

Initial Environmental Examination

June 2019

IND: Rajasthan State Highway Investment Program - Tranche 2

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

CURRENCY EQUIVALENTS

(as of 20 March 2019)

Currency unit	–	Indian Rupee (Rs)
INR1.00	=	\$ 0.01453
\$1.00	=	INR 68.8230

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archeological Survey of India
CCF	–	Chief Conservator Forest
CFE	–	Certificate for Establishment
CFOD	–	Certificate for Operation detailed
PREA	–	project report Executing Agency
EAC	–	Expert Appraisal Committee
EARF	–	Environmental Assessment and Review Framework
EFP	–	Environment Focal Person
EMP	–	environmental management plan
EMOP	–	environmental monitoring plan
GOI	–	Government of India
GOR	–	Government of Rajasthan
GRC	–	grievance redress committee
GRM	–	grievance redress mechanism
IEE	–	initial environmental examination
IRC	–	Indian Road Congress
MDR	–	Major District Road
MFF	–	Multi-tranche Financing Facility
MOEF& CC	–	Ministry of Environment and Forests
MORTH	–	Ministry of Roads Transport and Highway
ODR	–	Ordinary District Road
PD	–	Project Director
PIU	–	project implementation unit
PMC	–	project management consultant
PPP	–	Public-Private Partnership
RSHDP	–	Rajasthan State Highway Development Program
RSHIP	–	Rajasthan State Highway Investment Program
RSPCB	–	Rajasthan State Pollution Control Board
ROW	–	right of way
SH	–	State Highway
SOE	–	Safeguard Officer – Environment
SPS	–	ADB Safeguard Policy Statement, 2009
VGf	–	Viability Gap Funding
WLS	–	Wildlife Sanctuary

WEIGHTS AND MEASURES

km	–	kilometer
m	–	meter

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EXECUTIVE SUMMARY

1. Rajasthan, with 10.41% of country's total geographical area, is the largest state of India occupying 3.42 lakh square kilometer (km²). area. Total population is 68.6 million, forming 5.5% of the country's total population. It ranks among top four states in attracting tourists from all across the globe. State's economy is largely dependent on agriculture, dairy, minerals, and tourism, which all require strong road network. Rajasthan being located between landlocked northern states and western port states imposes additional burden on roads due to interstate movement of goods and passenger traffic. Long international boundary necessitates good quality road infrastructure in border areas.

2. As of 31 March September 2016, Rajasthan has a road network of 2,14,223 kilometer (km), including 8,149 km of national highways, 15,025 km of state highways 6,715 km of major district roads (MDRs), 29,682 km of other district roads, and 1,54,652 km of village/rural roads. Road density in Rajasthan is only about 62.59 km per 100 km², compared to the national average of 166 km as of 31st March 2015. Road Density per lakh population in Rajasthan is 313 km corresponding to national figure of 436 km. Further, nearly 80% of the roads are single lane. Years of under-investment due to scarcity of financial resources and inadequate maintenance has left many of the state highways and MDRs in poor conditions, both in terms of riding quality and network.

3. The GOR has requested Asian Development Bank (ADB) to consider a multi-tranche financing facility (MFF) of \$500 million to finance part of the RSHDP comprising approximately 2,300 km of state highways and MDRs. The MFF will provide financing support to the contracts of Build Operate and Transfer (BOT) through public private partnership (PPP) annuity and engineering procurement and construction (EPC) models under tranches to support the capacity development of RPWD on key areas such as business procedures for PPP project management and road safety of state highway system.

4. In the second tranche, 11 roads totaling approximately 754.463 km are being considered for financing. The scope of works for roads under tranche 2 is limited to widening of existing roads to mainly two-lane with granular shoulder. The 11 sub-project roads under Tranche-II are located in 13 districts of Rajasthan state namely: Ajmer, Barmer, Bikaner, Bundi, Churu, Hanumangarh, Jodhpur, Jalore, Nagaur, Sri Ganganagar, Pali, Sikar, and Tonk respectively. The State can be divided into two major divisions structurally along the Aravalli range which cuts the state into east Rajasthan and west Rajasthan. Four of the sub-project roads fall on the west side of the range, three sub-project roads (Nasirabad-Mangliyawas-Padukalan, Jodhpur-Sojat and Bhinmal – Pantheri Posana – Jeevana) traverses the range and four of them are on the east side of the range in Rajasthan.

5. The project is categorized as category 'B' in accordance with ADB's Safeguards Policy Statement (SPS) 2009, warranting an initial environmental examination (IEE). Project categorization has been done using Rapid Environment Assessment (REA) checklist of ADB for roads and highways after survey and initial consultations. Project scope is limited to improvement and widening of existing single/intermediate/two-lane roads to mainly two-lane with granular shoulder. Hence, it expected that stress on existing natural resource viz, land, water, soil, and aggregates are not significantly adverse. Widening and improvement will be mostly accommodated within available right of way except in few roads where bypasses are proposed. Project road does not pass through or located nearby any wildlife sanctuary, national park, protected area network archeological monument/heritage site or any other simila eco-sensitive areas. Few sections of the project roads are passing through protected/open scrub forest. These are mostly degraded forest

with very less floral and faunal diversity. Moreover, diversion of forest land is involved in three sub-project roads (Beawar-Masuda-Goyla, Arain- Sarwar Highway and NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha) of approximately 32.9 hectares. As per environmental impact assessment Notification 2006, and its amendments by the Ministry of Environment, Forests, and Climate Change (MOEF& CC), the project is not under purview of environmental clearance.

6. Existing roads under Tranche-II have varying width and road conditions. ROW is generally 25-30 m in most cases with reduced width in settlements varying from 5 to 15 m. Major part is two-lane with or without earthen shoulder. Riding condition is mostly poor to fair. Roadside drains are present in some urban stretches but mostly choked and non-functional. Overtopping of roads is not observed in general but water-logging is very common in built-up areas. Waterways are being crossed only in few roads. Project road improvement will mostly follow special codal provisions relevant to state highways prescribed by Indian Road Congress (IRC: SP: 73-2007 Manual of Standard and Specification for two-Laning of State Highways on B.O.T Basis) and Ministry of Road Transport and Highways (MORTH) Guidelines. Provisions for cases of any compromise or variation have been specifically highlighted and justified in relevant sections of the report. Since the project highway road will be a toll road, 19 toll plazas are proposed to include a weigh bridge, office building, a traffic aid post, a medical aid post and paved yard for parking and unloading of vehicles. Roof top rainwater harvesting has been proposed at toll plazas for augmentation of groundwater demand.

7. The climate of Rajasthan state is varied contrasting due to the Aravalli. The Aravalli Mountains stretching diagonally across the State from the southwest to northeast separate the desert and semi-desert areas to the west from the sub-humid areas in the east. The climate of Rajasthan can be divided into four seasons: pre-monsoon (April to June), monsoon (July to Sept), post-monsoon (October to December) and winter (January to March). On average, summer temperatures range from 25 to 46 °C. At times, temperatures touch a maximum of 51 °C. On average, the winter temperatures range from 8 to 28 °C which drops to -2 °C, creating wind-chill effects in some parts of the state. The state has an average normal rainfall of 531 mm in comparison with the national average of 1,200 mm, while desert areas have an average of 380 mm (State Water Policy, 2010). The rainfall pattern also varies in the different parts of the state. Western Rajasthan receives an annual average rainfall of 279 mm, while the eastern Rajasthan receives an annual average rainfall of 631 mm.

8. The dry and the parched regions are predominant in the major portions of the state. The main features of topography are rolling sand dunes, river-drained plains, rocky terrain, wetlands, plateaus, barren tracks or land filled with the thorny shrubs, wooded regions and ravines. From the oldest Archean Metamorphic, represented by Bhilwara Super Group to sub-recent alluvium and wind-blown sand, Rajasthan is endowed with a continuous geological sequence of rocks. A vast blanket of young unconsolidated deposits are present in western and north-western parts of the state which include the blown sand of the Thar Desert of western Rajasthan. The soil improves in fertility from west and northwest towards east and northeast. The State lies under seismic Zone II which is least active. Rajasthan has the maximum probability of occurrence of drought in India, with recurring droughts in three to four years in a cycle of five years.

9. Land use of the study area and 10 km buffer zone majorly imitates the land use of the state. However, abutting land use of the sub-project corridors varies from each other. Land use along Bidasar-Sri Dungargarh-Kalu, Bhinmal – Pantheri Posana – Jeevana, Losal-Salasar-Ratangarh, Siwana – Balesar and Nasirabad –Mangaliyawas- Padukalan are predominantly waste land with sparse plantation. Organized road side plantation has been done by forest department along most of road stretches, which are not impacted as sufficient ROW is available in nine of the sub-project

roads. In contrast, Beawar-Masuda-Goyla, Arain – Sarwar Highway and NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha require diversion of 32.92 ha of forest land and also have dominant vegetation and agricultural land use.

10. Project area is characterized mainly by rural/open areas and intermittently traversed by few semi-urban settlements/built-up areas. Sources of air pollution in the project area are mainly vehicular emissions, dust from unpaved shoulders/deteriorated roads, and domestic fuel burning. Monitored parameters of ambient air quality largely meet the prescribed limit of World Bank (WB), National Ambient Air Quality Standard (NAAQS) and Central Pollution Control Board (CPCB) except for particulate matter (PM₁₀) at Laxmipura-Dora-Dabi-Ranaji ka Gudha, Beawar–Pisangan, Govindgarh-Tehla and Tehla kod- Alniyawas due to poor road conditions and comparatively high traffic density. During construction phase, adequate mitigation measures will be executed to lower the particulate matter such as (i) Transport of fine construction materials in covered vehicle ; (ii) Loading and unloading of construction materials in covered areas and water sprinkling around these locations; (iii) Water sprinkling on earthworks periodically; and (iv) regular maintenance of machinery and equipment and mandatory pollution check of vehicles used in construction activities. Other measures are included in EMP. Noise level monitoring indicates that the noise level meet the prescribed noise standards for all land use categories.

11. Project districts other than Bundi (8.2%) and Pali (4.98%) have forest covers less than that of the state (4.7% of geographical area). Roadside protected forests are present along Beawar-Masuda-Goyla, Arain – Sarwar Highway and NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha. Forest diversion is required for all three (32.92 ha of land). Online application for forest clearance has been submitted for these roads. All these forests are degraded having very little or no floral and faunal diversity. The road side plantation is of mixed type and natural regeneration is seen. A total of 5,904 trees have been enumerated within right of way which could be affected. Predominant species in the project district are Neem, Babul, Khejri, Banyan, Jatropha, ker, Jar and Peepal with girth size between 120-180 cm.

12. Erratic and undefined movement of wild animals, mainly that of Nilgai (*Boselaphus tragocamelus*) is reported in most of the sub-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 Vermin category of Schedule V so that killing/hunting of such animals are outside purview of regulations. State government has nominated Tehsiladar (taxation officer), Ranger officers and other officers of same level to be the competent authority for killing of such animals. Besides, movement of Chinkara (a schedule-1 animal as per Wildlife Act but least concern under IUCN classification) was also reported in few sub-projects (Sadulshahar-Sangaria –Chaiya, Bhinmal – Pantheri Posana – Jeevana and Jodhpur -Sojat).

13. Agriculture plays a significant role in the State economy contributing about 20 to 34 % to the State's economy. Agriculture in Rajasthan is mostly dependent on rainfall that mostly remains scanty, low and irregular. Despite low rainfall, Rajasthan is among the largest producers of edible oils in the country and the second largest producer of oilseeds. Rajasthan is also the biggest wool-producing state in the country. The Industrial sector contributes about 26 to 30% to the State's economy. The mineral-rich State is fast emerging as a prominent industrial destination in the country. The State is geologically a veritable repository of minerals. There are about 64 different kinds of major and minor minerals produced in the State, contributing an annual revenue of more than Rs 600 crores. Rajasthan is the sole producer of Garnet (gem variety), Jasper and Wollastonite. Almost the entire production of Zinc (concentrate), Calcite, Asbestos and Gypsum in the country was reported from Rajasthan.

14. According to 2011 census the total population of the state is about 68.5 million. The population density of the state is 201 per km². (compared to the country's average of 436 km²). The decadal growth rate recorded during the previous decade at 28.41% is higher than the national level of 21.5%. Over 76% of the population reside in rural areas. The number of females per 1000 males (sex ratio) in Rajasthan was 951 in 2011 and had shown an increase as compared to that in 2001 at 931.

15. The critical project components that will have substantial interaction with the environment are as follow:

- i) Preconstruction stage:
 - a. Road alignment and design – involves the screening and selection roads to avoid environment sensitive areas, finalization of road alignment including by-passes to minimize land acquisition, minor geometric realignment like eccentric road widening where the available right-of-way (RoW) permits to preserve the trees on one side of the road from being cleared, and cross-drainage design to incorporate wildlife crossing function;
 - b. Utility shifting – removal and transfer the carriage way of electric, telephone, and water lines, drainage pipes, and hand pumps;
 - c. Construction mobilization - land clearing, installation of electricity and other utility connections, perimeter fencing, establishment of storage areas, waste disposal, and installation of production equipment (hot mix, concrete batching, rock crusher, casting) in the labor and camp sites; and
 - d. Tree cutting and clearing – tree marking, cutting, and grubbing.
- ii) Construction Phase
 - a. Road construction – includes earthworks for sub-grade, sub-base, gravelling of base; preparation of wearing course, and construction of shoulders;
 - b. Quarries and borrow area site management;
 - c. Construction plants operation for hot mix and cement batching;
 - d. Maintenance of by-passed roads - routine maintenance of sealed road pavement, foot paths, kerbs and channels, storm drainage, and pavement markings; and
 - e. Site-Restoration involves the clean-up and restoration of construction zones to near its original condition prior to Contractor demobilization to include: river beds used for sand mining; camps; hot mix plant, crushers, batching plant sites; and borrow areas rehabilitated.
- iii) Post-Construction Phase
 - a. Road maintenance similar to the by-passed roads; and
 - b. Vegetation control – involves periodic mechanical mowing, trimming, removal of brush, and removal of trees when necessary to aesthetics and to prevent potential safety hazards (e.g. reduced visibility, obstruction of signs, and debris in the roadway).

16. Mitigation measures were identified to reduce the significant adverse impacts including residual effects. As the project roads will be implemented based on engineering, procurement, and construction (EPC) modality, a number of construction alternatives like location of camp and plant sites, borrow area, source quarries, and even minor geometric realignments to minimize the number, remains to be decided for these roads and from which a host of impacts will be assessed. The analysis of impacts revealed the following:

- a. During the pre-construction phase, major potential negative impacts include permanent loss of trees, disturbance of national protected species, and increase road crashes from inadequate road alignment and design. While medium potential impacts includes increase in animal-vehicle crashes from unregulated higher vehicular speed, and localized flooding from inadequate drainage design;
- b. During construction, major potential negative impacts from the project includes the loss of productive soil from new borrow areas. Medium potential impacts from increase dust emissions, generation of noise, risks of accident from improper management of borrow areas, and inadequate clean-up operation, restoration and rehabilitation prior to decommissioning; and
- c. Only minor environmental impacts were identified during project operation.

17. During construction phase, adequate guidance and resources will be provided by RPWD to the Contractor to comply with the borrow area management requirements, suppress dust, control noise, and implement proper closure. A PMC is already engaged by the RPWD to ensure mitigation and monitoring measures are implemented and in compliance with ADB and country's legal framework. Road-specific EMPs and concomitant costs is part of the bidding documents.

18. Total CO₂ emission at business-as-usual, and with project (including construction) scenarios were estimated at 175,162 tons/year and 208,177 tons/year, respectively. Although the with-project scenario remains higher than without project due to increase in number of trips, number of vehicles and longer local trips owing to improved road condition, the impacts are considered not very significant. Measures to ensure the GHG emission will not increase further during project operation includes the following:

- a. Maintain an adequate vehicle road capacity as congestion decreases vehicle speed, deteriorates fuel efficiency and increases emissions per kilometre travel;
- b. Maintain optimum range of vehicle speed within the toll road, CO₂ emissions drastically increases when vehicles are travelling less than 30 kmph and faster than 70 kmph;
- c. Maintain good riding quality of the toll road, expressed in roughness and measured as m/km. The impact of deteriorating road quality with decrease in fuel; and
- d. efficiency and hence increase in emission per km travel.

19. The total budget provided in the civil works contract and RPWD budget to implement the environmental management plan (EMP) and (EMoP) is INR244 million consisting of the following items: a) Mitigation cost which includes dust suppression, installation of movable noise barriers, connection of side drains to nearby ponds/tanks for water harvesting, toll booth water harvesting, compensatory plantation, additional plantation; b) Monitoring cost which includes air, water, noise, and soil quality; c) Provision of 2 vehicles to the DFO of Barmer and Jodhpur to assist in the rescue of injured Chinkara from road crashes.

20. A Grievance Redressal Committee (GRC) will be established at two-levels, one at the District or PIU level and another at PMU level. The GRC will provide an opportunity for affected persons to have their grievances redressed. Depending on the nature and significance of the grievances or complaints, the GRM will comprise procedures to address grievances at the project site or PIU level then PMU level. Most serious complaints which cannot be addressed at

the PIU level will be forwarded to the PMU. The PMU level will be comprised of members from the PWD, PMC, contractor, local community, and local forestry authority.

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

I. INTRODUCTION

A. Background

1. Rajasthan, with 10.41% of country's total geographical area is the largest state of India occupying 3.42 lakh square kilometer (km²). area. Total population is 68.6 million forming 5.5% of the country's total population. It ranks among top four states in attracting tourists from all across the globe. State's economy is largely dependent on agriculture, dairy, minerals, and tourism, which all require a strong road network. Rajasthan being located between landlocked northern states and western port states imposes additional burden on roads due to interstate movement of goods and passenger traffic. Long international boundary necessitates good quality road infrastructure in border areas.

2. As of 31 March September 2016, Rajasthan has a road network of 2,14,223 kilometer (km), including 8,149 km of national highways, 15,025 km of state highways 6,715 km of major district roads (MDRs), 29,682 km of other district roads, and 1,54,652 km of village/rural roads. Road density in Rajasthan is only about 62.59 km per 100 km², compared to the national average of 166 km as on 31st March 2015. Road Density per lakh population in Rajasthan is 313 km corresponding to national figure of 436 km. Further, nearly 80% of the roads are single lane. Years of under-investment due to scarcity of financial resources and inadequate maintenance has left many of the state highways and MDRs in poor conditions, both in terms of in terms of riding quality and network.

3. Appreciating the importance of good road network in social, regional and economic cohesion, the Government of Rajasthan (GOR) endeavors to improve all state highways and districts roads. GOR has announced development of approximately 20,000 km of state highways and district roads in next five years under Rajasthan State Highway Development Program (RSHDP) through various funding sources.

B. Rajasthan State Highway Improvement Program (RSHIP)

4. The GOR has requested Asian Development Bank (ADB) to consider a multi-tranche financing facility (MFF) of \$500 million to finance part of the RSHDP comprising approximately 2,300 km of state highways and major district roads. The MFF will provide financing support to the contracts of Build Operate and Transfer (BOT)¹ through public private partnership (PPP) annuity and engineering procurement and construction (EPC)² models under tranches to support the capacity development of RPWD on key areas such as business procedures for PPP project management and road safety of state highway system. The proposed models will require ADB financing to be used for 50% of total project costs to be paid during the construction period and

¹ BOT (Annuity) model is a traffic risk-neutral PPP model. In this variant, PWD will pay a fixed semi-annual annuity to the concessionaire for the expenses incurred in construction, operation and maintenance, and the returns thereon. This amount does not bear any relationship with the level of traffic; hence the concessionaire does not bear the traffic revenue risk. In addition to this, private investors are not exposed to development risks associated with conventional BOT development process, which is a very expensive and time consuming process. In this model, the concessionaire assumes risks relating to construction, technical, operation, and maintenance, while the other critical risks relating to land acquisition, permit/approval, traffic risk, and toll collection risk are allocated to the granting authority.

² The engineering and construction contractor will carry out the detailed engineering design of the project, procure all the equipment and materials necessary, and then construct to deliver a functioning facility or asset to their clients. Companies that deliver EPC Projects are commonly referred to as EPC Contractors.

the GOR will underpin the balance of 50% to be contributed by the private sector concessionaire. Such financing arrangements can maximize the impact of ADB's resources.

5. As stated above, the investment program is distributed in different tranches. In the second tranche, II roads totaling approximately 754.463 km is being considered for financing.

Table 1: List of RSHIP Tranche-II Roads

S. No	Road ID	Name of Road	Package	Length (Km)	Districts	Cost (Cr)
A. EPC Mode						
1	ADB-II/EPC/01	Jodhpur- Sojat Road (SH-58 ,H-II)	15	75.700	Jodhpur, Pali	209.71
2	ADB-II/EPC/01	Bhinmal – Pantheri Posana – Jeevana (MDR-169 ,H-V)	22	51.580	Jalore	129.53
3	ADB-II/EPC/02	Bidasar-Sri Dungargarh-Kalu (MDR-38 ,H-	21	82.200	Churu, Bikaner	113.58
4	ADB-II/EPC/02	Sadulshahar-Sangaria -Chaiya (SH-76, H-II)	21	95.300	Hanumangarh, Sriganganagar	111.85
5	ADB-II/EPC/03	Losal-Salasar-Ratangarh (SH-07, H-II)	11	78.603	Nagaur,Sikar, Churu	142.36
6	ADB-II/EPC/04	Siwana –Samdari- Balesar (SH-66; Highway-II)	6	90.650	Jodhpur, Barme	238.50
Total				474.03		945.53
B. BOT Annuity Mode						
7	ADB-II/Annuity/01	Beawar-Masuda-Goyla(MDR-57;H-II)	23	67.010	Ajmer	125.17
8	ADB-II/Annuity/01	Arain-Sarwar (SH-7E; H-IV)	12	44.260	Ajmer-Tonk	88.54
9	ADB-II/Annuity/01	NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha	2	49.600	Bundi	103.68
10	ADB-II/Annuity/02	Nasirabad –Mangaliyawas- Padukalan-(MDR-39;H-IV	4	62.960	Ajmer,Nagaur	111.55
11	ADB-II/Annuity/02	Beawar–Pisangan, Tehla -kod- Alniyawas (SH-59,VR-64;-H -III)	12	56.700	Ajmer,Nagaur	101.25
Total (A+B)				280.53		530.19
Grand Total				754.56		1,475.72
Note: Road length = chainage + by-pass + by-passed section						

6. The GOR decided to implement the Investment Program through PPP Division, PWD Rajasthan.

C. Project Objectives

7. Project aims to improve transport efficiency of the state road network, which will contribute to expansion of economic opportunities and poverty reduction. This will be realized through: (i) improving the state highway and major district road network; (ii) facilitating safe and efficient transport services; and (iii) enhancing GOR capacity for road asset development and management. The project's immediate outcomes will be improved accessibility to social services and markets, increased fuel efficiency, reduced travel time, accidents, vehicle emissions and better employment opportunities outside agriculture, both through improved access to economic centers, and increased industrial activities within the state.

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

D. IEE Objectives

9. The project is categorized as category 'B' in accordance with ADB's Safeguard Policy Statement (SPS) 2009 warranting an initial environmental examination (IEE). IEE identifies the environmental issues to be considered at project planning and design stage. The IEE report covers the general environmental profile of the study area and includes an overview of the potential environmental impacts and their magnitude on physical, ecological, economic, and social and cultural resources within the project's influence area during design, construction, and operation stages. An Environmental Management Plan (EMP) for each sub-project form part of this report which include mitigation measures for significant environmental impacts during implementation of the project, environmental monitoring program (EMoP), and the responsible entities for mitigation and monitoring. IEE has four basic objectives; (i) identify the environmental issues that should be taken into account due to project activities; (ii) determine the magnitude of potential environmental concerns and to ensure that environmental considerations are given adequate weight at planning/design stage; (iii) identify need for further environmental studies or Environmental Impact Assessment (EIA); and (iv) suggest enhancement measures, if any.

E. Extent of IEE

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

F. Approach and Methodology

11. This IEE report has been prepared on the basis of feasibility report, field investigations and stakeholder consultations to meet the requirements for environmental assessment process and documentation as per ADB's SPS 2009. IEE commenced with the review of legal requirements for the project. Next, technical details were collected compiled by feasibility consultant. This was followed by a discussion with the implementing agency to reconfirm the technical details. Further steps followed for IEE has been concisely described in the following paragraphs.

1. Reconnaissance Survey and Initial Consultations

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

2. Primary Data Collection

13. Environmental resource inventory was prepared for all environmental features viz. terrain, land use, waterways/water bodies, road side vegetation, sensitive receptors, common property resources, utilities, drainage, flooding/water logging, accident prone areas, etc. within the area of interest/core zone. Information about wildlife movement viz. species, location, reason of crossing the road, potential wildlife accident locations, frequency, season and timing of crossings etc. were also collected. This was done by trained persons under the supervision of an expert team comprised of wildlife experts. Similarly, floral survey was also carried out.

3. Secondary Data Collection

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

4. Public Consultations

15. Meaningful consultations were organized with the government agencies, local people/beneficiary population to know the level of project acceptability, understand their concerns, apprehensions, and overall opinion. Information were gathered about existing baseline environmental condition viz. ambient levels and its effects on health, water resources, water logging/flooding, flora and fauna, wildlife movement, socio-economic standing of local people, impact due to loss of land, other assets and common property resources, accident risk during construction and operation stage, perceived benefits and losses, etc. Information thus gathered was used to integrate it in project design and formulate mitigation measures and environmental management plan.

5. Other Tools, Additional Surveys and Studies

16. The Transport Emissions Evaluation Model for Projects (TEEMP)³ developed by Clean Air Asia⁴ was utilized to assess the CO₂ gross emissions. Required input data-set viz. road length and configuration, traffic, road roughness, emission factors etc. were collected from different sources.

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

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

17. Assessment of land use/land cover map of larger area beyond the project site helps in better planning and decision-making before creating any physical infrastructure in the region. Climate risk screening identified increased temperature as major risk which has the potential to affect and reduce the life of asphalt road pavements through softening and traffic-related rutting. Extreme heat can also stress the steel in bridges through thermal expansion and movement of bridge joints and paved surfaces. Although the period of prediction is far longer than the design life of asphalt which will require maintenance overlay every 10 years, mitigation measures and feasible options to reduced impact on pavement have been included in the environmental management plan-operation phase.

6. Assessment of Potential Impacts

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

7. Preparation of the Environment Management Plan

19. The road specific EMPs have been formulated with an aim to avoid, reduce, mitigate, or compensate for adverse environmental impacts/risks and propose enhancement measures. These include: (i) mitigation of potentially adverse impacts; (ii) monitoring of impacts and mitigation measures during project implementation and operation; (iii) institutional capacity building and training; (iii) compliance to statutory requirements; and (iv) integration of EMP with project planning, design, construction and operation.

G. Structure of the report

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

Executive Summary

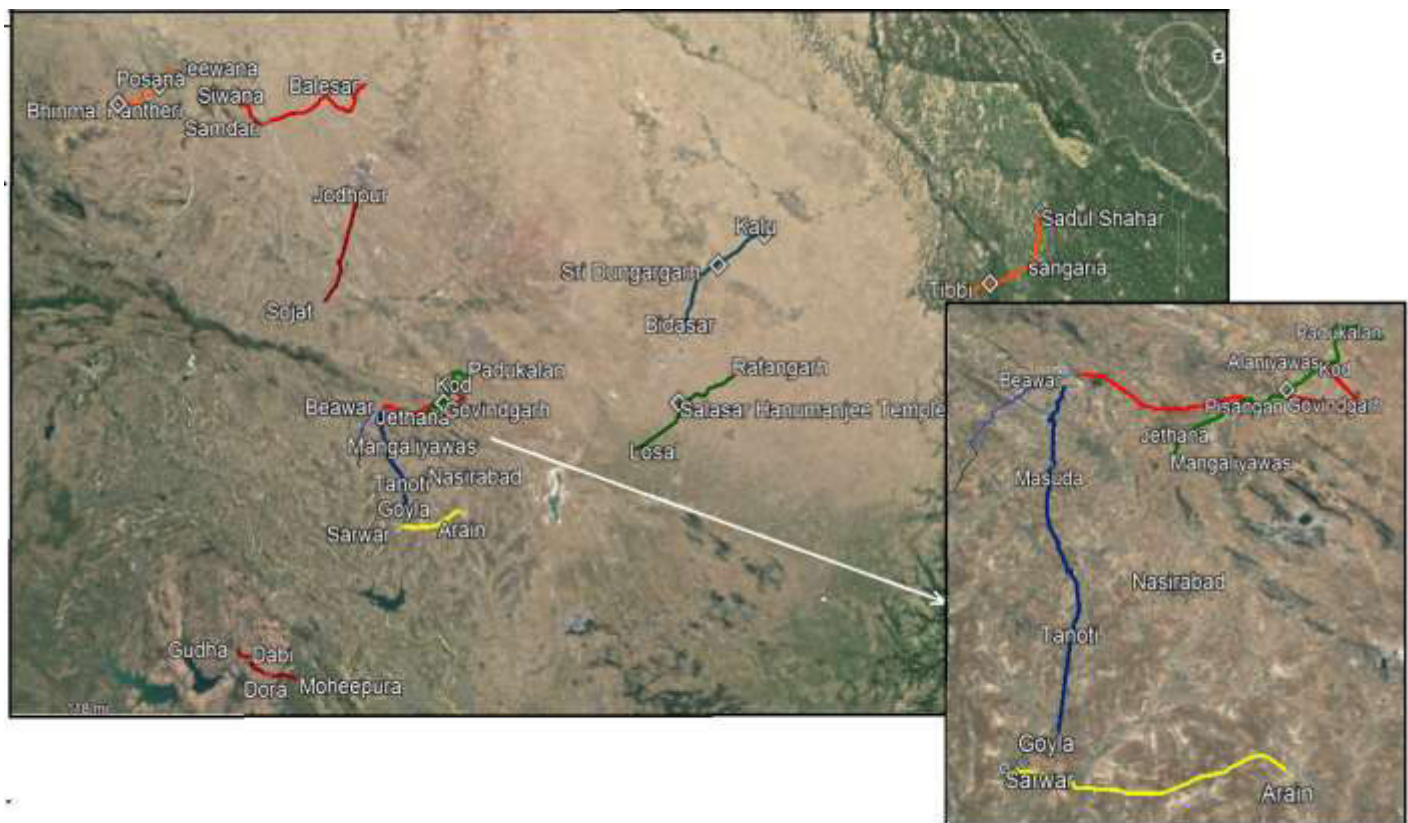
Chapter 1-	Introduction
Chapter 2-	Policy, Legal and Administrative Framework
Chapter 3-	Description of Project
Chapter 4-	Description of the Environment
Chapter 5-	Anticipated Impacts and Mitigation Measures
Chapter 6-	Information Disclosure, Consultation, and Participation
Chapter 7-	EMP and Grievance Redress Mechanism
Chapter 8-	Conclusion and Recommendation

II. DESCRIPTION OF THE PROJECT

A. Location of the Project

21. The 11 sub-project roads under Tranche-II are located in 13 districts of Rajasthan state namely: Ajmer, Barmer, Bikaner, Bundi, Churu, Hanumangrah, Jodhpur, Jalore, Nagaur, Sri Ganganagar, Pali, Sikar, and Tonk. The State can be divided into two major divisions structurally along the Aravalli range which cuts the state into east Rajasthan and west Rajasthan. Four of the sub-project roads fall on the west side of the range. Three sub-project roads (Nasirabad-Mangliyawas- Padukalan, Jodhpur-Sojat and Bhinmal – Pantheri Posana – Jeevana) traverse to the range and four of them are on the east side of the range in Rajasthan. Map 1 shows the location of sub-project roads.

Figure 1: Key Map Showing Sub-projects Locations



B. Project Category

22. Project categorization has been done using Rapid Environment Assessment (REA) checklist of ADB for roads and highways after survey and initial consultations. Project scope is limited to improvement and widening of existing single/intermediate/two-lane roads to mainly two-lane with granular shoulder. Hence it is expected that stress on existing natural resource viz, land, water, soil, and aggregates is not significantly adverse. Widening and improvement will be mostly accommodated within available right of way except in few roads where bypasses are proposed. Project road does not pass through or located nearby any wildlife sanctuary, national park, protected area network, archeological monument/heritage sites or any other similar eco-sensitive areas. Few sections of the project roads pass through protected/open scrub forest. These are mostly degraded forest with very little floral and faunal diversity. Diversion of forest land is

necessary in three sub-project roads: (i) Beawar-Masuda-Goyla for 6.35 Ha, (ii) NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha for 25.35 Ha and Arain-Sarwar for 1.21 Ha.

23. Erratic and undefined movement of wild animals predominantly the Blue Bulls was observed in most of the sub-project areas. Movement of Chinkara (a Schedule- I⁵ animal as per Indian Wildlife Act, 1972 and least concern as per IUCN) was also reported in few sub-projects (Sadulshahar-Sangaria –Chaiya , Bhinmal – Pantheri Posana – Jeevana and Jodhpur -Sojat). Adequate mitigation measures have been incorporated in design to avoid their collision with vehicles and ensure uninterrupted movement. Other impacts are mainly temporary and localized in nature which can be mitigated by effective implementation of Environmental Management Plan (EMP) included with the IEE. Hence, the project has been categorized as Category ‘B’ as per SPS 2009. As per Environmental Impact Assessment Notification 2006 and its amendments of Ministry of Environment, Forests and Climate Change (MOEFCC), the project is not under purview of environmental clearance. Therefore, there is no local requirement to prepare IEE or EIA.

