehicles using the road	Included in civil works cost.	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	temporary paved diversions will be constructed. • Restriction of construction activity to only one side of the existing road • The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "AE". • Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	nt of Bid Document						
9.2 Pedestrians, 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 animal movement is expected. • Large number of box culverts has been proposed. All	Same as above	Near habitation on both sides of schools, temples, 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.	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	structures having vertical clearance above 2m and not catering to perennial flow of water may serve as underpass for animals.							
9.3 Safety of Workers and accident risk from construction activities	• Contractorsto adopt and maintain safe working practices. • Usage of fluorescent and retro refectory signage, in local language at the construction sites • Training to workers on safety procedures and precautions. • Mandatory appointment of safety officer. • All regulations regarding safe scaffolding, ladders, working platforms, gangway, stair wells, excavations, trenches and safe means of entry and egress shall be complied with. • Provision of PPEs to workers. • Provision of a readily available first aid unit including an adequate supply of dressing materials.	Same as above	Construction sites	MI: Availability of Safety gears to workers. Safety signage Training records on safety. Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	Site observation Review records on safety training and accidents Interact with construction workers	Included in civil works cost	Obligation of EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• The contractor will not employ any person below the age of 18 years • Use of hazardous material should be minimized and/or restricted. • Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. • Accident Prevention Officer must be appointed by the contractor.							
9.4 Accident risk to local community	• Restrict access to construction sites only to authorized personnel. • Physical separation must be provided for movement of vehicular and human traffic. • Adequate signage must be provided for safe traffic movement Provision of temporary diversions and awareness to locals before opening new construction front	Same as above	Construction sites Sidewalks and pedestrian zones near constricted market areas and semi urban areas, habitations, haulage roads, diversion sites, sensitive receptors like schools, hospitals, temples etc.	MI: Safety signs and their location. Incidents of accidents. Complaints from local people. PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
10. Site restoration and rehabilitation								

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
1.1 Clean-up Operations, Restoration and Rehabilitation	• Contractor will prepare site restoration plans, which will be approved by the AE. • The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. • All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental Specialist (PMC), Environmental Specialist (AE) and Environmental Focal Person (EPC Contractor). • All the opened borrow areas will be rehabilitated and 'AE' will certify to satisfaction.	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	MI: Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. PT: Clean and tidy sites. No trash or debris left on site. Site restored and levelled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites is found satisfactory	Included in civil works cost.	EPC Contractor	AE/PMC/RP WD-PIU-PPP
C. Operation and Maintenance stage								
1. Air Quality								

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
1.1 Air pollution due to due to vehicular movement	• Roadside tree plantations shall be maintained at least with 70% survival rate. • 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 them 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. Obtaining of Pollution Under Control Certificates (PUCs) and their renewal on periodic basis.	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981, Motor Vehicles Act 1948 and subsequent Amendments .	Throughout the Corridor. Human Habitation during commencement of construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City. Sensitive Receptors along the alignment near schools viz; km 8.040 (LHS), km 8.199 (LHS), km 8.689 (RHS), km 13.550 (LHS), km 13.700 (RHS), km 14.201 (RHS), km 17.152 (RHS), km 20.000 (LHS), km 29.200 (LHS), km 41.894 (RHS), km 47.399 (RHS), km 50.900 (RHS), km 51.800 (RHS), km 55.096 (LHS), km 62.300 (RHS), km & 84.399 (LHS).	MI: Ambient air quality (PM_{10}, CO, SO_2, NO_2) PT: Levels are equal to or below baseline levels given in the IEE report.	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
2. Noise								
2.1 Noise due to movement of traffic	• Effective traffic management and good riding conditions shall be maintained • Speed limitation to 20 km/hour and honking restrictions near sensitive receptors • Monitoring of Performance of Noise Barriers constructed and New Construction of any further required noise barriers near sensitive receptors with consent of local community • 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	Residential and sensitive locations near schools viz; km 8.040 (LHS), km 8.199 (LHS), km 8.689 (RHS), km 13.550 (LHS), km 13.700 (RHS), km 14.201 (RHS), km 17.152 (RHS), km 20.000 (LHS), km 29.200 (LHS), km 41.894 (RHS), km 47.399 (RHS), km 50.900 (RHS), km 51.800 (RHS), km 55.096 (LHS), km 62.300 (RHS), km & 84.399 (LHS). Human Habitation during commencement of construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City.	MI: Noise levels PT: Levels are equal to or below baseline levels given in the IEE report.	Noise monitoring as per noise rules, 2000 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/RPWD-PIU-PPP
3. Land and Soil								
3.1 Soil erosion at embankmen	• Periodic checking to be carried to assess the effectiveness of the stabilization	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites	On site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
t during heavy rainfall.	measures viz. turfing, stone pitching, river training structures etc. • Necessary measures to be followed wherever there are failures			Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion.			Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
4. Water resources/ Flooding and Inundation								
4.1. Siltation	• Regular checks shall be made for soil erosion conditions for its effective maintenance.	Project requirement	Near surface water bodies like river, waterways at km 27.124, km 30.954, km 25.605, km 25.856, km 26.520, km 45.831, km 47.042, km 47.603 and ponds at section from km 40.850 to km 41.050 (RHS), km 42.900 to km 43.250 (B/S) and km 52.710 to km 52.910 (RHS).	MI: Water quality. PT: No turbidity of surface water bodies due to the road.	Site observations	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/RPWD-PIU-PPP
4.2 Water logging due to blockage of drains, culverts or streams	• Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams. • Monitoring of water borne diseases due to stagnant water bodies	Project requirement	Near surface water bodies/ cross drains/ side drains locations.	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging.	Site observations	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/RPWD-PIU-PPP
5. Flora								

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
5.1 Vegetation	• Planted trees, shrubs, and grasses to be properly maintained. • The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of 70% tree survival.	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/RPWD-PIU-PPP
6. Maintenance of Right of Way and Safety								
6.1 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 road side • No invasive plantation near the road sides	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	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/RPWD-PIU-PPP
6.2 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.	IRC: SP:55-2014 and IRC: SP:88-2010	Throughout the Project route especially at accident prone areas at major 4-arm junctions' locations viz; km 9.340, km 13.525, km 17.100, km 26.030 (Near school), km 62.160, km 67.050, km 78.140 and km 86.480 etc.	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road. Presence/ absence of	Review accident records Site observations	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/R	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• Monitor/ensure that all safety provisions included in design and construction phase are properly maintained • Highway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. • Tow-way facility for the breakdown vehicles if possible. • Road Safety Audit should be conducted on regular basis			sensitive receptor structures inside the stipulated planning line as per relevant local law PT: Fatal and non-fatal accident rate is reduced after improvement.			PWD-PIU-PPP	
6.3 Transport of Dangerous Goods	• Existence of spill prevention and control and emergency responsive system • Emergency plan for vehicles carrying hazardous material	OHS Standards/ Material Safety Data Sheet (MSDS)	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	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/R PWD-PIU-PPP	

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
D. Design and Pre-construction Stage								
1. Alignment/ Pavement/ Drainage								
1.1. Alignment Design	Proposed design adopted in accordance with the provisions of the following IRC and BIS Codes/ MoRTH guidelines/ AASHTO specifications. Geometrical design standards will mostly follow. **2-Lane Plus Carriageway:** • Carriageway Width = 7.0m, • Paved Shoulder Width = 2 x 1.5m, • Earthen/ Granular/ Paver block Shoulder Width= 2 x 2.0m or varying width shoulder. • Side Drain = 2 x 1.5m footpath drain • Roadway Width = 14.0m (Minimum) • Roadway Length = 68.130 km **4-Lane Divided Carriageway:**	Section 2 of the Manual of Specifications and Standards for Two Lanning of Highways with Paved Shoulder (IRC: SP:73-2018)	Widening of whole project road from km 0/000 to 86/700 (Length 86.700 km) shall follow the existing alignment unless geometric deficiencies with horizontal and vertical profiles which shall be corrected within available RoW as per prescribed standards. Raising and reconstruction of embankment at location where road top level is equal to less than HFL or Bypass/ Realignment sections. Bypasses=2 Nos. (Sections from km 29.600 to 31.400 and km 41.950 to km 42.950) Realignments = 5 sections (km 15.860 to km 16.270, km 43.300 to km 43.800, km 53.450 to km 54.300, km 55.150 to km 55.850 & km 69.025 to km 69.255)	MI: Recording of near miss, incident, accident, safety parameters etc w.r.t to designed alignment. PT: Design in compliance to prescribed Standards. MI: Design Parameter's compliance to prescribed Standards. PT: Designs are in accordance with site requirements	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• Carriageway Width = 7.5m each with 1.5m Median. • Paved Shoulder Width = 2 x 1.5m, • Paver Block Shoulder Width = 2 x 2.0m or varying width shoulder. • Side Drain = 2 x 1.5m footpath drain • Roadway Width = 30.0m (Approx.) • Roadway Length = 18.570 km							
1.2. Pavement Design	• Bottom of crust shall be at least 600mm above HFL to prevent any capillary action due to black cotton/ expansive/ cohesive soil. • Flexible Pavement Thickness is proposed for almost entire length with minimum design period of 20 years. • CBR value of sub grade as per IRC guidelines. • 40mm BC with PMB-70 has been considered as surface course and 60mm DBM with VG-30 has been considered for Base/ binder course. • Also, Rigid Pavement thickness for small section for a design	Section 5 of the Manual of Specifications and Standards and IRC:37 & IRC:58.	Flexible pavement is proposed for a minimum design period of 20 years for the carriageway and paved shoulders of entire project stretch, except Toll Plaza Sections where Rigid Pavement shall be provided for a design period of 30 years.	MI: Monitoring of wearing and damaging of pavement condition. PT: Design Parameter's compliance to prescribed Standards.	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	period of 30 years with PQC-M40 Grade of 300m, Dry Lean Concrete of 150mm and Granular Sub Base of 250mm.							
1.3. Drainage provisions	• Raised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also inconvenience caused to nearby community. • Provision of adequate nos. of cross drainage structures. • Increased (vent and height) in waterway of existing structures. • Roadside drains have been proposed with suitable outfalls. • Additional culverts and bridges • Causeway and submerged bridges to be replaced with high level bridges • Roadside longitudinal drains to avoid water logging in built-up-sections and rural sections proposed with suitable outfalls. • Prevention of waterlogging and	Provision of lined drain as per IRC: SP:42-2014 & IRC: SP:50-2013. IRC SP: 42-2014 and IRC SP: 50-2013. MORTH Specifications for Road and Bridge Works 5th Revision 2013	**<u>Cross-Drainages</u>** **Culverts** Reconstruction (9 nos. slab culverts to Box culverts, 6 nos. HPC to HPC/Box culverts) and 41 nos. of additional new HPC/ Box culverts. **Bridges** Reconstruction of 6 existing minor bridges at km 25.605, km 25.856, km 26.520, km 45.831, km 47.042 and km 47.603. 1 no. each New major bridge and new minor bridge at km 27.124 and km 30.954 respectively. Longitudinal drains (B/S together) Footpath cum covered drains in built-up sections = 41.66 km (B/S). RWH at every 2km in a staggered manner on LHS and EHS in the entire project length.	MI: Monitoring of the function of cross drainage, longitudinal drainages and climate adaptation during exigencies. PT: Standard Design and required numbers of cross and side drains, slab/ box culverts, and Hume pipes	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	overtopping due to intensive rainfall.							
1.4. Safety along the proposed alignment	• Vertical and horizontal geometrics in consistent to adequate numbers of road signs and pavement markings IRC/MORTH guidelines. • Provision of crash barriers at high embankments. • Speed breakers in habitat areas, schools, junction and curves to regulate speed. • Provision retro-reflective warning signboards, LED traffic beacons near school, hospital, religious places and forests • Safety kerb at all bridges • Informatory traffic signage/ Road markings on approach to built-up sections on	Design requirement IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC: 79, IRC: 99 IRC 119, and Section 800 of MoRTH Specifications	Curve locations Speed Breakers and signages, LED traffic beacons, Pedestrian facilities near built-up areas and toll plaza and near school, hospitals and other sensitive areas. Road Studs, Road signs, markings, object Markers etc shall be finalized in consultation with Authority's Engineer. Metal beam crash barriers provided at embankment above 3m, at sharp curve and along retaining wall locations and on approaches to structures, bridges, and culverts in consultation with Authority Engineer. Roadside & Median Safety barriers shall be provided finalized in consultation with Authority's Engineer. Toll Plaza = 2 Nos. at km 10.200 (Buchkallan) and at km 66.400 (Near Beetan)	MI: Monitoring of the functioning/ performance of proposed safety measures, w.r.t proposed numbers, location and site-specific needs and maintenance. PT: Required numbers and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	Ambulance and medical aid posts • Checking for overloading at toll plazas. • Speed restrictions in built up sections curve locations etc. • Roadside Safety Barriers near culverts, bridges. • Pedestrian Guard Rails / Footpath Facilities at Schools. • Other road safety furniture comprising road signs, road markings, object markers, hazard marker, studs, delineators, attenuators, safety barriers, pedestrian guard rails, boundary stones, kilometre stone etc.							
2. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. and paved surfaces	• Flexible Pavement Thickness is proposed for almost entire length with minimum design period of 20 years. • CBR value of sub grade as per IRC guidelines. • 40mm BC with PMB-70 has been considered as surface course and 60mm DBM with VG-30	IRC:37 & IRC:58 for flexible pavement design.	Entire stretch	MI: Monitoring pavement surface quality interms of roughness, cracking, rutting, softening etc.	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design cost of F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	has been considered for Base/ binder course.			PI:No softening, rutting, asphalt migration/ thermal expansion of joint				
2.2 Flooding/ Water-Logging	• Adequate number of CD structures. Additional culverts also proposed. • CD structures designed for 50year return period. • Water ways of bridges and culverts have been increased. • Roadside drains also provided • Embankment height raised along low lying/ potential water-logged areas. • Improvement in existing culverts through increase in vent size or retrofitting's. • Longitudinal Drains designed so that runoff resulting from storms to a specified frequency of occurrence can be drained off immediately without overflowing or not being impounded in lower level of the	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	Reconstruction (9 nos. slab culverts to Box culverts, 6 nos. HPC to HPC/ Box culverts) and 41 nos. of additional new HPC/ Box culverts. Reconstruction of 6 existing minor bridges at km 25.605, km 25.856, km 26.520, km 45.831, km 47.042 and km 47.603. 1 no. each New major bridge and new minor bridge at km 27.124 and km 30.954 respectively. Footpath cum covered drains in built-up sections = 41.66 km (B/S). RWH at every 500m in the entire project length.	MI: Monitoring overtopping/ flooding w.r.t design, functioning and numbers in accordance with site needs. PT: Standard Design and required numbers of cross & side drains, slab/ box culverts Hume pipes, road embankment height, design and number of bridges. Design and numbers are in accordance	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	Project Area and market areas.			with site needs				
2.3 Earthquake	• Relevant IS codes shall be 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: Integrity of proposed structures like bridges, culverts and others. PT: Design conforms BIS and IRC guidelines.	Review of design documents and drawings and comparison with site conditions	F/S consultant, Detailed design cost to be borne by concessionaire	Design Consultant	PMC/RPWD-PIU-PPP
2.4 Drought	• Ensure water availability for compaction work and consolidation of sub-structure	IRC:78-2000 Standard Specifications and Code of Practice for Road Bridges	Entire Stretch	MI: Monitoring GW levels, public consultations with local communities. PT: Water availability and scarcity in the region and d/s of waterways.	Design and drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	Design Consultant	PMC/RPWD-PIU-PPP
2.5 Forest Fires	• Measures to avoid accident followed by fuel spills. • Removal of maintenance slash or management by controlled burning. • Plant fire-resistant species in RoW	Design requirement	There is no forest along proposed road.	MI: Monitoring of likely damage to roadside flora and spillage/ fuel accumulation induced accident.		Covered under F/S consultant cost	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• Thinning slashing during non-dry season. • No construction camp within 500m of Notified Forest Areas.			PT: Zero incidence of forest fires.				
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. • Minimize resettlement impact due to heavily congested built-up section • Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. • Complete all necessary land and property acquisition procedures prior to the commencement of civil work. • Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. • Compensation and assistance as per	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.	Refer SIA/ RAP for more details.	MI: Monitoring payment of compensation and assistance to DPs as per RP. PT: Minimal number of complaints/ grievances. No case referred to arbitrator/ court. Payment in compliance of compensation entitlement matrix of RPs.	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	RPWD and implementing NGO	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	project Resettlement Plan • Income restoration as per RP • Preference in employment and petty contracts during construction to APs • Constitute GRC as per RP							
4. Diversion of Forest Land and Cutting of Trees								
4.1 Need for cutting of trees and diversion of forest land	• Geometric adjustments to minimize tree cutting and diversion of forest land • Obtain tree cutting permission from forest department • Provision for mandatory compensatory afforestation (1:3) for deposit of payment to Forestry Department • Provision for additional compensatory plantation on 1:3 bases to be implemented by concessionaire	Forest Conservation Act, 1980	Forest Diversion = Nil Total number of affected trees= 1, 075 Nos. Mandatory compensatory plantation in 1:3 ratio = 3, 225 saplings Overall, Contractor shall plant at least 8, 000 saplings as compensatory afforestation.	MI: Monitoring number and location of geometric adjustments made to avoid forestland and tree cutting, budget amount allocated for compensatory afforestation and additional plantation. PT: Avoiding or bare minimum tree felling on Govt. land/ forest/ private land.	Review final design. Check budget provision for compensatory afforestation Onsite validations of plantations carried out.	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	RPWD, Design cousulant	PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	• All telephone and electrical poles/wires and underground cables should be shifted before start of construction • Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services • Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any	Project requirement	Throughout the corridor	MI: Monitoring number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities PT: Nos. of complaints should be bare minimum or. Minimal time for utility shifting.	Interaction with concerned utility authorities and local public	Included under RPWD's costs	EPC Contractor/ RPWD/utility company	AE/PMC/ RPWD-PIU-PPP
E. Construction Stage								
1. Preparatory activities								
1.1. Preparatory activities	• Submit appointment letter and resume of the EPC Contractor's Environmental Focal Person (EFP) to PMU • EFP will engage PMC Environment Specialist and PMU Safeguard Officer-Environment to a meeting to discuss in detail the EMP, seek	Project requirement	Project Office, EPC Contractor's construction camp	MI: Check the Contract document, EMP and construction Method for proper addressing all environmental managemen t plans.	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	clarification and recommend corresponding revisions if necessary • EFP will prepare implementation schedule of the approved EMP, EMoP, and agreements reached during the meeting with PMC-ES and PMU-SOE • EFP will consult Environmental Safeguard Implementation Manual and will apply monthly monitoring formats (Checklists) and establish deadlines for submission in consultations with ES (PMC) and ES (AE). • EFP will submit for PMC-ES approval an action plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g., fuel,			PT: Compliance of EMP during construction activities.Approvals, attendance				

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	lubricants, explosives), iii) waste disposal sites, iv) temporary storage location, iv) water use, and v) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan. • EFP will submit for approval of PMC-ES the construction camp layout before its establishment.							
1.2. Site induction	• No works will be initiated by the EPC contractor until the site induction training is carried out by the PMC • Site induction training includes but not limited to: i) discussion and review of EMP and EMoP detailing how specific environmental risks associated with their Scope of Work will be managed legal	Project requirement	Conference/ Meeting Room in construction camp of EPC Contractor or any other suitable place, adequately big enough in areal size for observed required social distancing, where Audio-visual facilities for delivering training programmes, can be installed.	MI: Check Training modules, participants list and number of trainings PT: Participants adhere the Compliance of EMP during construction activities.	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	compliance, inspection and audits, and progress tracking and reporting; ii) environmental training and awareness needs shall be determined and documented via a training needs analysis prior to commencement; iii) Health and Safety Awareness Course, which details general environmental awareness and specific performance requirements expected on site; and iv) GRM and v) compliances to implementation of Community Occupational Safety & Health Plan (COSHP) for prevention and control of spread of COVID-19..							
1.3. Poor siting and layout of workers camp and other infrastructure facilities	• The location, layout and basic facility provision of each labour camp and others will be submitted to (Supervision Consultant) and	Project requirement. General Condition of the Bid Document	All contractors and sub-contractors	MI: Review the design Check compliance with design sitting.	Observations on the site location	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	Project Implementing Unit (PIU) prior to their construction. • Ensure solid waste and liquid management plan subject to the review and approval of the Supervision Consultant • Camps sitting to maintain minimum distance from following: # 500m from habitations # 500m from water bodies # 500m from main traffic routes • Land agreement with land owner for establishment of construction/ labour camps • Submit CTE/ CTO from PCB for establishment of camps, crushers, HMP, WMM, batching plants etc.			PT: Confirms Camps site not disturbs the nearby habitation and main road traffic. Not to pollute receiving waterbodies.				
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of	• Concessionaire to submit location and layout plan for storage areas of construction materials agreed by PD-PPP-PIU-RPWD and TL (AE).	MORT&H Specifications for Road and Bridge works Air (P and CP) Act	Throughout project corridor as required during construction activities, Human Habitation during commencement of construction activities in Chodwas, Benen, Buchkallan, Bankaliya,	MI: NAAQS Limits, Complaints from locals due to dust. PT: Compliance	Standards CPCB methods Observations Public consultation	Included in civil works cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

	Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision /Monitoring
	construction materials	• 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.	1974- Sunsequent Amendments and Central Motor and Vehicle Act 1988 General Conditions of Bid Document,	Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City.	s to NAAAQS Number of complaints should be zero.	Review of monitoring data maintained by EPC contractor			
2.2	Emission of air pollutants (HC, SO_2, NO_X, CO etc) from vehicles due to traffic congestion and use of equipment and machinery	• Regular maintenance of machinery and equipment. • Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. • Only crushers licensed by the PCB shall be used. • DG sets with stacks of adequate height and use of low Sulphur diesel as fuel. • LPG should be used as fuel source in	The Air (Prevention and Control of Pollution) Act, 1981 and applicable subsequent Amendments.	Asphalt mixing plants, crushers, DG set's locations, Human Habitation during construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City.	MI: Levels of HC, SO_2, NO_2, and CO. Status of PUC certificates PT: Compliances to NAAQS. PUC certificates of equipment and machinery's is up to date.	Standards CPCB methods Review of monitoring data maintained by EPC contractor	Included in civil works cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	construction camps instead of wood • Ambient air quality monitoring. • Contractor to prepare traffic management and dust suppression plan duly approved by PD-PIU-PPP-RPWD after review by TL (AE). • Periodic pollution checking of all vehicles and obtaining of Pollution Under Control Certificates (PUCs) and their renewal at required periods of time.							
3. Noise and Vibration								
3.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	• All equipment to be timely serviced and properly maintained. • Construction equipment and machinery to be fitted with silencers and maintained properly. • Only IS approved equipment shall be used for construction activities. • Timing of noisy construction activities shall be done during night time and	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for	Throughout project section especially at construction sites and residential and sensitive locations as near schools viz; km 8.040 (LHS), km 8.199 (LHS), km 8.689 (RHS), km 13.550 (LHS), km 13.700 (RHS), km 14.201 (RHS), km 17.152 (RHS), km 20.000 (LHS), km 29.200 (LHS), km 41.894 (RHS), km 47.399 (RHS), km 50.900 (RHS), km 51.800 (RHS), km 55.096 (LHS), km 62.300 (RHS), km & 84.399 (LHS).	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	As per Noise rule, 2000 UNI 9916 "Criteria for measuring and assessing the effects of vibration on buildings" DIN 4150 BS 7385	Included in civil works costs	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	weekend near schools, • Implement noisy operations intermittently to reduce the total noise generated • Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. • Restrict construction near residential, built up and forest areas construction to day light hours. • Conduct condition surveys of all properties within 25 meters from road edge • Vibration monitoring during heavy machinery/ equipment operation • Honking restrictions near sensitive areas. • PPEs to workers • Noise monitoring as per EMoP.	Road and Bridge works DIN 4150 and BS 7385.	Human Habitation during construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City.	levels are within permissible limits for work zone areas	Consultation with local people Review of noise level monitoring data maintained by contractor Observation of construction site			
4. Land and Soil								
4.1 Land use Change and Loss of	• Non-agricultural areas to be used as	Project requirement,	Throughout the project section and borrow areas	MI: Borrow pit locations/To	Review borrow	Included in civil works cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

	Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision /Monitoring
	productive / topsoil	borrow areas to the extent possible. • If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. • Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original land use	applicable ADB and IRC Guidelines	Land identified for camp, storage areas etc.	p soil storage area, Compliances with applicable ADB and IRC Guidelines. PT: Zero complaints or disputes registered against contractor by land owner	area plan, site visits			
4.2	Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	• Bio-turfing of embankments to protect slopes. • Slope protection by providing • frames, dry stone pitching, masonry retaining walls, planting of grass and trees. • 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.	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	Throughout the entire project road for example retaining walls/ toe walls are proposed for 1.1 km at 3 ponds sections from km 40.850 to km 41.050 (RHS), km 42.900 to km 43.250 (B/S) and km 52.710 to km 52.910 (RHS). Slope protection events has been proposed with stone pitching at various near bridge approach locations.	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	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• The earth stockpiles to be provided with gentle slopes to soil erosion.	works Guidelines IX for Soil erosion						
4.3 Borrow area management	• Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/consents. • Depths of borrow pits to be regulated and sides not steeper than 25%. • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Transportation of earth materials through covered vehicles. • Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation • Borrow areas not to be dug continuously. • To the extent borrow areas shall be sited	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause 305.2.2 MORTH Specifications for Road and Bridgeworks, Applicable ADB and IRC Guidelines for Borrow Areas management	Borrow Area sites	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Numtestesber of accidents. Complaints from local people. PT: No case of non-compliance with applicable ADB and IRC Guidelines. Zero accidents. Zero complaints	Review of design documents and site observations	Included in civil works cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	away from habitat areas. • Borrow areas shall be levelled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fish pond. • EPC Contractor to submit copies of STPs/ Land Owners Consent Letters.			No use of black cotton soil				
4.4 Quarry Operations	• Aggregates will be sourced from existing licensed quarries. • Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to RPWD. • The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. • Obtain environmental clearance from SEIAA /DEIAA in case of opening new quarry.	Clause No.111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	New Quarry if needed and existing Quarries	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	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

	Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision /Monitoring
					prescribed limit				
4.5	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 demolished/ compacted land and undemolished land.	Site observation	Included in civil works cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP
4.6	Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris	• Construction vehicles and equipment will be maintained and refuelled in such a fashion that oil/diesel spillage does not contaminate the soil.	Design requirement	Fuelling station, construction sites, and construction camps and disposal location. 2 Nos. of Oil interceptors are proposed at the proposed two Truck-lay-by locations	MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area	Site observation	Included in civil work cost.	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
generated from demolition and road construction	• Fuel storage and refuelling 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 refuelling areas. • Waste oil and oil-soaked cotton/ cloth shall be stored in containers labelled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors • Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. • Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board.		at km 20.450 and km 58.100.	PT: Soil test conforming to no contamination. No sighting of spilled oil or bitumen in construction site or camp site.				
5. Water Resources								
5.1 Sourcing of water during Construction	• Requisite permission shall be obtained for	CGWA Guidelines	Throughout the Project section	MI: Approval from	Checking of documentation.	Included in civil work cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	abstraction of groundwater from Central Groundwater Authority. • Arrangements shall be made by EPC contractor that the water availability and supply to nearby communities remain unaffected. • Water intensive activities not to be undertaken during summer season. • Provision of water harvesting structure to augment recharging of groundwater conditions (aquifers) in the project area. • Permissions from Local Irrigation Department, in case using canal water. • Agreement letters with local level water suppliers.		All water harvesting structures and at toll plazas.	competent authority Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people.	Talk to local people			
5.2 Disposal of water during construction	• Provisions shall be made to connect road side drains with existing nearby natural drains.	Clause No.1010 EP Act, 1986 MORT&H Specifications for Road and	Throughout the Project section.	MI: Condition of drainage system in construction site. Presence /absence of water	Standards methods Site observation and review of documents	Included in civil work cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
		Bridgeworks		logging in project area. PT: Existence of proper drainage system. No water logging in project area				
5.3 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 esp. in the areas where land is sloping towards road alignment. • Road level shall be raised above HFL level wherever road level is lesser than HFL. • Culverts reconstruction shall not 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	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc near waterways at km 27.124, km 30.954, km 25.605, km 25.856, km 26.520, km 45.831, km 47.042, km 47.603 and ponds at section from km 40.850 to km 41.050 (RHS), km 42.900 to km 43.250 (B/S) and km 52.710 to km 52.910 (RHS).	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 observations	Included in civil works cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	immediately after construction.							
5.4 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, Clause No 501.8.6. MORT&H Specifications for Road and Bridgeworks Worldwide best practices	Near all waterbodies/ waterway at km 27.124, km 30.954, km 25.605, km 25.856, km 26.520, km 45.831, km 47.042, km 47.603 and ponds at km 40.850, km 42.900, km 52.710.	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	EPC Contractor	AE/PMC/ RPWD-PIU-PPP
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	• No vehicles or equipment should be parked or refuelled near water-bodies, so as to avoid contamination from fuel and lubricants.	The Water (Prevention and Control of Pollution) Act, 1974 and amendments	All water bodies like rivers, waterways at km 27.124, km 30.954, km 25.605, km 25.856, km 26.520, km 45.831, km 47.042, km 47.603 and ponds at section from km 40.850 to km 41.050 (RHS), km 42.900 to km 43.250 (B/S)	MI: Water quality of ponds, streams, rivers and other water bodies in project. Presence of	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• Oil and grease traps and fuelling platforms to be provided at refuelling locations. • All chemicals and oil shall be stored away from water and concreted platform with catchment pit for spills collection. • All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors. • Construction camp to be sited away from water bodies. • Wastes must be collected, stored and taken to approve disposal site only. • Water quality shall be monitored.	thereof. / as well as IS-10500:2012	and km 52.710 to km 52.910 (RHS), refuelling stations, construction camps, proposed Truck-lay-bye locations at km 20.450 and km 58.100.	oil floating in water bodies in project area PT: Surface water quality meets freshwater quality standards prescribed by CPCB.				
6. Flora and Fauna								

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
6.1 Vegetation loss due to site preparation and construction activities	• Restrict tree cutting up to toe line considering safety to road users. • Roadside trees to be removed with prior approval of competent authority. • Mandatory compensatory plantation at 1:3 basis by Forestry Department • Additional plantation on 1:3 basis as per the IRC guidelines to be carried out by concessionaire • Regular maintenance trees planted. • Provision of LPG in construction camp as fuel source to avoid tree cutting. • Plantation of trees on both sides of the road where technically feasible. Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and provide adequate sight distance. • Integrate vegetation management (IVM) with the carriage way	Forest Conservation Act 1980 + IRC: SP:21 and IRC: SP:66	Throughout project corridor. Estimated No. of affected tree = 1, 075 Nos. Mandatory compensatory plantation in 1:3 ratio = 3, 225 saplings Overall, Contractor shall plant at least 8, 000 saplings as compensatory afforestation.	MI: ROW width. Number of trees for felling. Compensatory plantation plan. Number of trees replanted. PT: Compensatory afforestation done on a 1:3 basis by concessionaire.	Review of relevant documents of tree cutting permit, compensatory plantation plan. and additional plantation strategy. Field observations	Mandatory Compensatory afforestation cost is included in project costs under RPWD. Additional compensatory afforestation, if required, costs included in civil works costs	Mandatory Compensatory plantation by forest Department and additional plantation by EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	completely clear of vegetation. • Controlled use of pesticides/ fertilize							
7. Construction Camps								
7.1 Impact associated with location	• All camps should be established with prior permission from PCB. Camps to maintain minimum distance from following: • #500m from habitation • #500m from forest areas where possible • #500 m from water bodies where possible • #500m from through traffic route • #500m from identified wildlife crossing areas	Design Requirement As identified in IEE, all applicable laws, rules and regulations including Contract Labour laws as well as, EHS policy and rules.	Construction camp	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	EPC Contractor	AE/PMC/ RPWD-PIU-PPP
7.2 Worker's Health in construction camp	• The location, layout and basic facility provision of each labour camp will be submitted to AE and approved by PD-PIU-PPP-RPWD. The EPC contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner.	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996	All construction camps.	MI: Camp health records, Compliance to SOPs of COSHP for COVID-19 Protection. Existence of proper first aid kit in camp site. Complaints	Camp records Site observation Consultation with contractor workers and local people	Part of the civil works costs	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. • Preventive medical facilities in camp • Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste. • The EPC 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. • Compliance to SOPs of COSHP for	and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof		from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions. Compliance to SOPs of COSHP for COVID-19 Protection.	living nearby			

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	COVID-19 Protection.							
8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	• Contractor to submit a waste/spoil disposal plan and get it approved by AE and PD-PIU-PPP-RPWD. • 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 quantity 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, Construction and Demolition Waste Management Rules-2016 and subsequent Amendments.	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.	EPC Contractor.	AE/PMC/ RPWD-PIU-PPP
8.2 Reuse and disposal of construction and dismantled waste	• The existing bitumen surface shall be utilized for paving of	Design Requirement, MORT&H	Throughout the project corridor	MI: Percentage of reuse of existing	Contractor records	Included in civil works cost.	EPC Contractor.	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. • All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. • Unusable and non-bituminous debris materials should be suitably disposed of 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	guidelines and General Conditions of Contract Document Construction and Demolition Waste Management Rules 2016 and subsequent Amendments.		surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or AE.	Field observation Interaction with local people			

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	be removed and disposed off-site.							
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	• Traffic Management Plan shall be submitted by the contractor and approved by the AE • The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. • The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. • On stretches where it is not possible to	Design requirement and IRC: SP: 27 -1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC: SP: 32 -1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC: SP:55-2014 The Building and other Construction workers	Throughout the project corridor especially at built-up areas, major/ minor intersections and accident-prone areas at sharp curves and sensitive areas like school, hospitals and religious places.	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 Checklists based monitoring Interaction with people in vehicles using the road	Included in civil works cost.	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. • Restriction of construction activity to only one side of the existing road • The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "AE". • Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	Act 1996 and Cess Act of 1996 Factories Act 1948 + Section 6 of Employer's Requirement of Bid Document						
9.2 Pedestrians, 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 animal movement is expected.	Same as above	Near habitation on both sides of schools, temples, 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	Field observation Interaction with local people	Included in civil works cost.	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	• Large number of box culverts has been proposed. All structures having vertical clearance above 2m and not catering to perennial flow of water may serve as underpass for animals.			schools, temples and public places. Zero complaints				
9.3 Safety of Workers and accident risk from construction activities	• Contractors to adopt and maintain safe working practices. • Usage of fluorescent and retro refectory signage, in local language at the construction sites • Training to workers on safety procedures and precautions. • Mandatory appointment of safety officer. • All regulations regarding safe scaffolding, ladders, working platforms, gangway, stair wells, excavations, trenches and safe means of entry and egress shall be complied with. • Provision of PPEs to workers. • Provision of a readily available first aid unit	Same as above	Construction sites	MI: Availability of Safety gears to workers. Safety signage Training records on safety. Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	Site observation Review records on safety training and accidents Interact with construction workers	Included in civil works cost	Obligation of EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	including an adequate supply of dressing materials. • The contractor will not employ any person below the age of 18 years • Use of hazardous material should be minimized and/or restricted. • Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. • Accident Prevention Officer must be appointed by the contractor.							
9.4 Accident risk to local community	• Restrict access to construction sites only to authorized personnel. • Physical separation must be provided for movement of vehicular and human traffic. • Adequate signage must be provided for safe traffic movement Provision of temporary diversions and awareness to locals before opening	Same as above	Construction sites Sidewalks and pedestrian zones near constricted market areas and semi urban areas, habitations, haulage roads, diversion sites, sensitive receptors like schools, hospitals, temples etc.	MI: Safety signs and their location. Incidents of accidents. Complaints from local people. PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	EPC Contractor	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	new construction front							
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	• Contractor will prepare site restoration plans, which will be approved by the AE. • The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. • All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental Specialist (PMC), Environmental Specialist (AE) and Environmental Focal Person (EPC Contractor). • All the opened borrow areas will be rehabilitated and 'AE' will certify to satisfaction.	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	MI: Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. PT: Clean and tidy sites. No trash or debris left on site. Site restored and levelled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites is found satisfactory	Included in civil works cost.	EPC Contractor	AE/PMC/ RPWD-PIU-PPP
F. Operation and Maintenance stage								

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
1. Air Quality								
1.1 Air pollution due to due to vehicular movement	• Roadside tree plantations shall be maintained at least with 70% survival rate. • 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 them 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. Obtaining of Pollution Under Control Certificates (PUCs) and their renewal on periodic basis.	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981, Motor Vehicles Act 1948 and subsequent Amendments .	Throughout the Corridor. Human Habitation during commencement of construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City. Sensitive Receptors along the alignment near schools viz; km 8.040 (LHS), km 8.199 (LHS), km 8.689 (RHS), km 13.550 (LHS), km 13.700 (RHS), km 14.201 (RHS), km 17.152 (RHS), km 20.000 (LHS), km 29.200 (LHS), km 41.894 (RHS), km 47.399 (RHS), km 50.900 (RHS), km 51.800 (RHS), km 55.096 (LHS), km 62.300 (RHS), km & 84.399 (LHS).	MI: Ambient air quality (PM_{10}, CO, SO_2, NO_2) PT: Levels are equal to or below baseline levels given in the IEE report.	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/ RPWD-PIU-PPP
2. Noise								

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
2.1 Noise due to movement of traffic	• Effective traffic management and good riding conditions shall be maintained • Speed limitation to 20 km/hour and honking restrictions near sensitive receptors • Monitoring of Performance of Noise Barriers constructed and New Construction of any further required noise barriers near sensitive receptors with consent of local community • 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	Residential and sensitive locations near schools viz; km 8.040 (LHS), km 8.199 (LHS), km 8.689 (RHS), km 13.550 (LHS), km 13.700 (RHS), km 14.201 (RHS), km 17.152 (RHS), km 20.000 (LHS), km 29.200 (LHS), km 41.894 (RHS), km 47.399 (RHS), km 50.900 (RHS), km 51.800 (RHS), km 55.096 (LHS), km 62.300 (RHS), km & 84.399 (LHS). Human Habitation during commencement of construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City.	MI: Noise levels PT: Levels are equal to or below baseline levels given in the IEE report.	Noise monitoring as per noise rules, 2000 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/ RPWD-PIU-PPP
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites	On site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision &	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	training structures etc. • Necessary measures to be followed wherever there are failures			PT: Zero or minimal occurrences of soil erosion.			monitoring by AE/PMC/RPWD-PIU-PPP	
4. Water resources/ Flooding and Inundation								
4.1 Siltation	• Regular checks shall be made for soil erosion conditions for its effective maintenance.	Project requirement	Near surface water bodies like river, waterways at km 27.124, km 30.954, km 25.605, km 25.856, km 26.520, km 45.831, km 47.042, km 47.603 and ponds at section from km 40.850 to km 41.050 (RHS), km 42.900 to km 43.250 (B/S) and km 52.710 to km 52.910 (RHS).	MI: Water quality. PT: No turbidity of surface water bodies due to the road.	Site observations	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/ RPWD-PIU-PPP
4.2 Water logging due to blockage of drains, culverts or streams	• Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams. • Monitoring of water borne diseases due to stagnant water bodies	Project requirement	Near surface water bodies/ cross drains/ side drains locations.	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging.	Site observations	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/ RPWD-PIU-PPP
5. Flora								
5.1 Vegetation	• Planted trees, shrubs, and grasses	Forest Conservat	Project tree plantation sites	MI: Tree/plants survival rate	Records and field observation	Included in Operation /	Implementation by EPC	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	to be properly maintained. • The tree survival audit to be conducted at least once in a year to assess the effectiveness	ion Act 1980		PT: Minimum rate of 70% tree survival.	s. Information from Forestry Department	Maintenance cost	Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
6. Maintenance of Right of Way and Safety								
6.1 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 road side • No invasive plantation near the road sides	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	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/ RPWD-PIU-PPP
6.2 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. • Monitor/ensure that all safety provisions included in design and construction	IRC: SP:55-2014 and IRC: SP:88-2010	Throughout the Project route especially at accident prone areas at major 4-arm junctions' locations viz; km 9.340, km 13.525, km 17.100, km 26.030 (Near school), km 62.160, km 67.050, km 78.140 and km 86.480 etc.	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road. Presence/ absence of sensitive receptor structures	Review accident records Site observations	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	AE/PMC/ RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/ guideline	Locations	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision /Monitoring
	phase are properly maintained • Highway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. • Tow-way facility for the breakdown vehicles if possible. • Road Safety Audit should be conducted on regular basis			inside the stipulated planning line as per relevant local law PT: Fatal and non-fatal accident rate is reduced after improvement.				
6.3. Transport of Dangerous Goods	• Existence of spill prevention and control and emergency responsive system • Emergency plan for vehicles carrying hazardous material	OHS Standards / Material Safety Data Sheet (MSDS)	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	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	

EFP: Environmental Focal Person, RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, PMC: Project Management Consultant, AE: Authority Engineer, IEE: Initial Environmental Examination, IRC: Indian Road Congress, DEIAA: District Environmental Impact Assessment Authority, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

Environmental Monitoring Plan for Dantiwara-Merta City Road

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
Air Quality	Construction stage	PM_{10} $PM_{2.5}$ SO_2, NO_X, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Human Habitation during commencement of construction activities in Chodwas, Benen, Buchkallan, Bankaliya, Riyaan, Pipar, Uchiya Bara, Nanan, Maadaliya, Gadh Sooriya, Borunda, Beetan, Indawar, Satlawas and Merta City. Batching and hot mix plants sampling part of SPCB annual renewal of permits Total No of Samples 2 times in each human habitations during construction period -52 samples One sample for HMP, one sample for Batching/ RMC Concreate Mix Plan and one sample for WMM Plant in each quarter during construction period. Total No of sample-18 samples.	During Active Construction Phase	Air quality standard by CPCB	70x 9000=Rs.63 00000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
				Total numbers of samples 70 during entire scheduled construction period. No of samples may increase for EOT period.					
	Operation stage			Toll Plaza-one same each quarter. Total 3 samples in a year. Human habitations, especially sensitive receptors. 3 samples in each quarter. Total no of 9 samples.	24 hr continuous, 3/year for 1 year of operation period (Total 3 times in a year Except Monsoon Season)	Air quality standard by CPCB	12X9000 =Rs 108000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Water Quality	Construction stage	Ground water: (IS: 10500:2012) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps	3/year till the end of construction activities (Total 3 times in a year baring monsoon), 1 bore well, 1 surface water sample in each quarter. Minimum 3 samples in each quarter. Total no 18 samples during entire scheduled construction period. No of samples may increase for EOT period.	Water quality standard by CPCB	18x 5000 = Rs 90000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
	Operation stage			Groundwater at 2 locations and surface water at 2 locations	3/year for 1 year	Water quality standard by CPCB	12x5000=Rs. 60000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968Using Noise level meter	Same as air quality Total numbers of samples 70 during entire scheduled construction period. No of samples may increase for EOT period.	During Active Construction Phase	National Ambient Noise Standard specified in Environment Protection Act, 1986	70x1500=Rs. 105000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
	Operation stage			Same as air quality	3/year for 1 year		12x1500=Rs. 18000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer RPWD / supervision consultant	Camp, Dumping/storage areas and HMP sites (Total 4 sample locations)	Once during entire construction stage	ICAR standards	4x3000=Rs.12000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination locations (Total 3 samples)	Once for the first year of operation	ICAR Standards	3x3000=Rs.9000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		Throughout the Project Corridor especially at River banks, bridge locations and river training structures	After first rain	Visual Checks	Included in Engineering Cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of AE/PMC/RPWD-PIU-PPP	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable	Once in a year before rainy season	None Specific	Included in Engineering Cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
	Operation Stage			drainage congestion areas	Once in a year before rainy season	None Specific	Routine Engineering Work	Engineering Team of RPWD/ AE/PMC/RPWD-PPP	
Borrow Areas- Prior obtaining of ECs for borrow areas is exempted by MoEFCC	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	ADB and IRC guidelines	EPC Contractor	EPC Contractor with approval from AE/PIU-RPWD-PPP	AE/PMC/RPWD-PIU-PPP
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			EPC Contractor with approval from AE/PIU-RPWD-PPP	
Construction Sites and Labour Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	EPC Contractor with approval from AE/RPWD-PIU-PPP	AE/PMC/RPWD-PIU-PPP
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD Additional Plantation: Provisional sum under Civil Cost	Compensatory: RPWD/Local Forest Departments Additional Plantation: Implementation by The EPC Contractor. Supervision and monitoring by AE/PMC/RPWD-PIU-PPP	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Quarterly during Defect Liability Period			The AE will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD-PIU-PPP through PMC/EPC Contractor will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by IE/Safety Consultant and approved by RPWD-PIU		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/IE/RPWD-PIU-PPP	Part of the regular monitoring	EPC Contractor	AE/PMC/RPWD-PIU-PPP
	Operation stage			Throughout the stretch	occurrence of accidents	Same as above	Same as above	Road Safety unit of RPWD-PIU-PPP, with support from local police, AE and PMC	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
Monitoring Costs: INR 1041000.00 excluding other applicable charges including GST to be mentioned in Terms and Conditions of Contract Agreement signed between EPC Contractor and Outsourced Monitoring Laboratory.									