C. Traffic

24. The average daily traffic (ADT) on the project road and surrounding network is presented in the succeeding table based on the traffic study prepared during the feasibility study. The summary of ADT in terms of vehicles and PCU in all locations is presented in Table 2. The traffic projection on the road consists of normal traffic, diverted traffic, and induced/generated traffic. Since most of the project corridors are not connecting major industrial places and no major activities are planned in near future, induced or diverted traffic is not expected except for Jodhpur- Sojat, Beawar-Masuda-Goyla, Losal-Salasar-Ratangarh and Bidasar-Sri Dungargarh-Kalu. Traffic projection has been done assuming 5% growth rate (both for construction as well as concession period). Existing and project traffic in different homogenous portions of sub-sections is given in Table 2.

Table 2: Present and Projected Traffic of Tranche-II Roads

Homogenous Sections	2015		2020		2025		2030		2035	
	Vehicle	PCU	Vehicle	PCU	Vehicle	PCU	Vehicle	PCU	Vehicle	PCU
Jodhpur- Sojat	1942	2518	1995	2634	2047	2749	2110	2888	2152	2980
	2144	3512	2196	3628	2249	3743	2312	3882	2354	3974
	1299	1095	1352	1210	1404	1326	1467	1464	1509	1557
Bhinmal – Pantheri Posana – Jeevana	2329	7095	2445	7450	2568	7822	2696	8213	2831	9167
	1134	3279	1166	3443	1224	3615	1285	3796	1349	4462
Bidasar-Sri Dungargarh-Kalu	1236	2307	1578	2945	2013	3758	2570	4797	3281	6123
	1430	2464	1825	3145	2330	4014	2973	5123	3795	6538
	839	1454	1071	1856	1367	2369	1744	3023	2226	3858
Sadulshahar-Sangaria -Chaiya	1600	2064	1680	2167	1764	2276	1852	2389	1945	2509
	1098	1353	1153	1421	1211	1492	1272	1566	1336	1645
	1365	1732	1433	1819	1505	1910	1580	2005	1659	2105
	692	848	727	890	763	935	801	982	841	1031
Losal-Salasar-Ratangarh	1587	1866	2025	2381	2585	3039	3299	3880	4211	4953
	3328	3685	4247	4702	5421	6001	6919	7659	8830	9779
	2149	2393	2743	3056	3500	3900	4468	4978	5702	6353
	2184	1812	2855	2369	3611	2997	4572	3794	5793	4807

⁵ Wildlife Protection Act, 1972 has six schedules which give varying degrees of protection. [Schedule I](#) and part II of [Schedule II](#) provide absolute protection - offences under these are prescribed the highest penalties. Species listed in [Schedule III](#) and [Schedule IV](#) is also protected, but the penalties are much lower. [Schedule V](#) includes the animals which may be hunted. The plants in Schedule VI are prohibited from cultivation and planting.

Homogenous Sections	2015		2020		2025		2030		2035	
	Vehicle	PCU	Vehicle	PCU	Vehicle	PCU	Vehicle	PCU	Vehicle	PCU
Siwana –Samdari-Balesar	1486	1803	1960	2378	2494	3026	3174	3851	4041	4903
	2375	2113	3110	2767	3937	3503	4990	4440	6327	5629
Beawar-Masuda-Goyla	8216	8578	10489	10949	13386	13973	17085	17834	21805	22761
	1086	1003	1386	1280	1769	1633	2257	2084	2881	2660
	1264	1092	1613	1394	2058	1779	2626	2270	3352	2897
NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha Road	4810	4010	3218	2683	4107	3424	5242	4370	6691	2924
	1282	1435	1646	1842	2101	2352	2682	3002	3424	3853
	1632	1687	2296	2373	2931	3030	3741	3867	4775	5439
Arain-Sarwar	1148	1263	1465	1480	1869	1888	2386	2410	3045	3075
	3522	3635	4495	4639	5736	5920	7321	7555	9344	9643
Nasirabad – Mangaliyawas-Padukalan	699	901	892	1149	1138	1468	1452	1874	1525	1968
	388	500	495	638	632	815	806	1040	846	1092
Beawar–Pisangan, Tehla -kot- Alniyawas	1697	1358	2166	1733	2764	2211	3528	2822	4502	3602
	1545	1355	1971	1729	2516	2227	3211	2569	4098	3627
	1243	1036	1586	1322	2025	1686	2584	2153	3298	2748

Source: Feasibility Report

D. Characteristics of Existing Roads

25. Existing roads under Tranche-II have varying width and road conditions. ROW is generally 20-30 m in most cases, with reduced width in settlements varying from 9 to 12 m except in Sarwar (5 m). Major part is two-lane with or without earthen shoulder. Riding condition is mostly poor to fair. Roadside drains are present in some urban stretches but mostly choked and non-functional. Overtopping of roads is not observed in general but water-logging is very common in built-up areas. Waterways will be crossed only in a few roads. Major bridges are present only on five (5) roads, while (9) roads have minor bridges, Bhinmal – Pantheri Posana – Jeevana road have few cross drainage (CD) structures. There is one (1) ROB in tranche-II. Bus shelters are present in some built-up areas. Most of the roads have inadequate road safety provisions. Horizontal and vertical profile are incoherent to applicable codal provisions. Horizontal curve is mostly insufficient in built-up areas. Vertical curves are deficient to severely deficient throughout the stretches of all sub-projects roads. This is due to the fact that roads are constructed on stabilized sand dunes which normally follow its undulating topography. Abutting land use is mainly agricultural along tranche 2 roads except along Jodhpur- Sojat, Bidasar-Sri Dungargarh-Kalu, Siwana to Balesar, Nasirabad to Padukalan, Beawar–Pisangan, Govindgarh-Tehla and Tehlakod- Alniyawas which are dominated by fallow/barren land. Habitated portion varies from 5-15% of the total alignment along most of the sub-projects.

E. Improvement / Strengthening Proposal

26. Project road improvement will mostly follow special codal provisions relevant to state highways prescribed by Indian Road Congress (IRC: SP: 73-2007 Manual of Standard and Specification for two-Laning of State Highways on B.O.T Basis) and Ministry of Road Transport and Highways (MORTH) Guidelines. In case of any compromise or variation thereof has been specifically highlighted with reasons in relevant section of the report.

27. Improvement of the project roads involves its widening from single/intermediate/2-lane lane to 2-lane with granular shoulder of 2.5 m on either side. Main upgradation components involve improvement in pavement conditions and geometrics, reconstruction and widening of CD structures, provision of roadside drains, raising of embankment in water logged sections, junctions/intersection improvement, safety provisions for road users and wildlife and provision of road facilities like bus bays/bus shelters, and toll plaza. Environmental enhancement measures like

additional plantation and rain water harvesting are also included. Salient features of the improvement proposals are discussed in brief in following paragraphs.

28. All efforts have been made to accommodate the improvement work within available ROW. Land acquisition is inevitable for curve improvement, 19 toll plazas and 14 proposed bypasses (1 for Bhinmal – Pantheri Posana – Jeevana, 1 Siwana –Samdari- Balesar, 1 for Arai-Sarwar and 4 for Nasirabad to Padukalan and 7 for Losal-Salasar-Ratangarh 35.3 km).

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

30. 11 new major bridges have been proposed under the projects. Remaining other existing major bridges which are recently constructed have been either retained or proposed for widening. All vented and flush causeways have been upgraded to minor bridge or slab culverts. Additional slab culverts and up-gradation of few pipe culverts are proposed in sub-projects.

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

32. All major junctions are proposed for improvement as per IRC guidelines mostly at grade. Additional earthen pedestrian walkways of 3 m width (Losal to Nechwa ,R.H.S. ,from km 3.700 to km 32.756 and Salasar to Ratangarh from km 47.737 to km 91.995 on L.H.S) have been proposed along Losal-salasar-Ratangarh sub-project roads for pilgrims visiting famous Salasar Temple located at 600 m from project highway.

33. Since the project highway road will be a toll road, the toll plazas are proposed to include a weigh bridge, office building, a traffic aid post, a medical aid post, and paved yard for parking and unloading of vehicles. Roof top rainwater harvesting proposed at both toll plazas for augmentation of groundwater.

34. Bus shelters have been provided at all important habitations. Bus bays have not been designed but an additional paved area of 4.0 m width and 20 m length shall be provided in order to enable a bus to stop without obstructing the flow of traffic. The Concessionaire may shift these locations, if necessary, in consultation with the local people and Independent/Authority Engineers.

35. Safe crossing facilities for pedestrians are proposed at major intersections and bus bays. These facilities are planned in accordance with the relevant provisions contained in IRC-11⁶, IRC-67⁷ and IRC-103⁸. At intersections, controlled form of crossing is achieved through provision of 3 m wide zebra crossing, accompanied by STOP line.

⁶ Recommended Practice for the Design and Layout of Cycle Tracks.

⁷ Code of Practice for Road Signs.

⁸ Guidelines for Pedestrian Facilities.

36. The project roads have been provided with all safety features as per IRC: 8⁹, IRC:25¹⁰, IRC:26¹¹, IRC:35¹², IRC:67¹³, IRC:103¹⁴ and Section 800¹⁵ of MORTH. Key features include provisions of crash barriers in high embankment areas, speed breakers near built-up areas, school, and toll plazas, speed restrictions in built-up sections and active wildlife crossing areas, delineators, road studs, cat's eye, chevrons, object markers etc. have been included in the design.

37. ROB's are not proposed for existing 9 level crossings because (i) TVU is less than warranted; (ii) approach length is not available due to heavily built- up area; and (iii) it is already proposed by Dedicated Freight Corridor Corporation Ltd (DFCCIL) where the roads are being crossed by proposed western freight corridors. Only one ROB is proposed for level crossing at Samdari in Siwana –Samdari- Balesar sub-project road.

38. For construction stage safety, a proper traffic diversion plan shall be prepared as per IRC: SP: 55-2014¹⁶. Separate traffic diversion plan shall be prepared for structures and CD works. The execution of the project road should be planned such that inconvenience to road users is minimal. The width of temporary diversion should be equal to the width of existing carriageway. Embankment heights are proposed for raising for grade improvement and locations where overtopping was reported either due to local drainage problem or ponding due to overflow of rivers during monsoons.

39. By-passed existing road sections will be subjected to regular road maintenance works by the Contractor. These include routine maintenance of sealed road pavement, foot paths, kerbs and channels, storm drainage, and pavement markings.

40. Existing road's characteristics and proposal for improvement has been summarized in Table 3.

⁹ Type Design for Highway Kilometer Stones.

¹⁰ Type Design for Boundary Stones.

¹¹ Type Design for 200-meter Stones.

¹² Code of Practice for Road Markings.

¹³ Code of Practice for Road Signs.

¹⁴ Guidelines for Pedestrian Facilities.

¹⁵ Specifications for Traffic Signs and other Safety-Related Works.

Table 3: Tranche-II Road's Salient Features and Improvement Proposals

Road	Existing Road's Salient Features	Improvement Proposal																														
Jodhpur- Sojat (SH-58)	<ul style="list-style-type: none">- Length=76.5- Location: The project road (section of SH-58) starts at km 0.00 from the junction with SH-61 in the district of Jodhpur and ends at km 76.500 junction with NH-162 in Pali district- Habitations are Jodhpur , Sinwero ki Dhani, Kakelao, Miyasani, Peethasani, Mortuka, Lolawas, Rajola, Chopra, Nayagaon, Chanwas, Roopwas and congested Sojat town- ROW: 25 to 30m- Configuration: Single lane is in 68.00 km. Intermediate lane and two lane in 0.5 km and 8.0 km respectively. Pavement condition is mostly poor (19.125km) to fair (26.01km). Only 31.365 km is in good condition- Junction/Intersections: 5 major and 24 minor- Cross Drains: 1 minor bridge, 7 slab culverts, 1 pipe culverts and 7 vented causeways- Terrain and Land use: plain. Land use mainly agricultural and habituated.	<ul style="list-style-type: none">- Project Road Length : 75.7 km- ROW: 30m- Configuration: Two lane of 3.5m with earthen shoulder of 2.5m on either side- Bypass: Nil- 12 Bus shelters on both sides- 5 Junction Improvements- 2 toll plazas at km 17+400 and at km 67+400- Cross Drainage Structures:																														
		<table><tr><th>Cross Drainage</th><th>New</th><th>Re construction</th><th>Widening & Repair</th><th>Retain with Minor Repair</th><th>Total</th></tr><tr><td>Pipe Culvert</td><td>35</td><td>-</td><td>-</td><td>-</td><td>35</td></tr><tr><td>Slab/Box Culvert</td><td>4</td><td>-</td><td>-</td><td>-</td><td>4</td></tr><tr><td>Minor Bridge</td><td>3</td><td>-</td><td>-</td><td>1</td><td>4</td></tr><tr><td>Major Bridge</td><td>5</td><td>-</td><td>-</td><td>-</td><td>5</td></tr></table>	Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total	Pipe Culvert	35	-	-	-	35	Slab/Box Culvert	4	-	-	-	4	Minor Bridge	3	-	-	1	4	Major Bridge	5	-	-	-	5
		Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total																									
		Pipe Culvert	35	-	-	-	35																									
		Slab/Box Culvert	4	-	-	-	4																									
		Minor Bridge	3	-	-	1	4																									
Major Bridge	5	-	-	-	5																											
Bidasar-Sri Dungargarh-Kalu (MDR-38)	<ul style="list-style-type: none">- Length=82.200 km- Location: The project road starts from Bidasar at km 0.000 and ends at the junction of SH-6A at Kalu at km 82.200.- Habitations are Bidasar, Dharmaas, Ridi, Bana, Sri Dungargarh, Kaluwas, Gusainsar, Lodera, Aadsar and Kaluon- ROW: 20 to 25m- Configuration: Single lane is in 28.4 km. Intermediate lane and two lane in 7 km and 46.80 km respectively. flexible & rigid pavement with moderate conditions except at few distress locations- Junction/Intersections: 4 major- Cross Drains: 9 nos. RCC slab culverts- Level Crossing: 1, at chainage 43+150km- Fly Over : One at chainage 45+750 km- Terrain and Land use: plain. Land use mainly agricultural , Residential and barren land.	<ul style="list-style-type: none">- Project Road Length : 82.000 km- ROW: 30m on existing and 12m at Bidasar, Ridi, Sridungargarh, Gosaisar and Kalu- Configuration: The proposed improvement proposal is - 63.9 km 2-lane with earthen shoulder, 7.5 km 2-lane with paved shoulder and remaining 1 km is CC pavement construction.- Bypass: Nil- 20 Bus shelters on both sides- 4 Junction Improvements- one level crossing is proposed for improvement- 2 toll plazas- Cross Drainage Structures:																														
		<table><tr><th>Cross Drainage</th><th>New</th><th>Re constructi</th><th>Widening & Repair</th><th>Retain with Minor Repair</th><th>Total</th></tr><tr><td>Pipe Culvert</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Slab/Box Culvert</td><td>-</td><td>8</td><td>-</td><td>1</td><td>9</td></tr><tr><td>Minor Bridge</td><td>-</td><td>-</td><td>-</td><td>1</td><td>-</td></tr><tr><td>Major Bridge</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table>	Cross Drainage	New	Re constructi	Widening & Repair	Retain with Minor Repair	Total	Pipe Culvert	-	-	-	-	-	Slab/Box Culvert	-	8	-	1	9	Minor Bridge	-	-	-	1	-	Major Bridge	-	-	-	-	-
		Cross Drainage	New	Re constructi	Widening & Repair	Retain with Minor Repair	Total																									
		Pipe Culvert	-	-	-	-	-																									
		Slab/Box Culvert	-	8	-	1	9																									
		Minor Bridge	-	-	-	1	-																									
Major Bridge	-	-	-	-	-																											

Road	Existing Road's Salient Features	Improvement Proposal																														
Bhinmal – Pantheri Posana – Jeevana	<ul style="list-style-type: none">- Length=55.00km- Location: starts from Mahabir Circle near AmbedkarTiraha at Bhinmal and runs along MDR-169 and finally ends at Jeevana Village at Km 33.200 of SH-16.- Habitations are Bhinmal,Kushalpura, Daspan, Pantheri, Unari, Posana , Siyavat,Mandavpur,Taaliyan & Jeewana- ROW: 15m to 30m in open areas but 9m in Pantheri village.- Configuration: Single lane (34 km) and Intermediate lane (21 km) respectively. The condition of the pavement varies from good to fair- Pavement condition is mostly good (33 km) to fair (22km).- Junction/Intersections: 2 major and 11 minor- Cross Drains: 3 slab culverts, 8 pipe culverts, 16 causeways- Terrain and Land use: The alignment passes through plain terrain ,mostly agriculture and stone mining	<ul style="list-style-type: none">- Project Road Length : 55.0 Km- Configuration: Two lane of 3.5m width with earthen shoulder of 2.5m on either side- Bypass: at Bhinmal of 2.68 km length and Realignment at Kushalpur- ROW: 30m- Level Crossing :nil- 4 Bus shelters- 2 toll plazas at Km 5.96 and 49.2- Cross Drainage Structures: <table><tr><th>Cross Drainage</th><th>New</th><th>Re construction</th><th>Widening & Repair</th><th>Retain with Minor Repair</th><th>Total</th></tr><tr><td>Pipe Culvert</td><td>11</td><td>4</td><td>-</td><td>-</td><td>15</td></tr><tr><td>Slab/Box Culvert</td><td>4</td><td>3</td><td>2</td><td>-</td><td>9</td></tr><tr><td>Minor Bridge</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Major Bridge</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table>	Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total	Pipe Culvert	11	4	-	-	15	Slab/Box Culvert	4	3	2	-	9	Minor Bridge	-	-	-	-	-	Major Bridge	-	-	-	-	-
	Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total																										
Pipe Culvert	11	4	-	-	15																											
Slab/Box Culvert	4	3	2	-	9																											
Minor Bridge	-	-	-	-	-																											
Major Bridge	-	-	-	-	-																											
Sadulshahar-Sangaria -Chaiya ((SH-76)	<ul style="list-style-type: none">- Length=94.0-Location: The project road lies in the Hanumangarh and Sri Ganganagar districts and traverses through Sadul Shahar, Karadwala, Amargarh, Chak Hira Singhwala, Bolanwali, Sangaria, Saliwal Village, Tandoor Wali, Tibbi, Silwala, Dabali Khurd, Mirjiwali mere and Bhoompura habitation.- Configuration: The available ROW varied from 10-30m. In the open areas it is varied 10-15m for 27.6 km length, 15-20m for 25.5m length, 20-25m for 20.4 km length, and 25-30m for km 9.9 lengths- CC pavement sections are observed in village sections totaling to 5.7km. 54% of project road length is in good condition and 31% in fair condition except isolated patches of failed sections and about 15% of the length is in poor condition. About 45% of shoulder is fair and 54% of length.-ROW: 8-30m- Junction/Intersections: There are 8 nos. major junctions and all major junctions are proposed for junction improvement- Cross Drains: There are 2 major bridge, 4 minor bridges and 163 culverts-Terrain and Land use: Plain terrain Land use mainly agricultural.	<ul style="list-style-type: none">- Project Road Length : 91.700 Km- Configuration: Two lane of 3.5m width with earthen shoulder of 2.5m on either side- Bypass: Nil- ROW: 30m in open area and minimum 12m to available space in dense habitation areas- Level Crossing :nil- 4 Bus shelters- 2 toll plazas at Km 32 and 41- Cross Drainage Structures: <table><tr><th>Cross Drainage</th><th>New</th><th>Re construction</th><th>Widening & Repair</th><th>Retain with Minor Repair</th><th>Total</th></tr><tr><td>Pipe Culvert</td><td></td><td>2</td><td></td><td></td><td>2</td></tr><tr><td>Slab/Box Culvert</td><td></td><td>9</td><td>152</td><td>2</td><td>161</td></tr><tr><td>Minor Bridge</td><td>2</td><td></td><td>2</td><td></td><td>4</td></tr><tr><td>Major Bridge</td><td>-</td><td>1</td><td>-</td><td>1</td><td>2</td></tr></table>	Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total	Pipe Culvert		2			2	Slab/Box Culvert		9	152	2	161	Minor Bridge	2		2		4	Major Bridge	-	1	-	1	2
Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total																											
Pipe Culvert		2			2																											
Slab/Box Culvert		9	152	2	161																											
Minor Bridge	2		2		4																											
Major Bridge	-	1	-	1	2																											

Road	Existing Road's Salient Features	Improvement Proposal
Losal-Salasar-Ratangarh	<ul style="list-style-type: none">- Length = 82.261 Km- The site for 2 laning project Highway comprises of the section of SH-7, commencing from 0+000 to 94+912 (excluding overlay portion 12.651 Km long on SH-20 from Nechhwa to Salaswar) i.e., Losal-Salasar-Ratangarh section in the State of Rajasthan.	<ul style="list-style-type: none">- Project Road Length : 78.603 Km- ROW: 16m in Open Rural area, 30m in Bypass, and 12m in Built-up area.- Configuration: Two lane of 7.0m with Paved shoulder of 1.5m on either side and Granular Shoulder 1.5m in built-up and 2.5m in rural area.- Bypass: 7- 34 Bus shelters on both sides- 17 Major Junctions and crossing bypasses 7 Improvements- 2 toll plazas at km 17.520 and at km 56.173- Cross Drainage Structures:
	Habitations are Losal, Singrawata, Mordunga, Shahpura,Jhajhar, Nechwa, Salasar, Gudawari, Shobhasar, Khuri, Malasi, Dhakawali, Kanwari, Menasar, Kusumdeshar, Bhinchari, Sangasar, Loonch and Ratangarh.	
	<ul style="list-style-type: none">- ROW: 10 to 25m- Configuration: Single lane is in 14.875 km, Intermediate lane is in 38.45 km, Two lane is in 28.726 km, and 4 lane is in 0.210 Km. Pavement condition is mostly poor.- Junction/Intersections: 17 major and 17 minor- Cross Drains: 0 minor bridge,0 slab culverts, 0 pipe culverts and 0 vented causeways	
	<ul style="list-style-type: none">-Terrain and Land use: plain. Land use mainly agricultural and habituated.	
NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha Road	<ul style="list-style-type: none">- Length=50 Km- Location: starts from T-Junction with NH-12 (Kota-Bundi Section) at Moheepura & terminates at 3-legged junction near Ranaji ka Gudha.- Habitations are Sitapura, Bharta Baodi, Laxmipura, Dora, Dabi, Bewadiya, Patpadiya & Ranaji ka Gudha- ROW: 25-30m- Configuration: 2 lane having flexible pavement, with widths varying- Junction/Intersections: 3major and 38 minor- Cross Drains: 7 minor bridges.10 slab culverts, 40 pipe culverts, 1 flush causeways and 2 vented causeways- Terrain and Land use: Mainly flat . Land use mainly agricultural.	<ul style="list-style-type: none">- Project Road Length : 48.857 Km- Configuration: two lanes with hard shoulder- Bypass: Nil- 14 Bus shelters- toll plazas- Nil- Cross Drainage Structures:

Road	Existing Road's Salient Features	Improvement Proposal																																										
Siwana to Balesar (SH-66;Highway-II)	<ul style="list-style-type: none">- Length=90.000 km- Location: The project road starts with junction of SH-138, near Siwana and ends at Junction with NH 115 near Balesar .- Habitations are Siwana, Meli, Karmawas, samdari, Surpura ,Kalayanpur Gangwas, Dhandhaniwas , Loharo ki Dhani and BValesar- ROW: 10-25m- Level Crossing:2- Configuration: : single lane road (85.1 Km) and rest of 4.9 km is intermediate lane carriageway. Out of 90.000 km, 36 km of project road (40%) is in very good condition, 17 km of project road (19%) is in Good Condition, 8 km of project road (9%) is in fair condition; and 29km of project road is in poor condition (32%).- Junction/Intersections: 7 major and 24 minor- Cross Drains: 2 major and 7 minor bridges. 5 slab culverts, 27 pipe culverts, 93 Box culvert- Terrain and Land use: Mainly plain. Land use mainly agricultural.	<ul style="list-style-type: none">- Project Road Length : 90.000 Km- Configuration: Configuration: 2 lane configuration of 7.0m carriage way with 2.5m granular shoulder and unlined drainage are proposed for 89.32 Km, and 1.5m paved shoulder and Footpath cum Box drain are proposed for 0.68 Km.- ROB:1 at Samdari- Bypass: at Samdari of 7.8 km Length, 4 Realignment 0.996 km- 6 Bus Bays- 2 toll plazas at Km 15+500 and km 67+000- Cross Drainage Structures:																																										
		<table><tr><th>Cross Drainage</th><th>New</th><th>Re construction</th><th>Widening & Repair</th><th>Retain with Minor Repair</th><th>Total</th></tr><tr><td>Pipe Culvert</td><td></td><td></td><td>27</td><td></td><td>27</td></tr><tr><td>Slab/Box Culvert</td><td></td><td></td><td>5/93</td><td></td><td>98</td></tr><tr><td>Minor Bridge</td><td>2</td><td></td><td></td><td></td><td>2</td></tr><tr><td>Major Bridge</td><td>4</td><td>-</td><td>-</td><td>-</td><td>4</td></tr></table>	Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total	Pipe Culvert			27		27	Slab/Box Culvert			5/93		98	Minor Bridge	2				2	Major Bridge	4	-	-	-	4												
		Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total																																					
		Pipe Culvert			27		27																																					
		Slab/Box Culvert			5/93		98																																					
Minor Bridge	2				2																																							
Major Bridge	4	-	-	-	4																																							
Beawar-Masuda-Goyla(MDR-57;H-II)	<ul style="list-style-type: none">- Length=70 km- Location: Starts at Beawar Chainage 54.500 km of NH-8 and ends at Km. 72.400 of MDR-57 / 28+600 of SH-26 at Goyla village in Ajmer district- Habitations Beawar, Andheri Devari, Pakhariyawas, Kimpura, Dholadata, Advaniya, Masuda, Begliyawas, Chhipiya, Bandanwada, Keetap, Tantoti, Chandma, Goyala Village.- ROW: 8-24m- Configuration: Intermediate lane road (24.970km) and 2 lane (41.800Km) .Existing road has 1.000-2.395m earthen shoulder.- Pavement condition is mostly poor (44%) to fair (56%).- Junction/Intersections: 6 major and 32 minor- Cross Drains:- Terrain and Land use: All open Land	<ul style="list-style-type: none">- Project Road Length : 66.10 Km- Configuration: 2 lane configuration of 7.0m carriage way with 2.5m granular shoulder and unlined drainage are proposed- Bus shelters-22- 2 toll plazas at Km -2+520 and 49+540- Cross Drainage Structures:																																										
		<table><tr><th>Cross Drainage</th><th>New</th><th>Re construction</th><th>Widening & Repair</th><th>Retain with Minor Repair</th><th>Total</th></tr><tr><td>Pipe Culvert</td><td>2</td><td>29</td><td>10</td><td>12</td><td>53</td></tr><tr><td>Slab/Box culvert</td><td></td><td>22</td><td>1</td><td>2</td><td>25</td></tr><tr><td>Minor Bridge</td><td></td><td>2</td><td></td><td>1</td><td>3</td></tr><tr><td>Major Bridge</td><td>1</td><td></td><td></td><td></td><td>1</td></tr><tr><td>ROB</td><td></td><td></td><td></td><td>1</td><td>1</td></tr><tr><td>Railway Line (LC-No. 29B)</td><td></td><td></td><td></td><td></td><td>1</td></tr></table>	Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total	Pipe Culvert	2	29	10	12	53	Slab/Box culvert		22	1	2	25	Minor Bridge		2		1	3	Major Bridge	1				1	ROB				1	1	Railway Line (LC-No. 29B)					1
		Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total																																					
		Pipe Culvert	2	29	10	12	53																																					
		Slab/Box culvert		22	1	2	25																																					
		Minor Bridge		2		1	3																																					
		Major Bridge	1				1																																					
		ROB				1	1																																					
		Railway Line (LC-No. 29B)					1																																					

Arai-Sarwar (SH-7E; H-IV)	<ul style="list-style-type: none">- Length=44.26 km- Location: The project road starts from Arai at km 0.000 and ends at the junction of SH-26 at Sarwar at km 44.260- Habitations are Arai, Chota Lamba, Aakodiya, Ankauriya, Jorawarpura, Kasheer, Borada, Fatehgarh, Indarpura, Sarwar etc- ROW: 9-30m- Configuration: The existing project road consists of Single, Intermediate and two lane roads .Pavement condition is flexible with moderate conditions except at few distress locations- Junction/Intersections: 14 major and several minor- Cross Drains: 1 nos. minor bridge and 79 nos. culverts.- Terrain and Land use: Plain/Rolling/Hilly terrain with varying ground elevation from mean sea level. It varies from 349–413m. Land use mainly agricultural.	<ul style="list-style-type: none">- Project Road Length : 44.26 Km- Configuration: The proposed pavement width is 7m 2.5m granular shoulder is proposed on either side- Bypass: at Khanpur of 4.85 Length- Bus shelters 8 nos bus bays at four different locations and 16 nos of bus shelter at eight locations are proposed.- 1 toll plazas at Km 30.650- Cross Drainage Structures: <table><tr><th>Cross Drainage</th><th>New</th><th>Re construction</th><th>Widening & Repair</th><th>Retain with Minor Repair</th><th>Total</th></tr><tr><td>Culvert</td><td></td><td>42</td><td>37</td><td></td><td>79</td></tr><tr><td>Minor Bridge</td><td></td><td></td><td>1</td><td></td><td>1</td></tr><tr><td>Major Bridge</td><td>-</td><td>-</td><td>-</td><td></td><td></td></tr></table>	Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total	Culvert		42	37		79	Minor Bridge			1		1	Major Bridge	-	-	-								
Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total																											
Culvert		42	37		79																											
Minor Bridge			1		1																											
Major Bridge	-	-	-																													
Nasirabad to Padukalan-(MDR-39;H-IV)	<ul style="list-style-type: none">- Length=63 km- Location: The project road starts from the T-Junction in Mangliyawas which is located at KM 24.0 in Ajmer District and ends at approximate distance of 63.0km i.e. at KM 87.0 at the T- Junction with NH-89 in the village of Padukalan located in Nagaur District□Habitations are Mangliyawas, Jethana, Sarasadi, Kalesara, Hanumant pura, Pisangan, Fatehpura, Sethan, Akhepura, Govindgarh, Alniyawas, Riya Badi, Sensda, Padu Khurd and Padukalan- ROW: 8-30m- Configuration: single ,intermediate/2-lane with degraded earthen or no shoulder in most stretches, inadequate and damaged cross drainage structures, and absence of side . Pavement condition is mostly poor- Junction/Intersections: 5 major and 33 minor- Cross Drains: 5 minor bridges, 16 slab culverts, 8 pipe culverts, 6 flush causeways and 3 vented causeways- Terrain and Land use: Mainly flat with few stretches rolling terrain. Land use mainly agricultural.	<ul style="list-style-type: none">- Project Road Length : 62.96 Km- Configuration: 2-lane of 7.0m carriageway with 1.5 m paved and 1.0 m earthen shoulder on either side- Bypass: at Sethan, Govindgarh and Alniyawa and Riyan Badi- 6 Bus shelters- 2 toll plazas at Km 30.500 and km81.700- Cross Drainage Structures: <table><tr><th>Cross Drainage</th><th>New</th><th>Re construction</th><th>Widening & Repair</th><th>Retain with Minor Repair</th><th>Total</th></tr><tr><td>Pipe Culvert</td><td>37</td><td>1</td><td>3</td><td>3</td><td>44</td></tr><tr><td>Slab/Box Culvert</td><td>7</td><td>1</td><td>14</td><td>1</td><td>23</td></tr><tr><td>Minor Bridge</td><td>5</td><td>1</td><td>4</td><td>2</td><td>12</td></tr><tr><td>Major Bridge</td><td>1</td><td>-</td><td>-</td><td>-</td><td>1</td></tr></table>	Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total	Pipe Culvert	37	1	3	3	44	Slab/Box Culvert	7	1	14	1	23	Minor Bridge	5	1	4	2	12	Major Bridge	1	-	-	-	1
Cross Drainage	New	Re construction	Widening & Repair	Retain with Minor Repair	Total																											
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Slab/Box Culvert	7	1	14	1	23																											
Minor Bridge	5	1	4	2	12																											
Major Bridge	1	-	-	-	1																											

Road	Existing Road's Salient Features	Improvement Proposal			
Beawar-Pisangan, Govindgarh-Tehla and Tehlakod- Alniyawas (SH-59, VR-64;-H -III)	- Length= 60.000 km	- Project Road Length : 57.060 Km			
	- Location: Beawar-Pisangan- Govindgarh-Tehla-Alniyawas, Section of SH-59 from km 0+000 to km 33+570, km 0.000 to km 13.720 and km 0.000 to 9.770	- Configuration: two lane with granular shoulders			
	- Habitations are BeawarKhas, NayaBadiya, Gola, Alipura, Nagleo, Nad, Pisangan, Govindgarh, Ladpura, NarsinghBasni, Tehla, Kod, Alniyawas etc.	- Bypass: Nil			
	- ROW: 15-30m	- 18 Bus bays			
	- Configuration: Single, intermediate & two lanes with earthen shoulders	- 2 toll plaza are proposed			
	- Pavement condition is mostly fair, some stretches are damaged	- Cross Drainage Structures:			
- Junction/Intersections: Major =5 nos., Minor=22 nos.					
- Cross Drains: 1 minor bridge, 24 culverts, 3 causeways					
-Terrain and Land use: Plain and Rolling. Land use mainly irrigated agricultural land.					

F. Construction Material (Quantity and Sourcing)

41. Due to favorable topography and geological conditions, aggregates for the project is available in abundance in most of the project districts with an average lead distance of 40–70 km. Good earth for embankment is also available within 0–5 km lead distance for all sub- projects . Soil for these sub-projects will be transported from nearby upland/foothills located within 15 km from project road. Sand is also available in plenty in beds of rivers being crossed by the project roads, but it cannot be mined due to court orders. The sand will be obtained from Bikaner .Water requirement for construction will be met through combination of ground water and surface water. Some of the project road lies within 300 km distance from operational thermal power plants and hence fly-ash utilization is mandatory as per Fly-Ash Notification 2016. However, due to technical constraint¹⁶ fly-ash utilization is not proposed including bypass section. Moreover, as confirmed by FS consultants, all the TPPs are tied up for supply of fly-ash to cement manufacturing and tiles/bricks manufacturing industries. Quantity and sources of construction materials are summarized in **Table 4**.

Table 4: Quantity of Construction Material

S. No	Name of Road	Earth, cum	Sand, cum	Cement, bags	Aggregates, cum	Bitumen , tons
1	Jodhpur- Sojat Road	979179	3406	102195	514835	2195
2	Bhinmal – Pantheri Posana – Jeevana	667187	2321	69633	350796	1496
3	Bidasar-Sri Dungargarh-Kalu	1063257	3699	110970	559042	2384
4	Sadulshahar-Sangaria - Chaiva	1232706	4289	128665	648136	2764
5	Losal-Salasar-Ratangarh	1016731	3538	106115	534582	2282

¹⁶ As per IRC SP 58 2001, a cushion of 0.5 m between fly-ash and granular material is required. Additionally, 1 to 3 m thick cushion of earth cover on slopes is required where fly-ash is to be used. Embankment height of the existing road varies between 0-0.5 m and for bypass it is 1.5-1.6 m which is less than desired height for fly-ash utilization both for existing road and new bypass section.

S. No	Name of Road	Earth, cum	Sand, cum	Cement, bags	Aggregates, cum	Bitumen , tons
6	Siwana –Samdari- Balesar	1172558	4083	122379	616511	2629
7	Beawar-Masuda-Goyla	866778	3036	90478	455735	1946
8	Arain-Sarwar	572506	1996	59782	301123	1301
9	NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha	640286	2229	66825	336656	1467
10	Nasirabad –Mangaliyawas-Padukalan	814589	2836	85712	428589	1832
11	Beawar–Pisangan, Tehla -kod- Alniyawas	5	2651	76545	385619	1671

Note: the above sources are tentative. Concessionaire is free to select the sources after compliance to legislations/permits and consent from panchayat and concurrence of land owners.

*. The sand will be obtained from Bikaner and Aggregate from Kotputli area from licensed quarries .Cement bags from open market and Bitumen from Mathura refinery.Earth will be borrowed from nearby areas after permission from local authorities.

G. Cost and Implementation Schedule

42. Project construction period will be 24 months for 6 sub-project-roads under EPC Mode and 18 months for 5 sub-project-roads under BOT Annuity Mode followed by 6 year performance based maintenance. Concessionaire will be recruited for the construction and maintenance related works. Estimated total project cost is approximately INR 1475.72 Cr.

III. POLICY AND LEGAL FRAMEWORK

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

A. International Agreements and Commitments

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

45. **Ramsar Convention on Wetlands, 1971:** The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an inter-governmental treaty, for the conservation and sustainable utilization of wetlands i.e. to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific and recreational value. Which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Out of 25 designated wetlands of International Importance in India, none of them is located in project influence area. Activities undertaken in the proximity of these wetlands should follow the guidelines of the convention.

46. **Convention on Protection of the World Cultural and Natural Heritage, 1972:** The United Nations Educational, Scientific and Cultural Organization (UNESCO), which seeks to encourage the identification, protection and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity has embodied these objectives in an

international treaty called the Convention concerning the Protection of the World Cultural and Natural Heritage in 1972. There are Twenty-six world cultural heritage and natural sites in India. None of them is located in project influence area.

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

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

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

50. **The Convention on the Conservation of Migratory Species of Wild Animals (CMS) 1983:** The Convention on Migratory Species (CMS) is an intergovernmental treaty, concluded under the aegis of the United Nations Environmental Programme (UNEP), concerned with the conservation of wildlife and habitats on a global scale and in particular terrestrial, aquatic and avian migratory species throughout their range. This international convention is relevant to the project due to occurrence of Chinkara (*Gazella bennettii*) in Western part of Rajasthan and its adjoining countries like Pakistan, Afghanistan Iran etc. The whole population is semi-nomadic. In the Thar Desert, the population historically had a transboundary character, but cross-border movements have been increasingly affected by militarization and fencing of the India-Pakistan border. The Seistan Basin lying between eastern Iran, SW Afghanistan and western Pakistan is also considered to hold a transboundary population.

B. Country's Legal Framework and Regulatory Requirements

51. The implementation of the RSHIP will comply with the environmental acts, policies, rules, and regulations of the Government of India which has a comprehensive coverage of environmental issues and requirements. This environmental legal framework imposes command and controls on certain activities deemed detrimental to the environmental integrity and encompass the conservation of various components of the biological and physical environment and environmental assessment procedures and requirements for public consultation. The policies and requirements which are most relevant in the context of this project are provided in **Table 5** below.

Table 5: Summary of Environmental Legislation Applicable to the Proposed Project

No.	Act	Application to the Project	Responsible Institution
1	National Environmental Policy, 2006	Project should adhere to the principle of environmental resources conservation and pollution abatement	MoEF& CC
2	Environment (Protection) Act (1986) and Rules (1986) including amendments	Project should follow applicable requirements of the Act and Rules	MoEF& CC
3	Environmental Impact Assessment (EIA) Notification under Environmental Protection Rules (2006, 2009, 2011) and relevant Office Memorandums (OM)	Category B2 projects does not require EIA. State highways not inside protected areas notified under the Wildlife Protection Act 1972 classified as Cat. B For tranche 2 none of the roads fall under category B	MoEF& CC
4	Wildlife Protection Act (1972 and amended in 1993)	Applicable to subprojects located within core or buffer zone of Protected Areas (Wildlife Sanctuaries, National parks, biosphere reserves etc) Permission from chief wildlife warden/ State Wildlife Board/ National Board of Wildlife For TII, none of the project roads are located inside core or buffer zone	MoEF& CC
5	Notification of Eco-Sensitive Zones	Restriction of activities (including construction, tree cutting, etc) in the notified zones There are no eco sensitive zones in or near the sub-project roads	MOEF& CC CCF
6	Notification No. S.O.319 I dated 7 May 1982 restricting certain activities in Aravalli Range	Prohibits certain development types on certain land uses. Road projects are allowed provided no tree cutting is done.	MoEF& CC
7	The Forest (Conservation) Act 1980 (Amended 1988) and Rules 1981 (Amended 2003)	Restricts use of forest lands for non- forest purposes. Applicable to project roads located in forests; requires prior permission to take up the works. Under TII, 2 subproject roads requires forest diversion of 12 ha.	MoEF& CC
8	The Water (Prevention and Control of Pollution) Act 1972 (Amended 1988) and Rules 1974	Provides effluent standards to be complied by the labor and construction camp. Requires control of suspended solids from exposed construction sites.	RSPCB
9	The Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and Rules 1982	Applicable for equipment and machineries potential to emit air pollution hot mix plant, rock crusher, diesel generator and construction vehicles. Consent for Establishment (CFE) and Consent for Operation (CFO) from RPCB	RPCB and Road Authorities
10	Noise Pollution (Regulation and Control) Amendment Rules, 2017	Applicable to construction vehicles, processing plants (hot mix, rock crusher, etc.) to meet day and night time standards	SPCB

No.	Act	Application to the Project	Responsible Institution
11	Fly Ash Notification, 1999 as amended up to 25th Jan 2016	Reuse of flyash from thermal power plants for projects 300 km. Although some roads are located within this radius, the materials specification does not qualify for use.	MoEF& CC
12	Office Memorandum dated 18.05.12 by MoEF& CC in view of Apex Court Order dated 27.2.2012	In case of renewal of quarries and opening of new borrow areas, required to conserve top soil, aquatic biodiversity, hydrological regime etc., by haphazard and unscientific mining of minor minerals	SEIAA
13	Solid Waste Management Rules, 2016	Solid waste generated from the camps and demolition debris	
14	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.	Rules defines and classifies hazardous waste. Provides procedures for handling hazardous wastes like oils, lubricants, and bitumen	RSPCB
15	Central Motor Vehicle Act (1988) and Rules (1988) and Motor Vehicles (Amendment) Bill, 2016.	To control vehicular air and noise pollution. To regulate development of the transport sector, check and control vehicular air and noise pollution.	State Transport Department
16	Ancient Monuments and Archaeological Sites and Remains Act (1958) and the Ancient Monuments and Archaeological Sites and Remains (Amendment) Bill, 2017	Applicable to subprojects located in proximity with the Protected Monuments/ Sites .No excavation /construction work is allowed within 300 m boundary of the protected monument Requires prior permission of Archaeological Survey of India (ASI) for taking works within 500 m of boundary of the Protected Monuments	Rajasthan Archaeological Dept. GOI
17	Antiquities and Art Treasures Act, 1972 along with Rules 1973	Chance find artifacts must be handed to District Authorities	District Magistrate
18	The Mining Act,1957 and its ammenments upto 27th March 2015	Regulate activities for safe and sound mining of aggregates from river and quarries.	
19	Mineral conservation and development Rule of 2017 and the Rajasthan Minor Mineral Concession Rules, 2017	Regulate the quarrying of minor minerals like stone, soil, and river sand	District Collector
20	Public Liability and Insurance Act 1991	Regulate the employment and conditions of construction workers and provide for their safety, health and welfare measure and for other matter incidental thereto.	District Collector
21	The Building and Other Construction Workers (regulation of employment and conditions of service) Act, 1996	Regulate the employment and conditions of construction workers and to provide for their safety, health and welfare measure and for other matter incidental.	Ministry of Labor and Employment

No.	Act	Application to the Project	Responsible Institution
22	Bonded Labour System (Abolition) Act, 1976 along with Rules, 1976	Abolition of bonded labor.	Ministry of Labor and
23	Contract Labour (Regulation and Abolition) Act 1970 along with rules, 1971	Prevent exploitation of contract labor and also to introduce better conditions of work.	Ministry of Labor and Employment
24	Employees Provident Funds and Miscellaneous Provisions Act 1952	Promote and secure the well-being of the employees where contractors employ more than 20 persons during Construction Phase.	Ministry of Labor and Employment
25	Minimum Wages Act 1948 along with Central Rules 1950	Ensure that workman gets at least minimum wages as fixed by Govt.	Ministry of Labor and Employment
26	Inter State Migrant Workmen (Regulation of Employment and Conditions Service Act, 1979	Protect workers whose services are Requisitioned outside their native states in India.	Ministry of Labor and Employment

52. The following requirements are particularly important and need special attention in order to avoid any delays for a project:

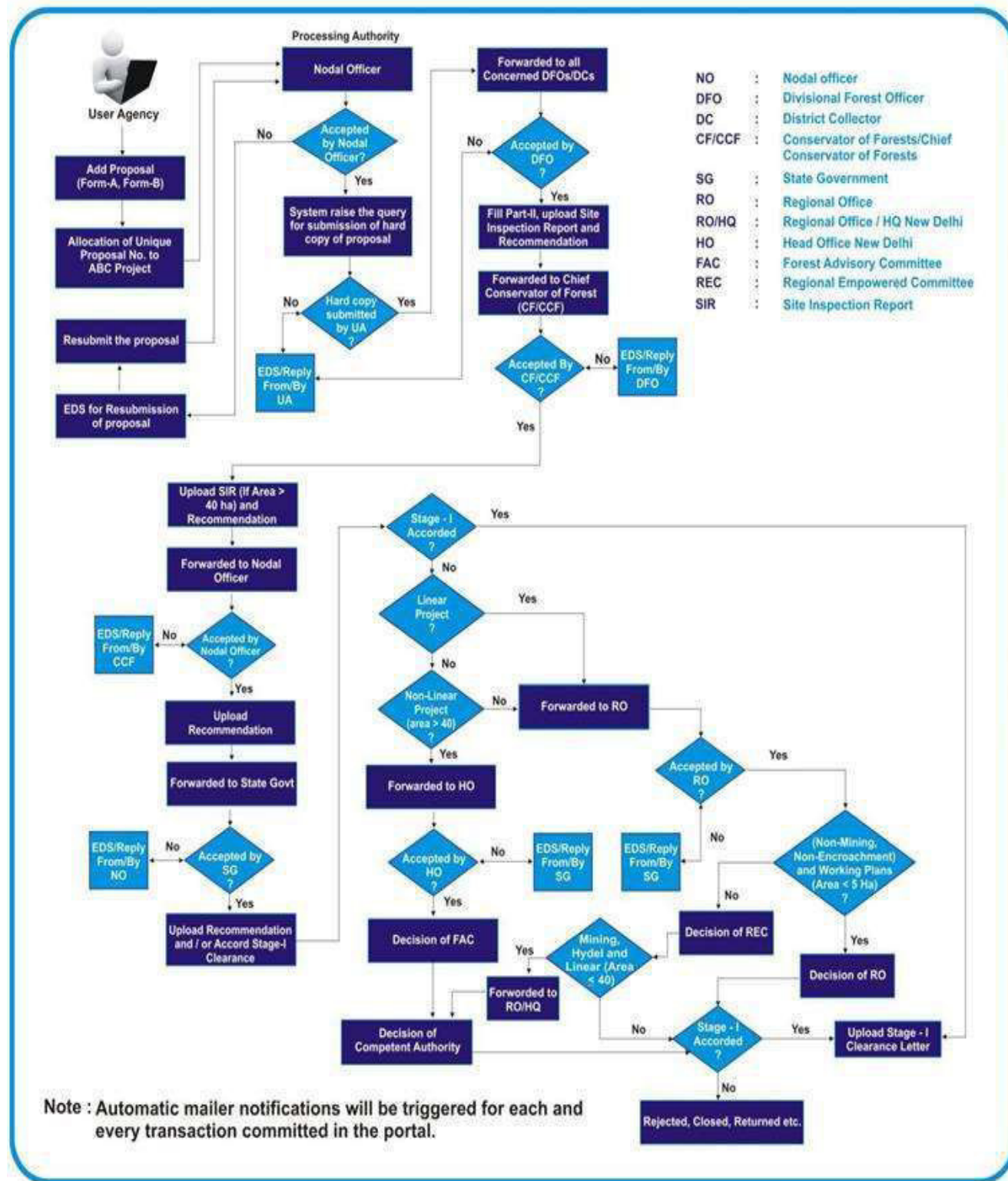
- i) Under EIA Notification 2006 (amended 2009, 2011, and 2013) all new state highways, or expansion of existing state highway outside hilly terrain above 1000 m above mean sea level (amsl) and or ecologically sensitive areas does not require environmental clearance.
- ii) Further, under the same notification, it is stated that any state highway projects will be treated as category A if located in whole or in part within 5 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972; (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time; (iii) Notified Eco-sensitive areas; and (iv) 5 km from interstate boundaries and international boundaries.
- iii) As per the Forest Conservation Rules (1981, amended 2003) a forestry clearance from Department of Forests is required for diversion of forest land for non-forest purpose. Processing of the forestry clearance entails two stages:
 - a. stage I and stage II. Amongst other requirements stage I clearance requires the applicant to make payments for compensation of forestry land that will be
 - b. acquired and trees that will be cut under the project. Accordingly timely allocation of budget for this purpose by the applicant is necessary to expedite the clearance process.
- iv) Cutting of trees in non-forest land require a tree cutting permit from the local forestry department. All trees cut under a project must be compensated by
 - a. compensatory afforestation as required by the State Forest Department.
- v) Placement of hot-mix plants, quarrying and crushers, batch mixing plants, discharge of sewage from construction camps requires No Objection Certificate
 - a. (Consent to Establish and Consent to Operate) from State Pollution Control
 - b. Board prior to establishment; the state of Rajasthan requires permanent conversion of land for use as hot-mix, batching plants, etc., for land uses other than commercial.

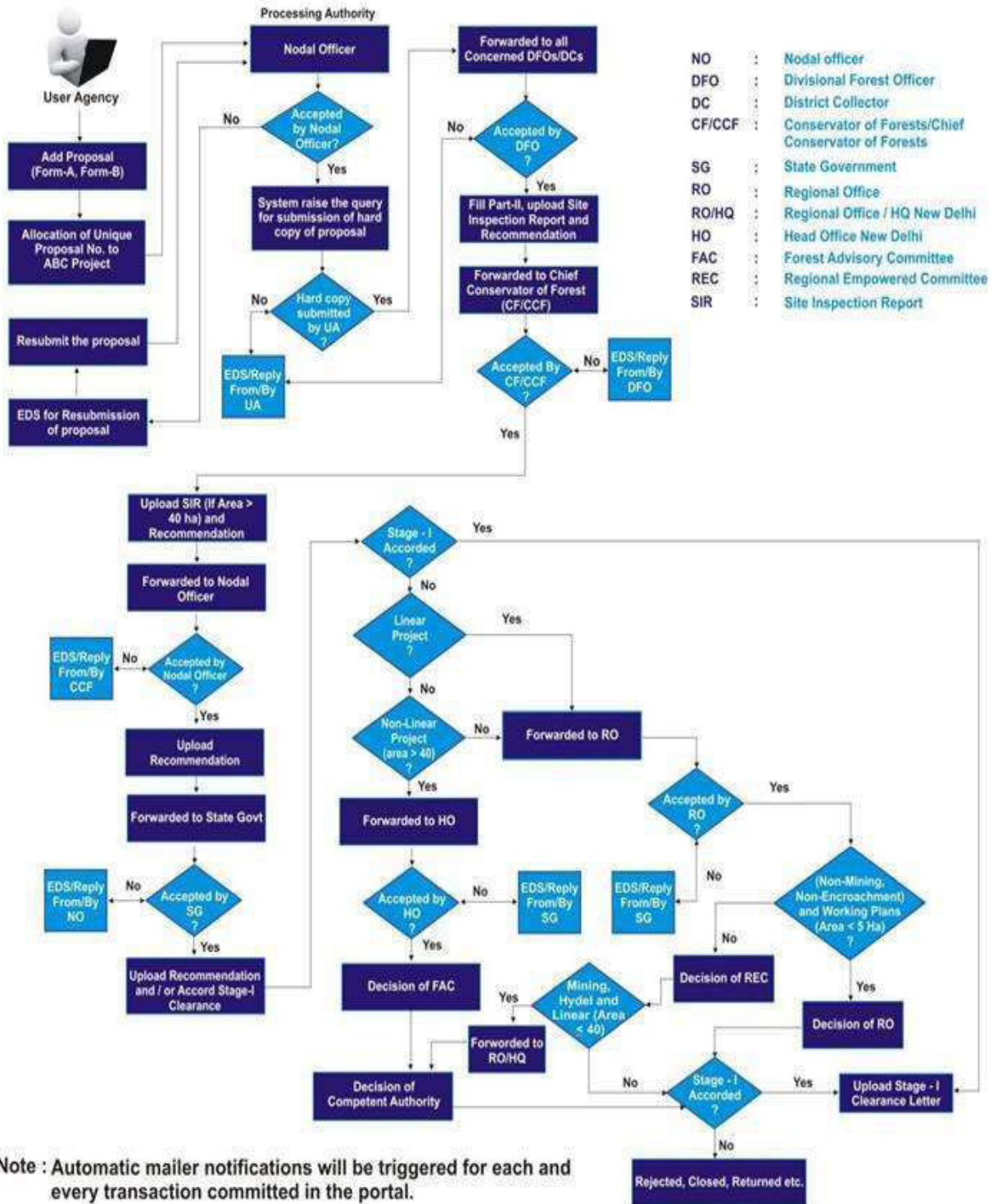
- vi) Permission from the District Level Environment Impact Assessment Authority (DEIAA) must be secured for all new borrow areas, regardless of area covered.
- vii) Permission from Central Ground Water Authority is required for extracting ground water for construction purposes.

C. Procedure for Forest Clearance

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

Figure 2: Procedure and Work Flow for Forest Clearance





D. Procedure and Work Flow for Forest Clearance Steps and Procedure for Obtaining Borrow Area Permit

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

E. Applicable Indian Road Congress (IRC) Codes to the Project Road

54. Key IRC guidelines have been summarized that have a direct/indirect bearing on the environmental management during design and construction stages.

Applicable Indian Road Congress (IRC) Codes

Sr. N.	IRC code Theme	IRC code
1	Recommended practice for borrow pits for Rural road embankments constructed by manual operations	IRC: 10 1961
2	Guidelines for Pedestrian Facilities	IRC: 103 -1988
3	Guidelines for EIA of Highway projects	IRC:104-1988
4	Ribbon developments on highways and its prevention	IRC: SP: 1996
5	Manual on Landscaping of road	IRC: SP: 21-1979
6	Report on recommendations of IRC Regional workshops on highway safety	IRC: SP: 27-1984
7	Road safety for Children (5-12 years old)	IRC: SP: 32-1988
8	Guidelines on road drainage	IRC: SP: 42-1994
9	Highway safety code	IRC: SP: 44-1994
10.	Guidelines for safety in construction zones	IRC: SP: 55-2001

F. ADB's Safeguards Requirement

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

56. Projects are classified into the following categories:

- ☐ **Category A.** The proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented; impacts may affect an area larger than the sites or facilities subject to physical works. A full-scale environmental impact assessment (EIA) including an environmental management plan (EMP), is required.
- ☐ **Category B.** The proposed project's potential environmental impacts are less adverse and fewer in number than those of category A projects; impacts are site-specific, few if any of them are irreversible, and impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE), including an EMP, is required.
- ☐ **Category C.** The proposed project is likely to have minimal or no adverse environmental impacts. No EIA or IEE is required although environmental implications need to be reviewed.
- ☐ **Category FI.** The proposed project involves the investment of ADB funds to, or through, a financial intermediary.

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

IV. DESCRIPTION OF EXISTING ENVIRONMENT

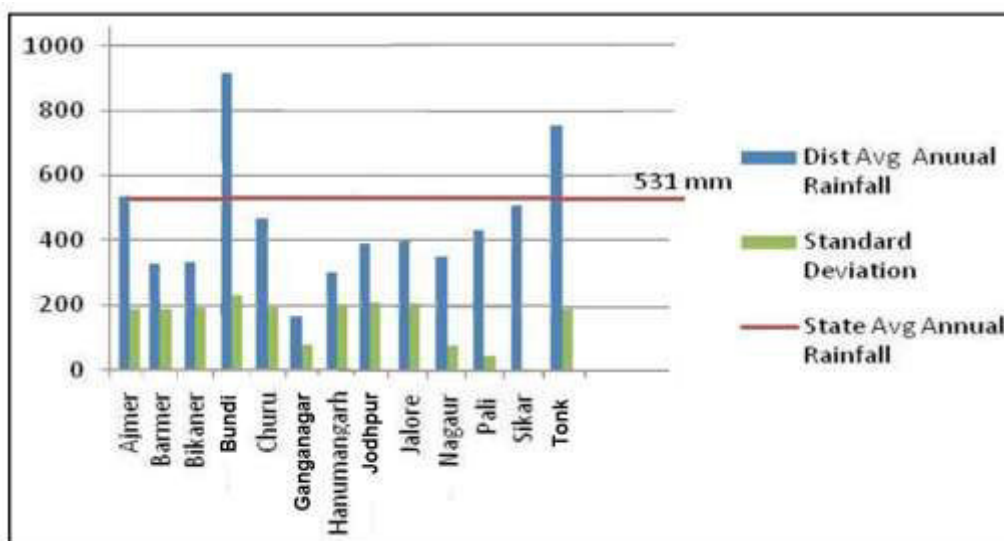
A. Physical Environment

1. Climate

58. The climate of Rajasthan state has varied contrasts and the presence of Aravalli is the greatest influencing factor. The Aravalli Mountains stretching diagonally across the State from the South-West to North-East separate the desert and semi-desert areas to the West from the sub-humid areas in the East. The climate of Rajasthan can be divided into four seasons: pre-monsoon (April to June), monsoon (July to Sept), post-monsoon (October to December), and winter (January to March).

59. There are distinct temperature range variations, diurnally and seasonally throughout the state, revealing the most typical phenomenon of the warm-dry continental climate. The summer begins in the month of March while the temperature keeps rising progressively through April, May and June. West of Rajasthan and the eastern side of Aravalli Range, in the region of Bikaner, Phalodi, Jaisalmer and Barmer, the maximum daily temperature hovers around 40°C to 45°C. Sometimes, it even reaches as high as 49°C during the summer months. Nights of summers see a considerable temperature fall with a minimum daily temperature around 20°C to 29°C. However, Udaipur and Mount Abu, have a pleasanter climate in summers with a relatively lower daily maximum temperature that reaches 38°C and 31.5°C, respectively. The daily minimum temperature at nights for these two stations hovers around 25°C and 22°C, respectively. The major portion of the state that consists of the arid west and the semi-arid mid-west has an average maximum of 45°C in June. January is the coldest month in the state of Rajasthan. The minimum temperatures sometimes fall to -2°C in the night at places like Sikar, Churu, Pali and Bikaner. The sandy land gets even colder with occasional secondary Western winds that cross the western, northern and eastern Rajasthan during winter months, and even cause light rainfall and chilly winds can be experienced during this period. Most of the Rajasthan, except the southeast Rajasthan comprising of Kota, Bundi and Baran and western Barmer have an average temperature of more than 10°C. Due to the cold western winds, the whole of Rajasthan sometimes come under the spell of the cold wave for two to five days during winters.

60. Rajasthan being predominantly a desert area, its climate varies mostly from arid to sub-humid. To the west of the Aravalli, the climate is marked by low rainfall, extreme diurnal and annual temperature, low humidity and high velocity winds. In the east of the Aravalli, the climate is semi-arid to sub-humid marked by lower wind velocity and higher humidity and better rainfall. The annual rainfall in the state differs significantly. The average annual rainfall ranges from less than 10 cm in north-west part of Jaisalmer region (lowest in the state), to 20 to 30 cm in the regions of Ganganagar, Bikaner and Barmer, 30 to 40 cm in the regions of Nagaur, Jodhpur, Churu and Jalor and more than 40 cm in the regions of Sikar, Jhunjhunun, Pali and the western fringes of the Aravalli range. The more fortunate eastern side of the Aravallis see 55 cm rainfall in Ajmer to 102 cm rainfall in Jhalawar, 92cm in Bundi and 75 cm in Tonk. Mount Abu in the Sirohi district in the southwest region receives the highest rainfall in the state (163.8 cm). The southwest monsoon begins in the last week of June in the eastern parts and may last until mid-September. Winters may also receive a little rainfall with the passing of western distribution over the region. However, Rajasthan receives most of its monthly rainfall during July and August.

Figure 3 : Rainfall Distribution in the Project Districts

61. The Aravalli plays a significant role here, as on the west of Aravallis the climate is arid having low rainfall, low humidity. To the east of Aravallis the climate is semi-arid to sub-humid having higher humidity and rainfall.

2. Topography/Landforms and Drainage

62. **Topography:** The geography of Rajasthan is enriched with variable topographic features. The dry and the parched region are predominant in the major portions of the state. The main features of topography are rolling sand dunes, river-drained plains, rocky terrain, wetlands, plateaus, barren tracks or land filled with the thorny shrubs, wooded regions and ravines. District wise topography of the project area is illustrated below:

Table 6: Details of Topography of Project Districts

District	Topography	Elevation
Ajmer	The land is flat and undulating. Mountains are almost absent in the city with the Aravalli Range being a major hilly tract in the region. Does not have any desert and is found to be separated from the Thar Desert by the Nagpathar Range.	486 m
Barmer	Most part of the district comes under the Great Indian Desert. In the eastern part of the district and to the west of Barmer city, exposures of hill ranges are seen is trending east –west direction. Salt lakes are found in the northeast and northwest parts of the district.	227m
Bikaner	District is comprised of desolate and dry regions which form part of the Great India Desert of Thar. Shifting sand –dunes of varying heights ranging from 6 to 30 meters. The general slope of the region is towards the west and North West.	242 m
Bundi	Topography of the district is characterized by flat to undulating terrain with small isolated mounds. It is divided in almost two equal parts by NE-SW trending Vindhyan Range.	274m
Churu	It is a part of the great Thar Desert. The terrain in general is sloping from south to north. There are no big hill in the district expect some hillocks.	292 m
Ganganagar	The district is a plain region of the vast Thar Desert land. It has sandy soil in the west dotted with 4-5 m high sand dunes. The northern part of the district is mostly covered with forest.	178 m

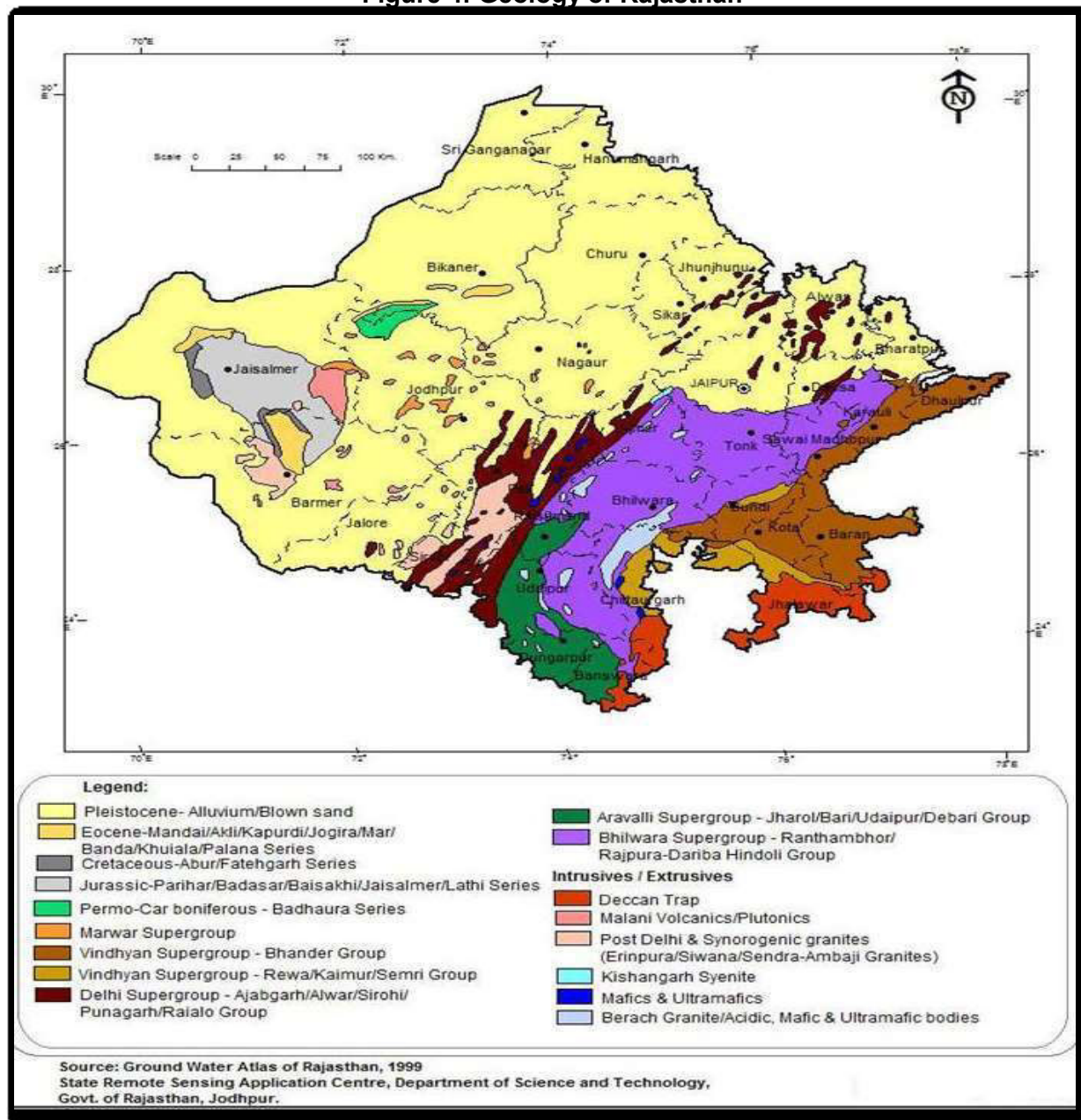
District	Topography	Elevation
Hanumangarh	Topography of district is almost plain with some hill formations in the southern part forming part of Aravalli mountain range. The town is located in the transition zone where Aravalli mountain ranges ends and a vast arid plain starts forming part of the Thar Desert characterized by sand dunes and scanty vegetation.	177 m
Jalore	District has almost an even topography in its western section; the eastern section is dominantly hilly, forming the flank of Mount Abu range. Generally the terrain slopes westwards.	268 m
Jodhpur	The western and north-western parts of Jodhpur district are characterized by sand dunes. With exception of some parts of Bilara and Osian tehsil, land surface of the district is nearly flat and sandy.	231m
Nagaur	Nagaur district is fairly even. Slope of the area is fairly even. Slope of the land surface is towards west. South-eastern part of the district comprises small scattered hillock. The northern, north-western and north-eastern part of the	302m
Pali	Topography of Pali area is mostly plain with some isolated hilly areas in southern parts. General slope is towards east/southeast.	207 m
Sikar	The district can be divided into two main topographic units the western half characterized by dunal country and waste land, and the eastern half characterized by NE-SW trending hill ranges.	437 m
Tonk	The District is characterized by general flat to undulating topography with small isolated ridges running in north- east to south-west direction between Gar and Banoli in the western part and the Aravalli hills towards Sawai Madhopur in the south-east.	289 m

63. **Drainage:** Project districts are drained by a number of rivers. The status of project road intersection is discussed in the following chapters of the report. The major river in the project districts are Bandi(Pali,Tonk and Jalore district), Banas(Tonk and Ajmer district), Jawai(Pali and Jalore district),Luni (Barmer ,Nagaur ,Jodhpur and Jalore district), Ghaggar (Bundi,Ganganagar and Hanumangarh district), Mantha(Nagaur and Sikar district),Mashi (Tonk district), ,Sukri(Barmer,Pali and Jalore district), sagarmati,Saraswati,Khari,Dai ,Rupangarh (Ajmer District), Kural, Mej Brahmani,Ghoda Pachhad (Bundi district) , Kantli, Pawta,Kavant (Sikar district).