ENVIRONMENT MANAGEMENT PLAN FOR CHURU-TARANAGAR-NOHAR ROAD

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1. Pavement damage and inadequate drainage provisions	• Proposed design adopted in accordance with the provisions of the following IRC and BIS Codes/ MoRTH guidelines/ AASHTO specifications. • Geometrical design standards will mostly follow: • 2-Lane Plus Carriageway: • Carriageway Width = 7.0m, • Paved Shoulder Width = 2 x 1.5m, • Earthen/ Granular/ Paver block Shoulder Width= 2 x 2.0m or varying width shoulder. • Side Drain = 2 x 1.5m footpath drain • Roadway Width = 14.0m (Minimum) • Roadway Length = 68.130 km • 4-Lane Divided Carriageway: • Carriageway Width = 7.5m each with 1.5m Median.	Section 2 of the Manual of Specifications and Standards for Two Lanning of Highways with Paved Shoulder (IRC: SP:73-2018)	10 pipe culverts are proposed to prevent water logging and flooding in Churu-Tara Nagar Section which is passed by no river or water body crossed by the project road. However, there are few minor dry natural streams crossed by the project road. 4 slab culverts and 8 pipe culverts are proposed in Taranagar-Nohar Section of the road. The Contractor shall prepare drainage plan for complete highway and provide Minimum 20 additional new	MI: Design and number of cross and side drains, slab/box culverts, and Hume pipes PT: Design and numbers are in accordance with site needs Checklists based monitoring	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Paved Shoulder Width = 2 x 1.5m, • Paver Block Shoulder Width = 2 x 2.0m or varying width shoulder.		culverts as per drainage design requirements at locations finalized in consultation with Authority Engineer (AE) and shall not be considered as Change of Scope. Toll Plaza = 3 1st Toll Plaza from CH-18+950 to CH-19+250 2nd Toll Plaza from CH-53+950 to 54+250 3rd Toll Plaza from CH-97+110 to 98+010					
1.2. Pavement Design	• Vertical and horizontal geometrics in consistent to IRC/MORTH guidelines • Provision of crash barriers at high embankments. • Speed breakers in habitat areas, schools, junction	Design requirement IRC:SP:73-2007 IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35,	Curve locations List of Major and Minor Junctions requiring improvements is given in Section-3 of Schedule-B. All	MI: number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost	Design Consultant	PMC/RPWD -PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	and curves to regulate speed. • Provision of retro-reflective warning signboards near school, hospital, religious places and forests • Safety kerb at all bridges • Informatory signage on approach to built-up section • Ambulance and medical aid posts • Checking for overloading at toll plazas • Speed restrictions in built up sections curve locations etc	IRC:67, IRC:103 and Section 800 of MoRTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	the existing junctions to be improved to the corresponding Design Vehicle and all minor junctions to be improved to 60m on side roads. Speed Breakers and signages near built-up areas and toll plazas 3 Toll Plazas: 1st Toll Plaza from CH-18+950 to CH-19+250 2nd Toll Plaza from CH-53+950 to 54+250 3rd Toll Plaza from CH-97+110 to 98+010.	PT: numbers and location are in accordance with site needs. Checklists based monitoring		to be borne by EPC Contractor		
1.3. Drainage provisions	• Raised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also	Provision of lined drain as per IRC: SP:42-2014 & IRC: SP:50-2013.	Cross-Drainages Culverts Reconstruction 4 nos. slab culverts to Box	MI: Monitoring of the function of cross drainage, longitudinal	Review of detail design documents & drawings and comparison	Covered under preliminary design preparation	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	inconvenience caused to nearby community. • Provision of adequate nos. of cross drainage structures. • Increased (vent and height) in waterway of existing structures. • Roadside drains have been proposed with suitable outfalls. • Additional culverts and bridges • Causeway and submerged bridges to be replaced with high level bridges • Roadside longitudinal drains to avoid water logging in built-up-sections and rural sections proposed with suitable outfalls. • Prevention of waterlogging and overtopping due to intensive rainfall.	IRC SP: 42-2014 and IRC SP: 50-2013. MORTH Specifications for Road and Bridge Works 5th Revision 2013	culverts, 18 nos. HPC to HPC/Box culverts) and 20 nos. of additional new HPC/ Box culverts. Longitudinal drains (B/S together) Footpath cum covered drains in built-up sections. RWH at every 2km in a staggered manner on LHS and EHS in the entire project length.	drainages and climate adaptation during exigencies. PT: Standard Design and required numbers of cross and side drains, slab/ box culverts, and Hume pipes	with site conditions	by F/S consultant Detailed design cost to be borne by EPC Contractor		
1.4. Safety along the proposed alignment	• Vertical and horizontal geometrics in consistent to adequate numbers of road signs and pavement markings IRC/MORTH guidelines. • Provision of crash barriers at high embankments.	Design requirement IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC: 79, IRC: 99 IRC 119,	Curve locations Speed Breakers and signages, LED traffic beacons, Pedestrian facilities near built-up areas and toll plaza	MI: Monitoring of the functioning/ performance of proposed safety measures, w.r.t proposed	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Speed breakers in habitat areas, schools, junction and curves to regulate speed. • Provision retro-reflective warning signboards, LED traffic beacons near school, hospital, religious places and forests • Safety kerb at all bridges • Informatory traffic signage/ Road markings on approach to built-up sections on Ambulance and medical aid posts • Checking for overloading at toll plazas. • Speed restrictions in built up sections curve locations etc. • Roadside Safety Barriers near culverts, bridges. • Pedestrian Guard Rails / Footpath Facilities at Schools. • Other road safety furniture comprising road signs, road markings, object markers, hazard marker, studs, delineators, attenuators, safety barriers, pedestrian guard rails, boundary stones, kilometre stone etc.	and Section 800 of MoRTH Specifications	and near school, hospitals and other sensitive areas. Road Studs, Road signs, markings, object Markers etc shall be finalized in consultation with Authority's Engineer Metal beam crash barriers provided at embankment above 3m, at sharp curve and along retaining wall locations and on approaches to structures, bridges, and culverts in consultation with Authority Engineer. Roadside & Median Safety barriers shall be provided finalized in consultation	numbers, location and site-specific needs and maintenance. PT: Required numbers and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc		to be borne by EPC Contractor		

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
			with Authority's Engineer. Toll Plazas=3					
2. Natural Disaster and Climate Change Risks								
2.1. Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt and paved surfaces	• Flexible Pavement Thickness is proposed for almost entire length with minimum design period of 20 years. • CBR value of sub grade as per IRC guidelines. • 40mm BC with PMB-70 has been considered as surface course and 60mm DBM with VG-30 has been considered for Base/ binder course.	IRC:37 & IRC:58 for flexible pavement design.	Entire stretch	MI: Monitoring pavement surface quality interms of roughness, cracking, rutting, softening etc. PI:No softening, rutting, asphalt migration/ thermal expansion of joint	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design cost of F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP
2.2. Flooding/ Water-Logging	• Adequate number of CD structures. Additional culverts also proposed. • CD structures designed for 50year return period. • Water ways of bridges and culverts have been increased. • Roadside drains also provided • Embankment height raised along low lying/	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	Reconstruction (4 nos. slab culverts 18 HPC culverts) and 20 nos. of additional new HPC culverts. Footpath cum covered drains in built-up sections.	MI: Monitoring overtopping/ flooding w.r.t design, functioning and numbers in accordance with site needs.	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	potential water-logged areas. • Improvement in existing culverts through increase in vent size or retrofitting's. Longitudinal Drains designed so that runoff resulting from storms to a specified frequency of occurrence can be drained off immediately without overflowing or not being impounded in lower level of the Project Area and market areas.		RWH at every 2000 m in a staggered manner in the entire project length.	PT: Standard Design and required numbers of cross & side drains, slab/ box culverts Hume pipes, road embankment height, design and number of bridges. Design and numbers are in accordance with site needs				
2.3. Earthquake	• Relevant IS codes shall be 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: Integrity of proposed structures like bridges, culverts and others. PT: Design conforms BIS and IRC guidelines.	Review of design documents and drawings and comparison with site conditions	F/S consultant, Detailed design cost to be borne by concessionaire	Design Consultant	PMC/RPWD-PIU-PPP
2.4. Drought	• Ensure water availability for compaction work and consolidation of sub-structure	IRC:78-2000 Standard Specifications and Code of Practice for Road Bridges	Entire Stretch	MI: Monitoring GW levels, public consultations	Design and drawings of foundations, substructure and	Covered under F/S consultant cost	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
				with local communities. PT: Water availability and scarcity in the region and d/s of waterways.	superstructure of structures			
2.5. Forest Fires	• Measures to avoid accident followed by fuel spills. • Removal of maintenance slash or management by controlled burning. • Plant fire-resistant species in RoW • Thinning slashing during non-dry season. • No construction camp within 500m of Notified Forest Areas.	Design requirement	There is no forest along proposed road.	MI: Monitoring of likely damage to roadside flora and spillage/ fuel accumulation induced accident. PT: Zero incidence of forest fires.		Covered under F/S consultant cost	Design Consultant	PMC/RPWD-PIU-PPP
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. • Minimize resettlement impact due to heavily congested built-up section • Social Impact Assessment and Resettlement Plan to be undertaken as per	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary	Refer SIA/RAP for more details	MI: Payment of compensation and assistance to DPs as per RP Number of complaints/grievances related to compensatio	Check LA records; design drawings vs land plans; Interview with affected persons Check status of employment given to local	Part of administrative and resettlement costs	RPWD and implementing NGO	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	national policy and ADB' guidelines. • Complete all necessary land and property acquisition procedures prior to the commencement of civil work. • Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. • Compensation and assistance as per project Resettlement Plan • Income restoration as per RP • Preference in employment and petty contracts during construction to APs • Constitute GRC as per RP	resettlement policy. Contract Clause for preference to local people during employment.		n and resettlement PT: Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case referred to arbitrator/court.	people during construction			
4. Diversion of Forest Land and Cutting of Trees								
4.1. Need for cutting of trees and diversion of forest land	• Geometric adjustments to minimize tree cutting and diversion of forest land • Obtain tree cutting permission from forest department • Provision for mandatory compensatory afforestation (1:3) for deposit of payment to Forestry Department	Forest Conservation Act, 1980	Forest Diversion = Nil Total number of affected trees= 269 (Churu-Taranagar Section), 2745 (Taranagar-Nohar Section), Nos.3014 Mandatory compensatory	MI: Monitoring number and location of geometric adjustments made to avoid forestland and tree cutting, budget amount	Review final design. Check budget provision for compensatory afforestation Onsite validations of plantations carried out.	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	RPWD, Design cousulant	PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Provision for additional compensatory plantation on 1:3 bases to be implemented by concessionaire		plantation in 1:3 ratio Overall, EPC Contractor shall plant at least 20000 saplings as compensatory afforestation as per Schedule-C.	allocated for compensatory afforestation and additional plantation. PT: Avoiding or bare minimum tree felling on Govt. land/ forest/ private land.				
5. Shifting of Utilities								
5.1. Disruption of utility services to local community	• All telephone and electrical poles/wires and underground cables should be shifted before start of construction • Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services • Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any	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. Minimal time for utility shifting Checklists based monitoring	Interaction with concerned utility authorities and local public	Included under RPWD's costs	EPC Contractor/ RPWD/utility company	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
B. Construction Stage								
1. Preparatory activities								
1.1 Preparatory activities	• Submit appointment letter and resume of the EPC Contractor's Environmental Focal Person (EFP) to PMU • EFP will engage PMC Environment Specialist and PMU Safeguard Officer-Environment to a meeting to discuss in detail the EMP, seek clarification and recommend corresponding revisions if necessary • EFP will prepare implementation schedule of the approved EMP, EMoP, and agreements reached during the meeting with PMC-ES and PMU-SOE • EFP will consult Environmental Safeguard Implementation Manual and will apply monthly monitoring formats (Checklists) and establish deadlines for submission in consultations with ES(PMC) and ES (AE). • EFP will submit for PMC-ES approval an action plan to secure all permits	Project requirement	Project Office, EPC Contractor's construction camp	Approvals, attendance Checklists based monitoring	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g. fuel, lubricants, explosives), iii) waste disposal sites, iv) temporary storage location, iv) water use, and v) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan. • EFP will submit for approval of PMC-ES the construction camp layout before its establishment.							
1.2 Site induction	• No works will be initiated by the EPC contractor until the site induction training is carried out by the PMC • Site induction training includes but not limited to: i) discussion and review of EMP and EMoP detailing how specific	Project requirement	Conference/Meeting Room in construction camp of EPC Contractor or any other suitable place, adequately big enough in aerial size for	Approvals, attendance Checklists based monitoring	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	environmental risks associated with their Scope of Work will be managed legal compliance, inspection and audits, and progress tracking and reporting; ii) environmental training and awareness needs shall be determined and documented via a training needs analysis prior to commencement; iii) Health and Safety Awareness Course, which details general environmental awareness and specific performance requirements expected on site; and iv) GRM and v) compliances to implementation of Community Occupational Safety & Health Plan (COSHP) for prevention and control of spread of COVID-19..		observed required social distancing, where Audio-visual facilities for delivering training programmes, can be installed.					
2. Air Quality								
2.1 Dust Generation due to constructio3n activities and transport, storage and handling of	• Concessionaire to submit location and layout plan for storage areas of construction materials agreed by PD-PPP-PIU-RPWD and TL (AE). • Transport, loading and unloading of loose and	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974-Sunsequent	Throughout project corridor as required during construction activities, Human Habitation	MI: NAAQS Limits, Complaints from locals due to dust.	Standards CPCB methods Observations Public consultation	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
construction materials	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.	Amendments and Central Motor and Vehicle Act 1988 General Conditions of Bid Document,	during commencement of construction activities in Gajsar, Sahjoosar, Ginri Patta Lohsana, Bhairoosar, Chalkoi Baneerotan, Anandsinghpura, Taranagar Bhalau Tal, Bhanin, Dheerwas Bara, Sahwa, Khopran, Meghana, Durjana, Dalpatpura, Nohar.Chainages of both habitations and schools are given in Section 15 of Schedule-A). These locations will remain as it is.	PT: Compliances to NAAAQS Number of complaints should be zero.	Review of monitoring data maintained by EPC contractor			
2.2 Emission of air pollutants (HC, SO2, NOX, CO etc) from vehicles	• Regular maintenance of machinery and equipment. • Batching, asphalt mixing plants and crushers at	The Air (Prevention and Control of Pollution) Act, 1981 and	Asphalt mixing plants, crushers, DG set's locations, Human	MI: Levels of HC, SO2, NO2, and CO. Status of	Standards CPCB methods	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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due to traffic congestion and use of equipment and machinery	downwind (1km) direction from the nearest settlement. • Only crushers licensed by the PCB shall be used. • DG sets with stacks of adequate height and use of low Sulphur diesel as fuel. • LPG should be used as fuel source in construction camps instead of wood • Ambient air quality monitoring. • Contractor to prepare traffic management and dust suppression plan duly approved by PD-PIU-PPP-RPWD after review by TL (AE). • Periodic pollution checking of all vehicles and obtaining of Pollution Under Control Certificates (PUCs) and their renewal at required periods of time.	applicable subsequent Amendments.	Habitation during construction activities in Gajsar, Sahjoosar, Ginri Patta Lohsana, Bhairoosar , Chalkoi Baneerotan, Anandsinghpura, Taranagar Bhalau Tal, Bhanin, Dheerwas Bara, Sahwa, Khopran, Meghana, Durjana, Dalpatpura, Nohar.(Chainages of both habitations and schools are given in Section 15 of Schedule-A).These locations will remain as it is.	PUC certificates PT: Compliances to NAAQS. PUC certificates of equipment and machinery's is up to date.	Review of monitoring data maintained by EPC contractor			
3. Noise and Vibration								
3.1 Disturbance to local residents and sensitive receptors due	• All equipment to be timely serviced and properly maintained. • Construction equipment and	Legal requirement Noise Pollution (Regulation and Control)	Throughout project section especially at construction sites and	MI: day and night Noise levels. Number of complaints	As per Noise rule, 2000 UNI 9916 "Criteria for	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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to excessive noise from construction activities and operation of equipment and machinery	machinery to be fitted with silencers and maintained properly. • Only IS approved equipment shall be used for construction activities. • Timing of noisy construction activities shall be done during night time and weekend near schools, • Implement noisy operations intermittently to reduce the total noise generated • Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. • Restrict construction near residential, built up and forest areas construction to day light hours. • Conduct condition surveys of all properties within 25 meters from road edge • Vibration monitoring during heavy machinery/ equipment operation • Honking restrictions near sensitive areas. • PPEs to workers • Noise monitoring as per EMoP.	Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works DIN 4150 and BS 7385.	residential and sensitive locations as nearschools and Habitations, Gajsar, Sahjoosar, Ginri Patta Lohsana, Bhairoosar, Chalkoi Baneerotan, Anandsinghpura, Taranagar Bhalau Tal, Bhanin, Dheerwas Bara, Sahwa, Khopran, Meghana, Durjana, Dalpatpura, Nohar(Chainages of both habitations and schools are given in Section 15 of Schedule-A).These locations will remain as it is.	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	measuring and assessing the effects of vibration on buildings" DIN 4150 BS 7385 Consultation with local people Review of noise level monitoring data maintained by contractor Observation of construction site			
4. Land and Soil								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
4.1 Land use Change and Loss of productive / topsoil	• Non-agricultural areas to be used as borrow areas to the extent possible. • If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. • Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original land use	Project requirement, Applicable ADB and IRC Guidelines	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area, Compliances with Applicable ADB and IRC Guidelines PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	• Bio-turfing of embankments to protect slopes. • Slope protection by providing • frames, dry stone pitching, masonry retaining walls, planting of grass and trees. • Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. • The earth stockpiles to be provided with gentle slopes to soil erosion.	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road for example retaining walls/ toe walls are proposed. Slope protection events has been proposed with stone pitching at various near sites.	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	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
4.3 Borrow area management	• Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/consents. • Depths of borrow pits to be regulated and sides not steeper than 25%. • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Transportation of earth materials through covered vehicles. • Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation • Borrow areas not to be dug continuously. • To the extent borrow areas shall be sited away from habituated areas. • Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fish pond. • EPC Contractor to submit copies of STPs/Land Owners Consent Letters.	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act)+Clause 305.2.2 MORTH Specifications for Road and Bridgeworks, Applicable ADB and IRC Guidelines for Borrow Areas management	Borrow sites /locations	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 with Applicable ADB and IRC Guidelines. Zero accidents. Zero complaints No use of black cotton soil. Checklists based monitoring	Review of design documents and site observations	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
4.4 Borrow area management	• Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/consents. • Depths of borrow pits to be regulated and sides not steeper than 25%. • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Transportation of earth materials through covered vehicles. • Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation • Borrow areas not to be dug continuously. • To the extent borrow areas shall be sited away from habitat areas. • Borrow areas shall be levelled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fish pond. • EPC Contractor to submit copies of STPs/ Land Owners Consent Letters.	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause 305.2.2 MORTH Specifications for Road and Bridgeworks, Applicable ADB and IRC Guidelines for Borrow Areas management	Borrow Area sites	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Numtestesber of accidents. Complaints from local people. PT: No case of non-compliance with applicable ADB and IRC Guidelines. Zero accidents. Zero complaints No use of black cotton soil	Review of design documents and site observations	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
4.5 Quarry Operations	• Aggregates will be sourced from existing licensed quarries. • Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to RPWD. • The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. • Obtain environmental clearance from SEIAA /DEIAA in case of opening new quarry.	Clause No.111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	New Quarry if needed and existing Quarries	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	EPC Contractor	AE/PMC/RPWD-PIU-PPP
4.6 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	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	Site observation	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	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.			condition PT: Zero occurrence of demolished/ compacted land and undemolished land.				
4.7 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	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 Checklists based monitoring	Site observation	Included in civil work cost.	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	MoEF/SPCB authorized vendors • Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. • Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board							
5. Water Resources								
5.1 Sourcing of water during Construction	• Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. • Arrangements shall be made by EPC contractor that the water availability and supply to nearby communities remain unaffected. • Water intensive activities not to be undertaken during summer season. • Provision of water harvesting structure to augment recharging of groundwater conditions (aquifers) in the project area.	CGWA Guidelines	Throughout the Project section Water harvesting structure at toll plazas	MI: Approval from competent authority Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people. Checklists based monitoring	Checking of documentation Talk to local people	Included in civil work cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Permissions from Local Irrigation Department, in case using canal water. • Agreement letters with local level water suppliers.							
5.2 Disposal of water during construction	• Provisions shall be made to connect road side drains with existing nearby natural drains. • All hand pumps and wells are proposed for relocation at suitable locations in consultation with local community. • Water harvesting structures have been proposed along the project road subject to technical feasibility as per guidelines of CGWB. These measures will significantly augment the ground water/surface water availability in the area	Clause No.1010 EP Act 1986 MORT&H Specifications for Road and Bridgeworks	Throughout the Project section There is no water body along the alignment.	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 work cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
5.3 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 esp. in the areas where land is	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc. There is no water body along the alignment.	MI: Proper flow of water in existing streams and rivers PT: No complain of water shortage by	Review of design documents Site observation	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	sloping towards road alignment. • Road level shall be raised above HFL level wherever road level is lesser than HFL. • No construction will be established within 500mts of a water body. • Culverts reconstruction shall not 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. • The design of drainage system such as surface and sub-surface drainage will be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes and the service roads will be discharged through longitudinal drains, designed for adequate cross section, bed slopes, invert levels and the outfalls. If necessary, the walls of the drains will be designed to retain the adjoining earth.			downstream communities. No record of overtopping/ water logging Checklists based monitoring				

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• The design discharge will be evaluated for flood of 50-year return period for calculation of waterway and design of foundations. Proposed water way will not be reduced from existing one. Linear waterways of the • The design of drainage system such as surface and sub-surface drainage will be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes and the service roads will be discharged through longitudinal drains, designed for adequate cross section, bed slopes, invert levels and the outfalls. If necessary, the walls of the drains will be designed to retain the adjoining earth. • The design discharge will be evaluated for flood of 50-year return period for calculation of waterway and design of foundations. Proposed water way will not be reduced from existing one. Linear waterways of							

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	the most of the major rivers are bank to bank. Therefore, proposed bridge length will be bank to bank. • The design of drainage system such as surface and sub-surface drainage will be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes and the service roads will be discharged through longitudinal drains, designed for adequate cross section, bed slopes, invert levels and the outfalls. If necessary, the walls of the drains will be designed to retain the adjoining earth. • The design discharge will be evaluated for flood of 50-year return period for calculation of waterway and design of foundations. Proposed water way will not be reduced from existing one. Linear waterways of the most of the major rivers are bank to bank. Therefore, proposed bridge length will be bank to bank.							

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
5.4 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 works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. • Retaining walls at water bodies /ponds to avoid siltation near ponds. • No construction camp within 500m of any water body • Locate all parking, repair and fuel and hazardous material storage area away from any water body. Vehicle parking and maintenance areas will have waterproof floors from which drainage is collected and treated to legal standards.	Design requirement, ClauseNo501.8.6.MORT&H Specifications for Road and Bridgeworks Worldwide best practices	Near all waterbodies /waterway.There is no water body along the alignment.	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	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Refuel vehicles only in dedicated areas with waterproof floors from which drainage flows to an oil/water separator before discharge							
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	• No vehicles or equipment should be parked or refueled near water-bodies, so as to avoid contamination from fuel and lubricants. • Oil and grease traps and fueling platforms to be provided at re-fueling locations. • All chemicals and oil shall be stored away from water and concreted platform with catchment pit for spills collection. • All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors.	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof./ as well as IS-10500:2012	Water bodies, refueling stations, construction camps. There is no water body along the alignment.	MI: Water quality of ponds, streams, rivers and other water bodies in project Presence of oil floating in water bodies in project area PT: Surface water quality meets freshwater quality standards prescribed by CPCB Checklists based monitoring	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Construction camp to be sited away from water bodies. No construction camp within 500mts of water body. • Wastes must be collected, stored and taken to approve disposal site only. • Water quality shall be monit • Locate all parking, repair and fuel and hazardous material storage area away from any water body. Vehicle parking and maintenance areas will have waterproof floors from which drainage is collected and treated to legal standards. • Refuel vehicles only in dedicated areas with waterproof floors from which drainage flows to an oil/water separator before discharge.							
6. Flora and Fauna								
6.1 Vegetation loss due to site preparation and construction activities	• Restrict tree cutting up to toe line considering safety to road users. • Roadside trees to be removed with prior approval of competent authority.	Forest Conservation Act1980 + IRC:SP:21 and IRC:SP:66	Throughout project corridor Estimated No. of affected tree=269 (Churu-Taranagar	MI: ROW width Number of trees for felling Compensatory plantation plan	Review of relevant documents – tree cutting permit, compensatory plantation plan. and	Mandatory Compensatory afforestation cost is included in project costs	Mandatory Compensatory plantation maintained by EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Mandatory compensatory plantation at 1:3 basis by Forestry Department • Additional plantation on 1:3 basis as per the IRC guidelines to be carried out by EPC Contractor. • Regular maintenance trees planted. • Provision of LPG in construction camp as fuel source to avoid tree cutting. • Plantation of trees on both sides of the road where technically feasible. Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and provide adequate sight distance. • Integrate vegetation management (IVM) with the carriage way completely clear of vegetation. • Controlled use of pesticides/ fertilizers		Road) and 2745 (. .Taranagar-Nohar Road), Compensatory Plantation on1:3 basis. EPC Contractor shall do 20000 nos. of sapling plantations as per Schedule-C.	Number of trees replanted. PT: Compensatory afforestation done on a 1:3 basis by EPC Contractor. Checklists based monitoring	additional plantation strategy Field observations	under RPWD		
7. Construction Camps								
7.1 Impact associated with location	• All camps should be established with prior permission from PCB. Camps to maintain	Design Requirement As identified in IEE, All applicable	Construction camp	MI: Location of campsites and distance from habitation,	On site observation Interaction with workers	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	minimum distance from following: • # 500 m from habitation • # 500 m from forest areas where possible • # 500 m from water bodies where possible • # 500 m from through traffic route • # 500 m from identified wildlife crossing areas • # 500 m within a waterbody	laws, rules and regulations including Contract Labour laws as well as, EHS policy and rules.		forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	and local community Checklists based monitoring			
7.2 Worker's Health in construction camp	• The location, layout and basic facility provision of each labor camp will be submitted to AE and approved by PD-PIU-PPP-RPWD. The EPC contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. • Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. • Preventive medical facilities in camp • Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The EPC Contractor will take all	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	All construction camps	MI: Camp health records, Compliance to SOPs of COSHP for COVID-19 Protection. Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	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. • Compliance to SOPs of COSHP for COVID-19 Protection.			cases of STD. Clean and tidy camp site conditions. Compliance to SOPs of COSHP for COVID-19 Protection. Checklist based monitoring				
8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	• Contractor to submit a waste/spoil disposal plan and get it approved by AE and PD-PIU-PPP-RPWD. • 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	Design Requirement, MORT&H guidelines and General Conditions of Contract Document, Construction and Demolition Waste Management Rules-2016 and	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.	EPC Contractor.	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	dumping sites away from residential areas and water bodies • Dumping sites must be having adequate capacity equal to the number of debris generated. • Public perception and consent from the village Panchayats has to be obtained before finalizing the location.	subsequent Amendments.		Checklists based monitoring				
8.2 Reuse and disposal of construction and dismantled waste	• The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. • All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. • Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority.	Design Requirement, MORT&H guidelines and General Conditions of Contract Document Construction and Demolition Waste Management Rules 2016 and subsequent Amendments.	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or AE.	Contractor records Field observation Interaction with local people	Included in civil works cost.		