3. Geology and Soil

64. **Geology:** From the oldest Archaen Metamorphic, represented by Bhilwara Super Group to sub-recent alluvium and wind-blown sand, Rajasthan is endowed with a continuous geological sequence of rocks (Figure 2). A vast blanket of young unconsolidated deposits are present in western and north-western parts of the state which include the blown sand of the Thar Desert of western Rajasthan. A wide variety of hard rock which include various types of metamorphic schist, quartzite, marble and gneiss of pre-Cambrian age with associated acid and basic intrusive rocks remain exposed in the rest areas of the state.

Figure 4: Geology of Rajasthan



65. The major geological formation of the districts in which proposed roads are sited is summarized in the following table 7.

Table 7: Major Geological Formation of Project Districts

S.No.	District	Major Geological Formation
1.	Ajmer	Granites, felspathics chists, calgeneisses marble and quartzites rocks.
2.	Barmer	Aeolian sand, Alluvium, Tertiary sandstone, Lathi sandstone and Barmer sandstone (Mesozoic), Malani rhyolite, granite and Jalore Siwana granite (Post Delhi).
3.	Bikaner	Sandstone, Limestone -Evaporite sequence: Sandstone - clay - Sandstone sequence, Aeolian sand, River flood Deposits.
4.	Bundi	Sirbu shale, Lower Bhandar sandstone, Samaria shale, Lower Bhandar limestone, Ganugarh shale ,Dolomite, ferruginous, chert, carbonaceous, phyllite, ferruginous phyllites with thin band of conglomerate, gritty quartzite & quartzite

S.No.	District	Major Geological Formation
5.	Churu	Delhi Supergroup , Erinpura Granite, Malani Igneous Suite and the Marwar Supergroup and the tertiary sediments including the Palana Formation of Palaeocene age.
6.	Ganganagar	A thick cover of blown sand and alluvium.
7.	Hanumangarh	Alluvium, Sandstone
8.	Jalore	Older alluvium, Younger alluvium, Jalore Granite, Siwana Granite, Malani Rhyolite (Volcanics) Idar Granite, Erinpura Granite.
9.	Jodhpur	Alluvium and blown sand, Sandstone, Gypsum, siltstone , limestone, cherty and dolomitic with shale, Rhyolite with tuffs , Granite , Gneiss, Schist and Phyllite
10.	Nagaur	Aeolian sand, Alluvium, Nagaur Sandstone, Bilara Limestone and Jodhpur Sandstone of Marwar Super Group, Eranpura granite & rocks of Delhi Super group.
11.	Pali	Post-Delhi intrusive (Jalore granite, Malani rhyolite) and metamorphic rocks of Udaipur Group of Aravali Super group, followed by thin alluvial cover of sub-Recent to Recent period of Quaternary Era.
12.	Sikar	Alluvium, Gneiss, Schist
13.	Tonk	Gneiss, phyllite, quartzite, amphibolite, migmatite and dolomitic marble

Source: District Groundwater Brochures, CGWB.

66. **Soil:** The Aravallis divide Rajasthan state into eastern and western Rajasthan. The soil improves in fertility from west and northwest towards east and northeast. In many parts of the state the soils are saline or alkaline. The soils of the State have been divided into the 7 groups (Figure 3) on the basis of their occurrence, chief characteristics and suitability for cultivation. These soil types are: Desert Soil, Grey and Brown (Desert) Soil, Red and Yellow Soil, Ferruginous Red Soil, Mixed Red and Black Soil, Medium Black Soil, and Alluvial Soils.

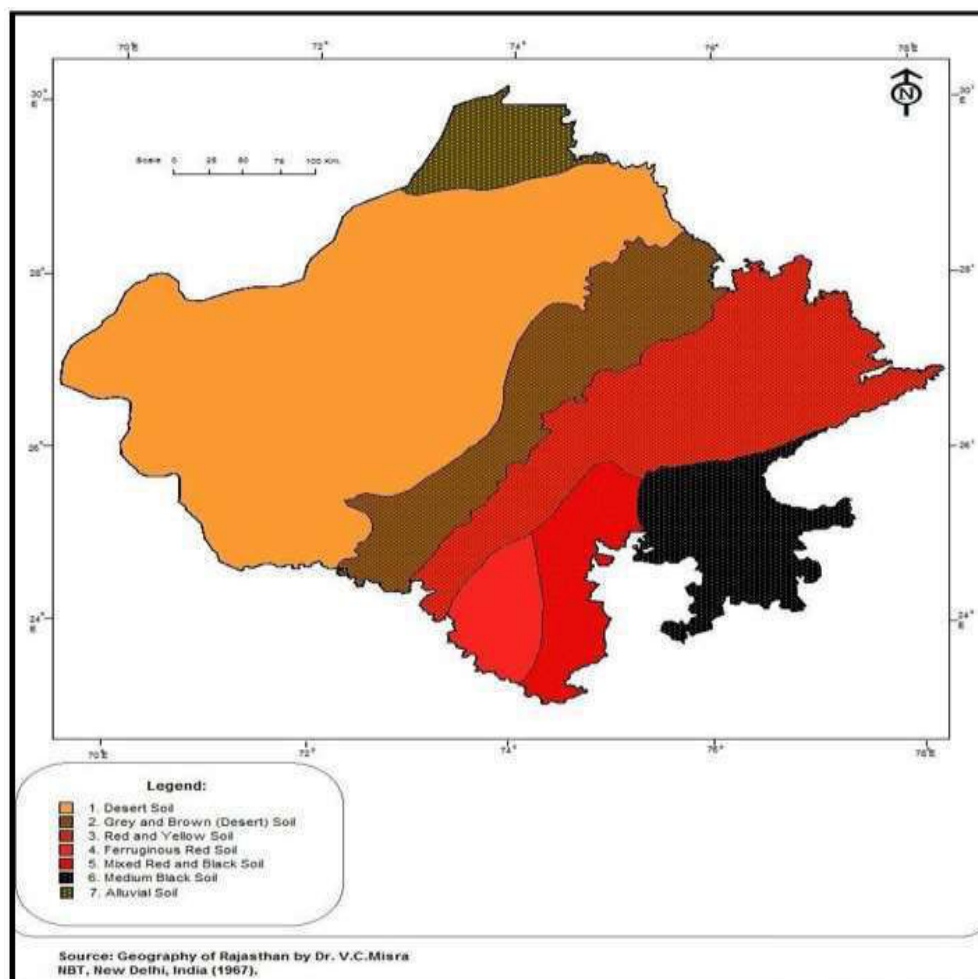
67. The soil type varies from district to district in the state of Rajasthan. The soil type of project district is summaries in the following Table 8.

Table 8: Soil Formation of Project Districts

S.No.	District	Soil Formation
1.	Ajmer	Soil of the district are Sierozeme, Lithosols and Regosols of hills, Brown soils (Saline phase) & Alluvium types.
2	Barmer	Soil of the region falls within low rainfall zone of 200- 400 mm. The soil is generally desert type and sand dunes. Specifically soil is aeolian, coarse sand in texture and some places calcareous. The nutrient status of the Barmer soil is graded as very low to medium level.
3.	Bikaner	The soils of Bikaner district are predominantly light textured, weak – structured, sand to sandy loam with the clay content. Soils are generally of desertic type with poor fertility status and very low water retention capacity. In general the soils have good porosity (40%) and good to very good permeability.
4	Bundi	Soil of the district are Brown , Alluvium and Black soils
5.	Churu	Soil of the region falls within rainfall zone of 100-350 mm. The soil is desert type. Sand dunes Aeolian soil is loamy coarse in texture and calcareous. The nutrient status of the Churu soil is graded as very low to medium level.
6.	Ganganagar	Seirozems, desert soil .The whole district of Ganganagar consists of alluvial and Aeolian soil as it is flooded by the Ghaggar River.
7.	Hanuman garh	The district soil type varies in northern, southern and central parts. Majorly the district has alluvial soils, loamy soil, entisols i.e. desert soil, arid soil i.e. non calcic brown desert soil.

8.	Jalore	Soils are shallow with deep gravel encrusted with CaCO_3 . The texture of the Soils in general varies from sandy to sandy loam. The fertility status of the soils in general is low and the proportion of organic matter varies from 0.2 to 1.0 %.
9.	Jodhpur	Red desertic soils, Desert soils, Sand dunes, Lithosols & Regosols of hills, Saline soils and Sierozems.
10.	Nagaur	Soil of the region falls within low rainfall zone of 300- 500 mm. The soils are sandy loam, shallow depth red soils in depressions. The nutrient status of the Nagaur soil is graded as medium to high level.
11.	Pali	In Pali town, the top soil of up to a depth of about 4 m is characterized by loose sand, followed by hard soil mixed with boulders from 4 to 10 m below the ground.
12.	Sikar	Soil of the region falls within rainfall zone of 300 – 500 mm. The soil is sandy loam, shallow depth red soils in depressions. The nutrient status is graded as low to medium level.
13.	Tonk	The soil in the district varies from sandy loam to loam in Niwai block and parts of Tonk block and from clayey loam to loam in the remaining area.

Figure 5: Soils of Rajasthan



4. Natural Hazard

68. **Earthquake:** As per the seismic zone classification of India, State of Rajasthan lies in Zone II i.e. least active zone. As per the BIS classification the project road area majorly classified as Zone II (least to moderate) except Bikaner, Barmer and Jalore districts are classified as Zone III (Moderate damage risk zone). Map showing earthquake zone of Rajasthan is given below.

Figure 6: Earthquake Zone of Rajasthan

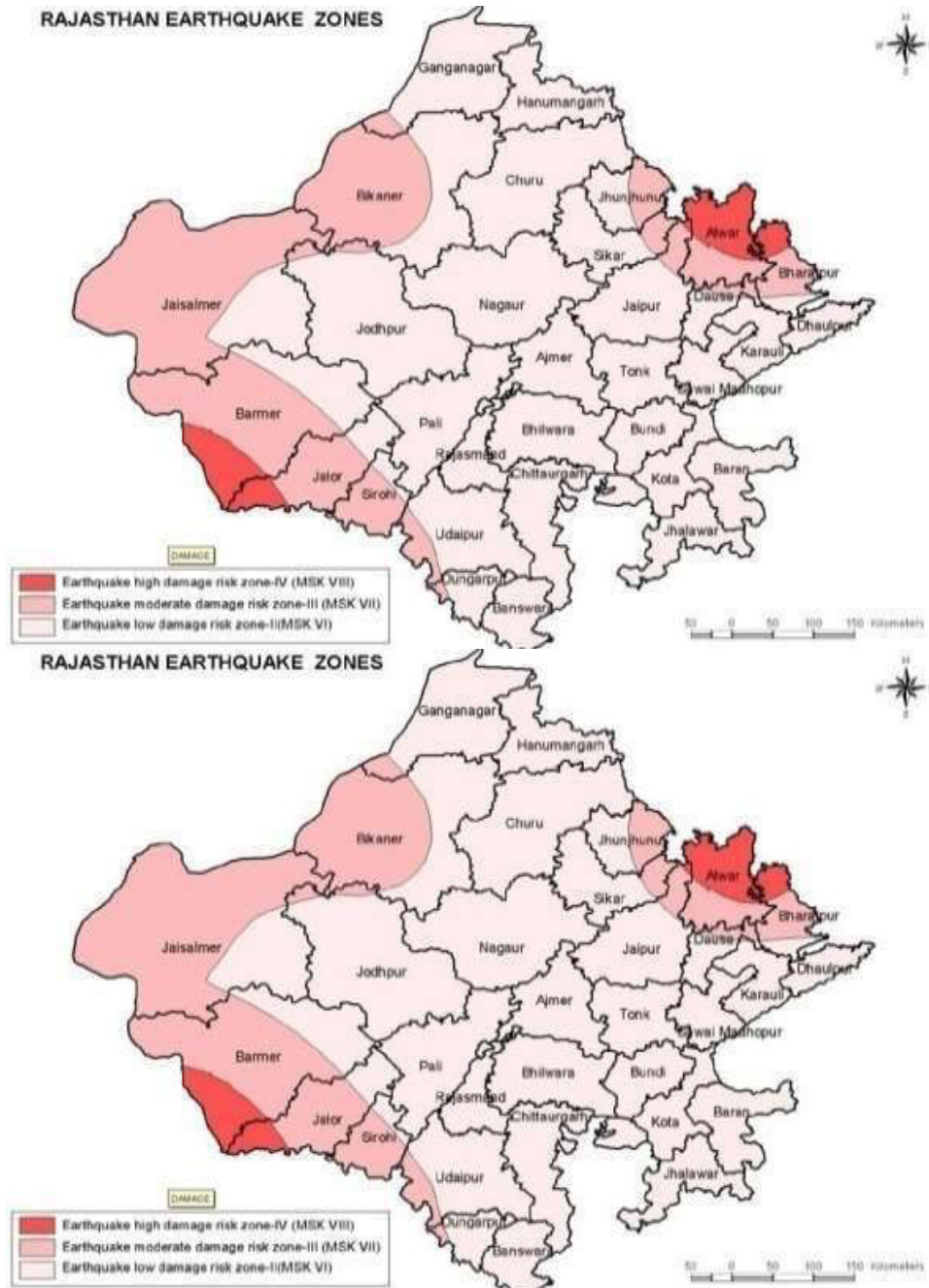
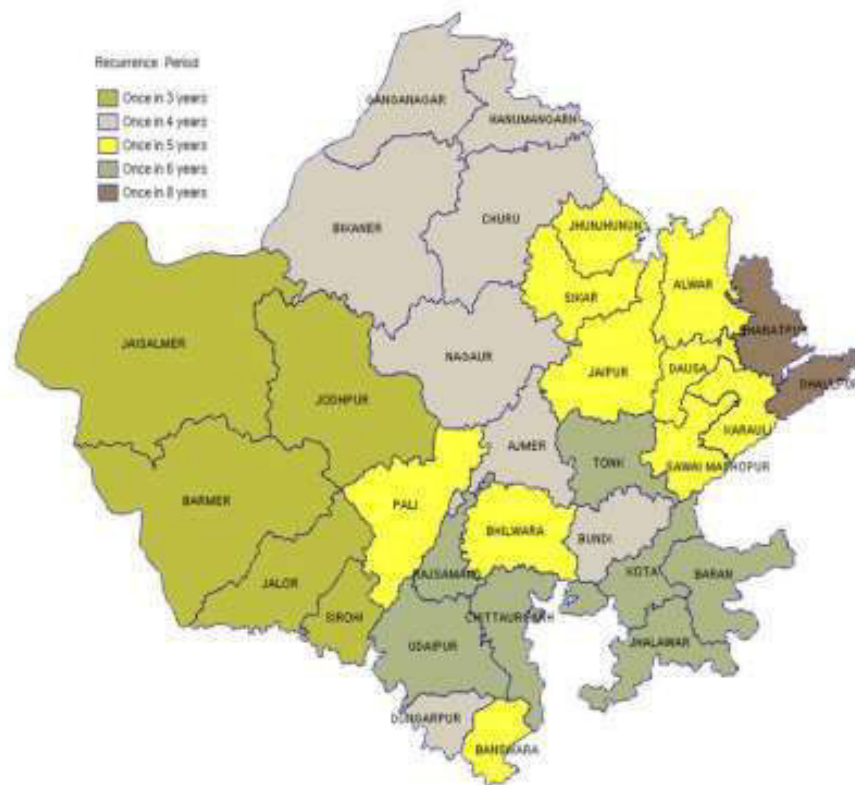


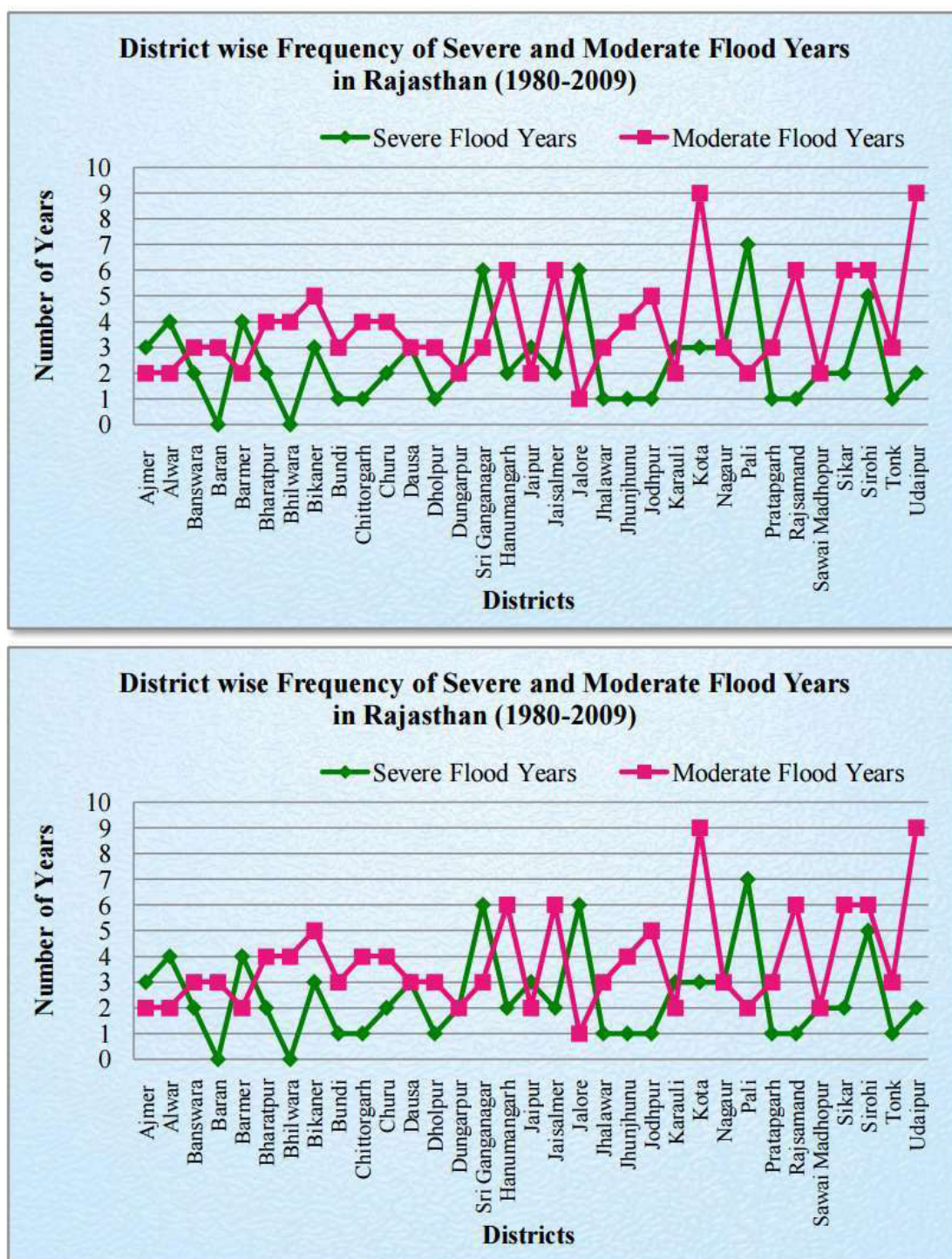
Figure 7: Drought Frequency of various districts in Rajasthan



69. **Drought:** The state of Rajasthan has the maximum probability of occurrence of drought in India, with recurring droughts in 3–4 years in a cycle of 5 years (Mall et al., 2006) and this condition may deteriorate in terms of severity of droughts in Rajasthan (RPCB, GoR, 2010). Low rainfall coupled with erratic behavior of the monsoon in the state makes Rajasthan the most vulnerable to drought. In Rajasthan, there have been 48 drought years of varied intensity in the period 1901-2002, which means that the chance of occurrence of a meteorological drought in the state is 47% (Rathore, 2004). The frequency of drought occurrence in the project districts is given in the Figure 6 below.

70. **Flood:** The state of Rajasthan is popularly known as the Desert State of India is largely water deficit yet there are incidents of flood in that state and there are flood prone regions as well. The flood prone regions in the state lies in Bundi, Ganganagar, Jalore, Jodhpur, Nagaur Pali and Tonk districts. These regions spread across the Basins and Sub-Basins of the rivers Banas, Ghaggar, Luni, Banas. Graph – 2 depicts the district wise frequency of “Moderate Flood” and “Severe Flood” years in the state.

Figure 8: District wise frequency of “Moderate Flood”



Source: Flood Manual, Rajasthan (Disaster Management and Relief Department).

Figure 9 : Flood prone area map



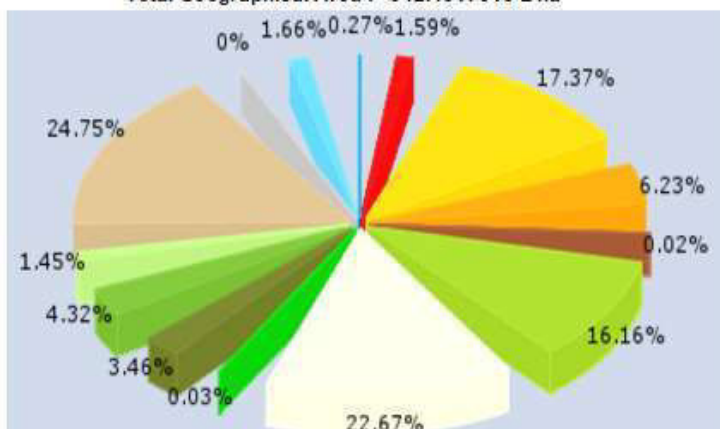
Source: Flood Manual, Rajasthan (Disaster Management and Relief Department).

5. Land Use Land Cover

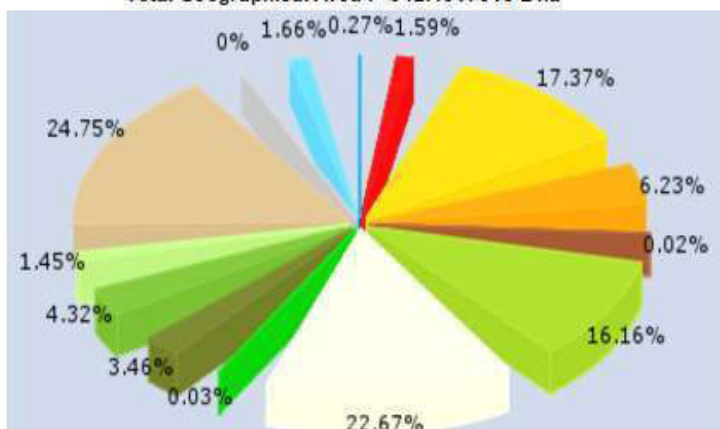
71. **State Profile:** Most of the geographical area of the state is available for utilization. Major portion of the land use is under agriculture. Total cultivable land is 136.25 lakh ha. (39.79%), 77.62 lakh ha. (22.67%) is under current fallow and 84.77 lakh ha is under wasteland (24.75%). The net forest area is 26.64 lakh ha. (7.78%). The most important crops are wheat and barley are cultivated over large areas, as are pulses, sugarcane, cotton, tobacco and oilseeds. The area of 0.11 lakh ha. (0.03%) is under plantation. Around 1.59% of the land is under Built up sections (Figure 8), where incidentally concentration of tribal population is also found.

LULC Class	Area (L ha)	LULC Class	Area (L ha)
Built-up	5.45	Kharif Crop	59.49
Rabi Crop	21.35	Zaid Crop	0.07
Double/Triple Crop	55.34	Current Fallow	77.62
Plantation	0.11	Deciduous Forest	11.84
Degraded/Scrub Forest	14.8	Grassland	4.98
Wasteland	84.77	Rann	0.01
Waterbodies max	5.68	Waterbodies min	0.94
Total			342.4517613

LULC Information (2014-15) for Rajasthan
Total Geographical Area : 342.4517613 L ha



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Figure 10: Land Use/ Land Cover Distribution of Rajasthan

6. Study Area and Influence Zone

72. Land use of the study area and 10 km buffer zone majorly imitate the land use of the state. However, abutting land use of the sub-project corridors varies each other. Land use along Bidasar-Sri Dungargarh-Kalu, Losal-Salasar-Ratangarh, Siwana –Samdari- Balesar, is predominantly waste land with plantation. Organized road side plantation has been done by forest department along most of its stretches. Jodhpur- Sojat Road, Nasirabad –Mangaliyawas- Padukalan, Beawar–Pisangan and Tehla -kod-Alniyawas are characterized with maximum percentage of wasteland and agricultural land. Sadulshahar-Sangaria –Chaiya, Beawar-Masuda-Goyla, Arain-Sarwar, NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha, comprises of vegetation and agricultural sections majorly. Detailed project wise Land use and Land cover summary and maps are given in the succeeding sections.

Table 9: Summary of Land use/ Land Cover

S.No	Particular	Built up	Agri.	Vegetation / Forest	Plantation/ Shrub	Waste/ Barren	Water body
1	Jodhpur- Sojat Road	2.67	19.44	42.66	3.59	29.05	2.05
2	Bhinmal – Pantheri Posana – Jeevana	3.45	15.66	11.4	13.21	53.4	2.88
3	Bidasar-Sri Dungargarh-Kalu	4.52	21.37	11.17	12.07	50.09	0.78
4	Sadulshahar-Sangaria -Chaiya	6.12	30.56	11	25.14	26.78	0.67
5	Losal-Salasar-Ratangarh	5.78	21.67	8.14	11.43	52.13	0.85
6	Siwana –Samdari- Balesar	5.96	18.05	39.08	7.54	27.43	1.94
7	Beawar-Masuda-Goyla	2.48	41.18	38.3		17.64	0.4
8	Arain-Sarwar	2.12	7.67	2.56	14.7	72.45	0.5
9	NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha	1.92	5.35	1.7	7.05	80.42	3.56
10	Nasirabad –Mangaliyawas- Padukalan	8.00	51	2.31	6.06	32.02	0.61
11	Beawar–Pisangan, Tehla -kod-Alniyawas	3.91	11.13	7.12	11.89	65.21	0.74

Figure 11: Landuse within 10 Km Bhinmal – Pantheri Posana – Jeevana and Bidasar- Dungargarh- Kalu

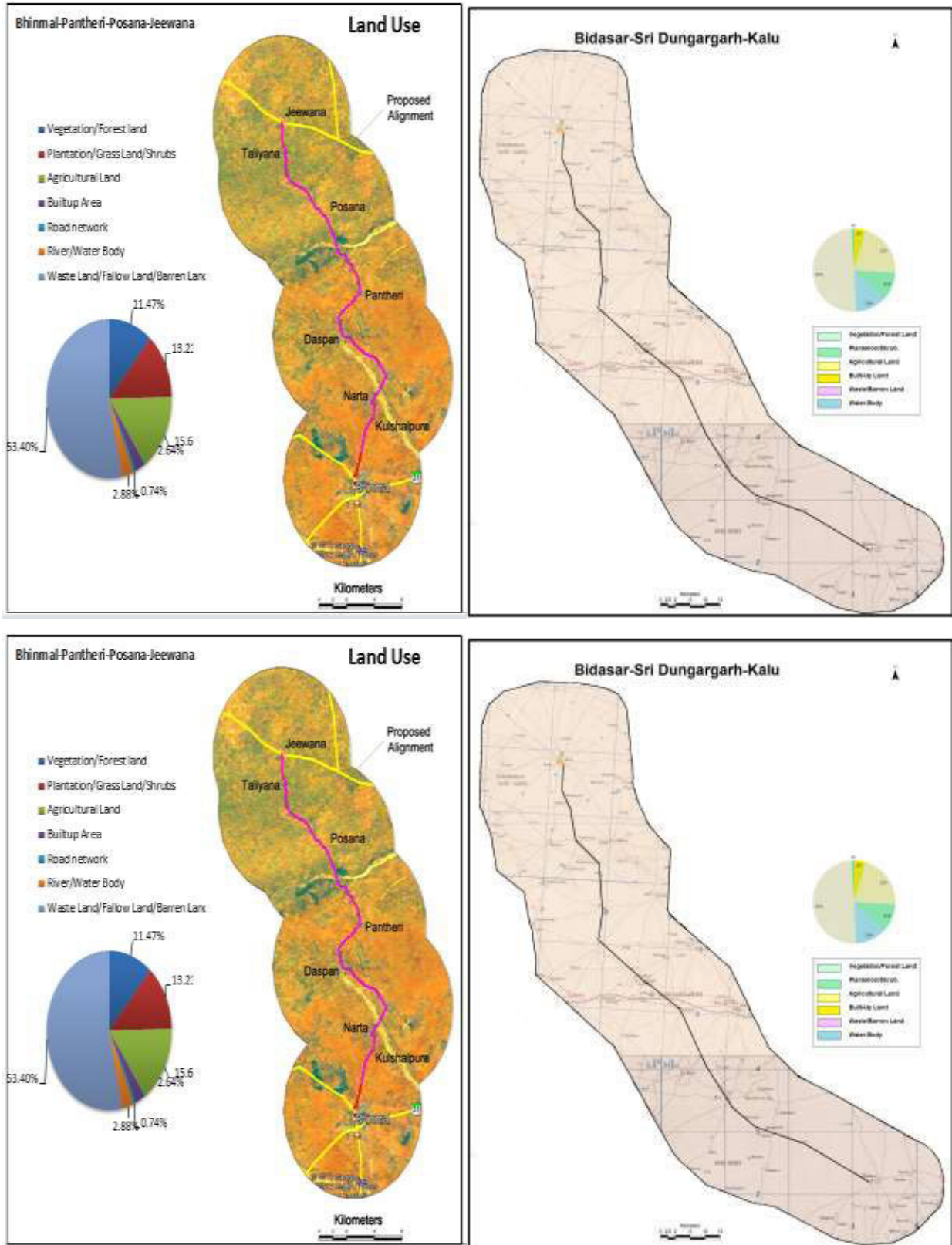


Figure 12: Landuse within 10 Km Sadulshahar-Sangaria -Chaiya and Losal-Salasar-Ratangarh

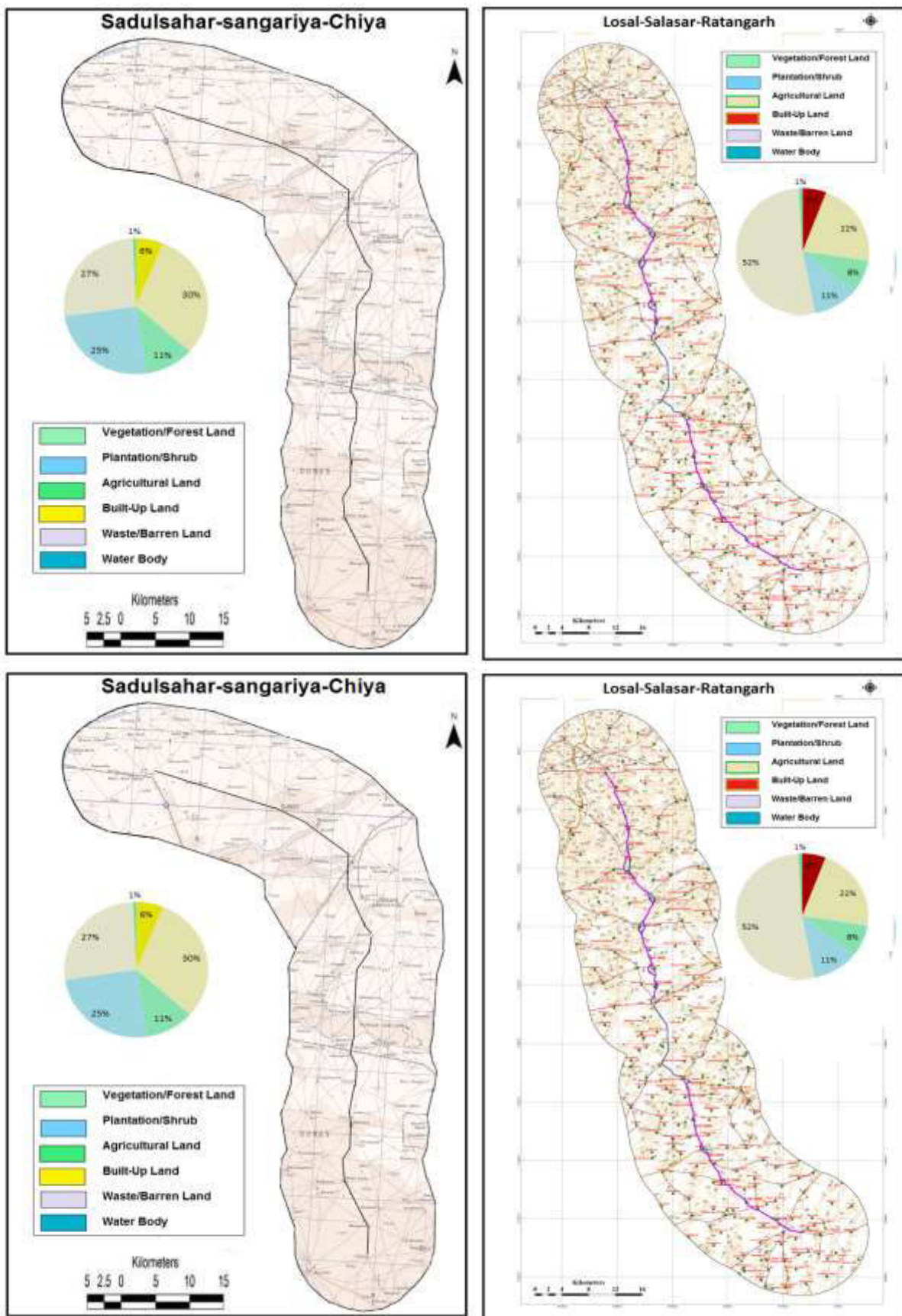
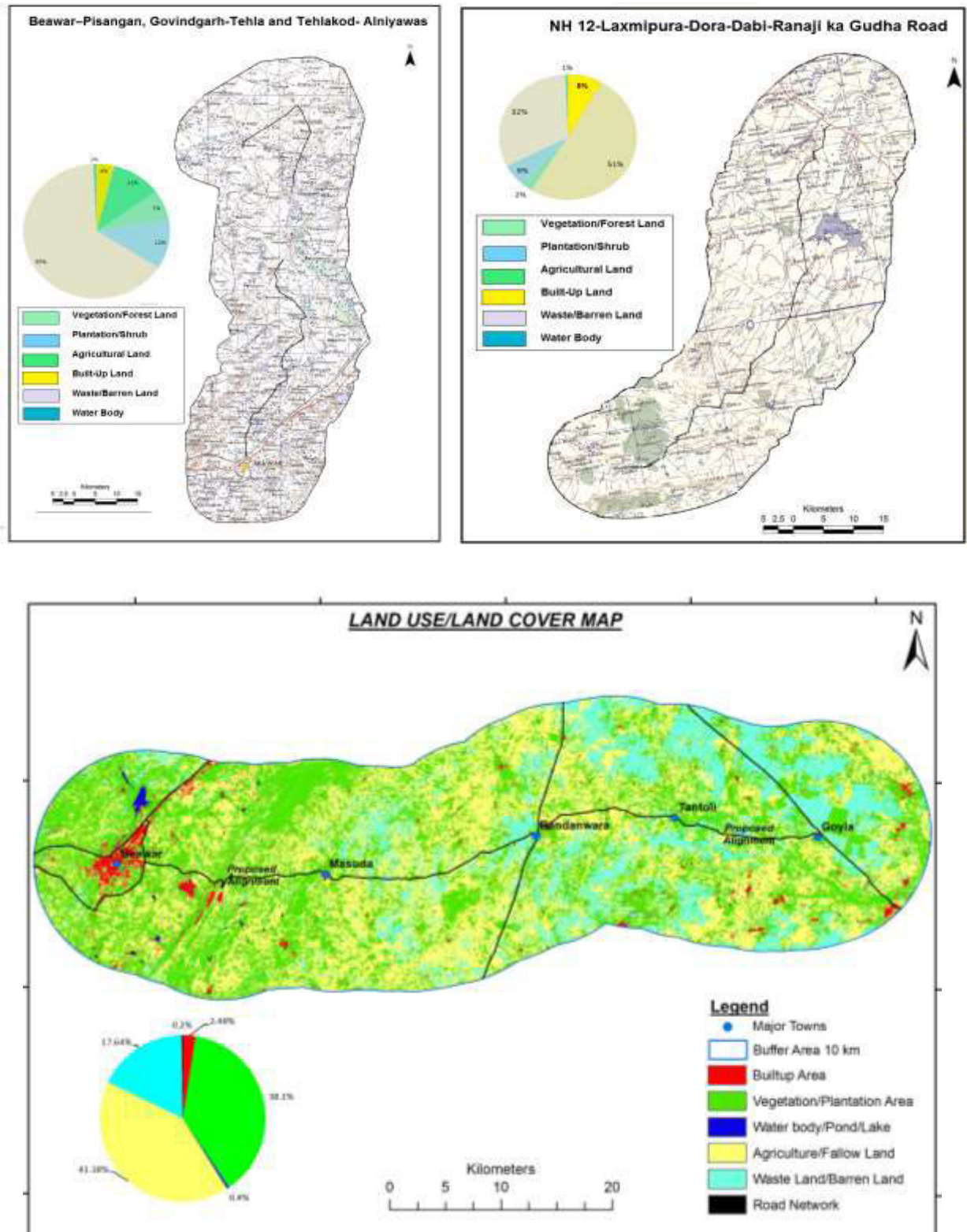


Figure 13: Landuse within 10 Km Beawar- Alniyawas and NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha



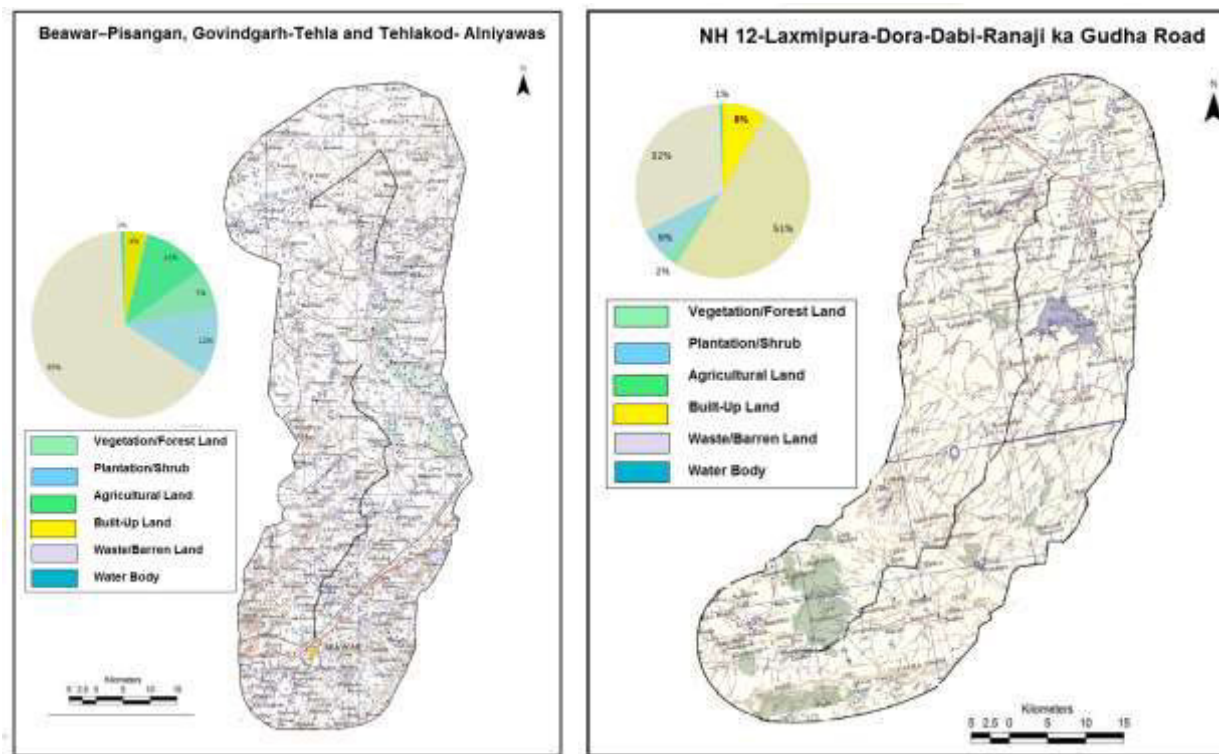


Figure 14 : Landuse within 10 Km Sadulshahar-Masuda-Goyla and Losal-Salasar-Ratangarh

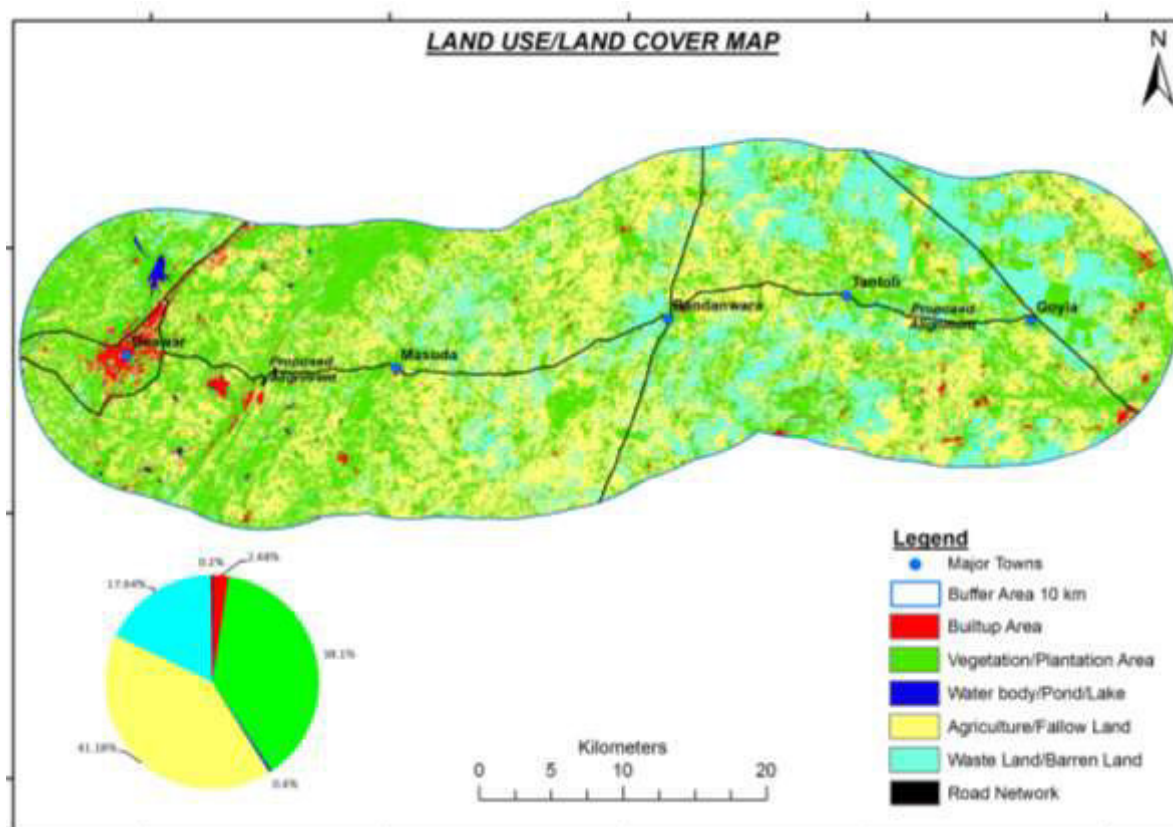
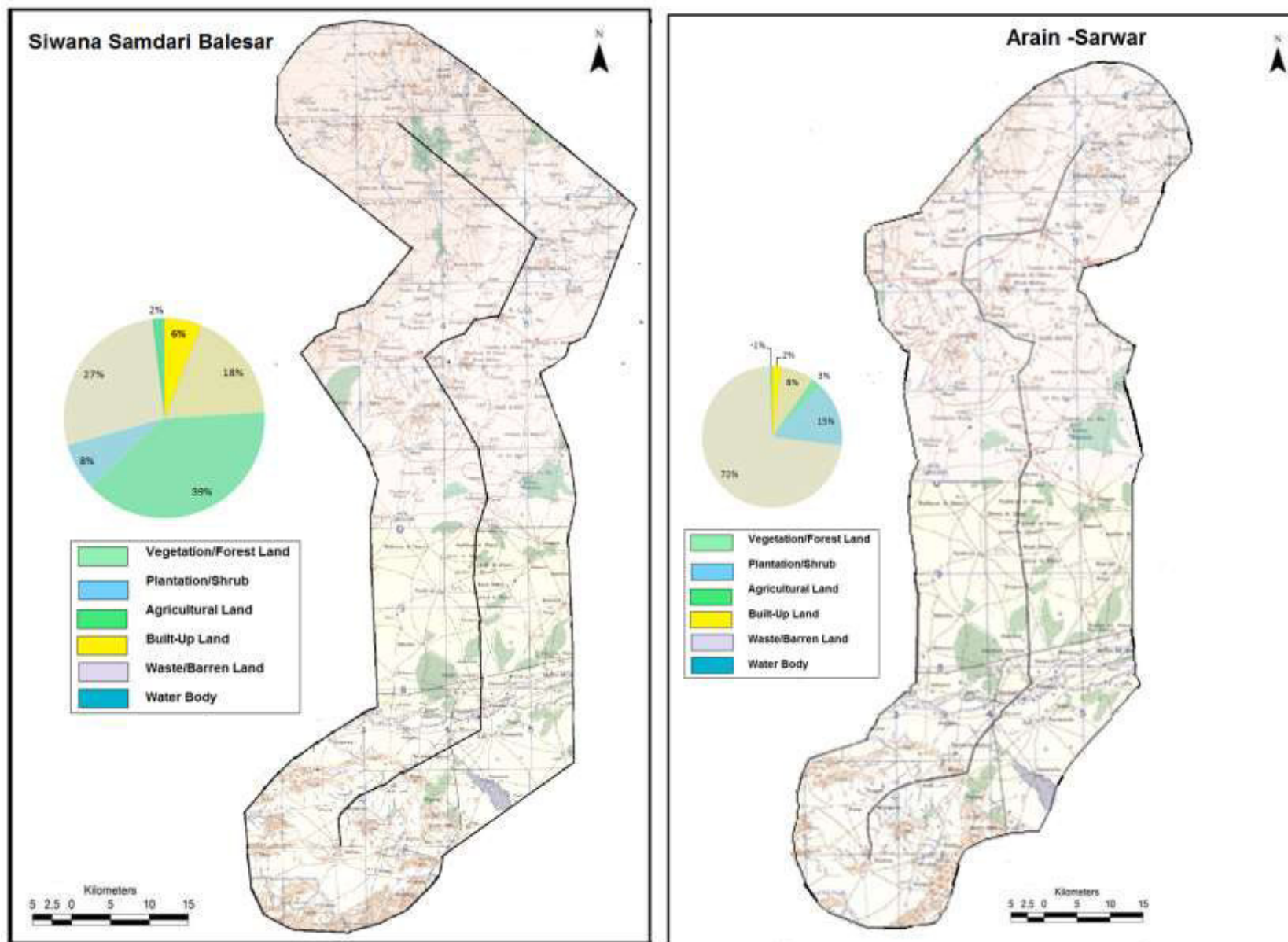


Figure 15 : Landuse within 10 Km Siwana –Samdari- Balesar and Arain-Sarwar



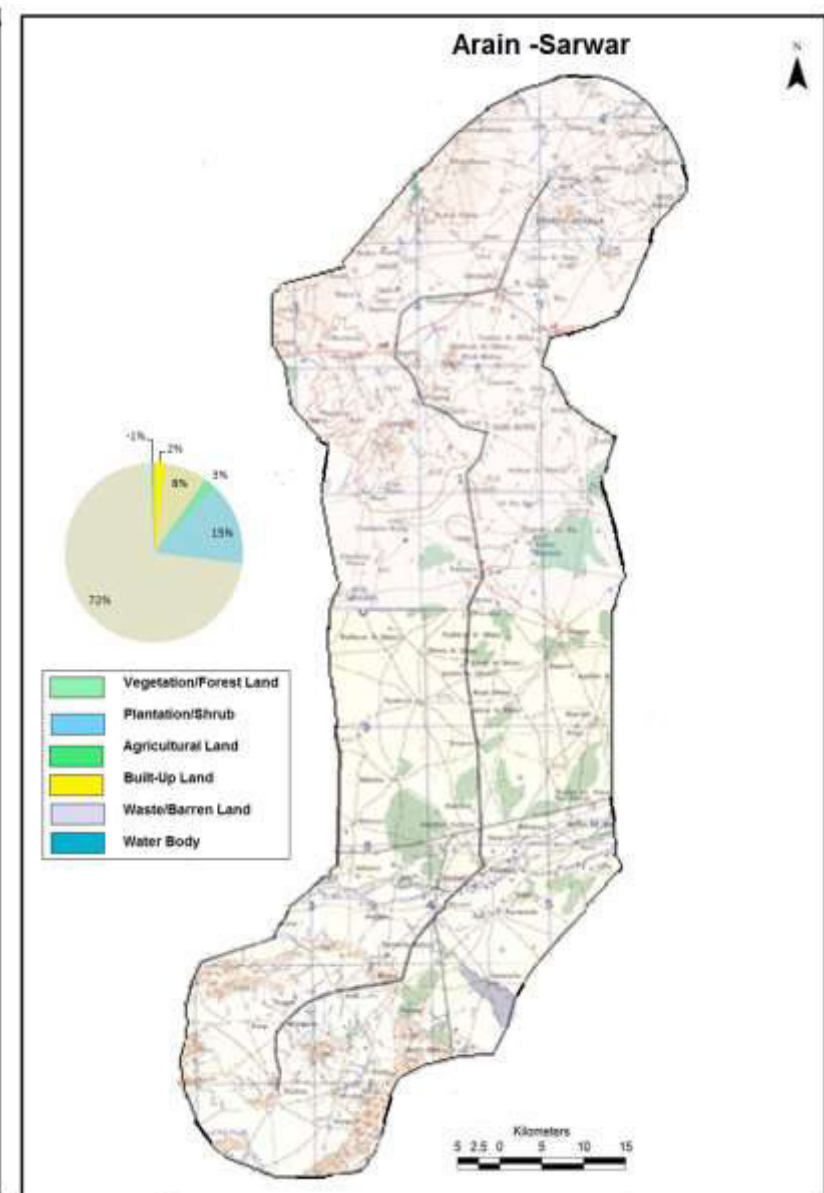
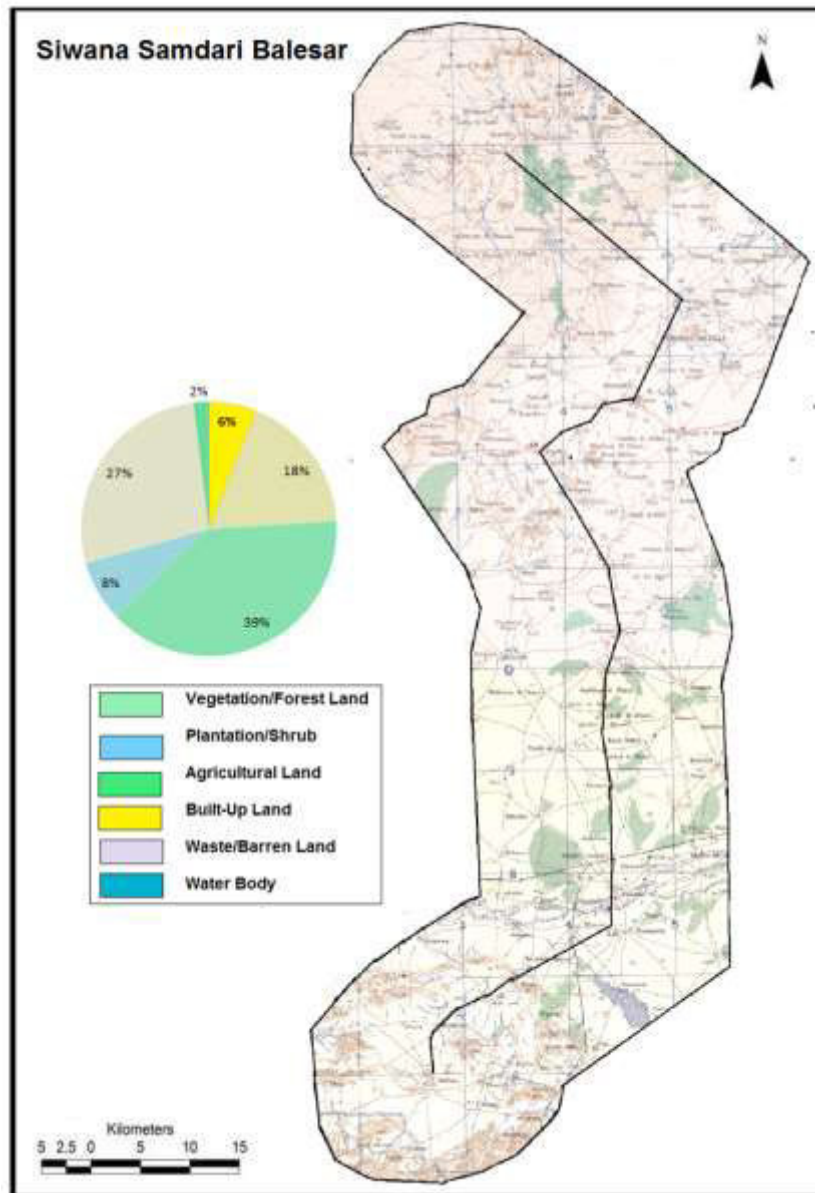
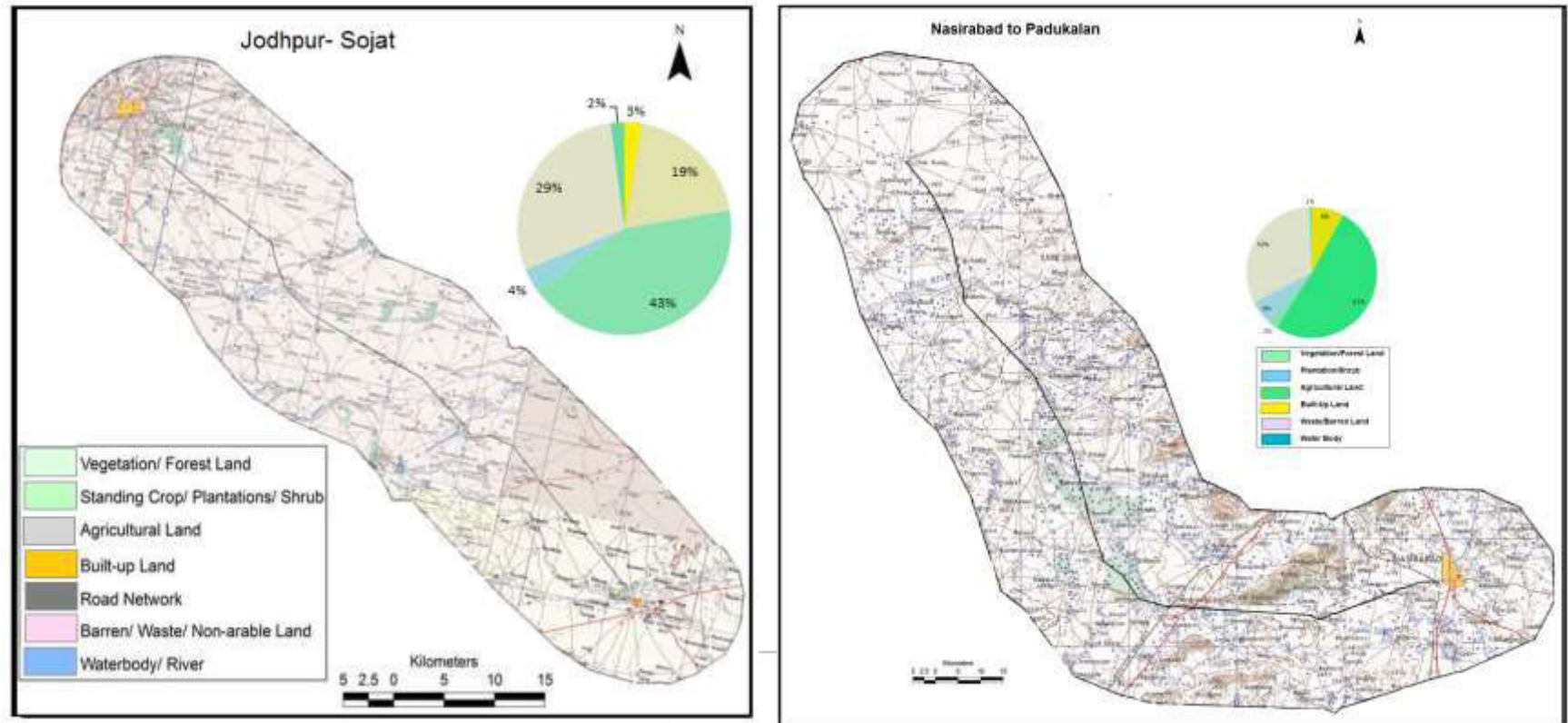
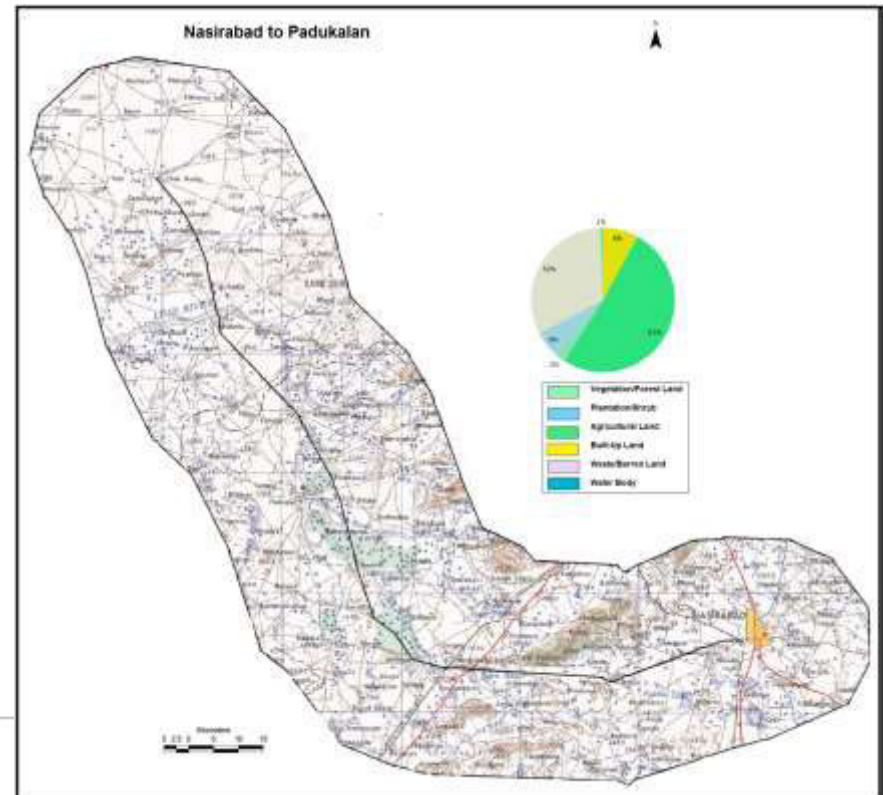
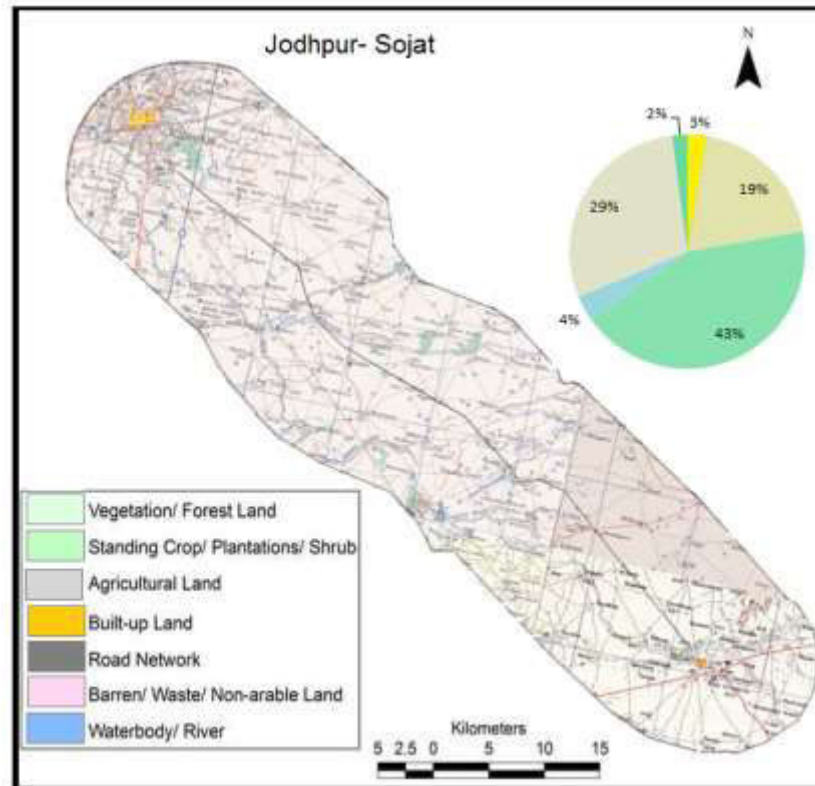


Figure 16: Landuse within 10 Km Johpur-Sojat and Nasirabad –Mangaliyawas- Padukalan





7. Air Quality

73. Project area is characterized mainly by rural/open areas and intermittently traversed by few semi-urban settlements/built-up areas. Sources of air pollution in the project area are mainly vehicular emission, dust emanation due to use of unpaved shoulders/deteriorated roads by vehicles and domestic fuel burning as the project area is rich in vegetation, all such emissions will be very well dissipated.

74. Monitored parameters of ambient air quality largely meet the prescribed limit (Appendix B) of World Bank (WB), National Ambient Air Quality Standard (NAAQS) and Central Pollution Control Board (CPCB) except particulate matter (PM₁₀) and Carbon Mono oxide (CO). At NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha and Beawar-Pisangan, Tehla -kod- Alniyawas Particulate matter (PM₁₀) is higher than the permissible limit. Increased level in these areas may be attributed due to poor road conditions and high traffic density. Detailed 24 hourly data is appended as Appendix B. Compliance status of Air quality data is presented in Table 11.

Table 10: Status of AAQ in the Project Area

S.No.	Particulars	WB EHS (in µg/m ³)	GOI NAAQS (in µg/m ³)	Remarks
1	Jodhpur- Sojat Road	√	√	All parameter are meeting WB interim target GOI limits .
2	Bhinmal – Pantheri Posana – Jeevana	√	√	
3	Bidasar-Sri Dungargarh- Kalu	√	√	
4	Sadulshahar-Sangaria - Chaiya	√	√	
5	Losal-Salasar-Ratangarh	√	√	
6	Siwana –Samdari- Balesar	√	√	
7	Beawar-Masuda-Goyla	√	√	
8	Arain-Sarwar	√	√	
9	NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha	X	X	All parameter are meeting WB interim target GOI limit Except PM ₁₀ & PM _{2.5} .
10	Nasirabad –Mangaliyawas-Padukalan	√	√	
11	Beawar–Pisangan, Tehla -kod- Alniyawas	√	X	

Note: □ √ within limits X- above limits

8. Noise Level

75. Traffic noise is the principal source of noise in the project area. The area mostly includes rural open areas with a good vegetation cover and therefore the noise levels are relatively low. Noise level monitoring indicates that the noise level mostly meets the prescribed noise standards (Appendix C) for all land use categories viz. commercial, industrial as well as residential zones. There is no continuous sound frequency of impulsive nature near industries. It is anticipated that noise level will decrease significantly after road expansion and improvement work enabling decongestion at existing built up areas. Noise level in the project area has been appended as Appendix C. Compliance status of Noise quality data is presented in Table 12.