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• 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.			Checklists based monitoring				
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	• Traffic Management Plan shall be submitted by the contractor and approved by the AE • The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. • The Contractor will ensure that the	Design requirement and IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 - 1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC:SP:55-2014	Throughout the project corridor especially at intersections.	MI: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents PT: No complaints. No accidents due to poor traffic management. Traffic	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.	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.			signs, demarcation lines etc. present in appropriate locations on site. Checklists based monitoring				
	• On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. • Restriction of construction activity to only one side of the existing road • The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "AE". • Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document						
9.2 Pedestrians, animal movement	• Temporary access and diversion, with proper drainage facilities. • Access to the schools, temples and other public places must be maintained when	Same as above	Near habitation on both sides of schools, temples, construction sites, haulage roads, diversion sites.	MI: Presence/ absence of access routes for pedestrians. Road signage	Field observation Interaction with local people	Included in civil works cost.	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	construction takes place near them. • Fencing wherever animal movement is expected. • Large number of box culverts has been proposed.All structures having vertical clearance above 2m and not catering to perennial flow of water may serve as underpass for animals			Number of complaints from local people PT: Easy access to schools, temples and public places. Zero complaints Checklists based monitoring				
9.3 Safety of Workers and accident risk from construction activities	• Contractors to adopt and maintain safe working practices. • Usage of fluorescent and retro refectory signage, in local language at the construction sites • Training to workers on safety procedures and precautions. • Mandatory appointment of safety officer. • All regulations regarding safe scaffolding, ladders, working platforms, gangway, stair wells, excavations, trenches and safe means of entry and egress shall be complied with.	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	Site observation Review records on safety training and accidents Interact with construction workers	Included in civil works cost	Obligation of EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Provision of PPEs to workers. • Provision of a readily available first aid unit including an adequate supply of dressing materials. • The contractor will not employ any person below the age of 18years • 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.			Checklists based monitoring				
9.4 Accident risk to local community	• Restrict access to construction sites only to authorized personnel. • Physical separation must be provided for movement of vehicular and human traffic. • Adequate signage must be provided for safe traffic movement • Provision of temporary diversions and awareness to locals	Same as above	Construction sites	MI: Safety signs and their location, Incidents of accidents, Complaints from local people PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	before opening new construction fronts.			Checklists based monitoring. Checklists based monitoring				
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	• Contractor will prepare site restoration plans, which will be approved by the AE. • The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. • All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental Specialist (PMC), Environmental Specialist (AE) and Environmental Focal Person (EPC Contractor). • All the opened borrow areas will be rehabilitated and 'AE ' will certify	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	MI: Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. PT: Clean and tidy sites. No trash or debris left on site. Site restored and leveled. Checklists based monitoring	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found satisfactory	Included in civil works cost.	EPC Contractor	AE/PMC/RPWD-PIU-PPP
C. Operation and Maintenance stage								
1. Air Quality								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
1.1 Air pollution due to due to vehicular movement	• Roadside tree plantations shall be maintained at least with 70% survival rate. • 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 them 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. Obtaining of Pollution Under Control Certificates (PUCs) and their renewal on periodic basis.	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981, Motor Vehicles Act 1948 and subsequent Amendments .	Throughout the Corridor. Human Habitation during commencement of construction activities in Gajsar, Sahjoosar, Ginri Patta Lohsana, Bhairoosar, Chalkoi Baneerotan, Anandsinghpura, Taranagar BhalauTal, Bhanin, Dheerwas Bara, Sahwa, Khopra, Meghana, Durjana, Dalpatpura, Nohar.(Chainages of both habitations and schools are given in Section 15 of Schedule-A). Sensitive Receptors along the alignment	MI: Ambient air quality (PM10, CO, SO2 NO2) PT: Levels are equal to or below baseline levels given in the IEE report Checklists based monitoring	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
2. Noise								
2.1 Noise due to movement of traffic	• Effective traffic management and good riding conditions shall be maintained • Speed limitation to 20 km/hour and honking restrictions near sensitive receptors • Monitoring of Performance of Noise Barriers constructed and New Construction of any further required noise barriers near sensitive receptors with consent of local community • 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	Residential and sensitive locations location s of air quality monitoring. Human Habitation during commencement of construction activities in Gajsar, Sahjoosar, Ginri PattaLohsana, Bhairoosar, Chalkoi Baneerotan, Anandsinghpura, Taranagar BhalauTal, Bhanin, Dheerwas Bara, Sahwa, Khopran, Meghana, Durjana, Dalpatpura(Chainages of both habitations and schools are given in	MI: Noise levels PT: Levels are equal to or below baseline levels given in the IEE report Checklists based monitoring	Noise monitoring as per noise rules, 2000 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
			Section 15 of Schedule-A)					
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc. • Necessary measures to be followed wherever there are failures	Project requirement	At embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion. Checklists based monitoring.	On site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
4. Water resources/Flooding and Inundation								
4.1 Siltation	• Regular checks shall be made for soil erosion conditions for its effective maintenance.	Project requirement	Near surface Water bodies. There is no water body along the alignment.	MI: Water quality PT: No turbidity of surface water bodies due to the road Checklists based monitoring	Site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
4.2 Water logging due to blockage of drains, culverts or streams	• 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.	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	MI: Presence/ absence of water logging along the road	Site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Monitoring of water borne diseases due to stagnant water bodies			PT: No record of overtopping/ Water logging. Checklists based monitoring				
5. Flora								
5.1 Vegetation	• Planted trees, shrubs, and grasses to be properly maintained. • The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of 70% tree survival Checklists based monitoring	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
6. Maintenance of Right of Way and Safety								
6.1 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 road side • 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. Checklists based monitoring	Visual inspection Check accident records	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
6.2 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. • Monitor/ensure that all safety provisions included in design and construction phase are properly maintained • Highway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. • Tow-way facility for the breakdown vehicles if possible. • Road furniture shall be as per Schedule-C and applicable IRC Codes. • Road Safety Audit should be conducted on regular basis	IRC:SP:55-2014/And IRC:SP:88-2010	Throughout the Project route	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 Checklists based monitoring	Review accident records Site observations	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
6.3 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	Review of spill prevention and emergency response plan	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
				PT: Fully functional emergency system. Checklists based monitoring	Spill accident records			

EFP: Environmental Focal Person, RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, PMC: Project Management Consultant, AE: Authority Engineer, IEE: Initial Environmental Examination, IRC: Indian Road Congress, DEIAA: District Environmental Impact Assessment Authority, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENTAL MONITORING PLAN FOR CHURU-TARANAGAR-NOHAR ROAD

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
Air Quality	Construction stage	PM 10 PM 2.5 SO2, NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Human Habitation during commencement of construction activities in Gajsar, Sahjoosar, Ginri Patta Lohsana, Bhairoosar Chalkoi Baneerotan, Anandsinghpura, Taranagar Bhalau Tal, Bhanin, Dheerwas Bara, Sahwa, Khopran, Meghana, Durjana, Dalpatpura, Nohar. (Chainages of both habitations and schools are given in Section 15 of Schedule-A) Batching and hot mix plants sampling part of SPCB annual renewal of permits Total No of Samples 2 times in each human habitations during construction period -62 One sample for HMP, One sample for Batching/RMC Concreate Mix Plan and one sample for WMM Plant in each quarter during	During Active Construction Phase	Air quality standard by CPCB	110x 9000=Rs.99 0000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
				construction period. Total No of sample-48 samples. Total numbers of samples 110 during entire scheduled construction period. No of samples may increase for EOT period.					
	Operation stage			Toll Plaza-3 sample each quarter. Total 12 samples in a year. Human habitations, especially sensitive receptors. 6 samples in each quarter. Total no of 18 samples.	24 hr continuous, 3/year for 1 year of operation period (Total 3 times in a year Except Monsoon Season)	Air quality standard by CPCB	30X9000 =Rs 270000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Water Quality	Construction stage	Ground water: (IS: 10500:2012) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps	3/year till the end of construction activities (Total 3 times in a year baring monsoon), 6 bore well, 6 surface water sample in each quarter. Minimum 3 samples in each quarter. Total no 90 samples during entire scheduled construction period. No of samples may	Water quality standard by CPCB	90x 5000 = Rs 450000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
					increase for EOT period.				
	Operation stage			Groundwater at 4 locations and surface water at 4 locations	3/year for 1 year	Water quality standard by CPCB	24x5000=Rs 120000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968Using Noise level meter	Same as air quality Total numbers of samples 70 during entire scheduled construction period. No of samples may increase for EOT period.	During Active Construction Phase	National Ambient Noise Standard specified in Environment Protection Act, 1986	110 x1500=Rs.165000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
	Operation stage			Same as air quality	3/year for 1 year		30x1500=Rs .45000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer RPWD / supervision consultant	Camp, Dumping/storage areas and HMP sites (Total 4 sample locations)	Once during entire construction stage	ICAR standards	4x3000=Rs. 12000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination locations (Total 3 samples)	Once for the first year of operation	ICAR Standards	3x3000=Rs. 9000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		Throughout the Project Corridor especially at River banks, bridge locations and river training structures	After first rain	Visual Checks	Included in Engineering Cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of AE/PMC/RPWD-PIU-PPP	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	Engineering Team of RPWD/ AE/PMC/RPWD-PPP	
Borrow Areas- Prior obtaining of ECs for borrow areas is exempted by MoEFCC	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	ADB and IRC guidelines	EPC Contractor	EPC Contractor with approval from AE/PIU-RPWD-PPP	AE/PMC/RPWD-PIU-PPP
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			EPC Contractor with approval from AE/PIU-RPWD-PPP	
Construction Sites and Labor Camp	Construction stage	Visual Checks of Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	EPC Contractor with approval from AE/RPWD-PIU-PPP	AE/PMC/RPWD-PIU-PPP
Tree Plantation	Construction Stage	Visual check based Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD Additional Plantation: Provisional sum under Civil Cost	Compensatory: RPWD/Local Forest Departments Additional Plantation: Implementation by The EPC Contractor. Supervision and Monitoring by AE/PMC/RPWD-PIU-PPP	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Quarterly during Defect Liablity Period			The AE will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD-PIU-PPP through PMC/EPC Contractor will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by IE/Safety Consultant and approved by RPWD-PIU		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/IE/RPWD-PIU-PPP	Part of the regular monitoring	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/Monitoring
	Operation stage			Throughout the stretch	occurrence of accidents	Same as above	Same as above	Road Safety unit of RPWD-PIU-PPP, with support from local police, AE and PMC	
Monitoring Costs: INR 46611000.00 excluding other applicable charges including GST to be mentioned in Terms and Conditions of Contract Agreement signed between EPC Contractor and Outsourced Monitoring Laboratory.									

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Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1. Alignment Design	• Proposed design adopted in accordance with the provisions of the following IRC and BIS Codes/ MoRTH guidelines/ AASHTO specifications. • Geometrical design standards will mostly follow. • 2-Lane Plus Carriageway: • Carriageway Width = 7.0m, • Paved Shoulder Width = 2 x 1.5m, • Earthen/ Granular/ Paver block Shoulder Width= 2 x 2.0m or varying width shoulder. • Side Drain = 2 x 1.5m footpath drain • Roadway Width = 14.0m (Minimum) • Road Way Length=38+60Km • Paver Block Shoulder Width = 2 x 2.0m or varyin • Side Drain = 2 x 1.5m footpath drain	Section 2 of the Manual of Specifications and Standards for Two Lanning of Highways with Paved Shoulder (IRC: SP:73-2018)	Widening of whole project road from km 72/000 to 110. + 600 (Length 38+ 600 km) shall follow the existing alignment unless geometric deficiencies with horizontal and vertical profiles which shall be corrected within available RoW as per prescribed standards. Raising and reconstruction of embankment at location where road top level is equal to less than HFL.	MI: Recording of near miss, incident, accident, safety parameters etc w.r.t to designed alignment. PT: Design in compliance to prescribed Standards. MI: Design Parameter's compliance to prescribed Standards. PT: Designs are in accordance with site requirements	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP
1.2. Pavement Design	• Bottom of crust shall be at least 600mm above HFL to prevent any capillary action due to black cotton/ expansive/ cohesive soil.	Section 5 of the Manual of Specifications and Standards	Flexible pavement is proposed for a minimum design period	MI: Monitoring of wearing and damaging of	Review of detail design documents & drawings and comparison	Covered under preliminary design preparation	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Flexible Pavement Thickness is proposed for almost entire length with minimum design period of 20 years. • CBR value of sub grade as per IRC guidelines. • 40mm BC with PMB-70 has been considered as surface course and 60mm DBM with VG-30 has been considered for Base/ binder course. • Also, Rigid Pavement thickness for small section for a design period of 30 years with PQC-M40 Grade of 300m, Dry Lean Concrete of 150mm and Granular Sub Base of 250mm.	and IRC:37 & IRC:58.	of 20 years for the carriageway and paved shoulders of entire project stretch, except Toll Plaza Sections where Rigid Pavement shall be provided for a design period of 30 years.	pavement condition. PT: Design Parameter's compliance to prescribed Standards.	with site conditions	by F/S consultant Detailed design cost to be borne by EPC Contractor		
1.3. Drainage Provisions	• Raised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also inconvenience caused to nearby community. • Provision of adequate nos. of cross drainage structures. • Increased (vent and height) in waterway of existing structures. • Roadside drains have been proposed with suitable outfalls. • Additional culverts and bridges	Provision of lined drain as per IRC: SP:42-2014 & IRC: SP:50-2013. IRC SP: 42-2014 and IRC SP: 50-2013. MORTH Specifications for Road and Bridge Works 5th Revision 2013	Cross-Drainages Culverts Reconstruction (3 nos. slab culverts, 2 stone slab culverts, 7 Utility Pipe Culverts, 4 pipe Culverts and 1 Box Culvert. The Contractor shall prepare drainage plan for complete highway and provide additional new	MI: Monitoring of the function of cross drainage, longitudinal drainages and climate adaptation during exigencies. PT: Standard Design and required numbers of cross and side drains, slab/ box	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Causeway and submerged bridges to be replaced with high level bridges • Roadside longitudinal drains to avoid water logging in built-up-sections and rural sections proposed with suitable outfalls. • Prevention of waterlogging and overtopping due to intensive rainfall.		culverts as per drainage design requirements at locations finalised in consultation with Authority Engineer (AE) and shall not be considered as Change of Scope. Bridges Reconstruction of 1 minor bridge at km 05+431 Longitudinal drains (B/S together) Footpath cum covered drains in built-up sections = 41.66 km (B/S). RWH at every 2km in a staggered manner on LHS and EHS in the entire project length	culverts, and Hume pipes				

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
			Note: Utility Pipes are retained to be treated with minor/major repairs such as vegetation clearance, plastering of reinforcement exposed surface, silt removal & bed clearance and replacement of parapet which are damaged etc. in accordance with Section 7 of the Manual					
1.4. Safety along the proposed alignment	• Vertical and horizontal geometrics in consistent to adequate numbers of road signs and pavement markings IRC/MORTH guidelines. • Provision of crash barriers at high embankments. • Speed breakers in habitat areas, schools, junction and curves to regulate speed. • Provision retro-reflective warning signboards, LED traffic beacons near school, hospital, religious places and forests • Safety kerb at all bridges	Design requirement IRC:SP:73-2007 IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MoRTH Specifications	Curve locations Speed Breakers and signages near built-up areas and toll plaza Road Studs, object Markers etc.	MI: number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc PT: numbers and location are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	Design Consultant	PMC/RPWD -PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Informatory traffic signage/ Road markings on approach to built-up sections on Ambulance and medical aid posts • Checking for overloading at toll plazas. • Speed restrictions in built up sections curve locations etc. • Roadside Safety Barriers near culverts, bridges. • Pedestrian Guard Rails / Footpath Facilities at Schools. • Other road safety furniture comprising road signs, road markings, object markers, hazard marker, studs, delineators, attenuators, safety barriers, pedestrian guard rails, boundary stones, kilometer stone etc.	Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012						
2. **Natural Hazards and Climate Change risks**								
2.1. Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. 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 PT: No softening, rutting, asphalt migration/thermal expansion of joint	Review of design documents and drawings and comparison with site conditions	preliminary design cost of F/S consultant Detailed design cost to be borne by concessionaire		PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
2.2. Flooding/Water-Logging	• Adequate number of CD structures. Additional culverts also proposed. • CD structures designed for 50year return period. • Water ways of bridges and culverts have been increased. • Roadside drains also provided • Embankment height raised along low lying/ potential water-logged areas. • Improvement in existing culverts • 2 Box culverts, 5 Slab culverts, 7 Pipe culverts, 25 Syphons and 2 Cross drains are proposed to prevent water logging and flooding.	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	Same as 1.1	MI: Design and numbers of cross & side drains, slab/box culverts Hume pipes, road embankment height, design and number of bridges PT: Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	Design Consultant	PMC/RPWD-PIU
2.3. Earthquake	• Relevant IS codes shall be 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 PT: Design conforms BIS and IRC guidelines	Review of design documents and drawings and comparison with site conditions	F/S consultant, Detailed design cost to be borne by concessionaire	Design Consultant	PMC/RPWD-PIU
2.4. Drought	• Ensure water availability for compaction work and consolidation of sub-structure	IRC:78-2000 Standard Specifications and Code of Practice for Road Bridges	Entire Stretch	MI: Monitoring GW levels, public consultations with local communities	Design and drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	Design Consultant	PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
				PT: Water availability and scarcity				
2.5. Forest Fires	• Measures to avoid accident followed by fuel spills. • Removal of maintenance slash or management by controlled burning. • Plant fire-resistant species in RoW • Thinning slashing during non-dry season. • No construction camp within 500m of Notified Forest Areas.	Design requirement	There is no forest along proposed road	MI: Damage to roadside flora and spillage /fuel accumulation induced accident PT: Zero incidence of forest ire		Covered under F/S consultant cost	Design Consultant	PMC/RPWD-PIU
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. • Minimize resettlement impact due to heavily congested built-up section • Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. • Complete all necessary land and property acquisition procedures prior to the commencement of civil work. • Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework.	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.	Refer SIA/RAP for more details	MI: Payment of compensation and assistance to DPs as per RP Number of complaints/grievances related to compensation and resettlement PT: Minimal number of complaints/grievances. All cases of resettlement and	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	RPWD and implementing NGO	PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Compensation and assistance as per project Resettlement Plan • Income restoration as per RP • Preference in employment and petty contracts during construction to APs • Constitute GRC as per RP			rehabilitation if any are resolved at GRC level. No case referred to arbitrator/court				
4. **Diversion of Forest Land and Cutting of Trees**								
4.1. Need for cutting of trees and diversion of forest land	• Geometric adjustments to minimize tree cutting and diversion of forest land • Obtain tree cutting permission from forest department • Provision for mandatory compensatory afforestation (1:3) for deposit of payment to Forestry Department • Provision for additional compensatory plantation on 1: 3 basis to be implemented by concessionaire	Forest Conservation Act, 1980	Forest Diversion =Nil Total number of affected trees= 1192 EPC Contractor shall plant 4000 saplings as per Schedule-C.	MI: Number and location of geometric adjustments made to avoid forestland and tree cutting, budget amount allocated for compensatory afforestation and additional plantation (1:3) PT: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,	Review final design. Check budget provision for compensatory afforestation and additional plantation. Onsite validations of plantations carried out. Checklists based monitoring	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	RPWD, Design consultants forest department	SHAH/Forest department, IE/PMC/RPWD-PIU
5. **Shifting of Utilities**								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
5.1. Disruption of utility services to local community	• All telephone and electrical poles/wires and underground cables should be shifted before start of construction • Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services • Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any.	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. Minimal time for utility shifting	Interaction with concerned utility authorities and local public Checklists based monitoring	Included under RPWD's costs	EPC Contractor/ RPWD/utility company	AE/PMC/RPWD-PIU
B. Construction Stage								
1. Preparatory activities								
1.1 Preparatory activities	• Submit appointment letter and resume of the EPC Contractor's Environmental Focal Person (EFP) to PMU • EFP will engage PMC Environment Specialist and PMU Safeguard Officer-Environment to a meeting to discuss in detail the EMP, seek clarification and recommend corresponding revisions if necessary • EFP will prepare implementation schedule of the approved EMP, EMoP, and agreements reached	Project requirement	Project Office, EPC Contractor's construction camp	Approvals, attendance Checklists based monitoring	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD/utility company	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	during the meeting with PMC-ES and PMU-SOE • EFP will consult Environmental Safeguard Implementation Manual and will apply monthly monitoring formats (Checklists) and establish deadlines for submission in consultations with ES(PMC) and ES (AE). • EFP will submit for PMC-ES approval an action plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g. fuel, lubricants, explosives), iii) waste disposal sites, iv) temporary storage location, iv) water use, and v) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan. • EFP will submit for approval of PMC-ES the construction camp layout before its establishment.							
1.2 Site induction	• No works will be initiated by the EPC contractor until the	Project requirement	Conference/Meeting Room in construction	Approvals, attendance	PMC accomplishment report	Part construction cost for	EPC Contractor/	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	site induction training is carried out by the PMC • Site induction training includes but not limited to: i) discussion and review of EMP and EMoP detailing how specific environmental risks associated with their Scope of Work will be managed legal compliance, inspection and audits, and progress tracking and reporting; ii) environmental training and awareness needs shall be determined and documented via a training needs analysis prior to commencement; iii) Health and Safety Awareness Course, which details general environmental awareness and specific performance requirements expected on site; and iv) GRM and v) compliances to implementation of Community Occupational Safety & Health Plan (COSHP) for prevention and control of spread of COVID-19..		camp of EPC Contractor or any other suitable place, adequately big enough in aeral size for observed required social distancing, where Audio-visual facilities for delivering training programmes, can be installed.	Checklists based monitoring		Contractor and PMC Contract	RPWD/utility company	
1.3 Poor siting and layout of workers camp and other infrastructure facilities	• The location, layout and basic facility provision of each labour camp and others will be submitted to (Supervision Consultant) and Project Implementing Unit (PIU) prior to their construction. • Ensure solid waste and liquid management plan subject to	Project requirement. General Condition of the Bid Document	All contractors and sub-contractors	MI: Review the design Check compliance with design sitting. PT: Confirms Camps site not disturbs	Observations on the site location	Part construction cost for Contractor and PMC Contract	EPC Contractor	AE/PMC/RPWD-PPP-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	the review and approval of the Supervision Consultant • Camps sitting to maintain minimum distance from following: • # 500m from habitations • # 500m from water bodies • # 500m from main traffic routes • Land agreement with land owner for establishment of construction/ labour camps • Submit CTE/ CTO from PCB for establishment of camps, crushers, HMP, WMM, batching plants etc.			the nearby habitation and main road traffic. Not to pollute receiving waterbodies. Checklists based monitoring				
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	• Concessionaire to submit location and layout plan for storage areas of construction materials agreed by PD-PPP-PIU-RPWD and TL(AE). • 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-Sunsequent Amendments and Central Motor and Vehicle Act 1988 General Conditions of Bid Document,	Throughout project corridor as required during construction activities, Human Habitation during commencement of construction activities in Akhegarh, Bhikru, Barolichchar, Katara, Nadbai, Gangroulli, Asrawan, Pidi,	MI: NAAQS Limits, Complaints from locals due to dust PT: Compliances to NAAAQS Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by EPC contractor Checklists based Monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
			Kumher. Chainages of these built up areas and schools are as per 15 (Schedule-A) and Section 7.22 of Schedule--B.					
2.2 Emission of air pollutants (HC, SO2, NOX, CO etc) from vehicles due to traffic congestion and use of equipment and machinery	• Regular maintenance of machinery and equipment. • Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. • Only crushers licensed by the PCB shall be used. • DG sets with stacks of adequate height and use of low Sulphur diesel as fuel. • LPG should be used as fuel source in construction camps instead of wood • Ambient air quality monitoring. • Contractor to prepare traffic management and dust suppression plan duly approved by PD-PIU-PPP-RPWD after review by TL (AE). • Periodic pollution checking of all vehicles and obtaining of Pollution Under Control	The Air (Prevention and Control of Pollution) Act, 1981 and applicable subsequent Amendments. Requirements of Report of Environmental Pollution (Prevention and Control) Authority for the National Capital Region, dated 24th April 2017, submitted to all SPCBs.	Asphalt mixing plants, crushers, DG sets locations Human Habitation during commencement of construction activities in Akhegarh, Bhikru, Barolichchar, Katara, Nadbai, Gangroulli, Asrawan, Pidi, Kumher. Chainages of these built up areas and schools are as per 15 (Schedule-A) and Section	MI: Levels of HC, SO2, NO2, and CO. Status of PUC certificates PT: Compliances to NAAQS. PUC certificates of equipment and machinerys is upto date	Standards CPCB methods Review of monitoring data maintained by EPC contractor Checklists based Monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	Certificates (PUCs) and their renewal at required periods of time.		7.22 of Schedule-B.					
3. Noise								
3.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	• All equipment to be timely serviced and properly maintained. • Construction equipment and machinery to be fitted with silencers and maintained properly. • Only IS approved equipment shall be used for construction activities. • Timing of noisy construction activities shall be done during night time and weekend near schools, • Implement noisy operations intermittently to reduce the total noise generated • Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. • Restrict construction near residential, built up and forest areas construction to day light hours. • Honking restrictions near sensitive areas. • PPEs to workers • Noise monitoring as per EMoP.	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites and residential and sensitive locations. Human Habitation during commencement of construction activities in Akhegarh, Bhikru, Barolichchar, Katara, Nadbai, Gangroulli, Asrawan, Pidi, Kumher. Chainages of these built up areas and schools are as per 15 andaa(Schedule-A) and Section 7.22 of Schedule--B.	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 Checklists based monitoring	Included in civil works costs	EPC Contractor	AE/PMC/RPWD-PIU
4. Land and Soil								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
4.1 Land use Change and Loss of productive / topsoil	• Non-agricultural areas to be used as borrow areas to the extent possible. • If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. • Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original land use	Project requirement, Applicable ADB and IRC Guidelines	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area, Compliances with Applicable ADB and IRC Guidelines PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	• Bio-turfing of embankments to protect slopes. • Slope protection by providing • frames, drystone pitching, masonry retaining walls, planting of grass and trees. • 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 than2:1. • The earth stockpiles to be provided with gentle slopes to soil erosion.	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	MI: Occurrence of slope failure or erosion issues PT: No slope failures. Minimal erosion issues Checklists based monitoring	Review of design documents and site observation	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU
4.3 Borrow area management	• Non-productive, barren lands, upland shall be used for borrowing earth with the	IRC Guidelines on borrow areas and for	Borrow sites /locations	MI: Existence of borrow areas in inappropriate	Review of design documents	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	necessary permissions/consents. • Depths of borrow pits to be regulated and sides not steeper than 25%. • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Transportation of earth materials through covered vehicles. • Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation • Borrow areas not to be dug continuously. • To the extent borrow areas shall be sited away from habitated areas. • Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fish pond.	quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act)+Clause 305.2.2 MORTH Specifications for Road and Bridgeworks, Applicable ADB and IRC Guidelines for Borrow Areas management		unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people. PT: No case of non-compliance with Applicable ADB and IRC Guidelines. Zero accidents. Zero complaints No use of black cotton soil	and site observations Checklists based monitoring			
4.4 Quarry Operations	• Aggregates will be sourced from existing licensed quarries. • Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to RPWD.	Clause No.111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry	New Quarry if needed	MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry	Review of design documents, contractor documents and site observation Compliance to EC	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. • Obtain environmental clearance from SEIAA //DEIAA in case of opening new quarry	Areas Management Environmental Protection Rules		redevelopment plan PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit	conditions in case of opening new quarries Checklists based monitoring			
4.5 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 be restored to its original condition PT: Zero occurrence of destroyed/compacted land and undestroyed land	Site observation Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU
4.6 Contamination of soil due to leakage/ spillage of oil,	• Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel	Design requirement	Fueling station, construction sites, and construction	MI: Quality of soil near storage area	Site observation	Included in civil work cost.	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
bituminous and non-bituminous debris generated from demolition and road construction	spillage does not contaminate the soil. • Fuel storage and refueling sites to be kept away from drainage channels. • Unusable debris shall be dumped in ditches and low lying areas. • To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. • Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors • Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. • Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board		camps and disposal location.	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	Checklists based monitoring			
5. Water Resources								
5.1 Sourcing of water during Construction	• Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. • Arrangements shall be made by EPC contractor that the water availability and	CGWA Guidelines	Throughout the Project section Water harvesting structure at toll plazas	MI: Approval from competent authority Complaints from local people on	Checking of documentation Talk to local people	Included in civil work cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	supply to nearby communities remain unaffected. • Water intensive activities not to be undertaken during summer season. • Provision of water harvesting structure to augment recharging of groundwater conditions (aquifers) in the project area. • Permissions from Local Irrigation Department, in case using canal water. • Agreement letters with local level water suppliers.			water availability PT: Valid approval from competent authority. Zero complaints from local people.	Checklists based monitoring			
5.2 Disposal of water during construction	• Provisions shall be made to connect road side drains with existing nearby natural drains.	Clause No.1010 EP Act 1986 MORT&H Specifications for Road and Bridgeworks	Throughout the Project section. There is no major water body along the alignm	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 Checklists based monitoring	Included in civil work cost	EPC Contractor	AE/PMC/RPWD-PIU
5.3 Alteration in surface water hydrology	• Existing drainage system to be maintained and further enhanced.	Design requirement, Clause No 501.8.6.	Near all drainage channels, river/	MI: Proper flow of water in existing	Review of design documents	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. • Road level shall be raised above HFL level wherever road level is lesser than HFL. • Culverts reconstruction shall not 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.	MORT&H Specifications for Road and Bridge	nallah crossings etc.	streams and rivers PT: No complain of water shortage by downstream communities. No record of overtopping/ water logging	Site observation Checklists based monitoring			
5.4 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 works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system.	Design requirement, ClauseNo501. 8.6. MORT&H Specifications for Road and Bridgeworks Worldwide best practices	Near all waterbodies /waterway	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	Field observation Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Retaining walls at water bodies /ponds to avoid siltation near ponds			to turbidity and TSS limit				
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	• No vehicles or equipment should be parked or refueled near water-bodies, so as to avoid contamination from fuel and lubricants. • Oil and grease traps and fueling platforms to be provided at re-fueling locations. • All chemicals and oil shall be stored away from water and concreted platform with catchment pit for spills collection. • All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors. • Construction camp to be sited away from water bodies. • Wastes must be collected, stored and taken to approve disposal site only. • Water quality shall be monitored	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof / as well as IS-10500:2012	Water bodies, refueling stations, construction camps.	MI: Water quality of ponds, streams, rivers and other water bodies in project Presence of oil floating in water bodies in project area PT: Surface water quality meets freshwater quality standards prescribed by CPCB	Conduction of water quality tests as per the monitoring plan Field observation Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
6. Flora and Fauna								
6.1 Vegetation loss due to site preparation and construction activities	• Restrict tree cutting up to toe line considering safety to road users. • Roadside trees to be removed with prior approval of competent authority. • Mandatory compensatory plantation at 1:3 basis by Forestry Department • Additional plantation on 1:3 basis as per the IRC guidelines to be carried out by concessionaire • Regular maintenance trees planted. • Provision of LPG in construction camp as fuel source to avoid tree cutting. • Plantation of trees on both sides of the road where technically feasible. Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and provide adequate sight distance. • Integrate vegetation management (IVM) with the carriage way completely clear of vegetation. • Controlled use of pesticides/ fertilizers	Forest Conservation Act1980 + IRC:SP:21 and IRC:SP:66	Throughout project corridor Estimated No. of affected tree=1168 EPC Contractor shall plant 4000 saplings as per Schedule-C. EPC Contractor shall look after operation and maintenance of this plantation.	MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. PT: compensatory afforestation done on a 1:3 basis by concessionaire.	Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy Field observations Checklists based monitoring	Mandatory Compensatory afforestation cost is included in project costs under RPWD. Additional compensatory afforestation costs included in civil works costs	Mandatory Compensatory plantation by forest Department and additional plantation by EPC Contractor	AE/PMC/RPWD-PIU
7. Construction Camps								
7.1 Impact associated with location	• All camps should be established with prior permission from PCB. Camps	Design Requirement	Construction camp	MI: Location of campsites and distance	On site observation	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	to maintain minimum distance from following: • # 500 m from habitation • # 500 m from forest areas where possible • # 500 m from water bodies where possible • # 500 m from through traffic route • # 500 m from identified wildlife crossing areas • # No construction camp within 500 m of water body	As identified in IEE, All applicable laws, rules and regulations including Contract Labour laws as well as, EHS policy and rules.		from habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	Interaction with workers and local community Checklists based monitoring			
7.2 Worker's Health in construction camp	• The location, layout and basic facility provision of each labor camp will be submitted to AE and approved by PD-PIU-PPP-RPWD. The EPC contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. • Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. • Preventive medical facilities in camp • Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The EPC Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health.	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	All construction camps	MI: Camp health records, Compliance to SOPs of COSHP for COVID-19 Protection. Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	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. • Compliance to SOPs of COSHP for COVID-19 Protection.			vectors. Zero cases of STD. Clean and tidy camp site conditions. Compliance to SOPs of COSHP for COVID-19 Protection. Checklists based monitoring				
8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	• Contractor to submit a waste/spoil disposal plan and get it approved by AE and PD-PIU-PPP-RPWD. • 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	Design Requirement, MORT&H guidelines and General Conditions of Contract Document, Construction and Demolition Waste Management Rules-2016 and subsequent Amendments.	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 Checklists based monitoring	Included in civil works cost.	EPC Contractor.	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	has to be obtained before finalizing the location.							
8.2 Reuse and disposal of construction and dismantled waste	• The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. • All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. • Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. • The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. • Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.	Design Requirement, MORT&H guidelines and General Conditions of Contract Document Construction and Demolition Waste Management Rules 2016 and subsequent Amendments.	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or CSC	Contractor records Field observation Interaction with local people Checklists based monitoring	Included in civil works cost.		
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	• Traffic Management Plan shall be submitted by the contractor and approved by the CSC.	Design requirement and	Throughout the project corridor especially at intersections.	MI: Traffic management plan. Presence/	Review traffic management plan	Included in civil works cost.	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. • The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.	IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 - 1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC:SP:55-2014		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	Field observation of traffic management and safety system Interaction with people in vehicles using the road Checklists based monitoring			
	• On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. • Restriction of construction activity to only one side of the existing road • The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from “Engineer”.	The building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer’s Requirement of Bid Document						

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.							
9.2 Pedestrians, 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 animal movement is expected. • Large number of box culverts has been proposed..All structures having vertical clearance above 2m 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, 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 Checklists based monitoring	Included in civil works cost.	EPC Contractor	AE/PMC/RPWD-PIU
9.3 Safety of Workers and accident risk from construction activities	• Contractors to adopt and maintain safe working practices. • Usage of fluorescent and retro refectory signage, in local language at the construction sites • Training to workers on safety procedures and precautions. • Mandatory appointment of safety officer. • All regulations regarding safe scaffolding, ladders,	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety	Site observation Review records on safety training and accidents Interact with construction workers	Included in civil works cost	Obligation of EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	working platforms, gangway, stair wells, excavations, trenches and safe means of entry and egress shall be complied with. • Provision of PPEs to workers. • Provision of a readily available first aid unit including an adequate supply of dressing materials. • The contractor will not employ any person below the age of 18years • 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.			Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents. Checklists based monitoring				
9.4 Accident risk to local community	• Restrict access to construction sites only to authorized personnel. • Physical separation must be provided for movement of vehicular and human traffic. • Adequate signage must be provided for safe traffic movement • Provision of temporary diversions and awareness to locals before opening new construction fronts.	Same as above	Construction sites	MI: Safety signs and their location Incidents of accidents Complaints from local people PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	• Contractor will prepare site restoration plans, which will be approved by the AE. • The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. • All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. • All the opened borrow areas will be rehabilitated and 'AE ' will certify	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	MI: Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. PT: Clean and tidy sites. No trash or debris left on site. Site restored and leveled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found satisfactory Post-construction EMP implementation checklists-based monitoring	Included in civil works cost.	EPC Contractor	AE/PMC/RPWD-PIU
C. Operation and Maintenance stage								
1. Air Quality								
1.1 Air pollution due to due to vehicular movement	• Roadside tree plantations shall be maintained at least with 70% survival rate. • Regular maintenance of the road will be done to ensure good surface condition • Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981, Motor Vehicles Act 1948 and subsequent Amendments	Throughout the Corridor. Human Habitation during commencement of construction activities in Akhegarh, Bhikru, Barolichchar, Katara, Nadbai,	MI: Ambient air quality (PM10, CO, SO2 NO2) PT: Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Signages shall be provided reminding them 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. Obtaining of Pollution Under Control Certificates (PUCs) and their renewal on periodic basis.	Requirements of Report of Environmental Pollution (Prevention and Control) Authority for the National Capital Region, dated 24th April 2017, submitted to all SPCBs.	Gangroulli, Asrawan, Pidi, Kumher Sensitive Receptors along the alignment					
2. Noise								
2.1 Noise due to movement of traffic	• Effective traffic management and good riding conditions shall be maintained • Speed limitation to 20 km/hour and honking restrictions near sensitive receptors • Monitoring of Performance of Noise Barriers constructed and New Construction of any further required noise barriers near sensitive receptors with consent of local community • 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	Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof	Residential and sensitive locations location s of air quality monitoring. Human Habitation during commencement of construction activities in Akhegarh, Bhikru, Barolichchar, Katara, Nadbai, Gangroulli, Asrawan, Pidi, Kumher	MI: Noise levels PT: Levels are equal to or below baseline levels given in the IEE report	Noise monitoring as per noise rules, 2000 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RP WD-PIU	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	measures while constructing a building near road.							
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc. • Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RP WD-PIU	
4. Water resources/Flooding and Inundation								
4.1 Siltation	• Regular checks shall be made for soil erosion conditions for its effective maintenance.	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	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RP WD-PIU	
4.2 Water logging due to blockage of drains, culverts or streams	• Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams. • Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RP WD-PIU	
5. Flora								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
5.1 Vegetation	• Planted trees, shrubs, and grasses to be properly maintained. • The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RP WD-PIU	
6. Maintenance of Right of Way and Safety								
6.1 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 road side • 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	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RP WD-PIU	
6.2 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. • Monitor/ensure that all safety provisions included in design and construction phase are properly maintained • Highway patrol unit(s) forround the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of	IRC:SP:55-2014/And IRC:SP:88-2010	Throughout the Project route	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	Review accident records Site observations	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RP WD-PIU	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	any accident victims, if possible. • Tow-way facility for the breakdown vehicles if possible. • Road Safety Audit should be conducted on regular basis			as per relevant local law PT: Fatal and non fatal accident rate is reduced after improvement				
6.3 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	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU	

EFP: Environmental Focal Person, RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, PMC: Project Management Consultant, AE: Authority Engineer, IEE: Initial Environmental Examination, IRC: Indian Road Congress, DEIAA: District Environmental Impact Assessment Authority, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENTAL MONITORING PLAN FOR KHERLI-NADBAI-KUMHER ROAD

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/ Monitoring
Air Quality	Construction stage	PM 10 PM 2.5 SO2, NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Human Habitation during commencement of construction activities in Akhegarh, Bhikru, Barolichchar, Katara, Nadbai, Gangroulli, Asrawan, Pidi, Kumher. Chainages of these built up areas and schools are as per 15 (Schedule-A) and Section 7.22 of Sc Batching and hot mix plants sampling part of SPCB annual renewal of permits Total No of Samples 2 times in each human habitations during construction period -36 samples One sample for HMP, One sample for Batching/RMC Concreate Mix Plan and one sample for WMM Plant in each quarter during construction period. Total No of sample-18 samples. Total numbers of samples 54 during entire scheduled construction period. No of samples may	During Active Construction Phase	Air quality standard by CPCB	60x9000= Rs.5400000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/ Monitoring
				increase for EOT period.					
	Operation stage			Toll Plaza-one same each quarter. Total 3 samples in a year. Human habitations, specially sensitive receptors. 3 samples in each quarter. Total no of 9 samples.	24 hr continuous, 3/year for 1 year of operation period (Total 3 times in a year Except Monsoon Season)	Air quality standard by CPCB	32X9000= Rs 288000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU
Water Quality	Construction stage	Ground water: (IS: 10500:2012) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps	3/year till the end of construction activities (Total 3 times in a year baring monsoon), 1 bore well, 1 surface water sample in each quarter. Minimum 3 samples in each quarter. Total no 18 samples during entire scheduled construction period. No of samples may increase for EOT period.	Water quality standard by CPCB	30x 5000= Rs 150000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU
	Operation stage			Groundwater at 2 locations and surface water at 2 locations	3/year for 1 year	Water quality standard by CPCB	32x5000= Rs.160000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/ Monitoring
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968Using Noise level meter	Same as air quality Total numbers of samples 54 during entire scheduled construction period. No of samples may increase for EOT period.	During Active Construction Phase	National Ambient Noise Standard specified in Environment Protection Act, 1986	60X 1500= Rs.90000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU
	Operation stage			Same as air quality	3/year for 1 year		32x1500= Rs.4800.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer RPWD / supervision consultant	Camp, Dumping/storage areas and HMP sites (Total 3 sample locations)	Once during whole construction stage	ICAR standards	9x3000= Rs.27000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination locations (Total 3 samples)	Once for the first year of operation	ICAR Standards	9x3000= Rs.27000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		Throughout the Project Corridor especially at River banks, bridge locations and river training structures	After first rain	Visual Checks	Included in Engineering Cost	EPC Contractor	AE/PMC/RPWD-PIU
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of RPWD/ AE/PMC/RPWD	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	EPC Contractor	AE/PMC/RPWD-PIU
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	Engineering Team of RPWD/ AE/PMC/RPWD	
Borrow	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month		EPC Contractor	EPC Contractor with	AE/PMC/RPWD-PIU

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/ Monitoring
Areas- Prior obtaining of ECs for borrow areas is exempted by MoEFCC						ADB and IRC guidelines		approval from AE/PIU-RPWD	
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			EPC Contractor with approval from AE/PIU-RPWD	
Construction Sites and Labor Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	EPC Contractor with approval from AE/RPWD-PIU	AE/PMC/RPWD-PIU
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD Additional Plantation: Provisional sum under Civil Cost	Compensatory: RPWD/Local Forest Departments Additional Plantation: Implementation by The EPC Contractor. Supervision and Monitoring by AE/PMC/RPWD-PIU	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Quarterly during Defect Liability Period			The AE will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD-PIU through PMC/EPC Contractor will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by IE/Safety Consultant and approved by RPWD-PIU		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/IE/RPWD-PIU	Part of the regular monitoring	EPC Contractor	AE/PMC/RPWD-PIU
	Operation stage			Throughout the stretch	occurrence of accidents	Same as above	Same as above	Road Safety unit of RPWD with support from local police, AE and PMC	
Monitoring Costs: INR 6190000, 000 excluding other applicable charges including GST to be mentioned in Terms and Conditions of Contract Agreement signed between EPC Contractor and Outsourced Monitoring Laboratory.									

EFP: Environmental Focal Person, RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, PMC: Project Management Consultant, AE: Authority Engineer, IEE: Initial Environmental Examination, IRC: Indian Road Congress, DEIAA: District

Environmental Impact Assessment Authority, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard.