Table 11: Compliance Status of AAQ around the project area

S.No	PARTICULARS	WB EHS					GOI NAANS							
		Res		Inst		Indl	Res		Indl		Comm.		Sensitive	
		D	N	D	N	D/N	D	N	D	N	D	N	D	N
1	Jodhpur- Sojat Road	√	√	√	√	√	√	√	√	√	√	√	√	√
2	Bhinmal – Pantheri Posana – Jeevana	√	√	√	√	√	√	√	√	√	√	√	√	√
3	Bidasar-Sri Dungargarh-Kalu	√	√	√	√	√	√	√	√	√	√	√	√	√
4	Sadulshahar-Sangaria - Chaiya	√	√	√	√	√	√	√	√	√	√	√	√	√
5	Losal-Salasar-Ratangarh	√	√	√	√	√	√	√	√	√	√	√	√	√
6	Siwana –Samdari- Balesar	√	√	√	√	√	√	√	√	√	√	√	√	√
7	Beawar-Masuda-Goyla													
8	Arain-Sarwar	√	√	√	√	√	√	√	√	√	√	√	√	√
9	NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha	√	√	√	√	√	√	√	√	√	√	√	√	√
10	Nasirabad –Mangaliyawas-Padukalan	√	√	√	√	√	√	√	√	√	√	√	√	√
11	Beawar–Pisangan, Tehla - kod- Alniyawas	√	√	√	√	√	√	√	√	√	√	√	√	√

9. Groundwater

76. Availability, Occurrence and Yield. Rajasthan covers 10.5% of the country's geographical area but shares only 1.16% of its water resources. It is the driest state with nearly 70 percent of the area classified as arid and semi-arid region. Rajasthan has always been a water deficit area. Water resources in the state are not only scarce but have a highly uneven distribution both in time and space with most of the available water resources been confined to south and south-eastern part of the State. The ground water condition of the state is quite alarming. The condition has deteriorated very fast in the last two decades. The stage of groundwater exploitation, which was just 35% in the year 1984, has reached a level of 125% in 2014. At present, Rajasthan has 248 water blocks, out of which 44 are in safe category, 28 (semi-critical), 9 (critical) and 164 are over-exploited. Out of all the water blocks in the project districts, Sujangarh and Rajgarh blocks of Churu district are 'overexploited' and only Rajgarh is notified by Central Ground Water Authority

(CGWA) which means that development of ground water extraction is no longer permitted in this block.

Table 12: District-wise Groundwater Detail

District	Water Bearing Formation	Water Table		Stage of GW Development
		Pre Monsoon	Post Monsoon	
Ajmer	Gneiss, Schist & Alluvium	3.13-30.80	1.45-28.89	122.79%
Barmer	Quaternary alluvium, Tertiary sandstone, Lathi sandstone, Malani rhyolite and granite.	5.60-111.90	0.90-111.75	104.11%
Bikaner	Alluvium, Tertiary sandstone, Sandstone, Limestone	8.54-111.70	7.64-116.24	132.48%
Bundi	Alluvium, Shale, Sandstone, Limestone and Phyllite.	0.8-13.49	5.8-23.49	95%
Churu	Range from unconsolidated alluvium to semi consolidated sandstones and consolidated schistose rocks.	11.06-112.15		93%
Sri Ganganagar	Alluvium	0.91-44.75	1.29-45.03	46%
Hanumang arh	Younger Alluvium	1.7-47.25	1.56-47.14	80.41%
Jalore	Older and Younger alluvium, Granite, Rhyolite.	4.74-64.60	2.84-75.85	197.11%
Nagaur	Quaternary Alluvium, Nagaur Sandstone, Bilara Limestone and Jodhpur Sandstone, Granite, Schist and Phyllites.	10-80	6-75	168%
Sikar	Quaternary alluvium and Consolidated formations (quartzite, schist, phyllite, gneiss and amphibolite) of Delhi super group	3.13-30.80	1.45-28.89	153.03%
Tonk	Alluvium comprising of sand, silt and clay, Bhilwara Supergroup comprising of mica schist, gneisses, phyllites and quartzites	2.05-28.70	1.05-24.50	99%

Source: District wise brochure, CGWA.

77. **Groundwater Quality:** Monitored parameters largely conforms to the drinking water standards (IS:10500-1991) prescribed by Bureau of Indian Standard. This was also ascertained by the study done by Central Ground Water Board (CGWB) in the project districts. Some of the parameters like electrical conductivity, fluoride, nitrate and iron exceed the desirable limits in some districts but all are within the permissible limit. Project site specific compliance of the permissible and desirable limit is tabulated as under:

Table 13: Compliance Status of Ground Water Quality around the project area

S.NO.	PARTICULARS	GOI LIMITS		REMARKS
		Desirable	Permissibl	
1	Jodhpur- Sojat Road	X	√	Chloride,Fluoride ,Nitrate and Iron

S.NO.	PARTICULARS	GOI LIMITS		REMARKS
		Desirable	Permissible	
2	Bhinmal – Pantheri Posana – Jeevana	X	√	Some parameters are exceeding desirable limits but all are well
3	Bidasar-Sri Dungargarh-Kalu	√	√	-
4	Sadulshahar-Sangaria - Chaiya	X	√	Salinity, Chloride, Fluoride, Nitrate and Iron parameters are exceeding desirable limits but all are well within permissible limits.
5	Losal-Salasar-Ratangarh	X	√	Salinity, Chloride, Fluoride, Nitrate and Iron parameters are exceeding desirable limits but all are well within permissible limits.
6	Siwana – Samdari- Balesar	X	√	
7	Beawar-Masuda-Goyla	X	√	
8	Arain-Sarwar	X	√	
9	NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha	X	√	
10	Nasirabad – Mangaliyawas-Padukalan	X	√	
11	Beawar–Pisangan, Tehla - kod- Alniyawas	X	√	

Source: Baseline Monitoring conducted at project sites.

10. Surface water Quality

78. Surface water resources in the state are in a precarious situation. Except in canal command area in the north, surface water potential is very low in the central, western and southern parts of the state (CAZRI, 2009).

79. Total surface water available in the state is 21.71 BCM, out of which 16.05 BCM is economically utilizable. The state has so far harnessed 11.84 BCM which is 72% of economically utilizable portion (State Water Policy, 2010).

80. Constant drinking water supply is available in project district by Government supply. Churu, Hanumangarh and Jhunjhunu are getting constant water supply from Apni Yojna of Government of Rajasthan. Surface water is not used for drinking or domestic purpose in the project area except for outdoor bathing, cattle feeding and irrigation at some places although surface water samples from rivers and ponds have been analysed to confirm its suitability for different classes prescribed for freshwater classification by CPCB. Analyzed samples are summarized in Table 15 for compliance of the prescribed limits.

Table 14: Compliance Status of Surface Water Quality around the project area

S. NO.	PARTICULARS	GOI (CPCB)		Irrigation	REMARKS
		Drinking Water Source w/o conventional treatment but after disinfection	Outdoor bathing (Organised)		
1	Jodhpur- Sojat	X	√	√	DO, BOD & coliform

2	Bhinmal – Pantheri Posana – Jeevana	X	√	√	are not meeting drinking water criteria.
3	Bidasar-Sri Dungargarh-Kalu	No Surface water body in close vicinity hence not monitored			
4	Sadulshahar- Sangaria -Chaiya	√	√	√	water is fit for all usage
5	Losal-Salasar- Ratangarh	No Surface water body in close vicinity hence not monitored			
6	Siwana –Samdari- Balesar	√	√	√	water is fit for all usage
7	Beawar-Masuda- Goyla	X	√	√	DO, BOD & coliform are not meeting drinking water criteria.
8	Arain-Sarwar	X	√	√	
9	NH 12-Laxmipura- Dora-Dabi-Ranaji ka Gudha	X	√	√	
10	Nasirabad – Mangaliyawas- Padukalan	X	√	√	DO, BOD & coliform are not meeting drinking water criteria.
11	Beawar–Pisangan, Tehla -kod- Alniyawas	X	√	√	

11. Waterways and Water Bodies

81. Project roads are crossing six rivers as summarized in the following table. Besides there are a number of ponds/stagnant and water bodies. All waterways and water bodies has been listed in Table below.

Table 15: List of waterways/ Water Bodies

Road	Ch. Km	Side	Water Body/Waterway	Type
Jodhpur- Sojat Road	2.0.00	Crossing	JoHari River	Non Perennial
	20.446		Mithri River	
	25.556		Luni River	
	39.190		Radiya River	
	56.600		Guhiya River	
	57.800		Tributory of Guhiya River	
	73.450		Sukri River	
	32.300	LHS	Pond	
	35.950			
	42.050			
	54.600			
Bhinmal – Pantheri Posana – Jeevana	13.150	Crossing of streams ,generally dry	Small Monsoon streams	Non Perennial
	16.755			
	24.180			
	24.329			
	26.600			
	27.762			
	30.462			

Road	Ch. Km	Side	Water Body/Waterway	Type
	33.966			
	34.760			
	35.725			
	35.963			
	37.270			
	40.532			
	52.950			
	28.800			
	30.715			
	30.853			
	50.639			
Bidasar-Sri Dungargarh-Kalu	49.000	LHS	Pond	Non Perennial
	64.200			
Sadulshahar-Sangaria - Chaiya	10.100	Crossing	Canal	
	14.500			
	19.500			
	28.300			
	51.300			
	59.100			
	74.100		Ghaggar River	
		Canal		
	79.900	RHS	Pond	
	80.100			
	81.100	Crossing	Canal	
	82.710			
	87.400			
	91.910	RHS	Pond	
95.200	Crossing	Canal		
Losal-Salasar-Ratangarh	Nil			
Siwana –Samdari- Balesar	26.000 – 27.000	Crossing	Luni River	Non Perennial
	22.400	RHS	Water body	
	50.300	LHS		
	69.400			
	79.500	RHS		
	80.500	LHS		
	83.500	RHS		
	90.000	LHS		
	90.300	RHS		
Beawar-Masuda-Goyla	Nil			
Arain-Sarwar	2.200	LHS	Pond	Non Perennial
	2.410			
	6.300			
	6.770	RHS		
	7.200	RHS		
	29.025	LHS		

Road	Ch. Km	Side	Water Body/Waterway	Type
	37.500	Crossing	River	
	38.300			
NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha	13.200			
Nasirabad –Mangaliyawas-Padukalan	57/600		Luni River	
	68/000			
Beawar–Pisangan, Tehla -kod- Alniyawas	5.100		River	
	24.280	LHS	Pond	
	8.620	Both Side	Pond	
	7.450	Crossing	River	

B. Ecological Resource

1. State Profile

82. **Forest:** Rajasthan state is largely arid for the most part. Only 9.5% of the state's total geographical area is recorded as forest. The forests of Rajasthan are spread unequally in the northern, southern, eastern and southeastern parts. The total reserved and protected forest areas are 12,453.92 and 17,415.00 km² respectively and the unclassified forest constitutes about 2,768.86 km². The extent of natural forests in Rajasthan is not only one of the lowest in the country but also low in terms of forest productivity. On the contrary, the State is endowed with the largest expanse of wasteland, which is about 20% of the total wastelands of the country.

83. **Floral and Faunal Species:** The flora and fauna in Rajasthan are specifically endemic to the dry region and they are adapted to survive in Rajasthan's water-scarce and arid regions. The forest vegetation includes the grasses, shrubs and thorny trees. The commonly found tree species in Rajasthan are bamboo, khejri, teak and varied species of acacia. Some of the national parks have several species of plants and herbs, having great medicinal value. The fauna of Rajasthan contains about 25 species of serpents and 23 species of lizards. The wildlife in Rajasthan includes species like Indian gazelles or chinkaras, black bucks, Indian foxes, great Indian bustards, the Nilgai, and wild cats. Nilgai has been spotted in almost all project sites.

84. **Protected area Network:** Rajasthan has five National Park and 25 Wildlife Sanctuaries under protected area network. None of these protected areas are located within 10 km radius of the project site.

Figure 17: Sub-project Locations w.r.t to nearest Protected Area Network of the State



2. Forest in the Project Districts

85. All Project districts have very less forest cover compared to state (9.67%) except Bundi (28.11%). Proportion of unclassified forest is highest followed by protected forest and reserve forest. Forest cover in different canopy classes of the project districts is given in Table 16 below.

Table 16: Forest Cover in Project Districts

S. No.	Name of District	Geographical Area in km ² (GA)	Reserve Forest	Protected Forest	Unclassified Forest	Forest area in km ²	% in GA
1	Ajmer	8,481	194.99	418.09	0.02	618.44	7.23
2	Barmer	28,387	0.0	568.33	44.77	627.41	2.16
3	Bundi	5,550	837.29	706.65	16.04	1557.33	28.11
4	Churu	16,830	7.80	10.84	53.18	72.95	0.43
5	Bikaner	27,244	0.0	234.29	1014.45	1249.06	4.58
6	Hanumangarh	9,656	0.0	111.25	126.21	239.46	2.46
7	Sri Ganga Nagar	10990	0.0	50.65	582.79	633.44	5.76
8	Jalore	10,640	122.24	298.05	30.40	452.61	4.24
9	Jodhpur	22,850	4.68	175.52	62.70	250.14	1.06
10	Nagaur	17,718	0.80	206.23	33.89	240.93	1.36
11	Pali	12,387	819.45	141.62	2.51	963.58	7.78
12	Sikar	7,732	9.92	619.18	8.59	639.35	8.25
13	Tonk	7,194	101.42	230.75	3.80	330.05	4.67
States forest % in GA is 9.67							

Source: State Industrial Profile 2015-16

3. Forest along the Project Roads

86. Protected forests are present along three sub-project road sections. These are (i) Beawar-Masuda-Goyla; (ii) Arain-Sarwar; and (iii) NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha. All these forests are degraded having very little or no floral and faunal diversity. Application for forest diversion have been filled. The details are summarized in Table 17.

Table 17: Status of Forest Diversion Proposal

S.No	ROAD NAME	Area in Ha	Date of Application	Remarks
1	Bewar Masuda- Goyala Road , Section of SH-26A	6.35	09-Sep-16	The FC application filed on 26.09. 2018. Queries raised on 05.01.2018 are to be replied.
2	Arain-Sarwar Highway, SH- 7E Road	1.2186	14-Sep-16	Resubmitted on 14.08.2017 queries raised on 23.01.2018 are to be replied
3	Laxmipura-Dora-Dabi-Ranaji Ka Guda- NH-12	25.35	18-Oct-17	Queries raised on 09.07.2018 are to be replied

4. Trees within Right of Way

87. The road side plantation is mixed type and natural regeneration is seen. A total of 5,904

trees have been enumerated within right of way. Predominant species in the project district are Neem, Babul, Khejri and Ardu and other indigenous species. Majority of trees are of girth size are between 60-90 cm. All efforts will be made to restrict the tree cutting to toe line of the formation width considering the safety issue. Details of the trees enumerated in project district are given in Table 18 below. Species of trees likely to be effected due to widening is appended as Appendix G.

Table 18: Affected Trees due to Project Development

Road Section	Girth Size of Affected Trees (in cm)					Total
	30-60	60-90	90-120	120-180	>180	
Jodhpur- Sojat Road	203	139	15		3	360
Bhinmal – Pantheri Posana – Jeevana	311	568	331	183	18	1411
Bidasar-Sri Dungargarh-Kalu	99	176	38	1	4	318
Sadulshahar-Sangaria -Chaiya	355	645	375	215	23	1613
Losal-Salasar-Ratangarh	66	121	70	39	4	300
Siwana –Samdari- Balesar	17	31	18	10	1	77
Beawar-Masuda-Goyla	72	132	76	43	4	327
Arain-Sarwar	114	33	4	-	-	151
NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha		26	16	5		47
Nasirabad –Mangaliyawas- Padukalan	71	130	76	43	4	324
Beawar–Pisangan, Tehla -kod-Alniyawas	308	384	190	68	26	976
Total						5,904

5. Wildlife movement along the Project Road:

88. Erratic and undefined movement of wild animals mainly that of Nilgai (Blue bull) is reported in most of the sub-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 Vermin category of Schedule V so that killing/hunting of such animals are outside purview of regulations. State government has nominated Tehsiladar, Ranger officers and other officers of same level to be competent authority for killing of such animals. Besides, movement of Chinkara (a schedule-1 animal as per Wildlife Act but least concern under IUCN classification) was also reported in few sub-projects (Sadulshahar-Sangaria –Chaiya , Bhinmal – Pantheri Posana – Jeevana and Jodhpur -Sojat).

C. Economic Development

89. Rajasthan's economy is predominantly agricultural and rural with fluctuations in the growth rate of the NSDP (Net State Domestic Product) because of the uncertainties in agriculture as it is almost entirely dependent on rainfall. The Gross State Domestic Product (GSDP), Net State Domestic Product (NSDP), and Per Capita Income (PCI) are key parameters to assess the economic performance of the state during a specific period of time. The trend of the past few years (2005-10) indicates an upward trend in the GSDP/NSDP and PCI both at current and constant prices in the state (State Economic Review, 2009-10). The State GSDP estimates at current price and constant prices for the year 2009-10 show an increase of 8.97% and 2.51% respectively over the previous year. For NSDP, these increases turn out to be 8.80% and 2.21% respectively. The PCI estimates at Rs 28,885 at current price (2009-10) also show an increase of 6.98% over the previous years (State Economic Review, 2009-10).

1. Agriculture and allied sector

90. The Agriculture and allied sector plays a significant role in the State economy. It includes the agriculture, animal husbandry, forestry, and fishing sectors, which contributes about 20 to 34% to the State's economy (State Economic Review, 2009-10). Agriculture in Rajasthan is mostly dependent on rainfall that mostly remains scanty, low and irregular. Despite low rainfall, Rajasthan is among the largest producers of edible oils in the country and the second largest producer of oilseeds. Rajasthan is also the biggest wool-producing state in the country. The main food grain crops of the state are maize, wheat, rice, jawar, bajra and pulses. The other main agriculture products include oilseeds, groundnut and vegetables. Rajasthan is known for its spice production. The chilly of Mathania is famous throughout India. The Pushkar region of Rajasthan is renowned for its horticulture and produces Rose flowers. The state also produces herbs and aromatic products.

2. Industries and Mineral Resources

91. **Industries:** The Industrial sector also plays a significant role in the State economy. It includes mining, quarrying, manufacturing, utilities such as electricity, gas and water supply, and the construction sector. Together these sectors contribute about 26 to 30 % to the State's economy (State Economic Review, 2009-10). The mineral-rich State is fast emerging as a prominent industrial destination in the country. Major industries are textiles and woolens, sugar, cement, glass, sodium plants, dyes, pesticides, zinc, fertilizers, railway wagons, ball bearings, water and electricity meters, television sets, synthetic yarn, and insulating bricks.

92. **Minerals:** The State is geologically a veritable repository of minerals. There are about 64 different kinds of major and minor minerals produced in the State, contributing an annual revenue of more than Rs. 600 crores. Rajasthan is the sole producer of garnet (gem variety), jasper and wollastonite. Almost the entire production of zinc (concentrate), calcite, asbestos and gypsum in the country was reported from Rajasthan. Besides, Rajasthan is the leading producer of ball clay (40%), feldspar (70%), fluorite (graded) (59%), Kaolin (44%), lead concentrate (80%), ochre (72%), phosphorite (79%), silver (54%), steatite (85%), barites (53%), copper (34%), quartzite (33%) and silica sand (21%).

3. Infrastructure Facility

93. **Roads:** The total road length in the state of Rajasthan is 1, 86,086 km out of which 1,12,717 km is with PWD, Rajasthan. This includes National Highways, State Highways, major district roads, other district road and village roads. There are 20 National Highways passing through the state of Rajasthan. The total length of these is 5,722 km, out of which for the present 1,447 km has been transferred to NHAI.

94. **Railway:** Rajasthan has a good railway network with a total length about 5911 km, out of which 3842.15 km (65 %) is under broad gauge. During the year 2008 the total length of railways was 5683.01 km, out of which almost 3885.47 km (68.37%) was covered under broad gauge, 1,710.78 km (30.10%) under meter gauge and 86.76 km (1.53%) under narrow gauge. The national average of railway route length per 1000 km² of geographical is 19.23 km. The same in Rajasthan is 17.05 km. One of the most important means that contributes significantly to the state's revenue collection and economy is the super luxurious train-Palace on Wheels.

95. **Aviation:** Rajasthan has full-fledged airports at Jaipur, Bikaner, Kota, Jodhpur, Udaipur,

and Jaisalmer. Jaipur has recently been designated as an international airport at Sanganer.

96. **Power:** The total installed generation capacity in the State is 7,716.63 MW of which the state generates about 4,820.30 MW; 3,847 MW from state sector projects (RVUN), and 972.95 MW from partnership projects. The state also gets 1,878.18 MW power from the central government. Apart from conventional power generation, the state also generates 883.145 MW power from non-conventional sources like wind (851.84 MW) and Biomass (31.30 MW) respectively.

D. Social and Cultural Resources

97. **Demography:** According to 2011 census the total population of the state is about 68.5 million. The population density of the state is 201 per km². (compared to the country's average of 436 km²). The decadal growth rate recorded during the previous decade at 28.41% is higher than the national level of 21.5 %. Over 76% of the population resides in rural areas. The number of females per 1000 males (sex ratio) in Rajasthan was 951 in 2011 and had shown an increase as compared to that in 2001 at 931. The future demographic projections suggest a further increase. Facts and figures about demography of the project district is summarized in the succeeding table.

Table 19a: Demography of the Project Districts

Indicators	Aimer	Barmer	Bikaner	Bundi	Churu	Ganganagar	Hanumangarh
Area km ²	8,481	28,387	27,244	5,776	16,830	10,978	1774692
Population	2583052	2603751	2363937	1,110,906	2039547	1,969,168	931184
Male	1324085	1369022	1240801	577,160	1051446	1,043,340	843508
Female	1258967	1234729	1123136	533,746	988101	925,828	16.91
Population Growth (%)	18.40	32.52	41.19	15.40	6.01	10.04	16.91
Density/km ²	305	92	78	192	147	179	184
Sex Ratio (Per 1000)	951	902	905	925	940	887	906
Average Literacy	69.33	56.53	65.13	61.52	66.75	69.64	67.13
Male Literacy	82.44	70.86	75.90	75.44	78.78	78.50	77.41
Female Literacy	55.68	40.63	53.23	46.55	54.04	59.70	55.84
Child proportion (0-6 Age)	14.76	19.26	16.94	14.39	15.58	12.97	13.20
Boys proportion (0-6 Age)	15.14	19.24	16.92	14.63	15.89	13.20	13.40
Girls Proportion (0-6 Age)	14.35	19.29	16.97	14.14	15.25	12.71	12.98

Table 19b: Demography of the Project Districts (continued...)

Indicators	Jalore	Jodhpur	Nagaur	Pali	Sikar	Tonk
Area km ²	10,640	22,850	17,718	12,387	7,732	7,194
Actual Population	1828730	3,687,165	3307743	2037573	2677333	1,421,326
Male	936634	1,923,928	1696325	1025422	1374990	728,136
Female	892096	1,763,237	1611418	1012151	1302343	693,190
Population Growth (%)	26.21	27.74	19.20	11.94	17.03	17.30
Density/km ²	172	161	187	164	346	198
Sex Ratio (Per 1000)	952	916	950	987	947	952
Average Literacy	54.86	65.94	62.80	62.39	71.91	61.58
Male Literacy	70.67	78.95	77.17	76.81	85.11	77.12
Female Literacy	38.47	51.83	47.82	48.01	58.23	45.45
Child proportion (0-6 Age) (%)	17.30	16.45	15.33	14.60	14.19	14.36
Boys proportion (0-6 Age) (%)	17.83	16.67	15.76	15.27	14.95	14.81
Girls Proportion (0-6 Age) (%)	16.75	16.21	14.88	13.91	13.38	13.87

Source: Census Survey, 2011

98. **Educational Facility:** There has been a leap in the literacy rate in the last ten years. The literacy rate has grown from 61% in 2001 to over 67% in 2011. Primary education is free and mandatory for all children in the state. At present, the state has nine universities and more than 250 colleges, 55,000 primary and 7,400 secondary schools. 41 engineering colleges at present. There are 23 polytechnics and 152 Industrial Training Institutes (ITIs) that impart vocational training. The state has 10 medical colleges, 8 dental colleges and 28 pharmacy institutes. Rajasthan also has 26 Management Institutes.

99. **Health Infrastructure:** Rajasthan has 108 hospitals, 1612 primary health centers (PHCs) in rural area and 37 in urban area, 12,701 sub-centers, 428 CHCs, 195 dispensaries, Maternity and Child welfare centers and 37,417 inpatient beds. The broad objectives of the state's Department of Health include enhancing maternal and child healthcare, stabilizing population growth and improving nutritional status.

100. **Tourism:** Rajasthan is a land of great beauty and diversity. From the Thar Desert in the west to the fertile Southeastern plains enhances the beauty of state. The main cities in Rajasthan enjoying benefit of tourist attraction are Jaipur, Jodhpur, Udaipur, Mount Abu, Bikaner, Jaisalmer, Chittor, Bharatpur and Alwar. The customs and traditions, fairs and festivals, handicrafts, art and music reflect the very broad spectrum of the Rajasthani culture where much of the Rajasthani thought, philosophy and culture is being reflected all over the state.

101. **Archaeological and Historical Monuments and Sensitive Receptors:** There are no archeological or historical monuments along the project roads. However, there are a number of religious structures and other community property resources (CPR)¹⁷ including sensitive receptors like schools and health centers. List of all sensitive receptors have been listed in road specific EMPs.

V. IMPACT ASSESSMENT AND MITIGATION MEASURES

102. This Chapter presents the environmental assessment process and planning undertaken by RPWD in addressing the environmental impacts and risk associated with the upgrading of state highways under the RSHIP Tranche 2. This chapter starts with the identification and screening of potential impacts. The identification of impacts was conducted by identifying the general project components e.g. site mobilization, establishment of camps, road construction, and road operation and corresponding interaction with specific environmental aspects e.g. physical, biological, and human.

103. The critical project components that will have substantial interaction with the environment are as follow:

- i. Preconstruction stage:
 - a) Road alignment and design – involves the screening and selection roads to avoid environment sensitive areas, finalization of road alignment
 - b) including by-passes to minimize land acquisition, minor geometric
 - c) realignment like eccentric road widening where the available RoW permits to preserve the trees on one side of the road from being cleared,

¹⁷ In India CPRs are structures or facilities that belong to a community such as hand pumps, wells, schools, health centers, temples, grave yards etc. Some Physical Cultural Resources (PCR) such as temples can also be a CPR if it belongs to the community.

- d) and cross-drainage design to incorporate wildlife crossing function
 - e) Utility shifting – removal and transfer the carriage way of electric, telephone, and water lines, drainage pipes, and hand pumps
 - f) Construction mobilization - land clearing, installation of electricity and other utility connections, perimeter fencing, establishment of storage areas, waste disposal, and installation of production equipment (hot mix, concrete batching, rock crusher, casting) in the labor and camp Sites.
 - g) Tree cutting and clearing – tree marking, cutting, and grubbing
- ii. Construction Phase
 - a) Road construction – includes earthworks for sub-grade, sub-base, gravelling of base; preparation of wearing course, and construction of shoulders
 - b) Quarries and borrow area site management
 - c) Construction plants operation for hot mix and cement batching
 - d) Maintenance of by-passed-roads - routine maintenance of sealed road pavement, foot paths, kerbs and channels, storm drainage, and pavement markings.
 - e) Site-Restoration involves the clean-up and restoration of construction zones to near its original condition prior to Contractor demobilization to include: river beds used for sand mining; camps; hot mix plant, crushers, batching plant sites; and borrow areas rehabilitated.
- iii. Post-Construction Phase
 - a) Road maintenance similar to the by-passed roads
 - b) Vegetation control – involves periodic mechanical mowing, trimming, removal of brush, and removal of trees when necessary to enhance aesthetics and to prevent potential safety hazards (e.g. reduced visibility, obstruction of signs, and debris in the roadway).

A. Identification and Assessment of Environmental Impacts

104. The identification of potential effect requires identifying the components of the physical, biological, and human environments that are at risk of being impacted in the upgrading of state roads in Rajasthan. Similar to the classical Leopold matrix, it involved an integration grid between the valued environmental components and project activities. The valued environmental components for this project were drawn from the environmental baseline and are as follow:

- a. Physical environment – air quality and greenhouse gas emissions, land and soil, surface water quality and quantity, and groundwater quality and quantity,
- b. Biological environment – terrestrial vegetation, mammals, avifauna, and special status species (Chinkara)
- c. Human environment– private land and buildings, public infrastructures, soundenvironment, aesthetic and visual, and community and occupational health and safety.

105. The assessment of potential environmental impacts requires the definition of the effects associated with the state highway upgrading in terms of intensity, duration, and scope as follow:

- i) **Intensity of the effect:** The intensity of the effect refers to the level of disruption to the component. Three levels have been defined:
 - (a) **Low:** Little change in the characteristics of the component. Difficult to quantify;

- (b) **Average:** Change in certain characteristics of the component. The change may be quantifiable;
 - (c) **High:** Change in all or in the main characteristics of the component. The change is quantifiable.
- ii) **Duration of the effect:** Duration means the time dimension of the effect. The terms permanent, temporary and short are used to describe the period of time:
- (a) **Short-lived:** the effect disappears promptly;
 - (b) **Temporary:** the effect is felt during one project activity or, at most, throughout implementation of the project;
 - (c) **Permanent:** the effect has repercussions for the life of the infrastructure.
- iii) **Scope of the effect:** The scope describes the spatial dimension of the effect caused by an action in the environment. It refers to the distance or area covered by the disruption. The terms regional, local and limited are used to describe the scope:
- (a) **Limited:** the scope is limited when the action affects only one environmental element located near the project;
 - (b) **Local:** the scope is local when the action affects the study area;
 - (c) **Regional:** the scope is regional when the action affects areas beyond the study area
- iv) **Assessment of the potential effect.** These three parameters are incorporated into a multicriteria matrix, making it possible to place the potential effect into one of three categories:
- (a) **Major (MAJ):** signifies an effect that is permanent and that affects the integrity, diversity and sustainability of the element. Such an effect substantially or irremediably alters the quality of the environment.
 - (b) **Medium (MED):** signifies a perceptible, temporary and/or low- return effect that has little impact on the environmental component and is not irreversible. Such an effect is short-lived and/or limited in scope.
 - (c) **Minor (MIN):** signifies that the effect is non-existent or virtually non-existent, that it does not affect the environmental component in any observable or quantifiable way and that it is related to a randomly occurring natural effect. As a rule, this would be a short- lived effect, limited in scope.

Table 20: Multi-Criteria Analysis to Determine the Potential Environmental Impacts

Intensity	Scope Duration	Short-lived	Temporary	Permanent
Low	Limited	MIN	MIN	MED
	Local	MIN	MIN	MED
	Regional	MIN	MED	MAJ
Average	Limited	MIN	MED	MED
	Local	MED	MED	MAJ
	Regional	MED	MAJ	MAJ
High	Limited	MED	MAJ	MAJ
	Local	MED	MAJ	MAJ
	Regional	MAJ	MAJ	MAJ

106. The relationship between these project phases and its components, and the

environment were established to identify anticipated environmental impact is provided in the succeeding table.

Table 21: Grid Displaying the Interaction between Environmental Components and RSHIP Tranche 2 Upgrading

Environmental Component	Pre-Construction					Construction						Operation	
	Road Alignment and Design	Construction and Camp Site Location	Utility shifting	Construction Mobilization	Tree Cutting/Land Clearing	Drainage works	Road Construction	Quarries and borrow sites	Construction plants and camp site operations	Maintenance of by-passed roads	Site Restoration	Road Maintenance	Vegetation Control
Physical													
Air Quality and GHG							X	X	X	X		X	
Land and Soil				X		X	X	X			X		
Surface Water Quality and Quantity				X		X	X	X	X				
Groundwater Quality and Quantity				X				X					
Biological													
Terrestrial Vegetation	X	X			X		X		X				
Mammals	X	X					X		X				
Avifauna					X								
Special Status Species	X	X				X	X		X				
Human													
Private Land and Buildings	X	X					X		X				
Public Infrastructures			X				X					X	
Sound Environment				X			X	X	X				
Heritage and archeology			X				X						
Aesthetic and Visual			X										
Community and OH Safety	X						X	X		X			

B. Identified Impacts and Proposed Mitigation Measures

107. Mitigation measures were identified to reduce the significant adverse impacts including residual effects.

The analysis of impacts shown in the succeeding table revealed the following:

- During the pre-construction phase, major potential negative impacts include permanent loss of trees, disturbance of national protected species, and increase road crashes from inadequate road alignment and design. While medium potential impacts includes increase in animal-vehicle crashes from unregulated higher vehicular speed, and localized flooding from inadequate drainage design.
- During construction, major potential negative impacts from the project includes the loss of productive soil from new borrow areas. Medium potential impacts from increase dust missions, generation of noise, risks of accident from improper management of borrow areas, and inadequate clean-up operation, restoration and rehabilitation prior to decommissioning.
- Only minor environmental impacts were identified during project operation.

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

1. Typical Potential Beneficial Impacts

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

2. Typical Potential Adverse Impacts

110. Major anticipated impacts arising from the sub-project roads improvement are: (i) economic displacement of some households impacting their livelihood, (ii) cutting of trees and disruption in wildlife movement, (iv) adverse impacts due to borrowing and quarrying, (v) increased risk of accident due to faster vehicular movement (iv) increase in air pollution and noise pollution due to increased traffic. Most of the impacts are reversible, temporary, localized in nature, and can be easily mitigated/minimized/avoided by effective implementation of EMP

i. Pre-construction Phase Impacts and Mitigations

Terrestrial Vegetation/Trees, Forest and Wildlife Movement

111. Trees: A total of 5904 trees (<8 trees/km) have been enumerated in proposed ROW. Most of them are indigenous and none of them are of rare/endangered/threatened category. Geometric adjustment till final design by the contractors/concessionaires will be made to minimize affected trees. Further, tree cutting will be restricted to toe line of the formation width without compromising road safety elements. The mandatory compensatory plantation will be done on 1: 3 basis by the Forestry Department. Additional plantation will be done as a strategy to minimize GHG emissions from increase in traffic due to road upgrading. No tree will be uprooted without prior approval of competent authority.

112. Forest: Few sections of the project roads are passing through protected forests. These are not natural forests. Roadside land/plantation within ROW excluding black-top is notified as protected forest. Diversion of forest land is involved in three sub-project roads (Beawar-Masuda-Goyla, Arain- Sarwar Highway and NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha). Since this diversion of forest land is regulated, EA needs to follow the regulatory requirements like payment of Net Present Value (NPV), allocation of equivalent degraded land for development of forest area, compensatory afforestation, etc. while securing the forest clearance.

113. Wildlife: Erratic and undefined movement of wild animals mainly that of Nilgai (*Boselaphus tragocamelus*) is reported in most of the sub-projects. This species is under Schedule-III of wildlife act and not assessed as per IUCN. Movement of Chinkara, a schedule-1 animal as per Wildlife Act but least concern under IUCN classification, was also reported in a few sub-projects (Sadulshahar-Sangaria –Chaiya, Bhinmal – Pantheri Posana – Jeevana and Jodhpur -Sojat). A number of pipe culverts are proposed to be converted into box culverts. Culverts which do not cater to perennial flow will serve as underpass for Chinkara. Installation of animal crossing signposts on either direction along 5 km of open grazing land where movement is more anticipated is also recommended. These are proposed to caution drivers about speed limits and prohibition on the use of dipper light since sudden change in illumination saturates retinas rendering the animals temporarily blind, causing their abrupt movement. Roadside plantation shall include trees with thin canopy or maller trees to provide better sight distance. Grazing species of shrubs shall be cleared to avoid collection of wild animal near highways.

Loss of Land and Assets

114. All efforts have been made to accommodate the improvement work within available ROW along existing alignment causing minimal land acquisition. However, it is inevitable for curve improvement, 19 toll plazas and 14 proposed bypasses (1 for Bhinmal – Pantheri Posana – Jeevana, 1 Siwana –Samdari- Balesar, 1 for Arai-Sarwar and 4 for Nasirabad to Padukalan and 7 for Losal-Salasar-Ratangarh) resulting in significant number of displaced persons either economically, physically or both, thereby affecting their livelihood.

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

1.

Community Safety

116. With increased traffic volume, communities including road users may be at risk due to road crashes in absence of adequate safety provisions such as crash barriers at accident prone areas. Safety provisions in accordance to IRC guidelines, which include provision of (i) rumble strips in habitat areas to regulate speed (ii) retro-reflective warning sign boards nears school, hospital and religious places (iii) proper side-walks/pedestrian zone along the road near habitat areas, school, hospital, religious places, etc., are included in preliminary design which will be further reviewed during detailed design (iv) compliance with IRC codal provisions of state highway for curvature and grading. Provision of safety kerb at all bridges is also proposed. The design should attempt to equalize cut and fill.

Localized flooding/waterlogging from Inadequate Drainage

117. 9Project area is largely free from flooding. However, water logging was observed in several built-up sections along majority of the sub-project roads due to inadequate drainage facilities. Some the proposed mitigations are (i) construction of concrete pavement in habitat areas considering alignment level and drainage, (ii) raise road level above the nearby areas with provision of adequate side drains to evacuate the rain water and domestic discharges (iii) raise embankment height above the HFL, (iv) provision of adequate CD structure, and improvement in their carrying capacity.

Worker's Camp Siting

118. Poor siting and layout of workers camp may cause (i) loss of agricultural produce if sited on cultivable land, (ii) health hazard to workers and nearby communities, (iii) surface water pollution in case sited near water bodies, (iv) local drainage problem, (v) wear and tear to haul routes if materials are transported via village roads, (vi) fire, electrical, and other safety risks.

119. The location, layout and basic facility provision of each labor camp will be submitted to PMC and PIU prior to their construction. All camps should maintain minimum distance of 500 m from habitation, water bodies, and from through traffic route. The construction shall commence only after approval of PMC. Preparation of solid waste management plan that includes collection, storage, and disposal subject to the review and approval of the AE/IE.

Utility Shifting, Aesthetic and Visual

120. Delay and unplanned shifting of public utilities like telephone and electrical poles, water pipelines, OFC cables, etc., may cause disruption of utility services to local community. Diggings, shifting and re-establishment of poles may impair the view of community areas

121. All efforts shall be made to reduce the duration of utility shifting impact and restore the disturbed areas. All utilities should be shifted before the start of construction. Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services. Visual barriers to be provided when necessary, on active construction zones. Consultation with affected people should be done prior to the start of utility shifting presenting construction timelines and guidelines. Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services, if any.

Heritage and Archaeology

122. Rajasthan, being immensely rich in historical and archeological source material, digging for various road construction purposes may unearth important artifacts. A rapid response procedure to protect chance finds while minimizing disruption to project activities should be in place. Relevant provisions of Ancient Monuments and Archeological Sites and Remains Act (1958) should be implemented to include: i) consultation with the Rajasthan Archeology Department, ii), demarcation of the discovery site, iii) chance finds report, iv) arrival and actions of cultural authority, and v) suspension/non-suspension/further suspension of work.

ii. Construction Phase Impacts and Mitigations

Topography and Geology

123. Project scope is limited to expansion of existing roads with or without bypasses. Abutting topography is predominantly plain with intermittent rolling sand dunes. Cut-and-fill operations are confined to ROW to improve/maintain the vertical profile of road. The surplus soil from cut operations, which is unsuitable for selected subgrade, will be used to reinstate the borrow areas. Therefore, overall impact on the topography of the project area is unlikely. Likely impact on the geological resources may occur from the extraction of materials (borrow of earth, granular sub-base and aggregates for base courses and bridges). Rajasthan being naturally endowed with rock/mineral deposits, there are already large number of licensed/approved quarries which are under operation. All construction material such as aggregates, sand and earth to be procured or

borrowed only after requisite permission from mining department and environmental clearance from DEIAA have been obtained.

Mitigation Measures

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

Air Quality

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

Mitigation Measures

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

programme to the RCD prior to construction.

- Additional plantation proposed on 1: 7 basis to improve the micro-climate

Noise

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

Mitigation Measures

- All equipment will be timely serviced and properly maintained to minimize its operational noise. Noise level will be one of the considerations in equipment selection which will favour lower sound power levels. Construction equipment and machinery will be fitted with silencers and maintained properly.
- Stationary noise making equipment will be placed along un-inhabited stretches.
- Timing of noisy construction activities will be regulated near residential areas and sensitive receptors. Maximum construction activities will be undertaken during night time and weekends when sensitive receptors such as schools are not functioning. Alternatively, construction work will be executed during day time near residential areas. The health centres along the project roads are of primary level with first aid outdoor treatment facility and hence are anticipated to require any permanent noise barrier.
- Noisy operations will be separated to reduce the total noise generated, and, where feasible, traffic will be re-routed during construction to avoid the accumulation of noise beyond standards.
- If the abovementioned schemes prove to be inadequate, the provision of temporary noise barrier will be made near identified sensitive locations or near the noise source during construction.
- Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines.
- Noise monitoring will be carried out to ensure the effectiveness of mitigation
- Complaints on noise from local community will be received and addressed through the grievance redress mechanism system discussed in chapter VI.

Impact on Land and Soil

126. Loss of Productive Soil and Change in Land use: Top soil from borrow areas shall not be used for embankment formation as it is a specific condition by SEIAA/DEIAA in granting environmental clearance for borrow areas. Loss of topsoil is envisaged during construction stage if construction plant, offices, workers camps, stockyards, and borrow areas are located on fertile areas and if haul roads and traffic detours during construction are routed through agricultural

land. Change in land use is insignificant since widening and improvement is mostly within available right of way except due to some proposed bypasses which are inevitable. Hence, no specific mitigation proposed.

Mitigation Measures

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

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

Mitigation Measures

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

128. Borrow Areas and Quarries: Extraction of the soil from borrow areas and boulders/ aggregates/ granular sub-base from the river beds can result in some direct and indirect impacts on the local and regional environment. Impacts may be positive or negative and vary from case to case. Borrow areas may cause some adverse impacts if left un-rehabilitated. It may pose risk to people, particularly children and animals of accidentally falling into it as well as become

potential breeding ground for mosquitoes and vector-borne diseases. Illegal quarrying may lead to unstable soil condition, destroy the landscape of the terrain, and air and noise pollution.

Mitigation Measures

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

129. **Compaction and Contamination of Soil:** Soil of the haulage roads and construction camp area may be compacted due to movement of construction vehicles, machineries and equipment, and due to siting of construction camps and workshops. Soil may get contaminated due to inappropriate disposal of liquid waste, (lubricating oil and fuel spills, waste oil and lubricant and vehicle/equipment washing effluent) and solid waste (fuel filters, oily rags) likely to be generated from repair and maintenance of transport vehicles, construction equipment and machinery. Soil may also get contaminated due to inappropriate disposal of domestic solid waste and sewage from construction camps. Sub-soil contamination may also be attributed to scarified bitumen wastes, operation of the emulsion sprayer and laying of hot mix, storage and stockyards of bitumen and emulsion, and excess production of hot mix and rejected materials.

Mitigation Measures

- Fuel and lubricants will be stored at the pre-defined storage location. The storage area will be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils.
- Unavoidable waste will be stored at the designated place prior to disposal. To avoid soil contamination at the wash-down and re-fuelling areas, "oil interceptors" will be provided. Oil and grease spill and oil-soaked materials are to be collected and stored in labelled containers and sold off to SPCB/ MoEF authorized re-refiners.
- Movement of construction vehicles, machinery and equipment will be restricted to the designated haulage route.

- Approach roads will be designed along the barren and hard soil area to reduce the compaction induced impact on soil.
- The productive land will be reclaimed after construction activity.
- Septic tank/mobile toilets fitted with anaerobic treatment will be provided at camp.
- Domestic waste at construction camp will be segregated into biodegradable and non-biodegradable waste. Non-biodegradable waste will be given or sold to relevant agents for recycling or buried in nearby waste disposal sites following environmentally friendly practices.

Impact on Groundwater and Loss of Water Sources

130. Due to unfavourable geological conditions, groundwater is a scarce resource in Rajasthan. Out of all the project districts, Central Ground Water Authority has notified only Rajgarh block of Churu district for the regulation of ground water development and management. In notified areas, abstraction of ground water is not permissible for any purpose other than drinking and domestic use. None of the sub-project road is under notified area. However, prior permission/NOC is mandatory for abstracting groundwater for project purposes. Uncontrolled abstraction may hamper community water supply along project roads. Suitable arrangement for drinking in the campsite will be managed by contractors/concessionaires without affecting availability to local community. There are a few groundwater sources, mainly hand pumps, along project roads which are proposed to be shifted at suitable locations in consultation with local community.

Mitigation Measures

- All efforts have been taken while finalising the alignment to minimise the impact on ponds/other water sources.
- Some of the borrow areas are proposed to be converted into ponds. These measures will significantly augment the ground water/surface water availability in the area.
- All hand pumps and wells are proposed for relocation at suitable locations in consultation with local community.
- In view of the recent order by Green Tribunal, it is a pre-condition to recharge groundwater while granting permission for abstraction of groundwater by CGWA for any infrastructure project.
- The contractors/concessionaires will make arrangements for water required for construction in such a way that the water availability and supply to nearby communities will remain unaffected.
- No change in groundwater regime is envisaged hence no mitigation for this impact is proposed.

Siltation and Deterioration in Surface Water Quality

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

132. Extraction of sand from the river bed may increase turbidity and affect propagation of fishes and other aquatic life, mainly benthic organisms. The macro-benthic life which remains

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

Mitigation Measures

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

Hydrology and Drainage

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

Mitigation Measures

- Adequate cross drainage structures have been provided to avoid impediment to

natural flow of water. Additional balancing culverts have been provided. The embankment height has been designed to be consistent with the existing topography of the region.

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

Impact due to Construction Debris/Waste

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

Mitigation Measures

- The existing bitumen surface can be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, haulage routes etc.
- All excavated materials from roadway, shoulders, verges, drains, cross drainage and the like will be the property of the EA and will be used for backfilling embankments, filling pits, and landscaping.
- Unusable debris material should be suitably disposed at pre-designated disposal locations to the satisfaction of CSC. The bituminous wastes will be disposed in secure landfill sites only in environmentally accepted manner.
- Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.
- Following considerations will be made during selection of dumping sites;
 - 1.5 km from habitation and forest areas and 500 m from ponds.
 - Dumping sites do not contaminate any water sources, rivers etc, and
 - Consent from the village council has to be obtained before finalizing the location.
- Form works will be re-used to the extent possible. All stripped formworks will be examined for any damage and rectified in the workshop for re-use.

Ecological Resources

135. Terrestrial Vegetation/Trees: There are no national parks, wildlife sanctuaries or any other similar eco-sensitive areas in the project area. The cutting of 5,904 trees spread over a vast geographical area is unlikely to cause any change in micro climate. Compensatory plantation ration of 1:3 in lieu of each tree to be cut along the road will improve the local climate in the long term. No loss of any rare/endangered species is envisaged.

Mitigation Measures

- Avoid or minimize the number of trees to be cleared through minor geometric realignment or eccentric widening.
- Requisite permission from Forest Department will be secured for cutting of roadside trees.
- Ensure timely commencement of compensatory plantation, Roadside Plantation Strategy as per IRC, including manuring and controlled use of pesticides/fertilizers
- Additional plantation/avenue plantation is also proposed subject to availability of land.
- Provision of LPG in construction camp as fuel source to avoid tree cutting, wherever possible.
- For safe traffic operation, vertical clearance between the crown of the carriageway and lowest part of overhang of the tree available across the roadway will conform to IRC: SP: 21-2009. The pit size, fencing, watering, and manuring requirements will also conform to the standard above.
- In the event of design changes during construction, additional assessments including the possibility to save trees shall be made by the EA

136. Faunal Elements: Several mitigation measures recommended in the design stage will reduce if not totally avoid collisions of Nilgai/Chinkara with vehicles. As soon as construction starts, RPWD has to support forest department with a rescue van for injured Chinkaras. Budgetary provisions have already been included in EMP.

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

138. Aquatic Ecology: Temporary sedimentation and water quality deterioration is expected during the construction stage. Increase in turbidity due to erosion will lead to reduction of light penetration and make it an unsuitable place for aquatic fauna and flora. Further, due to the reduced light penetration to the water body, the primary productivity of the biota in the water body will be reduced resulting in increased mortality. In addition, when these particles settle on the bottom it will affect the breeding ground of aquatic animals. Improvement of existing embankments particularly along the waterways may increase silt while accidental spill of materials, chemicals, and fuels will deteriorate receiving water quality. For this project, the projected impact is insignificant since most of the waterways are non-perennial and construction of bridges will be mostly during summer. Siltation will be avoided by measures suggested above in impact on surface water resource section.

Impacts due to Construction Camp and Immigration of Workers

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

Mitigation Measures

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

Safety of Construction Workers and Accident Risk to Local Community

140. The following safety aspects will be observed: (i) safety of construction workers, (ii) safety of road users including pedestrians, (iii) safety to cattle, (iv) safety of local community, (v) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during design and construction stage, and (vi) conduct of safety audit. Impact and mitigations due to blasting operation as already been detailed in Noise and Vibration section.

Mitigation Measures

- During the construction phase, contractors/concessionaires will be required to adopt and maintain safe working practices. Internationally accepted and widely used safety procedures should be followed during: (i) road works (ii) handling of large construction equipment and machineries, (iii) handling of chemicals and hazardous materials and inflammable substances, (iv) welding, and (v) electrical

works etc.

- Contractors/concessionaires will arrange all PPEs for workers, first aid and fire fighting equipment at construction sites. An emergency plan will be prepared, duly approved by engineer in charge to respond to any instance of safety hazard.
- To avoid disruption of the existing traffic due to construction activities, comprehensive traffic management plan will be drawn up by the concessionaire. Traffic in construction zones will be managed as per the provisions of IRC SP 55.
- After construction is completed in a particular zone, it will be opened for normal operation. All diversions should be closed before start of normal operation.
- Use of retro-reflectorized traffic signs, and cantilever/gantry-type overhead signs, thermoplastic road marking paints, delineators, traffic cones, empty bitumen drums, barricades, and flagmen will be used to ensure traffic management and safety. Conduct of regular safety audit on safety measures adopted during construction.

Obstruction and Disruption of Traffic

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

Mitigation Measures

- The contractors/concessionaires will submit a traffic plan to the Project Engineer before the construction. This plan will recommend for approval, the safe and convenient temporary diversion of traffic during construction, design of barricades, delineators, signs, markings, lights, and flagmen, among others.
- For widening of existing carriageway and as part of it will be used for passage of traffic, paved shoulder will be provided on one side of the existing road by the contractors/concessionaires
- At least one 3.5 m lane to remain open to traffic at all times
- The surface used by the through traffic will be firm bituminous compacted surface free of defects
- The maximum continuous length over which construction under traffic may take place is limited to 750 meters.
- Construction activity will be restricted to only one side of the existing road.
- On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed.
- Transportation of quarry material to the construction sites through heavy vehicles will be done through existing major roads to the extent possible. This will restrict wear and tear to the village/minor roads. Small vehicles/un-motorised vehicle can also be used for its further transportation to the construction sites from temporary storage areas.

Transport and Storage of Materials

142. The construction material primarily will consist of aggregate, sand, cement, bitumen, and lubricating oil and fuel for vehicle and construction equipment. These will be primarily stored temporarily at construction camps. The oils, fuels and chemicals will be stored on concreted platform with spills collection pits. The cement will be stored under cover. All these temporary storage areas will be located at least 150m away from the habitat. The likely impacts due to

transportation and storage including fugitive emission have already been covered under different sections above.

Chance Find of Cultural or Archaeological Significance

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

iii. Post Construction and Operational Phase

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

Site Restoration

145. Contractors/concessionaires will prepare site restoration plans, which will be approved by the PMC. The clean-up and restoration operations are to be implemented by the contractors/concessionaires 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, at the contractors/concessionaires' expense, to the satisfaction of the Environmental Officer. All the opened borrow areas will be rehabilitated and PMC will certify in this regard.

Road repair and Maintenance Work and Increase in Traffic

146. Emissions from hot patch work, fumes from pavement marking works, dust from concrete grinding, and dust demolition debris may deteriorate local air quality. Mitigation measures recommended are:

- Provision of PPE to workers
- Water sprinkling to control dust
- Covered haul trucks
- Maintaining an adequate vehicle road capacity as congestion decreases vehicle speed, deteriorates fuel efficiency, and increases emission per km travel.
- Maintain optimum range of vehicle speed within the toll road. CO₂ emissions drastically increase when vehicles are travelling less than 30 kph and faster than 70 kph.
- Maintain good riding quality of the toll road, expressed in roughness

Soil Erosion and its Cumulative Impacts:

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

Impacts on Water Resources:

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

Pedestrian and Commuter Safety

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

- Provision of centreline road marking where possible, edge delineation etc.
- Provision of clearly marked signage at townships, sensitive areas such as potential wildlife crossings, schools, temples, etc.
- Enforcement of speed limits and other traffic rules, especially near potential wildlife crossings and built-up sections.
- Safety of road users could be ensured by regular repair of carriageway and hydraulic structures and by placing standard sign boards, barricading of the repairing site, etc.

Impacts on Air Quality

150. Air emissions due to vehicular movement are one of the prime sources of air pollution in the study area. The project roads are currently having 1 or 1.5-lanes. The widening and upgradation of the road will result into ease of traffic movement and reduction of traffic congestion. In the existing scenario, due to lesser width and higher roughness, the average vehicle speed is low, which results in more exhaust gas emissions. In the post-project scenario, improved road conditions and congestion-free traffic movement will reduce emissions.

Noise Impacts

151. During the operational phase, movement of traffic, traffic congestion, pedestrian interferences and increased use of horns due to interface between local/slow moving traffic with through traffic will be the prime source of noise. The noise levels at nearby schools, religious places, etc., may cause nuisance and irritation. There will be significant increase in the noise levels due to increase in traffic intensity as well as average speed of vehicles over the road's design life. However, with appropriate mitigation measures such as lowering of speed from 80km/hour to 30km/hour in residential and commercial areas which has already been included

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

Ecological Impacts

152. With the improved road surfaces, number of vehicles and the speed will be increased. This may result in the increased number of collision and roadkill. A set of mitigation measures have been suggested above in the pre-construction and construction stage sections. RPWD need to support jurisdictional forest departments to monitor the effectivity and adequacy of these mitigation measures. Fresh assessment is suggested in case of future widening.

VI. ESTIMATION FOR GREEN HOUSE GAS EMISSION

153. One of the main triggering factors for climate change is increase in greenhouse gas emission. Transportation sector in India contributes to around 7.5% of the total GHG emission. Out of which road transportation alone has a share of 87%¹⁸. Road construction accounts for 5% of its total life cycle GHG emission whereas, operation that is traffic accounts for rest 95%¹⁹. GHG emission likely to be generated from the project roads have been computed using the Transport Emissions Evaluation Model for Projects (TEEMP)²⁰ developed by Clean Air Asia²¹ was utilized to assess the CO₂ gross emissions with and without the project improvements. The main improvement from the project that was considered for the model are better surface roughness with less than 2m/km, and increase in capacity by widening of some of the roads from 1.0 lane and 1.5 lane to uniform 1.5 lane or from 1.5 lane to 2 lane. These translated into faster vehicle speed and less fuel consumption. The model was also been used to estimate CO₂ emission during construction stage.

154. Few assumptions made in this software are:

- i. Fuel efficiency as reckoned in business as usual (BAU) and with project scenario (WPS) is given in Table below. It is assumed that the fuel efficiency of the vehicles would increase due to improvement of the roads.
- ii. It is assumed that there would be no or minimum number of vehicles with vintage year before 2000 using Euro –I fuel type after 20 years (Table 23). Pre-Euro vehicles are assumed to be completely discarded.

Table 22: Fuel efficiency in km/l

Scenario	BAU		WPS	
	Petrol	Diesel	Petrol	Diesel
2 Wheeler	40.00		50.00	
3 Wheeler		15.00		20.00
Car	12.00	15.00	15.00	20.00
LCV		5.00		8.00

Scenario	BAU		WPS	
	Petrol	Diesel	Petrol	Diesel
Bus		5.00		8.00

¹⁸ emissions from fuel combustion highlights (2012 Edition) by International Energy Agency.

¹⁹ Indian Network for Climate Change Assessment, MoEF& CC, 2010

²⁰ TEEMP is an excel-based, free-of-charge spreadsheet models to evaluate emissions impacts of transport projects.

²¹ A network of 250 organizations in 31 countries established by the Asian Development Bank, World Bank, and USAID to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

HCV		5.00		
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Source: DPR Consultant

Table 23: Emission Standards of Fleet (%)

Vehicle Type	Current Scenario				Post 20 Years		
	Pre-Euro	Euro I	Euro II	Euro III	Euro I	Euro II	Euro III
2 Wheeler		50%	50%			30%	70%
3 Wheeler	80%	20%			20%	40%	40%
Car		40%	40%	20%		40%	60%
LCV		70%	20%	10%	10%	40%	50%
Bus		70%	20%	10%	10%	40%	50%
HCV		70%	20%	10%	10%	40%	50%

Source: DPR Consultant.

155. The model demands information on length of road or section, lane configuration, mode wise count of AADT in vehicles, average trip length, share or local traffic, trip length of local traffic, fleet characteristics i.e. breakdown of fleet based on fuel type, percentage breakdown of vehicle-fuel type based on Euro standard. Input parameters as considered for all the project roads are as given in succeeding Tables. Design period is considered to be 20 years and volume capacity saturation limit is considered based on the current traffic velocity and hence varies in each project road. Traffic forecasts were taken from the detailed project reports, which are assumed as 5% per annum at each of the project road.

Table 24: Input Parameters for TEEMP

Particular	Project Roads											
	Jodhpur – Sojat		Bidasar-Sri Dungargarh-Kalu		Bhinmal – Pantheri Jeevana		Sadulshahar-Sangaria - Chaiya		Losal-salasar-Ratangah		NH 12-Laxmipura-Dora- Gudha	
Length of Road	75.7		82.2		51.58		95.3		78.603		49.–	
BAU - No. of Lanes	2,1		1,1.5,2		1,1.5		1.5, 2, 1.0		1,1.5,2,4		–	
WPS - No. of Lanes	2		2		2		2		2		2–	
BAU - Lane Width	3.5,3.75		3.75,5.5,3.5		3.75,5.5		5.5, 3.5,		3.5,5.5,7,1		3.5–	
WPS - Lane Width	3.5		3.5		3.5		3.5, 3.5,		3.5		3.–	
BAU - Roughness (m/km)	5.2		5		5		5		5		1–	
WPS - Roughness	2		2		2		2		2		2	
Induced Traffic	Yes		No		No		No		Yes		No	
Start of Assessment	2017		2017		2017		2017		2017		2017	
AADT in Vehicles	2017	2035	2017	2035	2017	2035	2017	2035	2017	2035	2017	2035
2-wheelers	1	17	145	24	20	21	5	92	2126	4345	200	34
3-wheelers	3	58	12	20	21	25	4	77	176	467	37	62.
Car	2	46	400	68	15	15	1	20	145	597	379	64
HCV	4	71	208	35	29	31	7	12	56	219	40	68
Bus	3	62	100	17	22	24	6	10	23	304	28	47.
LCV	1	17	221	37	58	61	3	63	128	456	166	28
Total	1	31	239	40	46	48	1	24	2654	6388	265	45

Source: DPR Consultant

Table 24: Input Parameters for TEEMP (cont....)

Particular	Project Roads									
	Siwana to Balesar		Beawar-Masuda-Goyla		Arai-Sarwar		Nas-rabad - Padukala		Beawar-Pisangan,- Alniyawas	
Length (km)	90.65		67.01		44.26		62.96		56.–	
BAU - No. of Lanes	1,1.5		1,2		1,1.5, 2		1,1.5, 2		1,1.5, –	
WPS - No. of Lanes	2		2, 2		2		2		–	
BAU - Land	3.75,5.5		3.75,3.5		3.75, 5.5,3.5		3.75, 5.5,3.5		3.75, 5.5,3.–	
WPS - Lane	3.75		3.5		3.5		3.5		3.–	
BAU -	5		6, 5		5		5		–	
WPS -	2		2		2		2		2	
Induced	Yes		Yes		No		Yes		Yes	
Start of	2017		2017		2017		2017		2017	
AADT in Vehicles	2017	2035	2017	2035	2017	2035	207	2035	2017	2035
2-wheelers	887	15	5372	913	1439	2447	189	3225	1530	2601
3-wheelers	75	12	223	379	5	9	23	39	20	34
Car	490	83	1300	221	362	616	157	2681	205	349
HCV	250	42	450	765	110	187	287	488	26	44
Bus	100	17	1310	222	301	512	226	385	49	83
LCV	52	88	161	274	40	68	567	964	6	11
Total	185	31	8816	149	2257	3839	457	7782	1836	3122

Source: DPR Consultant

156. Maximum PCU for 1.0, 1.5 and two lanes were considered as 4,000, 6,000 and 8,000 respectively in consistent to IRC guidelines. Emission factors were taken from the CPCB/ MoEF& CC&CC (2007) Draft Report on Emission Factor Development for Indian Vehicles, The Automotive Research Association of India, and C. Reynolds *et. al* (2011) Climate and Health Relevant Emissions from in-use Indian three-wheelers rickshaw as presented in Table 4. Furthermore, it has been assumed that after 20 years, there will be reduction of 20% in the emissions, due to advancement of technology and improved efficiency:

Table 25: CO₂ Emission Factors for different vehicle types²²

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

157. The total emission of CO₂ as estimated during BAU and WPS for all the project roads individually is less than 100,000 tons per year threshold set by ADB. Therefore it is not necessary to implement options to reduce or offset CO₂ emissions under the project. The project road-wise CO₂ emission intensity are provided in succeeding Table.

158. The design life of road is 20 years. Total CO₂ emission at business-as-usual and with project scenarios (over the design life of road) were estimated as 35,02,652 tons and 4,074,335

²² It has been assumed that the emission factors will be reduced by 20% in 20 years.

tons, respectively. It is also to be noted that with project scenario will also include 47,530 tons of CO₂ emission due to road construction/ upgrade. It is therefore evident that with project scenario will be having lesser CO₂ emissions than the business-as-usual scenario (excluding construction related emissions).

159. Total CO₂ emission at business-as-usual, and with project (including construction) scenarios was at 175,162 tons/year and 208,177 tons/year, respectively. Although the with-project scenario remains higher than without project due to increase in number of trips, number of vehicles and longer local trips owing to improved road condition. Measures to ensure the GHG emission will not increase further during project operation includes the following:

- Maintain an adequate vehicle road capacity as congestion decreases vehicle speed, deteriorates fuel efficiency, and increases emission/km travel.
- The relationship between road capacity and vehicle speed is provided in Table 28
- Maintain optimum range of vehicle speed within the toll road, as provided in Figure 9 CO₂ emissions drastically increases when vehicles are travelling less than 30 kph and faster than 70 kph
- Maintain good riding quality of the toll road, expressed in roughness and measured as m/km. The impact of deteriorating road quality with decrease in fuel efficiency and hence increase in emission/km travel is presented Table 26.

Table 26: Speed-Flows Relationship with Traffic Volume-Capacity Ratios

V/C	Rural Road No. of Lanes	
	2	4
0	30.00	50.00
0.1	29.97	49.90
0.2	29.81	49.43
0.3	29.40	48.43
0.4	28.67	46.78
0.5	27.51	44.38
0.6	25.85	41.13
0.7	23.61	26.96
0.8	20.72	31.80
0.9	17.09	25.56
1.0	15.00	18.20
1.5	15.00	18.20
2.5	15.00	18.20

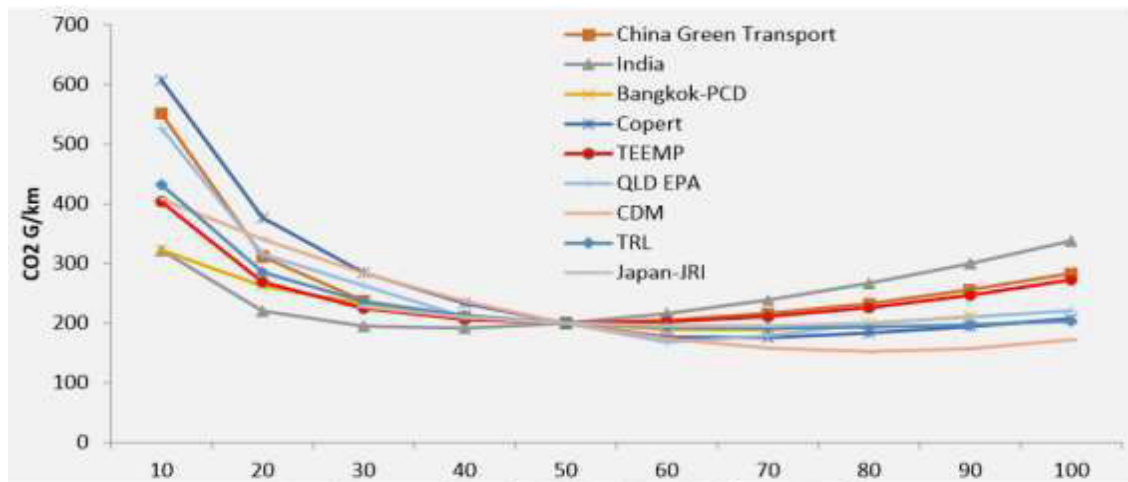


Figure 2: Impact of Speed on CO2 Emissions in Different Models

Figure 18: Impact of Speed on CO² Emission²³

Table 27: Effect of Road Roughness on Fuel Consumption

Roughness (m/km)	Impact on Fuel Consumption (kmpl)
2	1
3	0.99
4	0.98
5	0.98
6	0.97
7	0.96
8	0.95
9	0.95
10	0.94
11	0.93
12	0.92
13	0.92
14	0.91
15	0.90

²³ Transport Emissions Evaluation Model For Projects (Teemp) Roads Model User Guide.