ENVIRONMENT MANAGEMENT PLAN FOR PALODA-GARHI-ANANDPURI ROAD

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1. Pavement damage and inadequate drainage provisions	• Proposed design adopted in accordance with the provisions of the following IRC and BIS Codes/ MoRTH guidelines/ AASHTO specifications. • Geometrical design standards will mostly follow: • 2-Lane Plus Carriageway: • Carriageway Width = 7.0m, • Paved Shoulder Width = 2 x 1.5m, • Earthen/ Granular/ Paver block Shoulder Width= 2 x 2.0m or varying width shoulder. • Side Drain = 2 x 1.5m footpath drain • Roadway Width = 14.0m (Minimum) • Roadway Length = 54.100 km	Section 2 of the Manual of Specifications and Standards for Two Lanning of Highways with Paved Shoulder (IRC: SP:73-2018)	Repair of Major Bridge = 1 at Anans River (55+800). Reconstruction of 6 minor bridges at CHs at 34+410, 43+512, 61+150, 65+795, 66+780 and 71+325. All existing chainages. Reconstruction of 9 slab culverts, 5 box culverts, 75 pipe culverts. Widening of 8 culverts and repair of 35 pipe	MI: Design and number of cross and side drains, slab/box culverts, and Hume pipes PT: Design and numbers are in accordance with site needs Checklists based monitoring	Review of detail design documents & drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
			culvets in Garhi-Anandapuri section. Toll Plaza=1 at 41+00 (existing chainage)					
1.2. Pavement Design	• Vertical and horizontal geometrics in consistent to IRC/MORTH guidelines • Provision of crash barriers at high embankments. • Speed breakers in habitat areas, schools, junction and curves to regulate speed. • Provision of retro-reflective warning signboards near school, hospital, religious places and forests • Safety kerb at all bridgs • Informatory signage on approach to built-up section • Ambulance and medical aid posts • Checking for overloading at toll plazas	Design requirement IRC:SP:73-2007 IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MoRTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	Curve locations List of Major and Minor Junctions requiring improvements is given in Section-A of Schedule-B. All the existing junctions to be improved to the corresponding Design Vehicle and all minor junctions to be improved to 60m on side roads. Speed Breakers and signages near built-up areas and toll plazas 1 no of Toll plaza at 41+00 (	MI: number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc PT: numbers and location are in accordance with site needs. Checklists based monitoring	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD -PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Speed restrictions in built up sections curve locations etc		existing chainages)					
1.3. Drainage provisions	• Raised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also inconvenience caused to nearby community. • Provision of adequate nos. of cross drainage structures. • Increased (vent and height) in waterway of existing structures. • Roadside drains have been proposed with suitable outfalls. • Additional culverts and bridges • Causeway and submerged bridges to be replaced with high level bridges • Roadside longitudinal drains to avoid water logging in built-up-sections and rural sections proposed with suitable outfalls. • Prevention of waterlogging and	Provision of lined drain as per IRC: SP:42-2014 & IRC: SP:50-2013. IRC SP: 42-2014 and IRC SP: 50-2013. MORTH Specifications for Road and Bridge Works 5th Revision 2013	Cross-Drainages Culverts Repair of Major Bridge = 1 at Anans River (55+800). Reconstruction of 6 minor bridges at CHs at 34+410, 43+512, 61+150, 65+795, 66+780 and 71+325. All existing chainages. Reconstruction of 9 slab culverts, 5 box culverts, 75 pipe culverts. Widening of 8 culverts and repair of 35 pipe culverts in Garhi-Anandpuri section.	MI: Monitoring of the function of cross drainage, longitudinal drainages and climate adaptation during exigencies. PT: Standard Design and required numbers of cross and side drains, slab/ box culverts, and Hume pipes	Review of detail design documents & drawings and comparison with site conditions Checklists based monitoring	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	overtopping due to intensive rainfall.		Longitudinal drains (B/S together) Footpath cum covered drains in built-up sections. RWH at every 2km in a staggered manner on LHS and RHS in the entire project length.					
1.4. Safety along the proposed alignment	• Vertical and horizontal geometrics in consistent to adequate numbers of road signs and pavement markings IRC/MORTH guidelines. • Provision of crash barriers at high embankments. • Speed breakers in habitat areas, schools, junction and curves to regulate speed. • Provision retro-reflective warning signboards, LED traffic beacons near school, hospital,	Design requirement IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC: 79, IRC: 99 IRC 119, and Section 800 of MoRTH Specifications	Throughout project corridor as required during construction activities, Road safety measures should be implemented along human habitation during commencement of construction activities in Paloda, Metwala, Suja Ji Ka Gada, Khodan, Agarpurua, Garhi, Bori,	MI: Monitoring of the functioning/ performance of proposed safety measures, w.r.t proposed numbers, location and site-specific needs and maintenance. PT: Required numbers and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc	Review of design documents and drawings and comparison with site conditions Checklists based monitoring	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	religious places and forests • Safety kerb at all bridges • Informatory traffic signage/ Road markings on approach to built-up sections on Ambulance and medical aid posts • Checking for overloading at toll plazas. • Speed restrictions in built up sections curve locations etc. • Roadside Safety Barriers near culverts, bridges. • Pedestrian Guard Rails / Footpath Facilities at Schools. • Other road safety furniture comprising road signs, road markings, object markers, hazard marker, studs, delineators, attenuators, safety barriers, pedestrian guard rails, boundary stones, kilometre stone etc shall be as per Schedule-C.		Anjana, Arthoona, Kotra, Chajja, Ananapuri and Schools at 35+00, 36+500, 58+00, Schools at Agarpura, Khodan Sujaji Ka Gada, , Metwala. .					
2. Natural Disaster and Climate Change Risks								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
2.1. Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt and paved surfaces	• Flexible Pavement Thickness is proposed for almost entire length with minimum design period of 20 years. • CBR value of sub grade as per IRC guidelines. • 40mm BC with PMB-70 has been considered as surface course and 60mm DBM with VG-30 has been considered for Base/ binder course.	IRC:37 & IRC:58 for flexible pavement design.	Entire stretch	MI: Monitoring pavement surface quality interms of roughness, cracking, rutting, softening etc. PI:No softening, rutting, asphalt migration/ thermal expansion of joints of bridges	Review of design documents and drawings and comparison with site conditions Checklists based monitoring	Covered under preliminary design cost of F/S consultant Detailed design cost to be borne by EPC Contractor	Design Consultant	PMC/RPWD-PIU-PPP
2.2. Flooding/ Water-Logging	• Adequate number of CD structures. Additional culverts also proposed. • CD structures designed for 50year return period. • Water ways of bridges and culverts have been increased. • Roadside drains also provided • Embankment height raised along low lying/ potential water-logged areas. • Improvement in existing culverts through increase in vent size or retrofitting's.	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	Repair of Major Bridge = 1 at Anans River (55+800). Reconstruction of 6 minor bridges at CHs at 34+410, 43+512, 61+150, 65+795, 66+780 and 71+325. All existing chainages. Reconstruction of 9 slab culverts, 5 box culverts, 75 pipe culverts.	MI: Monitoring overtopping/ flooding w.r.t design, functioning and numbers in accordance with site needs. PT: Standard Design and required numbers of cross & side drains, slab/ box culverts Hume pipes, road embankment height, design and number of bridges. Design and numbers are	Review of design documents and drawings and comparison with site conditions Checklists based monitoring	Covered under costs for DPR consultants and PPTA consultants	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	Longitudinal Drains designed so that runoff resulting from storms to a specified frequency of occurrence can be drained off immediately without overflowing or not being impounded in lower level of the Project Area and market areas.		Widening of 8 culverts and repair of 35 pipe culverts in Garhi-Anandpuri section. Footpath cum covered drains in built-up sections. RWH at every 2000 m in a staggered manner in the entire project length.	in accordance with site needs				
2.3. Earthquake	• Relevant IS codes shall be 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: Integrity of proposed structures like bridges, culverts and others. PT: Design conforms BIS and IRC guidelines.	Review of design documents and drawings and comparison with site conditions Checklists based monitoring	F/S consultant, Detailed design cost to be borne by concessionaire	Design Consultant	PMC/RPWD-PIU-PPP
2.4. Drought	• Ensure water availability for compaction work and	IRC:78-2000 Standard Specifications	Entire Stretch	MI: Monitoring GW levels, public consultations	Design and drawings of foundations	Covered under F/S	Design Consultant	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	consolidation of sub-structure	and Code of Practice for Road Bridges		with local communities. PT: Water availability and scarcity in the region and d/s of waterways.	, substructure and superstructure of Structures Checklists based monitoring	consultant cost		
2.5. Forest Fires	• Measures to avoid accident followed by fuel spills. • Removal of maintenance slash or management by controlled burning. • Plant fire-resistant species in RoW • Thinning slashing during non-dry season. • No construction camp within 500m of Notified Forest Areas.	Design requirement	There is no forest along proposed road.	MI: Monitoring of likely damage to roadside flora and spillage/ fuel accumulation induced accident. PT: Zero incidence of forest fires.		Covered under F/S consultant cost	Design Consultant	PMC/RPWD-PIU-PPP
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. • Minimize resettlement impact due to heavily congested built-up section	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and	Refer SIA/RAP for more details	MI: Payment of compensation and assistance to DPs as per RP Number of complaints/grievances related to compensation and resettlement	Check LA records; design drawings vs land plans; Interview with affected persons	Part of administrative and resettlement costs	RPWD and implementing NGO	PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. • Complete all necessary land and property acquisition procedures prior to the commencement of civil work. • Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. • Compensation and assistance as per project Resettlement Plan • Income restoration as per RP • Preference in employment and petty contracts during construction to APs • Constitute GRC as per RP	ADB's involuntary resettlement policy. Contract Clause for preference to local people during employment.		PT: Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case referred to arbitrator/court.	Check status of employment given to local people during construction			
4. Diversion of Forest Land and Cutting of Trees								
4.1. Need for cutting of trees and diversion of forest land	• Geometric adjustments to minimize tree cutting and diversion of forest land	Forest Conservation Act, 1980	Forest Diversion = Nil Total number of affected trees= 5000	MI: Monitoring number and location of geometric adjustments made to avoid	Review final design. Check budget provision	Covered under preliminary design preparation	RPWD, Design consultant	PMC/RPWD-PIU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Obtain tree cutting permission from district revenue office/forest department. • Provision for mandatory compensatory afforestation (1:5) for EPC Contractor. • EPC Contractor shall be responsible for maintenance of saplings and plantations.		Mandatory compensatory plantation in 1:5 ratio Overall, EPC Contractor shall plant at least 25000 saplings as compensatory afforestation as per Schedule-C.	forestland and tree cutting, budget amount allocated for compensatory afforestation and additional plantation. PT: Avoiding or bare minimum tree felling on Govt. land/ forest/ private land.	for compensatory afforestation Onsite validations of plantations carried out. Checklists based monitoring	by F/S consultant Detailed design cost to be borne by EPC Contractor		
5. Shifting of Utilities								
5.1. Disruption of utility services to local community	• All telephone and electrical poles/wires and underground cables should be shifted before start of construction • Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services • Local people must be informed through appropriate means about the time of shifting of utility structures and	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. Minimal time for utility shifting Checklists based monitoring	Interaction with concerned utility authorities and local public Checklists based monitoring	Included under RPWD's costs	EPC Contractor/ RPWD/utility company	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	potential disruption of services if any							
B. Construction Stage								
1. Preparatory activities								
1.1 Preparatory activities	• Submit appointment letter and resume of the EPC Contractor's Environmental Focal Person (EFP) to PMU • EFP will engage PMC Environment Specialist and PMU Safeguard Officer-Environment to a meeting to discuss in detail the EMP, seek clarification and recommend corresponding revisions if necessary • EFP will prepare implementation schedule of the approved EMP, EMoP, and agreements reached during the meeting with PMC-ES and PMU-SOE • EFP will consult Environmental Safeguard Implementation Manual and will apply monthly monitoring formats (Checklists) and establish deadlines for	Project requirement	Project Office, EPC Contractor's construction camp	Approvals, attendance Checklists based monitoring	PMC accomplishment report Checklists based monitoring	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	submission in consultations with ES(PMC) and ES (AE). • EFP will submit for PMC-ES approval an action plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g. fuel, lubricants, explosives), iii) waste disposal sites, iv) temporary storage location, iv) water use, and v) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan. • EFP will submit for approval of PMC-ES the construction camp							

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	layout before its establishment.							
1.2 Site induction	• No works will be initiated by the EPC contractor until the site induction training is carried out by the PMC • Site induction training includes but not limited to: i) discussion and review of EMP and EMoP detailing how specific environmental risks associated with their Scope of Work will be managed legal compliance, inspection and audits, and progress tracking and reporting; ii) environmental training and awareness needs shall be determined and documented via a training needs analysis prior to commencement; iii) Health and Safety Awareness Course, which details general environmental awareness and specific performance requirements expected on site; and iv) GRM and v)	Project requirement	Conference/Meeting Room in construction camp of EPC Contractor or any other suitable place, adequately big enough in aerial size for observed required social distancing, where Audio-visual facilities for delivering training programmes, can be installed.	Approvals, attendance Checklists based monitoring	PMC accomplishment report Checklists based monitoring	Part construction cost for Contractor and PMC Contract	EPC Contractor/ RPWD-PPP-PIU	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	compliances to implementation of Community Occupational Safety & Health Plan (COSHP) for prevention and control of spread of COVID-19..							
2. Air Quality								
2.1 Dust Generation due to constructio3n activities and transport, storage and handling of construction materials	• Concessionaire to submit location and layout plan for storage areas of construction materials agreed by PD-PPP-PIU-RPWD and TL (AE). • 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-Sunsequent Amendments and Central Motor and Vehicle Act 1988 General Conditions of Bid Document,	Throughout project corridor as required during construction activities, human habitations during commencement of construction activities in Paloda, Metwala, Suja Ji Ka Gada, Khodan, Agarpurua, Garhi, Bori, Anjana, Arthoona, Kotra, Chajja, Ananapuri and Schools at 35+00, 36+500, 58+00, Schools at Agarpura, Khodan Sujaji Ka Gada, , Metwala.	MI: NAAQS Limits, Complaints from locals due to dust. PT: Compliances to NAAAQS Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by EPC contractor Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
			.Chainages of both habitations and schools are given in Section 15 of Schedule-A). These locations will remain as it is.					
2.2 Emission of air pollutants (HC, SO2, NOX, CO etc) from vehicles due to traffic congestion and use of equipment and machinery	• Regular maintenance of machinery and equipment. • Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. • Only crushers licensed by the PCB shall be used. • DG sets with stacks of adequate height and use of low Sulphur diesel as fuel. • LPG should be used as fuel source in construction camps instead of wood • Ambient air quality monitoring. • Contractor to prepare traffic management and dust suppression plan duly approved by PD-PIU-PPP-RPWD	The Air (Prevention and Control of Pollution) Act, 1981 and applicable subsequent Amendments.	Asphalt mixing plants, crushers, DG set's locations, Human Habitation during construction activities in Paloda, Metwala, Suja Ji Ka Gada, Khodan, Agarpurua, Garhi, Bori, Anjana, Arthoona, Kotra, Chajja, Aanadpuri and Schools at 35+00, 36+500, 58+00, Schools at Agarpura, Khodan Sujaji Ka Gada, , Metwala.Palod a. .(Chainages of both habitations and schools are	MI: Levels of HC, SO2, NO2, and CO. Status of PUC certificates PT: Compliances to NAAQS. PUC certificates of equipment and machinery's is up to date.	Standards CPCB methods Review of monitoring data maintained by EPC contractor Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	after review by TL (AE). • Periodic pollution checking of all vehicles and obtaining of Pollution Under Control Certificates (PUCs) and their renewal at required periods of time.		given in Section 15 of Schedule-A).These locations will remain as it is.					
3. Noise and Vibration								
3.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	• All equipment to be timely serviced and properly maintained. • Construction equipment and machinery to be fitted with silencers and maintained properly. • Only IS approved equipment shall be used for construction activities. • Timing of noisy construction activities shall be done during night time and weekend near schools, • Implement noisy operations intermittently to reduce the total noise generated • Manage existing traffic to avoid traffic jams and accumulation of	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 DIN 4150 and BS 7385.	Throughout project section especially at construction sites and residential and sensitive locations as near schools and habitations, Paloda, Metwala, Suja Ji Ka Gada, Khodan, Agarpurua, Garhi, Bori, Anjana, Arthoona, Kotra, Chajja, Ananadpuri and Schools at 35+00, 36+500, 58+00, Schools at Agarpura, Khodan Sujaji Ka Gada, , Metwala.	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 UNI 9916 "Criteria for measuring and assessing the effects of vibration on buildings" DIN 4150 BS 7385 Consultation with local people Review of noise level monitoring data maintained by contractor	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	noise beyond standards. • Restrict construction near residential, built up and forest areas construction to day light hours. • Conduct condition surveys of all properties within 25 meters from road edge • Vibration monitoring during heavy machinery/ equipment operation • Honking restrictions near sensitive areas. • PPEs to workers • Noise monitoring as per EMoP.		(Chainages of both habitations and schools are given in Section 15 of Schedule-A).These locations will remain as it is.		Observation of construction site Checklists based monitoring			
4. Land and Soil								
4.1 Land use Change and Loss of productive / topsoil	• Non-agricultural areas to be used as borrow areas to the extent possible. • If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. • Land for temporary facilities like construction camp, storage areas etc.	Project requirement, Applicable ADB and IRC Guidelines	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area, Compliances with Applicable ADB and IRC Guidelines PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	shall be brought back to its original land use							
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	• Bio-turfing of embankments to protect slopes. • Slope protection by providing • frames, dry stone pitching, masonry retaining walls, planting of grass and trees. • Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. • The earth stockpiles to be provided with gentle slopes to soil erosion.	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road for example retaining walls/ toe walls are proposed. Slope protection events has been proposed with stone pitching at various near sites.	MI: Occurrence of slope failure or erosion issues. PT: No slope failures. Minimal erosion issues	Review of design documents and site observation Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
4.3 Borrow area management	• Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/consents. • Depths of borrow pits to be regulated and	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act)+Clause	Borrow sites /locations	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents.	Review of design documents and site observations Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	sides not steeper than 25%. • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Transportation of earth materials through covered vehicles. • Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation • Borrow areas not to be dug continuously. • To the extent borrow areas shall be sited away from habituated areas. • Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fish pond. • EPC Contractor to submit copies of STPs/Land Owners Consent Letters.	305.2.2 MORTH Specifications for Road and Bridgeworks, Applicable ADB and IRC Guidelines for Borrow Areas management		Complaints from local people. PT: No case of non-compliance with Applicable ADB and IRC Guidelines. Zero accidents. Zero complaints No use of black cotton soil. Checklists based monitoring				

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
4.4 Borrow area management	• Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/consents . • Depths of borrow pits to be regulated and sides not steeper than 25%. • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Transportation of earth materials through covered vehicles. • Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation • Borrow areas not to be dug continuously. • To the extent borrow areas shall be sited away from habitat areas. • Borrow areas shall be levelled with salvaged material or other filling materials which do not pose contamination of	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause 305.2.2 MORTH Specifications for Road and Bridgeworks, Applicable ADB and IRC Guidelines for Borrow Areas management	Borrow Area sites	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Numtestesber of accidents. Complaints from local people. PT: No case of non-compliance with applicable ADB and IRC Guidelines. Zero accidents. Zero complaints No use of black cotton soil	Review of design documents and site observations Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	soil. Else, it shall be converted into fish pond. • EPC Contractor to submit copies of STPs/ Land Owners Consent Letters.							
4.5 Quarry Operations	• Aggregates will be sourced from existing licensed quarries. • Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to AE/RPWD-PIU-PPP/PMC. • The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. • Obtain environmental clearance from SEIAA /DEIAA in case of opening new quarry. • Observe compliance to EC Conditions.	Clause No.111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	New Quarry if needed and existing Quarries	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 Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
4.6 Compaction of soil and impact on quarry haul roads due to movement of	• Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction.	Design requirement	Parking areas, Haulage roads and construction yards.	MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural	Site observation Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
vehicles and equipment	• 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.			land or land which has not been restored to its original condition PT: Zero occurrence of demolished/ compacted land and undemolished land.				
4.7 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	Design requirement	Fueling station, construction sites, and construction camps and disposal location. No material should be disposed in water bodies water bodies after Mor, Metwala (RHS),	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	Site observation Checklists based monitoring	Included in civil work cost.	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	ditches and low lying areas. • To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. • Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors • Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. • Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board		at), at 34+00 (LHS), at 36+900, 52+700 (LHS) River at 55+600	construction site or camp site Checklists based monitoring				
5. Water Resources								
5.1 Sourcing of water during Construction	• Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority.	CGWA Guidelines	Throughout the Project section Water harvesting	MI: Approval from competent authority Complaints from local people on water availability	Checking of documentation Talk to local people	Included in civil work cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Arrangements shall be made by EPC contractor that the water availability and supply to nearby communities remain unaffected. • Water intensive activities not to be undertaken during summer season. • Provision of water harvesting structure to augment recharging of groundwater conditions (aquifers) in the project area. • Permissions from Local Irrigation Department, in case using canal water. • Agreement letters with local level water suppliers.		structure at toll plaza	PT: Valid approval from competent authority. Zero complaints from local people. Checklists based monitoring				
5.2 Disposal of water during construction	• Provisions shall be made to connect road side drains with existing nearby natural drains. • All hand pumps and wells are proposed for relocation at suitable locations in consultation with local community.	Clause No.1010 EP Act 1986 MORT&H Specifications for Road and Bridgeworks	Throughout the Project section. No wastewater should be disposed of in water bodies after Mor, Metwala (RHS), at), at 34+00 (LHS), at 36+900, 52+700 (LHS River at 55+600	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 work cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Water harvesting structures have been proposed along the project road subject to technical feasibility as per guidelines of CGWB. These measures will significantly augment the ground water/surface water availability in the area							
5.3 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 esp. in the areas where land is sloping towards road alignment. • Road level shall be raised above HFL level wherever road level is lesser than HFL. • No construction will be established within 500mts of a water body. • Culverts reconstruction shall not be done during lean flow period. In some cases these	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc. Water bodies after Mor, Metwala (RHS), at), at 34+00 (LHS), at 36+900, 52+700 (LHS River at 55+600	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 Checklists based monitoring	Review of design documents Site observation	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	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. • The design of drainage system such as surface and sub-surface drainage will be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes and the service roads will be discharged through longitudinal drains, designed for adequate cross section, bed slopes, invert levels and the outfalls. If necessary, the walls of the drains will be designed to retain the adjoining earth. • The design discharge will be evaluated for flood of 50-year return period for calculation of waterway and design of foundations. Proposed water way will not be reduced from existing one.							

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	Linear waterways of the • The design of drainage system such as surface and sub-surface drainage will be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes and the service roads will be discharged through longitudinal drains, designed for adequate cross section, bed slopes, invert levels and the outfalls. If necessary, the walls of the drains will be designed to retain the adjoining earth. • The design discharge will be evaluated for flood of 50-year return period for calculation of waterway and design of foundations. Proposed water way will not be reduced from existing one. Linear waterways of the most of the major rivers are bank to bank. Therefore, proposed bridge							

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	length will be bank to bank. • The design of drainage system such as surface and sub-surface drainage will be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes and the service roads will be discharged through longitudinal drains, designed for adequate cross section, bed slopes, invert levels and the outfalls. If necessary, the walls of the drains will be designed to retain the adjoining earth. • The design discharge will be evaluated for flood of 50-year return period for calculation of waterway and design of foundations. Proposed water way will not be reduced from existing one. Linear waterways of the most of the major rivers are bank to bank. Therefore, proposed bridge							

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	length will be bank to bank.							
5.4 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 works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. • Retaining walls at water bodies /ponds to avoid siltation near ponds. • No construction camp within 500m of any water body • Locate all parking, repair and fuel and hazardous material storage area away from any water body. Vehicle parking and	Design requirement, ClauseNo501. 8.6.MORT&H Specifications for Road and Bridgeworks Worldwide best practices	Near all waterbodies /waterway. No wastewater should be disposed off in water bodies after Mor, Metwala (RHS), at), at 34+00 (LHS), at 36+900, 52+700 (LHS River at 55+600	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	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	maintenance areas will have waterproof floors from which drainage is collected and treated to legal standards. • Refuel vehicles only in dedicated areas with waterproof floors from which drainage flows to an oil/water separator before discharge							
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	• No vehicles or equipment should be parked or refueled near water-bodies, so as to avoid contamination from fuel and lubricants. • Oil and grease traps and fueling platforms to be provided at re-fueling locations. • All chemicals and oil shall be stored away from water and concreted platform with catchment pit for spills collection. • All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof./ as well as IS-10500:2012	Water bodies, refueling stations, construction camps. No waster waster should be disposed off in water bodies after Mor, Metwala (RHS), at), at 34+00 (LHS), at 36+900, 52+700 (LHS River at 55+600	MI: Water quality of ponds, streams, rivers and other water bodies in project Presence of oil floating in water bodies in project area PT: Surface water quality meets freshwater quality standards prescribed by CPCB Checklists based monitoring	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	up. Readily available, simple to understand and preferably 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. No construction camp within 500mts of water body. • Wastes must be collected, stored and taken to approve disposal site only. • Water quality shall be monit • Locate all parking, repair and fuel and hazardous material storage area away from any water body. Vehicle parking and maintenance areas will have waterproof floors from which drainage is collected and treated to legal standards. • Refuel vehicles only in dedicated areas with waterproof floors from which drainage flows to an oil/water							

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	separator before discharge.							
6. Flora and Fauna								
6.1 6.1 Vegetation loss due to site preparation and construction activities	• Restrict tree cutting up to toe line considering safety to road users. • Roadside trees to be removed with prior approval of competent authority. • Mandatory compensatory plantation at 1:5 basis by EPC Contractor. • Regular maintenance trees planted. • Provision of LPG in construction camp as fuel source to avoid tree cutting. • Plantation of trees on both sides of the road where technically feasible. Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and provide adequate sight distance. • Integrate vegetation management (IVM) with the carriage way completely clear of vegetation. • Controlled use of pesticides/ fertilizers	Forest Conservation Act1980 + IRC:SP:21 and IRC:SP:66	Throughout project corridor Estimated No. of affected trees = 5000 tress. Compensatory Plantation on1:5 basis. EPC Contractor shall do 25000 nos. of sapling plantations as per Schedule-C.	MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. PT: Compensatory afforestation done on a 1:3 basis by EPC Contractor. Checklists based monitoring	Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy Field observations	Mandatory Compensatory afforestation cost is included in project costs under RPWD	Mandatory Compensatory plantation maintained by EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
7. Construction Camps								
7.1 Impact associated with location	• All camps should be established with prior permission from PCB. Camps to maintain minimum distance from following: • # 500 m from habitation • # 500 m from forest areas where possible • # 500 m from water bodies where possible • # 500 m from through traffic route • # 500 m from identified wildlife crossing areas • # 500 m within a waterbody	Design Requirement As identified in IEE, All applicable laws, rules and regulations including Contract Labour laws as well as, EHS policy and rules.	Construction camp	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 Checklists based monitoring	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
7.2 Worker's Health in construction camp	• The location, layout and basic facility provision of each labor camp will be submitted to AE and approved by PD-PIU-PPP-RPWD. The EPC contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. • Adequate water and sanitary latrines with septic tanks with soak pits shall be provided.	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	All construction camps	MI: Camp health records, Compliance to SOPs of COSHP for COVID-19 Protection. Existence of proper first aid kit in camp site Complaints from workers.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Preventive medical facilities in camp • Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The EPC 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. • Compliance to SOPs of COSHP for COVID-19 Protection.			PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions. Compliance to SOPs of COSHP for COVID-19 Protection. Checklist based monitoring				
8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	• Contractor to submit a waste/spoil disposal plan and get it approved by AE and PD-PIU-PPP-RPWD.	Design Requirement, MORT&H guidelines and General	At all Dumping/Disposal Sites.	MI: Location of dumping sites Number of public complaints.	Field survey and interaction with local people.	Included in civil works cost.	EPC Contractor.	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• 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 number of debris generated. • Public perception and consent from the village Panchayats has to be obtained before finalizing the location.	Conditions of Contract Document, Construction and Demolition Waste Management Rules-2016 and subsequent Amendments.	No disposal of any types of wastes in water bodies. Water bodies after Mor, Metwala (RHS), at), at 34+00 (LHS), at 36+900, 52+700 (LHS River at 55+600	PT: No public complaints. Consent letters for all dumping sites available with contractor Checklists based monitoring	Review of consent letter			
8.2 Reuse and disposal of construction and dismantled waste	• The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. • All excavated materials from	Design Requirement, MORT&H guidelines and General Conditions of Contract Document Construction and Demolition Waste	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris	Contractor records Field observation Interaction with local people	Included in civil works cost.		

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	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.	Management Rules 2016 and subsequent Amendments.		PT: No public complaint and consent letters for all dumping sites available with contractor or AE. Checklists based monitoring				
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	• Traffic Management Plan shall be submitted by the contractor and approved by the AE	Design requirement and IRC: SP: 27 - 1984, Report Containing	Throughout the project corridor especially at intersections.	MI: Traffic management plan. Presence/ absence of safety signs, traffic	Review traffic management plan Field observation	Included in civil works cost.	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. • The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.	Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 - 1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC:SP:55-2014		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. Checklists based monitoring	of traffic management and safety system Interaction with people in vehicles using the road			
	• On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed.	The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's						

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• 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 "AE". • Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	Requirement of Bid Document						
9.2 Pedestrians, 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 animal movement is expected. • Large number of box culverts has been proposed.All structures having vertical clearance above 2m and not catering to perennial	Same as above	Near habitation on both sides of schools, temples, 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 Checklists based monitoring	Field observation Interaction with local people	Included in civil works cost.	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	flow of water may serve as underpass for animals							
9.3 Safety of Workers and accident risk from construction activities	• Contractors to adopt and maintain safe working practices. • Usage of fluorescent and retro refectory signage, in local language at the construction sites • Training to workers on safety procedures and precautions. • Mandatory appointment of safety officer. • All regulations regarding safe scaffolding, ladders, working platforms, gangway, stair wells, excavations, trenches and safe means of entry and egress shall be complied with. • Provision of PPEs to workers. • Provision of a readily available first aid unit including an adequate supply of dressing materials. • The contractor will not employ any person	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents. Checklists based monitoring	Site observation Review records on safety training and accidents Interact with constructio n workers	Included in civil works cost	Obligation of EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	below the age of 18years • 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. • Compliance to Community Occupational Health & Safety Plan (COSHP) for COVID-19. • Accident Prevention Officer must be appointed by the contractor.							
9.4 Accident risk to local community	• Restrict access to construction sites only to authorized personnel. • Physical separation must be provided for movement of vehicular and human traffic. • Adequate signage must be provided for safe traffic movement • Provision of temporary diversions and awareness to locals	Same as above	Construction sites	MI: Safety signs and their location, Incidents of accidents, Complaints from local people PT: Zero incident of accidents. Zero complaints. Checklists based monitoring. Checklists based monitoring	Site inspection Consultation with local people	Included in civil works cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	before opening new construction fronts.							
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	• Contractor will prepare site restoration plans, which will be approved by the AE. • The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. • All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental Specialist (PMC), Environmental Specialist (AE) and Environmental Focal Person (EPC Contractor). • All the opened borrow areas will be rehabilitated and 'AE ' will certify	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	MI: Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. PT: Clean and tidy sites. No trash or debris left on site. Site restored and leveled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found satisfactory Post-construction Checklists based monitoring	Included in civil works cost.	EPC Contractor	AE/PMC/RPWD-PIU-PPP
C. Operation and Maintenance stage								
1. Air Quality								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
1.1 Air pollution due to due to vehicular movement	• Roadside tree plantations shall be maintained at least with 70% survival rate. • 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 them 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. Obtaining of Pollution Under Control Certificates (PUCs) and their renewal on periodic basis.	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981, Motor Vehicles Act 1948 and subsequent Amendments .	Throughout the Corridor. Human Habitations during commencement of road operations in Paloda, Metwala, Suja Ji Ka Gada, Khodan, Agarpurua, Garhi, Bori, Anjana, Arthoona, Kotra, Chajja, Ananapuri and Schools at 35+00, 36+500, 58+00, Schools at Agarpura, Khodan Sujaji Ka Gada, , Metwala..(Chainages of both habitations and schools are given in Section 15 of Schedule-A). Sensitive Receptors along the alignment	MI: Ambient air quality (PM10, CO, SO2 NO2) PT: Levels are equal to or below baseline levels given in the IEE report Checklists based monitoring	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
2. Noise								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
2.1 Noise due to movement of traffic	• Effective traffic management and good riding conditions shall be maintained • Speed limitation to 20 km/hour and honking restrictions near sensitive receptors • Monitoring of Performance of Noise Barriers constructed and New Construction of any further required noise barriers near sensitive receptors with consent of local community • 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	Residential and sensitive locations location s of air quality monitoring. Human Habitation during commencement of road operation in Paloda, Metwala, Suja Ji Ka Gada, Khodan, Agarpurua, Garhi, Bori, Anjana, Arthoona, Kotra, Chajja, Ananapuri and Schools at 35+00, 36+500, 58+00, Schools at Agarpura, Khodan Sujaji Ka Gada, , Metwala. (Chainages of both habitations and schools are given in Section 15 of Schedule-A)	MI: Noise levels PT: Levels are equal to or below baseline levels given in the IEE report Checklists based monitoring	Noise monitoring as per noise rules, 2000 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
3. Land and Soil								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
3.1 Soil erosion at embankment during heavy rainfall.	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc. • Necessary measures to be followed wherever there are failures	Project requirement	At embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion. Checklists based monitoring.	On site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
4. Water resources/Flooding and Inundation								
4.1 Siltation	• Regular checks shall be made for soil erosion conditions for its effective maintenance.	Project requirement	Near surface Water bodies. water bodies after Mor, Metwala (RHS), at), at 34+00 (LHS), at 36+900, 52+700 (LHS River at 55+600. No waste or waste water should be disposed off in these water bodies.	MI: Water quality PT: No turbidity of surface water bodies due to the road Checklists based monitoring	Site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
4.2 Water logging due to blockage of drains, culverts or streams	• 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.	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging.	Site observation	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Monitoring of water borne diseases due to stagnant water bodies			Checklists based monitoring				
5. Flora								
5.1 Vegetation	• Planted trees, shrubs, and grasses to be properly maintained. • The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of 70% tree survival Checklists based monitoring	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
6. Maintenance of Right of Way and Safety								
6.1 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 road side • 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. Checklists based monitoring	Visual inspection Check accident records	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	
6.2 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.	IRC:SP:55-2014/And IRC:SP:88-2010	Throughout the Project route	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive	Review accident records Site observations	Included in Operation / Maintenance cost	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
	• Monitor/ensure that all safety provisions included in design and construction phase are properly maintained • Highway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. • Tow-way facility for the breakdown vehicles if possible. • Road furniture shall be as per Schedule-C and applicable IRC Codes. • Road Safety Audit should be conducted on regular basis			receptor structures inside the stipulated planning line as per relevant local law PT: Fatal and non fatal accident rate is reduced after improvement Checklists based monitoring				
6.3 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	Implementation by EPC Contractor and Supervision & monitoring by AE/PMC/RPWD-PIU-PPP	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision/Monitoring
				Checklists based monitoring				

EFP: Environmental Focal Person, RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, PMC: Project Management Consultant, AE: Authority Engineer, IEE: Initial Environmental Examination, IRC: Indian Road Congress, DEIAA: District Environmental Impact Assessment Authority, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision /Monitoring
Air Quality	Construction stage	PM 10 PM 2.5 SO2, NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Human Habitation during commencement of construction activities in Paloda, Metwala, Suja Ji Ka Gada, Khodan, Agarpura, Garhi, Bori, Anjana, Arthoona, Kotra, Chajja, Ananapuri and Schools at 35+00, 36+500, 58+00, Schools at Agarpura, Khodan Sujaji Ka Gada, , Metwala.(Chainages of both habitations and schools are given in Section 15 of Schedule-A). Total no of samples=40 Batching and hot mix plants sampling part of SPCB annual renewal of permits Total No of Samples 2 times in each human habitations during construction period - One sample for HMP, One sample for Batching/RMC Concreate Mix Plan and one sample for WMM Plant in each	During Active Construction Phase	Air quality standard by CPCB	60x 9000=Rs.540000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision /Monitoring
				quarter during construction period. Total No of sample-samples=20. Total numbers of samples during entire scheduled construction period =60 No of samples may increase for EOT period.					
	Operation stage			Toll Plaza-3 sample each quarter. Total 12 samples in a year. Human habitations, especially sensitive receptors. 6 samples in each quarter. Total no of 18 samples.	24 hr continuous, 3/year for 1 year of operation period (Total 3 times in a year Except Monsoon Season)	Air quality standard by CPCB	30X9000 =Rs 270000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Water Quality	Construction stage	Ground water: (IS: 10500:2012) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps	3/year till the end of construction activities (Total 3 times in a year baring monsoon), 6 bore well, 6 surface water sample in each quarter. Minimum 3 samples in each quarter. Total no 50 samples during entire scheduled construction	Water quality standard by CPCB	50x 5000 = Rs 250000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision /Monitoring
					period. No of samples may increase for EOT period.				
	Operation stage			Groundwater at 4 locations and surface water at 4 locations	3/year for 1 year	Water quality standard by CPCB	24x5000=Rs 120000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968Using Noise level meter	Same as air quality Total numbers of samples during entire scheduled construction period. No of samples may increase for EOT period.	During Active Construction Phase	National Ambient Noise Standard specified in Environment Protection Act, 1986	60x1500=Rs .90000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
	Operation stage			Same as air quality	3/year for 1 year		30x1500=Rs .45000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer RPWD / supervision consultant	Camp, Dumping/storage areas and HMP sites (Total 4 sample locations)	Once during entire construction stage	ICAR standards	4x3000=Rs. 12000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination locations (Total 3 samples)	Once for the first year of operation	ICAR Standards	3x3000=Rs. 9000.00	EPC Contractor through approved monitoring agency	AE/PMC/RPWD-PIU-PPP

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision /Monitoring
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		Throughout the Project Corridor especially at River banks, bridge locations and river training structures	After first rain	Visual Checks	Included in Engineering Cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of AE/PMC/RPWD-PIU-PPP	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	EPC Contractor	AE/PMC/RPWD-PIU-PPP
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	Engineering Team of RPWD/ AE/PMC/RPWD-PPP	
Borrow Areas- Prior obtaining of ECs for borrow areas is exempted by MoEFCC	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	ADB and IRC guidelines	EPC Contractor	EPC Contractor with approval from AE/PIU-RPWD-PPP	AE/PMC/RPWD-PIU-PPP
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			EPC Contractor with approval from AE/PIU-RPWD-PPP	
Construction Sites and Labor Camp	Construction stage	Visual Checks of Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	EPC Contractor with approval from AE/RPWD-PIU-PPP	AE/PMC/RPWD-PIU-PPP
Tree Plantation	Construction Stage	Visual check based Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD Additional Plantation: Provisional sum under Civil Cost	Compensatory: RPWD/Local Forest Departments Additional Plantation: Implementation by The EPC Contractor. Supervision and Monitoring by AE/PMC/RPWD-PIU-PPP	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision /Monitoring
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Quarterly during Defect Liablity Period			The AE will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD-PIU-PPP through PMC/EPC Contractor will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by IE/Safety Consultant and approved by RPWD-PIU		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/IE/RPWD-PIU-PPP	Part of the regular monitoring	EPC Contractor	AE/PMC/RPWD-PIU-PPP
	Operation stage			Throughout the stretch	occurrence of accidents	Same as above	Same as above	Road Safety unit of RPWD-PIU-PPP, with support from local police, AE and PMC	
Monitoring Costs: INR 1236000.00 excluding other applicable charges including GST to be mentioned in Terms and Conditions of Contract Agreement signed between EPC Contractor and Outsourced Monitoring Laboratory.									

EFP: Environmental Focal Person, RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, PMC: Project Management Consultant, AE: Authority Engineer, IEE: Initial Environmental Examination, IRC: Indian Road Congress, DEIAA: District Environmental Impact Assessment Authority, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

Appendix H Noise Prediction Contours

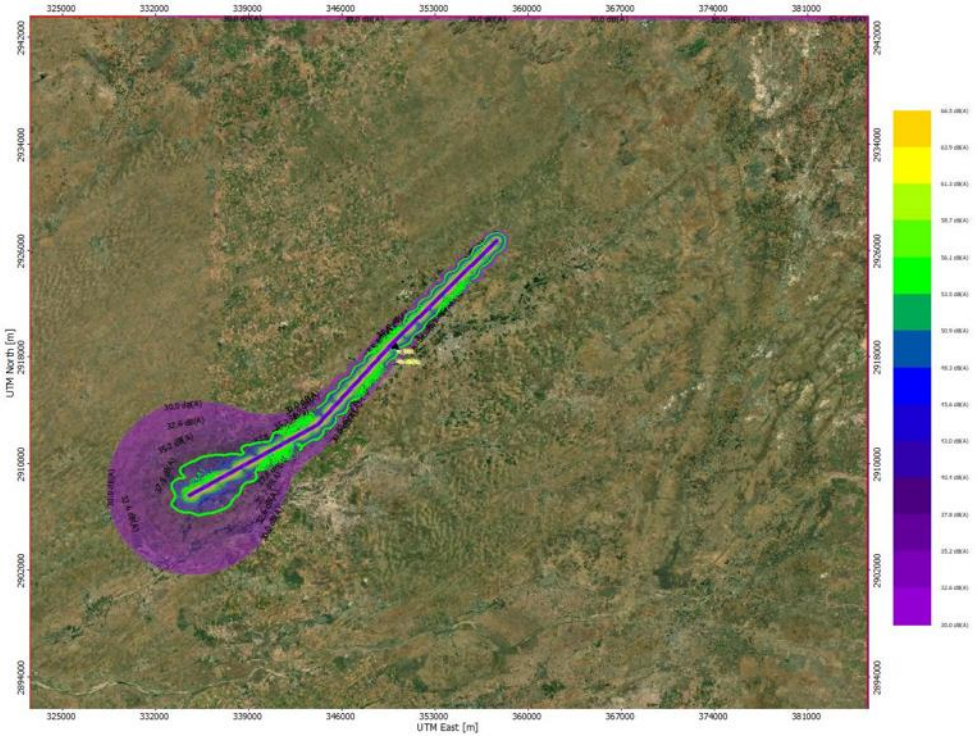

Figure 1: Noise Model Results- SH-21-Start Year

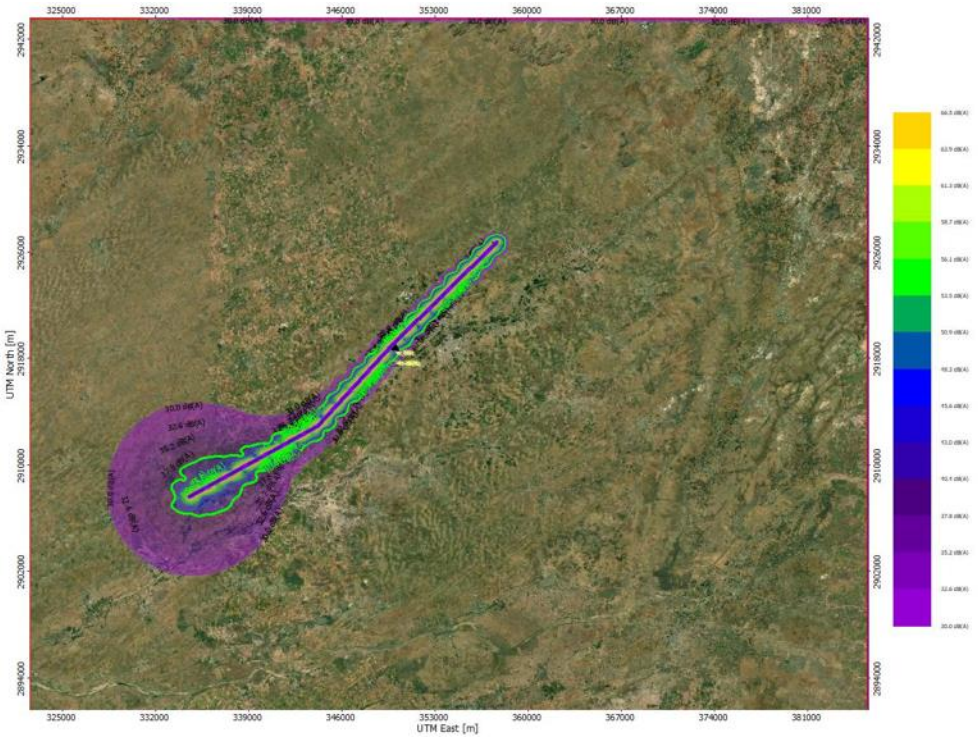

Figure 2: Noise Model Results- SH-21-2026

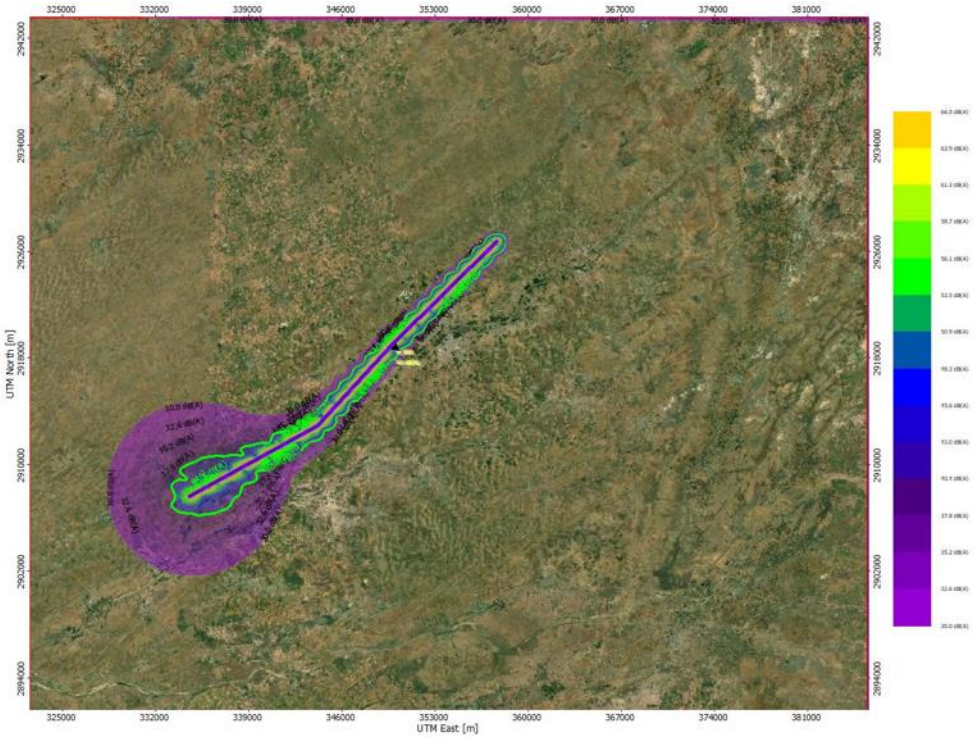

Figure 3: Noise Model Results- SH-21-2031

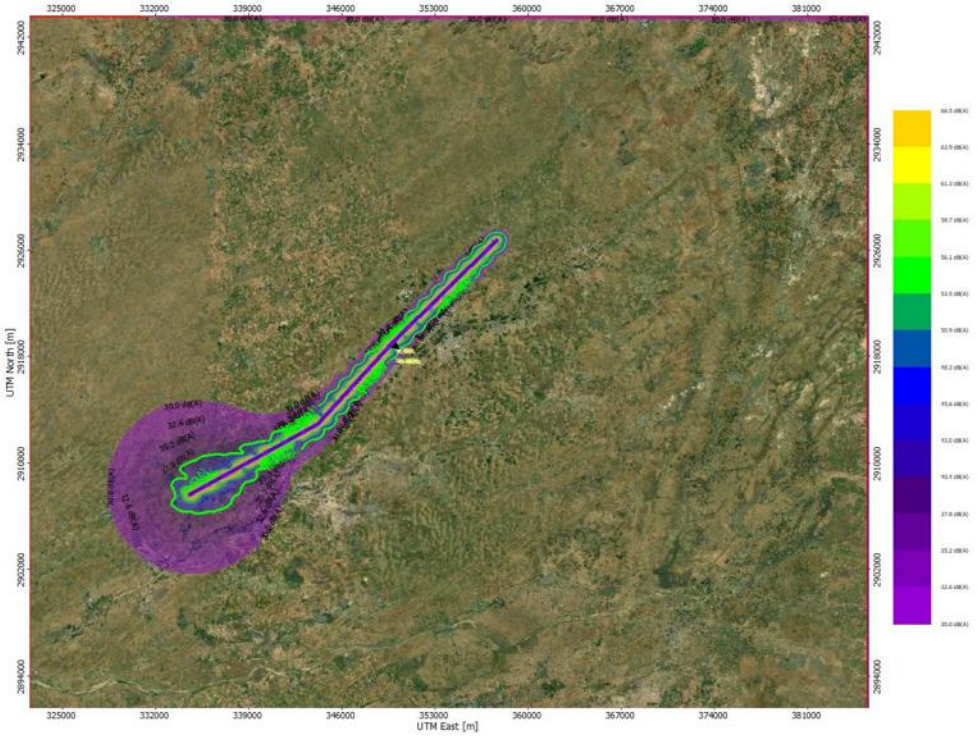

Figure 4: Noise Model Results- SH-21-2036

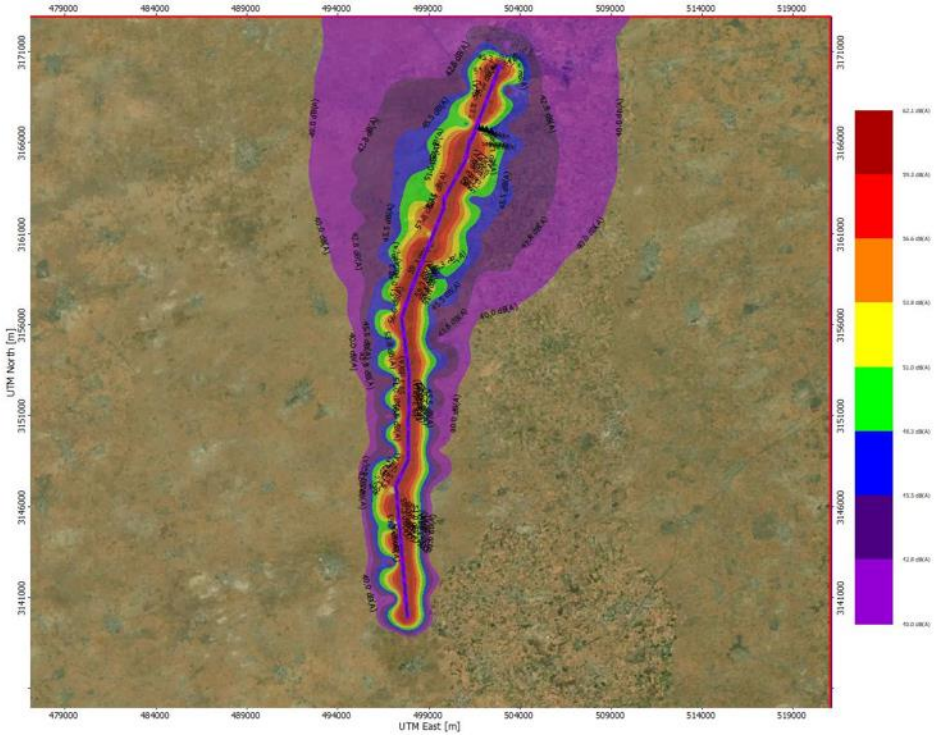

Figure 5: Noise Model Results- SH-36-Start Year

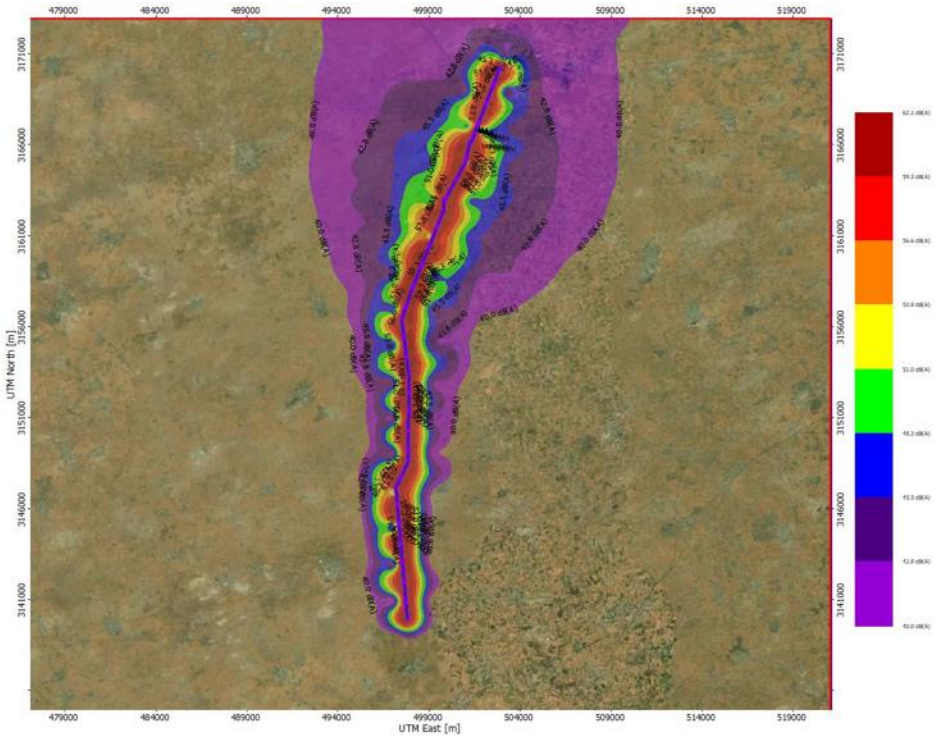

Figure 6: Noise Model Results- SH-36-2026

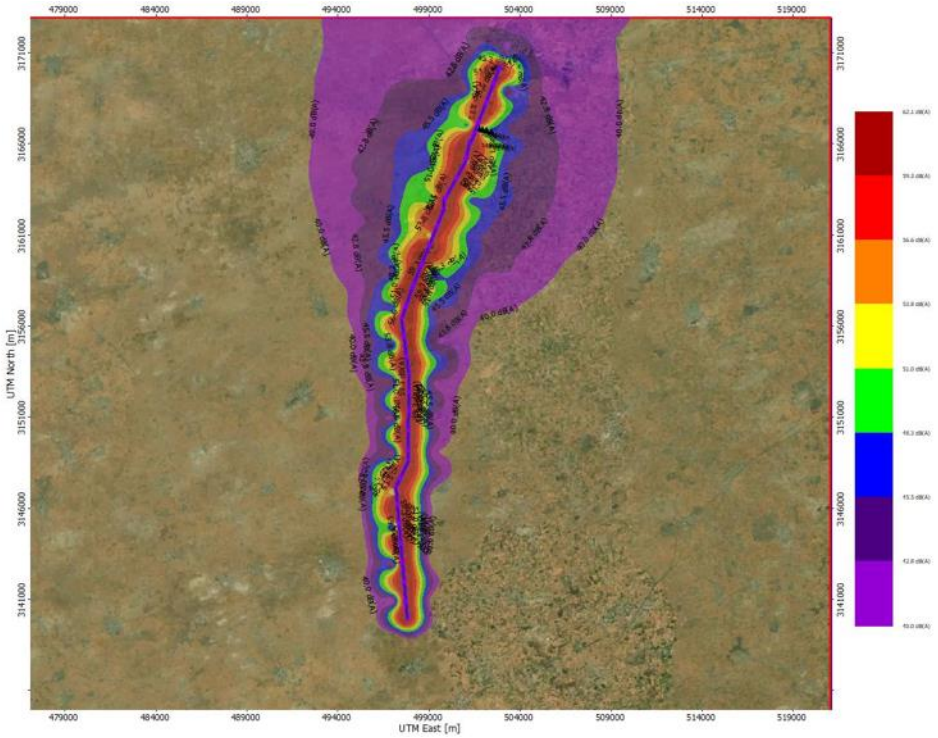

Figure 7: Noise Model Results- SH-36-2031

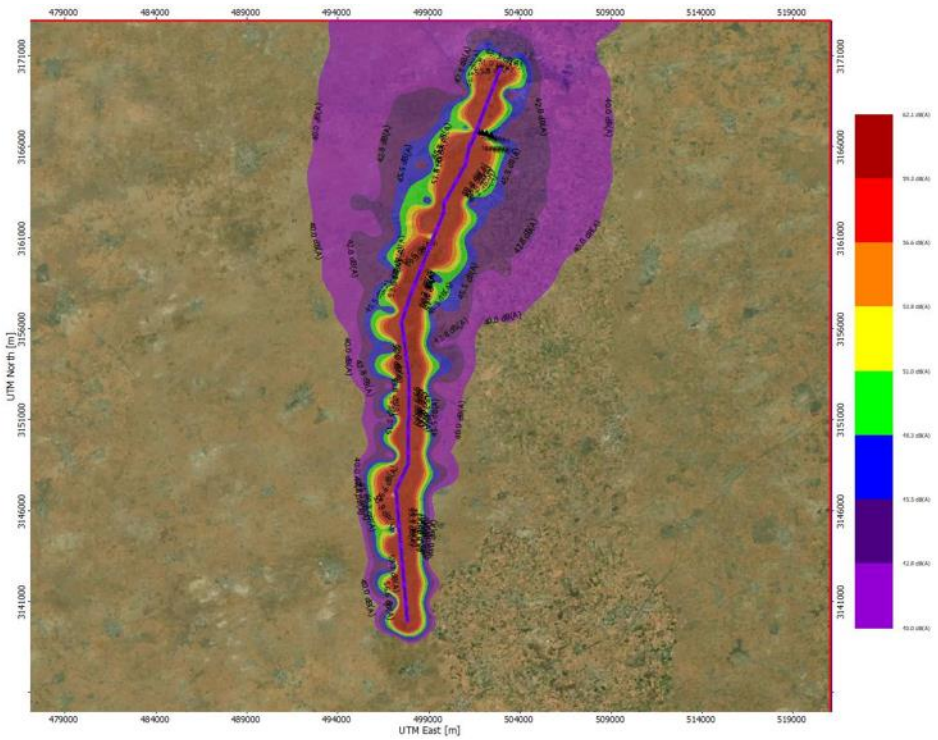

Figure 8: Noise Model Results- SH-36-2036

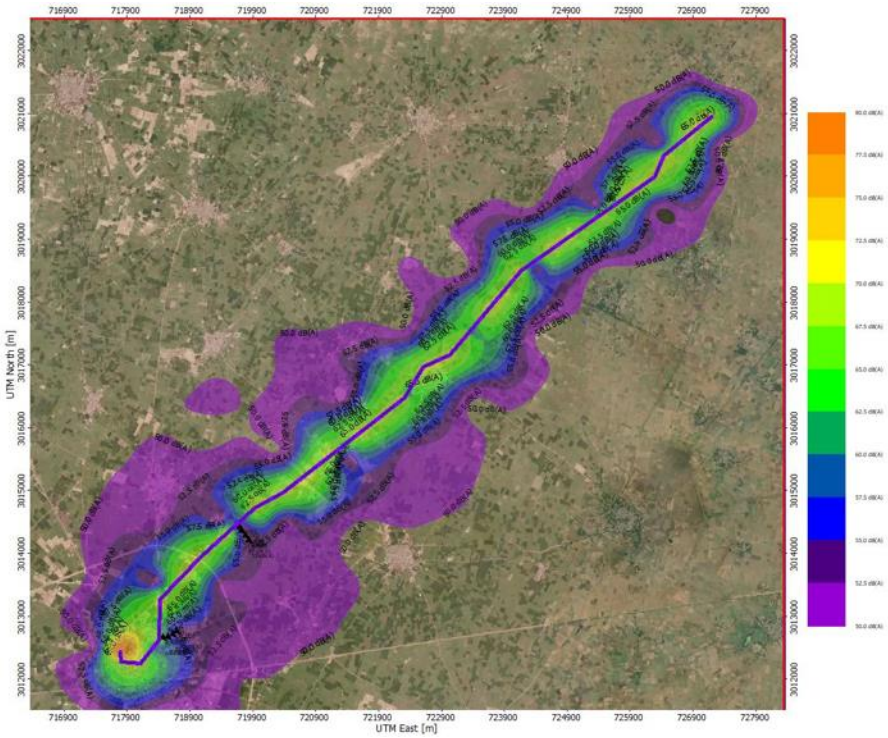

Figure 9: Noise Model Results- SH-44-Start Year

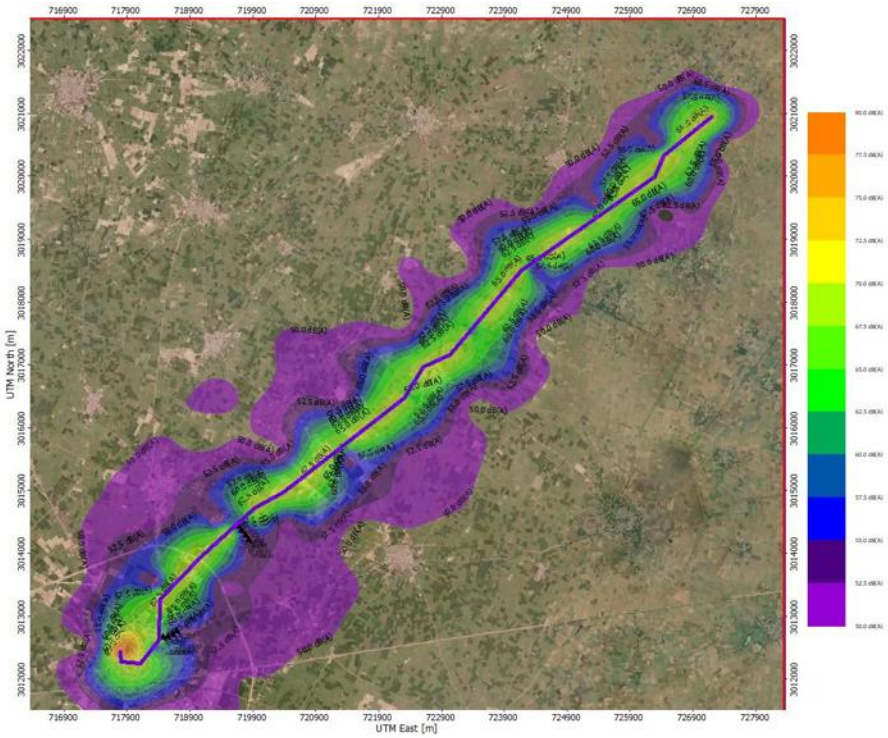

Figure 10: Noise Model Results- SH-44-2026

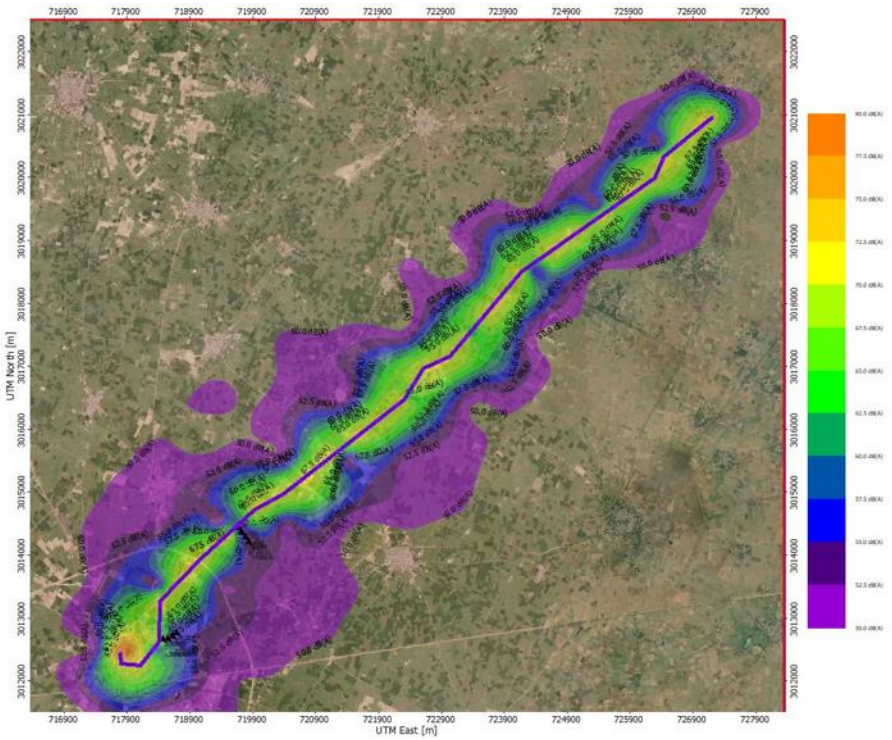

Figure 11: Noise Model Results- SH-44-2031

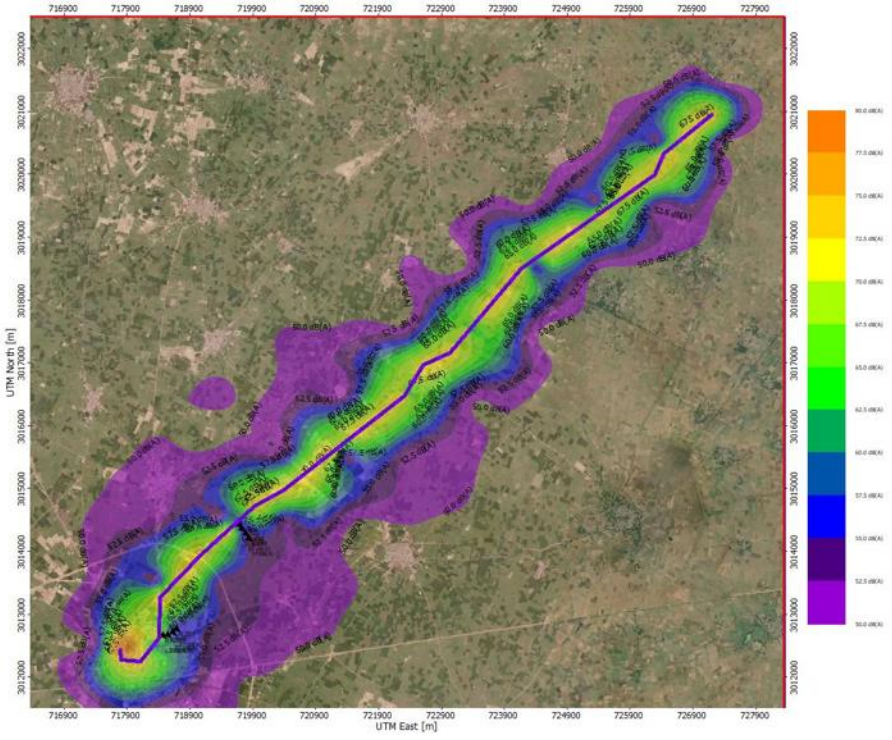

Figure 12: Noise Model Results- SH-44-2036

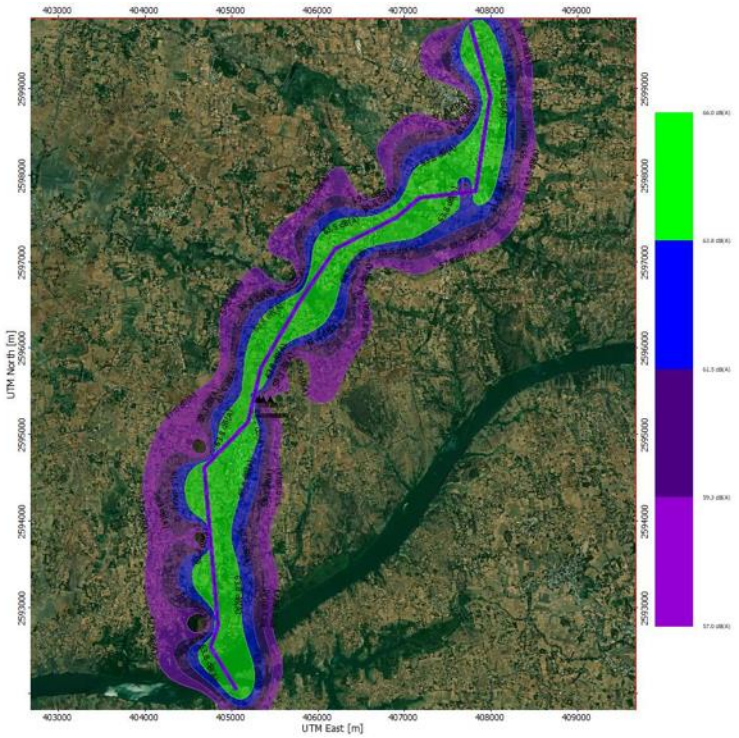

Figure 13: Noise Model Results- SH-10A-Start Year

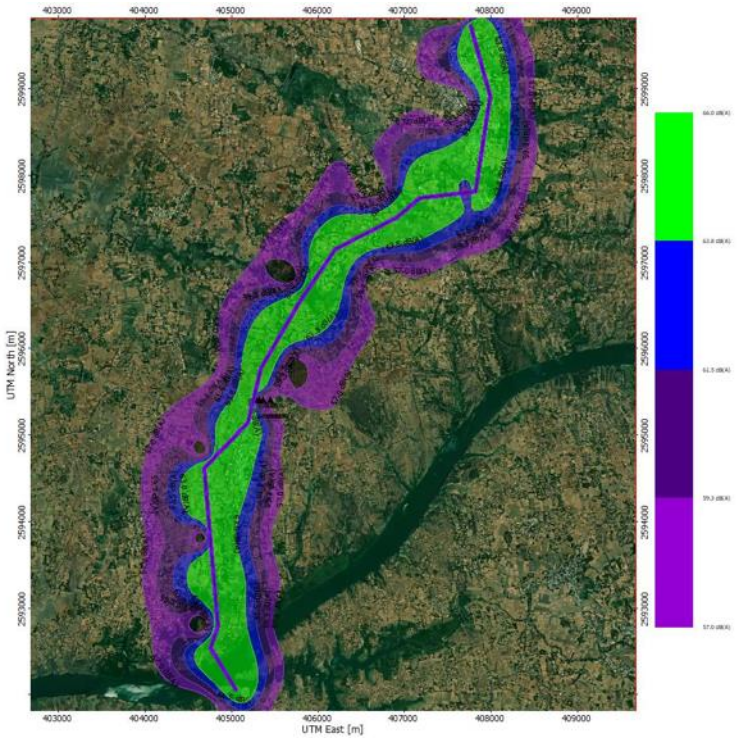

Figure 14: Noise Model Results- SH-10A -2026

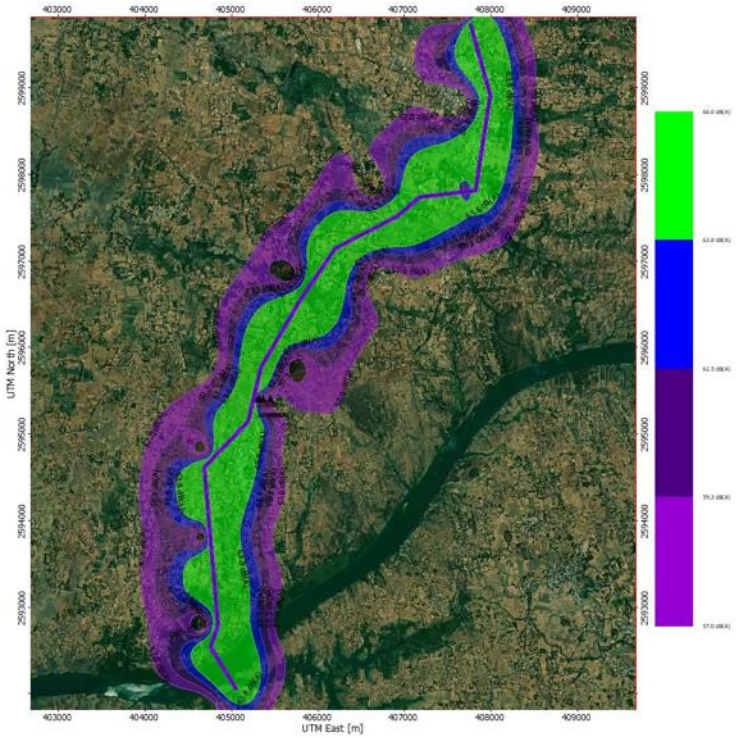

Figure 15: Noise Model Results- SH-10A -2031

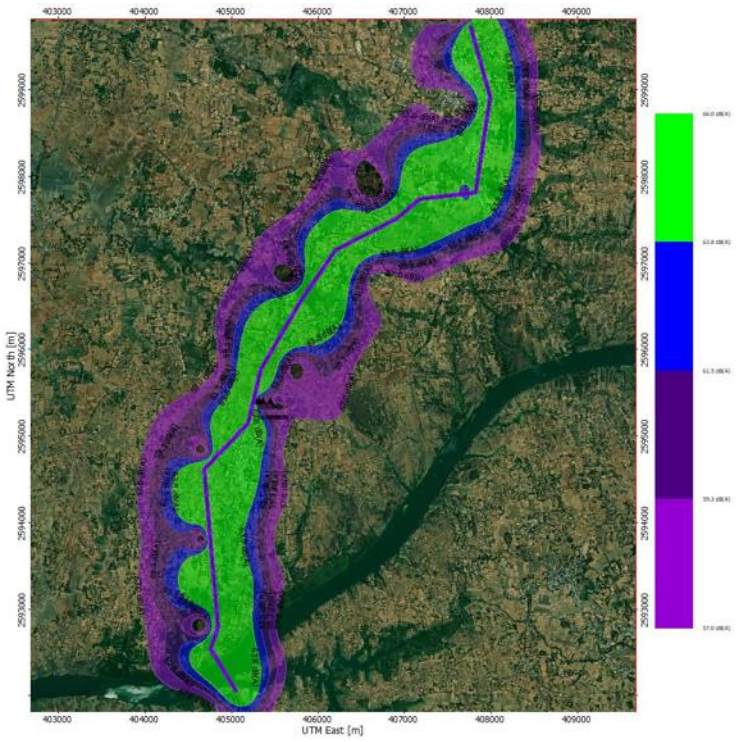

Figure 16: Noise Model Results- SH-10A -2036