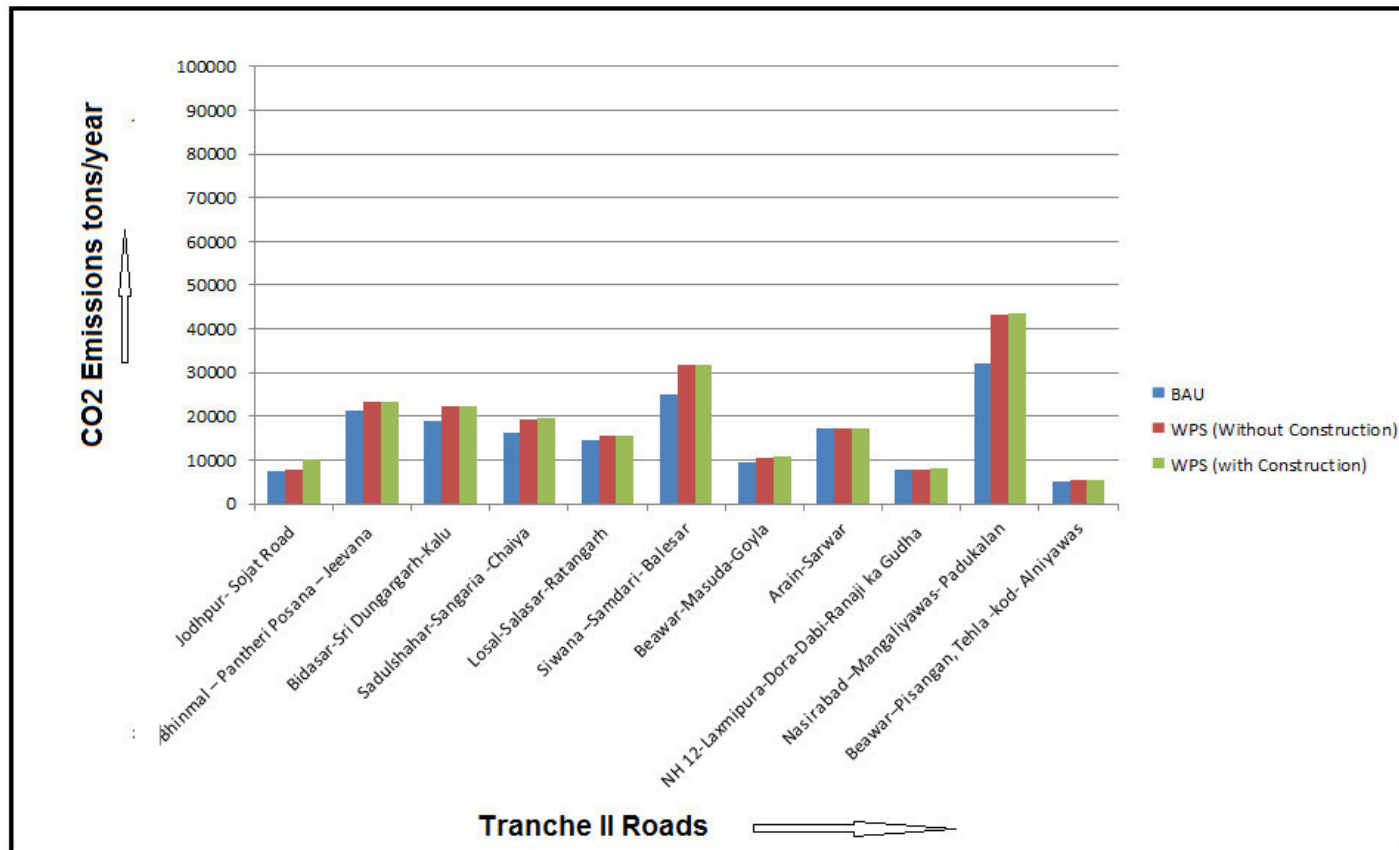
160. The project's CO₂ emission intensity indicators are provided in the succeeding table

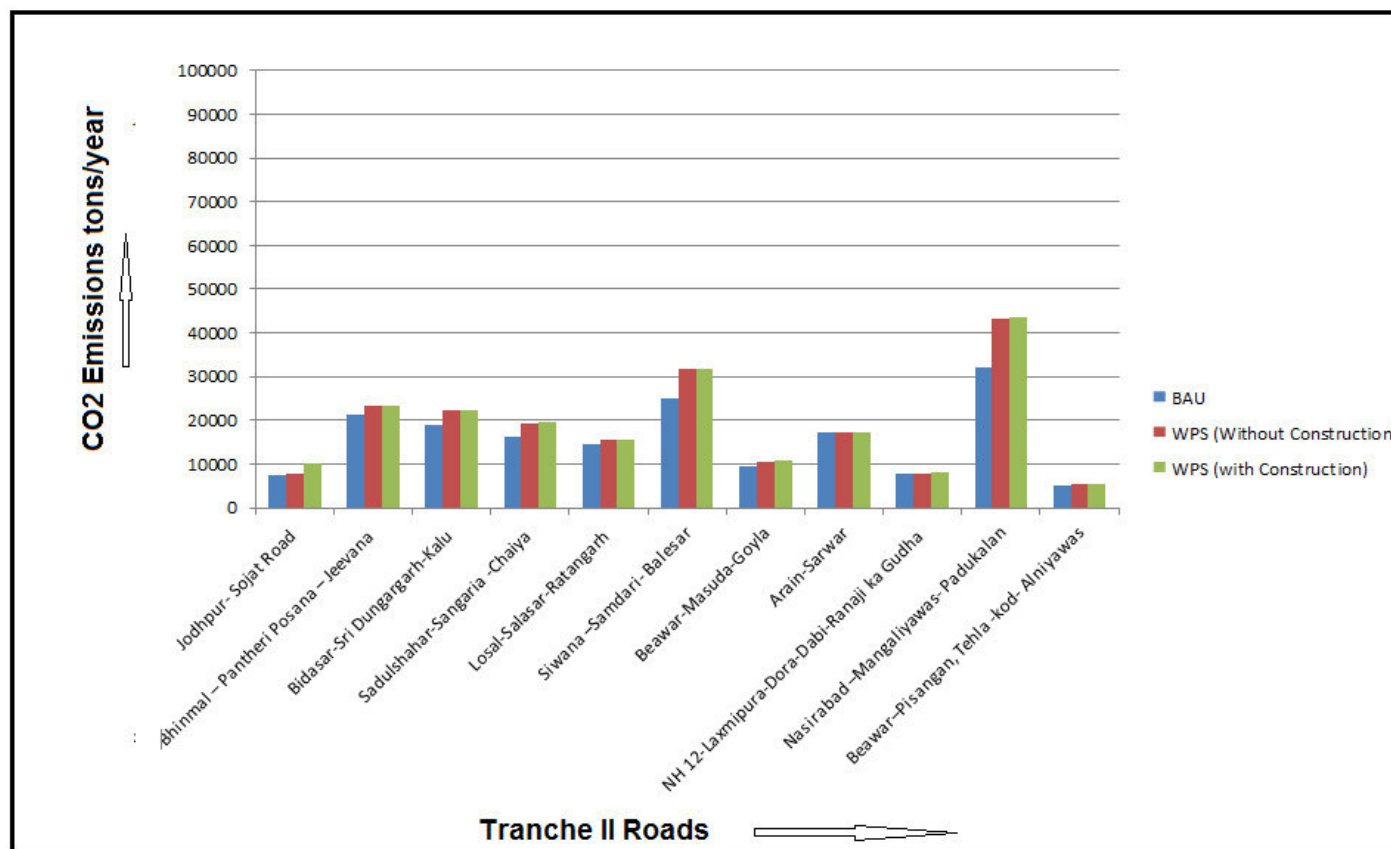
Table 28: Summary of CO2 Emissions with Different Scenarios

S. No.	Road	Road Length (km)	Parameter	Scenario				
				BAU	WPS (Without Construction)	WPS (with Construction)	WPS (without construction & with induced traffic)	WPS (with construction & with induced traffic)
1	Jodhpur- Sojat Road	75.700	total CO2 Emission in Project Life (tons)	146361	149313	152933	270840	274468
			tons/km	6679.60	2012.29	2060.11	3611.32	3659.140
			tons/year	7347.56	7646.69	10195.533	18056	18297.87
			tons/km/year	333.997	100.61	134.147	240.75	243.93
2	Bhinmal – Pantheri Posana – Jeevana	51.580	total CO2 Emission in Project Life	422941	462174	464670		
			tons/km	7,689.00	8,448.55	9008.724		
			tons/year	21147	23233.5	23399.9		
			tons/km/year	384.49	422.43	600.5816		
3	Bidasar-Sri Dungargarh-Kalu	82.200	total CO2 Emission in Project Life	376197	440284	444262		
			tons/km	7,523.94	5404.66	5,453.05		
			tons/year	18809.84	22213.13	22478.33		
			tons/km/year	376.2	270.23	273.43		
4	Sadulshahar-Sangaria Chaiya	95.300	total CO2 Emission in Project Life	324864	383505	388118		
			tons/km	7,734.86	4072.59	4,121.00		
			tons/year	16243	19405.8	19713.3333		
			tons/km/year	386.74	203.63	206.857002		
5	Losal-Salasar- Ratangarh	78.603	total CO2 Emission in Project Life	294535	306340	309960.00	556738	560358
			tons/km	7012.74	3923.54	3969.59	7093.14	7139.194
			tons/year	14726.76	15498	15739.33	28017.92	28259.253
			tons/km/year	350.64	196.18	199.25	354.66	357.730
6	Siwana –Samdari- Balesar	90.65	total CO2 Emission in Project Life	501956	628925	633329		
			tons/km	7381.7	6959.65	6962.888831		
			tons/year	25097.79	31666.46	31666.46		
			tons/km/year	369.09	347.98	351.2188307		
7	Beawar-Masuda-Goyla	67.01	total CO2 Emission in Project Life	192515	205845	209465	360599	364219
			tons/km	7130.19	3126.34	3180.361788	5436.11	5490.131788
			tons/year	9625.76	10473.25	10714.58333	18210.96	18452.29333
			tons/km/year	356.31	156.32	159.9214525	271.81	275.4114525
8	Arain-Sarwar	44.260	total CO2 Emission in Project Life	342048	340837	342967		
			tons/km	7601.07	5196.46	5244.58		

S. No.	Road	Road Length (km)	Parameter	Scenario				
				BAU	WPS (Without Construction)	WPS (with Construction)	WPS (without construction & with induced traffic)	WPS (with construction & with induced traffic)
9	NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha	49.500	tons/year	17102.41	17148.33	17290.33		
			tons/km/year	380.05	259.82	263.03		
			total CO2 Emission in Project Life	156038	153950	156370		
			tons/km	7430.4	3066.07	3114.96		
			tons/year	7801.92	7818.48	7979.81		
10	Nasirabad – Mangaliyawas-Padukalan	62.96	tons/km/year	371.52	153.2	156.46		
			total CO2 Emission in Project Life	642313	861961	865010		
			tons/km	7738.71	10421.81	10470.24		
			tons/year	32115.65	43250.5	43453.77		
			tons/km/year	386.94	521.09	524.32		
11	Beawar–Pisangan, Tehla -kod- Alniyawas (SH-59,VR-64;-H -III)	56.7	total CO2 Emission in Project Life	102884	104492	107251.00		
			tons/km	1018.66	1031.26	1079.92		
			tons/year	5144.22	5362.53	5546.46		
			tons/km/year	50.93	51.56	54.80		

Figure 19: Road wise CO₂ emissions in Tons/year





VII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Meaningful consultation

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

B. Objectives of the Public Consultations

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

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

C. Methodology

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

D. Project Stakeholders

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

E. Consultations with Government Agencies

166. The list of officials from various government departments contacted during IEE preparation and issues discussed is summarized in Table below.

Table 29: Summary of Consultation Held with Government Departments

S. No	Designation	Issues Discussed and Information Obtained
1	Chief Conservator of Forests ,Ajmer	Information was collected about forest stretches falling along Beawar-Masuda-Goyla road and NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha roads in Ajmer ,Bundi and Tonk districts. All help was extended for Biodiversity studies.
2	Deputy Conservator of Forests ,Tonk	
3	Deputy Conservator of Forests, Bundi	
4	Range Forest Officer ,Ganganagar	Shared specific locations of Nilgai and chinkara movement pattern w.r.t to sub- projects; Sadulshahar-Sangaria –Chaiya, Bhinmal – Pantheri Posana – Jeevana and Jodhpur –Sojat. Several generic measures to avoid wildlife-vehicle collisions on high speed highways were suggested by them. They assured full cooperation during implementation of the project to identify location specific mitigation measures for wildlife movement.
5	Deputy Conservator of Forests ,Hanumangarh	
6	Divisional Forest Officer , Jalore	
7	Divisional Forest Officer , Jodhpur	
8	Divisional Forest Officer ,Sikar	Information collected about forest stretches falling along Nasirabad –Mangaliyawas- Padukalan, Beawar–Pisangan-Tehla-kod-Alniyawas, Losal-Salasar-Ratangarh, Bidasar-Sri Dungargarh-Kalu, Jodhpur- Sojat sub-project roads. The officers cross-checked and confirmed that no forest stretch was falling along these sub-project roads and encouraged for road side and avenue plantation .
9	Deputy Conservator of Forests, Churu	
10	Divisional Forest Officer ,Barmer	
11	Divisional Forest Officer ,Pali	
12	Divisional Forest Officer ,Bikaner	
13	Deputy Conservator of Forests, Nagaur	Detailed information was also sought eco-sensitive wet-land. They confirmed that the subprojects were not crossing any eco-sensitive location ,wet land nor migratory route.
14	Member Secretary, Rajasthan Pollution Control Board	
15	Chief Engineer Rajasthan Pollution Control Board	
		Informed the authorities about the coming up Tranche II state highway projects and the permits/ approvals from RPCB. The authorities assured cooperation and support from their side.

Dy.: Deputy, DFO: Divisional Forest Officer, RFO: Range Forest Office, CF, Conservator of Forests, CCF: Chief Conservator of Forests Divn: Division

F. Consultations with Local People/Beneficiaries

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

- Awareness and extent of the project and development components;
- Benefits of the project for the economic and social upliftment of community;
- water logging and drainage problem if any;
- Environment and health
- Flora and fauna of the project area
- Socio-economic standing of the local people

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

- Adequate compensation and rehabilitation assistance to affected households
- Preference to locals in employment and petty contracts during construction
- Active role of gram-panchayats in road development activities
- Labour availability in the project area or requirement of outside labor;
- Local disturbances due to project construction work;
- Improvement in vertical profile of the roads
- Provision of side drains, culverts, safety measures, avenue plantation
- Buses, shelters, parking and lighting markets/built-up areas
- creation of new ponds/water harvesting structures assisted by project
- Water sprinkling in built-up areas.
- Signage and speed restriction near schools and active animal crossing

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

G. Consultations with Women and Vulnerable Groups

170. Focused group discussions were held with women and vulnerable groups. The purpose of these exclusive discussions was to ensure women were aware about the project and understand their concerns and expected benefits out of the project.













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

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

H. Disclosure of information

173. IEE report will be made available at PPP cell of RPWD and respective PIUs. The same will be posted on PWD's website. Based on ADB disclosure requirements, it will be posted on its website.

Table 30: Outcome of Consultations Held in the Project Area

JODHPUR- SOJAT ROAD					
			Demands and Suggestion	Response of Authorities	
Location	Male	Female	<ul style="list-style-type: none">• Participants required information about the rate of Compensation for residential structure.• Suitable location of proposed bypass in Mortuka was desired by villagers• Participants were concerned about the safety of local population and structures along the proposed roads.• Requested for construction of a bus stop in the village	<ul style="list-style-type: none">• The 2013 R&R policy and concerned entitlement matrix was explained to them.• Technically, socially and economically viable bypass will be adopted• Bypass is adopted to safeguard villagers interest• Bus stops are considered in the DPR	
Tibana	9	4			
Pithasani	9	6			
Mortuka	10	5			
Rajola Kallan	14	8			
Naya Gaon	14	10			
Roopwas	11	12			
<div><div><p>Public Consultation at Village Tibana</p></div><div><p>Public Consultation at Village Pithasani</p></div><div><p>Public Consultation at Village Mortuka</p></div><div><p>Public Consultation at Village Nayagaon</p></div><div><p>Public Consultation at Village Roopwas</p></div><div><p>Public Consultation at Village Rajola Kallan</p></div></div>					
<div><div><p>Public Consultation at Village Tibana</p></div><div><p>Public Consultation at Village Pithasani</p></div><div><p>Public Consultation at Village Mortuka</p></div><div><p>Public Consultation at Village Nayagaon</p></div><div><p>Public Consultation at Village Roopwas</p></div><div><p>Public Consultation at Village Rajola Kallan</p></div></div>					
BHINMAL – PANTHERI POSANA – JEEVANA					
Location	Male	Female	<ul style="list-style-type: none">• information Regarding land acquisition• Development of Rotary at junction• Proper drainage ,speed breakers ,signboards and road marking• Proper Railing for animal protection and movement ,fast utility shifting for less power cutoff• Local Borrow areas to be utilized• Bus shelter requirement at Bhagla Septa	<ul style="list-style-type: none">• The 2013 R&R policy and concerned entitlement matrix was explained to them.• All road safety features and road furniture's are included in DPR• Bus stops are considered in the DPR• Request will be made to line departments for quick relocation of utilities• Sufficient cross drainage structures will be provided	
Jeewana	18	7			
Taaliyana	18	5			
Posana	10	6			
Bhundwapur	9	6			
Pantheri	28	17			
Bhagla Septa	14	12			
Narta Kushalpura	9	7			



BIDASAR-SRI DUNGARGARH-KALU					
Location	Male	Female	Demands and Suggestion	Response of Authorities	
Gunsaisar Bada	12	6	<ul style="list-style-type: none"> In Dungargarh-Kalu Section very less amount of tree are present along the road Safety Measures like Zebra Crossing, rumble strips, sign boards near schools & health center to be provided In the Ridi village the existing road passes through many sharp curves in the habitation areas Safety measures for Cows near highways Preference in Employment in the proposed road construction work 	<ul style="list-style-type: none"> Near the habitation shadow trees like Sirus, Neem, Shisham etc. are proposed under compensatory and additional tree plantation All Safety measures are considered in DPR Four curves are proposed for improvement These issues will be properly addressed Preference in Employment will be given to locals as per their ability 	
Ridi village	15	6			
Dungargarh		7			

Public Consultation at Gosaisar Bada Public Consultation with Woman Sarpanch Dungargarh Consultation with Sarpanch of Ridi Village Public Consultation Ridi Village



Public Consultation in Gosaisar Bada

Public Consultation with Woman Sarpanch
Dungargarh

Consultation with Sarpanch of Ridi Village

Public Consultation
Ridi Village**SADULSHAHAR-SANGARIA -CHAIYA**

Location	Male	Female		
Bhompura	17	10	<ul style="list-style-type: none"> Adequate Road safety measures Restriction on honking near built-up areas and sensitive receptors Provision of Bus Shelters Adequate compensation and rehabilitation assistance to affected households Employment and petty contracts during construction to locals 	<ul style="list-style-type: none"> All road safety features and road furniture's are included in DPR No Honking Boards will be provided near sensitive receptors Adequate Bus Shelters are provided The concerned entitlement matrix was explained to them. Preference in Employment will be given to locals as per their ability
Chanduwali	15	8		
Hirasingh Wala	9	11		
Kishanpura Utrada	12	5		



Public Consultation in Bhompura



Public Consultation in Chanduwali



Public Consultation in Hira Singh Wala



Public Consultation in Kishanpura Utrada



Public Consultation in Bhompura



Public Consultation in Chanduwali



Public Consultation in Hira Singh Wala



Public Consultation in Kishanpura Utrada

LOSAL-SALASAR-RATANGARH					
Location	Male	Female	Demands and Suggestion	Response of Authorities	
Singrawat	14	6	<ul style="list-style-type: none">Participants enquired about;<ul style="list-style-type: none">- Road Configurations-Compensation Policy-Proposal in stretches with restricted ROW-Assistance for encroachers and squatters- Suggested to maintain half of the carriageway available for traffic during constructionSpecial Path way forSsalasar pilgrim was desired	<ul style="list-style-type: none">Participant was informed about road configuration,Information about resettlement assistance to non-titleholders was disseminated.They were assured that one lane of the existing road will remain available for the traffic during construction stage.Additional earthen pedestrian walkway of 3m-width from Losal to Nechwa ,R.H.S. and from Salasar to Ratangarh on L.H.S has been proposed for pilgrims	
Mordunga	17	8			
Shahpura	12	5			
Gudawari	27	7			
Malasi	32	12			
					
					
SIWANA –SAMDARI- BALESAR					
Location	Male	Female			
Meli	12	5	<ul style="list-style-type: none">Adequate Road safety measuresBus shelters on both sides in villagesSpeed breakers and signages near schools and habitationsWater Sprinkling in residential areas during constructionAdequate compensation to land looser		
Soorpura	15	6			
Mandli	9	3			
Samdari	16	8			
			<ul style="list-style-type: none">All road safety features and road furniture's are included in DPRadequate Bus Shelters are providedWater sprinkling will be done three times a day on roads during constructionThe 2013 R&R policy and concerned entitlement matrix was explained to them.		



BEAWAR-MASUDA-GOYLA				
Location	Male	Female	Demands and Suggestion	Response of Authorities
Beawar	12	4	<ul style="list-style-type: none"> Side drains and cross drainage in built-up area which remains water-logged during monsoon Measures to avoid accidents due to traffic Congestion during construction Measures to minimize air and noise pollution in residential areas during construction stage 	<ul style="list-style-type: none"> All demands and suggestions have been integrated in final design Proper traffic diversion will be adopted Necessary mitigations already incorporated in the design
Masuda	10	5		
Bandanwada	8	3		
Goyla	25	10		

Public consultation at Beawar,	Public consultation at Masuda,	Public consultation at Bandanwada	Public consultation at Goyala Village



NH 12-LAXMIPURA-DORA-DABI-RANAJI KA GUDHA				
			Demands and Suggestion	Response of Authorities
Location	Male	Female	<ul style="list-style-type: none">Local people informed that in some sections road submerges during normal rainfall alsoParticipants suggested viz., Minimal loss of structures, Adequate Rehabilitation and resettlement ,measuresAdequate safety provisions to be made particularly at locations of school, cattle underpass, provision of bus stop	<ul style="list-style-type: none">Adequate cross drainage structures and side drains will be provided for no water loggingWidening will be accommodated within available ROW and in case Land Acquisition cannot be avoided Proper Rehabilitation and resettlement ,measures will be taken upAll road safety features and road furniture's are included in DPR
Lakharipura	20	9		
Satrn	12	6		
Dora	14	7		
Laxmipura	30	10		
			<div></div> <p>Public Consultation Lakharipura and at Laxmipura, Village</p>	



Public Consultation Lakharipura and at Laxmipura, Village

Location	Male	Female	NASIRABAD –MANGALIYAWAS- PADUKALAN	Response of Authorities
Mangaliyawas	23	9	Demands and Suggestion	
Hanumantpura	10	5	<ul style="list-style-type: none"> • Safety measures like rumble strips and sign boards have been included in design. • Women members voiced their concern regarding safety of their children going to school • Informatory sign boards indicating village name and other relevant information • Employment of from each affected family 	<ul style="list-style-type: none"> • All demands and suggestions incorporated. • Near Every School Govt. and other main private school, sign boards are provided. • All road safety features and road furniture's are included in DPR • Preference to locals especially women will be preferred as per contract clauses.
Padukalan	30	17		



Public Consultation at Mangliyawas



Public Consultation at Hanumantpura



Public Consultation at Padukalan



BEAWAR-PISANGAN, TEHLA -KOD- ALNIYAWAS					
Location	Male	Female	Demands and Suggestion	Response of Authorities	
Nageolao	17	5	<ul style="list-style-type: none"> The proposed ROW width in the Nageolao village should be keep 12m to 14 for Minimum loss of the structures during widening Sign boards should be provided near the school along the proposed road for the safety. Proper compensation should be given to non-titleholders also Bypass for Gola village should be provided in LHS side of Beawar-Pisandan road to save one Temple and 2 Govt. Schools Proper cross drainage structures to be provided on luni to avoid soil cutting. 	<ul style="list-style-type: none"> In the Habitation area where available ROW is insufficient, minimum 12m to Available space will be proposed for PROW. Near Every School Govt. and other main private school, sign boards are provided. Special Entitlement matrix is framed for the sub-project roads based on Land Acquisition Act 2013. In the Gola village 15-20m ROW is available hence existing track will be used , for safety of school children measures like Zebra Crossing, Sign boards etc are proposed. On the Luni river sufficient culverts and stone pitching is proposed to control of soil erosion. 	
Gola	16	8			
Kod	10	20			

<p>Public Consultation in Nageolao Village</p>	<p>Public Consultation in Gola Village</p>	<p>Public Consultation with Sarpanch and Local village women in Kod village</p>
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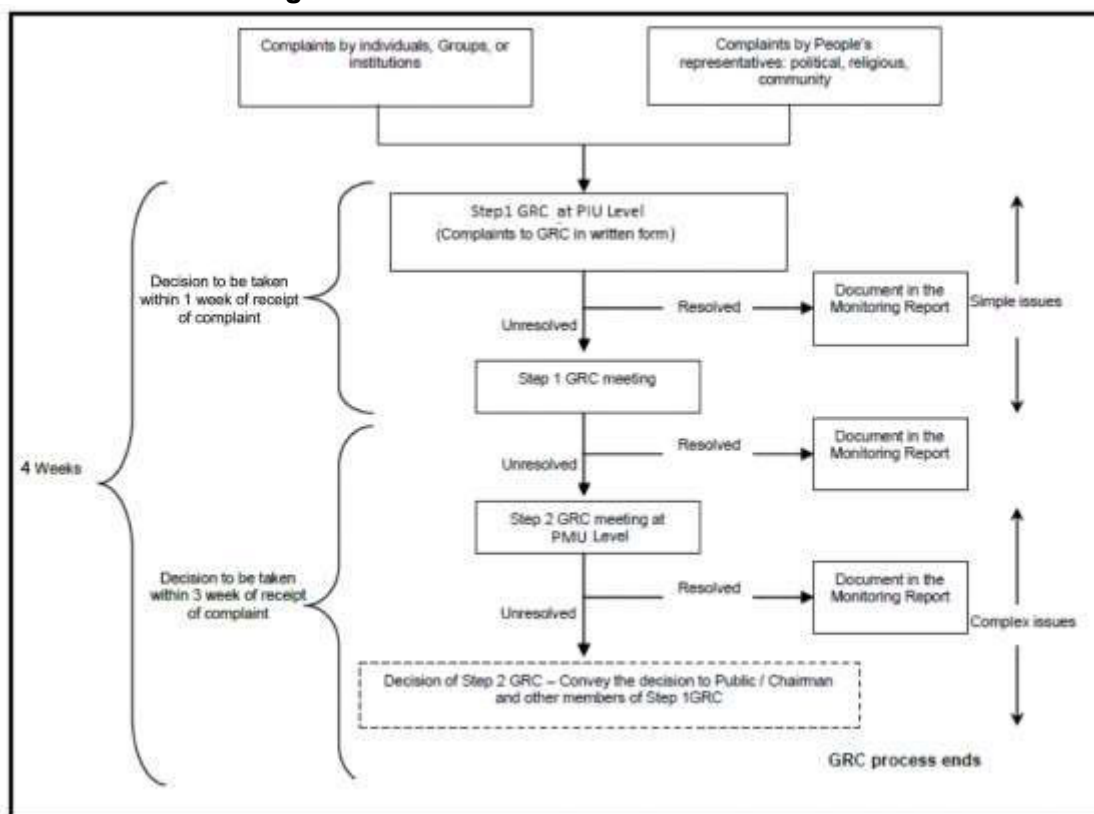
VIII. GRIEVANCE AND REDRESS MECHANISM

174. Grievances related to the implementation of the project, particularly regarding the environmental management plan will be acknowledged, evaluated, and responded to the complainant with corrective actions proposed using understandable and transparent processes that are gender responsive, culturally appropriate, and readily accessible to all segments of the affected people. The responsibility agency for addressing the grievances along with proper timelines will be clearly indicated. Records of grievances received, corrective actions taken and their outcomes will be properly maintained and form part of the environmental monitoring report to ADB.

175. A Grievance Redressal Committee (GRC) will be established at two-levels, one at the District or PIU level and another at PMU level. The GRC will provide an opportunity affected person to have their grievances redressed. Depending on the nature and significance of the grievances or complaints, the GRM will comprise procedures to address grievances at the project site or PIU level, PMU level. Most serious complaints which cannot be addressed at the PIU level will be forwarded to the PMU. The PMU level will comprise members from the PWD, PMC, contractor, local community, and local forestry authority.

176. During preparation of IEE or at latest during pre-construction stage, the local communities in the project area will be informed by the PMC and PIU on the grievance redress procedure and the contact persons for lodging complaints. Provisions shall also be made for lodging complaints at the respective PWD's website.

Figure 20: Grievance Redress Mechanism



IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Environment Management Plan

177. Environmental Management Plan (EMP) is intended to set out clearly and unambiguously the likely negative impacts of construction and/or operation of the project, the action that is required to avoid or mitigate each impact and the responsibility for taking each action. Responsibility is made legally binding when actions are subsequently specified in contracts.

178. The EMP has been prepared based on all foreseen impacts at the time of preparing this IEE. Mitigation measures were identified to reduce the significant adverse impacts including residual effects. As six of the project will be implemented based on engineering, procurement, and construction (EPC) modality a number of construction alternatives like location of camp and plant sites, borrow area, source quarries, and even minor geometric realignments to minimize the number of remains to be decided and from which a host of impacts may be generated and warrants updating of the EMP under the supervision of the PMC and ADB.

B. Environment Monitoring Program

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

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

C. Organizational Set-up

180. The Government of Rajasthan (GOR) through RPWD is the Executing Agency (EA) for the project. The PMU in RPWD will be responsible for ensuring that all components of the EARF are complied with. Under the PMU there will be a number of Project Implementation Units (PIUs) to manage individual road packages or groups of packages under the project. The PIU will be headed by a Project Director (PD). The PMU will have a Safeguard Officer-Environment (SOE) with a rank of Executive Engineer to coordinate with the PD-PIUs to ensure project implementation complies with the EARF and EMP.

181. The Project Management Consultants (PMC) will support the PMU to implement the project and supervise the contractor including environment safeguards. The PMC's team will include one Environmental Specialist to supervise and guide the contractor on implementation of the EMP and EMOP and will assign relevant staff on site per package to oversee day to day implementation of the EMP. The AE for contract packages following EPC modality and IE for contract packages following annuity modality will include an environmental specialist to carry out day to day and on-site supervision and monitoring of environment safeguards. The contractor's team will include health and safety officers and/or environmental focal persons to ensure implementation of the EMP and EMOP. The responsibilities of various agencies and parties for implementing environment safeguards are provided below.

182. Description of key responsibilities of various agencies and parties for implementing environment safeguards are provided below.

- (i) **PPP Division of Rajasthan PWD** will be the project management unit and responsible for the overall compliance of ADB Safeguard Policy Statement 2009 and the applicable laws and rules under the Ministry of Environment, Forest and Climate Change. The PMU will have a safeguard officer-environment (SOE) with a rank of executive engineer to coordinate with the project directors for PIUs to ensure that project implementation complies with the environmental assessment review framework and environmental management plan. The safeguard officer-environment is responsible for:
- Environmental screening and proposed categorization to reflect the significance of potential impacts or risks that a proposed road might present, and advise feasibility for inclusion and identify the needed level of assessment;
 - Reviewing and approving all environment safeguards related documents such as IEE, monitoring reports, and due diligence prepared under the investment program with recommendations and clarifications from the PIUs and PMC where necessary;
 - Continued employment of environmental specialist consultant (recruited under tranche 1) to provide support in preparing IEE reports, processing environmental statutory clearances, permits such as forestry clearances and others on behalf of PMC for roads under tranche 2 and subsequent tranches
 - Timely endorsement and signing of key documents and forwarding to the respective agency required for processing of forestry clearance, tree cutting permit, permission for groundwater extraction, etc., and disclosure on ADB and PWD websites;
 - Ensure all contractors obtain permits, licenses, etc. for activities such as operation of asphalt plants, quarries, borrow areas, etc., before the implementation of the respective construction activity; and
 - Taking proactive and timely measures to address any environment safeguards related challenges at the national or state level such as delays in processing of clearances during pre-construction stage and significant grievances (during construction stage).
 - Review sanctions proposed by the PIU and agree with the contractor/concessionaire on actions to be taken on the sanction

- (ii) **Project implementation units (PIU).** The project implementation unit through the PD will be responsible for supervising implementation of the environmental management plan (EMP) and environmental monitoring plan (EMOP) by the contractor/concessionaire through the following:
- Review all sub-plans identified in the EMP to be prepared by the Contractor to include camp layout, waste/debris management plan, borrow area management plan, traffic management plan with guidance from the PMC;
 - Review monthly/quarterly/annual environmental monitoring reports prepared by the Contractor/concessionaire-Environmental Focal Person (EFP);
 - Conduct monthly site and follow-up inspection to ensure the veracity of the submitted monitoring reports and enforce the EMP and EMOP;
 - Conduct compliance conference with the Contractor/Concessionaire to discuss non-compliance and agree on corrective measures with guidance from the PMC and PMU; and
 - Recommend sanctions to the PMU-SOE in case of recalcitrant contractors/concessionaires.
- (iii) **Project Management Consultant (PMC).** The main objective of Project Management Consultant is to support the project management unit (PMU) implements the environmental requirements of the Project by providing assistance in the monitoring of the EMP implementation by:
- Conduct environmental site induction training workshops to all contractors/concessionaires, IE/AE and PIUs to ensure understanding of the EMP and domestic environmental laws and regulations requirements particularly on the required clearances and permits, training on occupational and community health and safety,
 - Ensure timely mobilization of the Contractor's/concessionaire's EFP
 - Review and verify revised EMPs, sub-plans submitted by the contractor/concessionaire and advise the PMU on adequacy;²⁴
 - Conduct monthly site inspections to check the contractor's/concessionaire's compliance with the EMP and EMOP
 - Participate in public consultations on issues concerning the project and facilitate addressing environment related grievances that may be submitted to the project GRM or elevated by the AE/IE
 - Ensure contractors/concessionaires secure necessary permits and clearances;
 - Prepare environmental due diligence reports on EMP implementation needed for the processing of subsequent tranches;
 - Prepare summary monthly, quarterly, and annual environmental monitoring reports based on the monthly environmental progress reports prepared by the contractors'/concessionaires' EFP and site observations for the review and of PIUs/PMU and approval by PMU;
 - Prepare annual environmental monitoring reports for approval by PMU (copy to PIU, IE/AE) and further submission to ADB for public disclosure;

²⁴ 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.

- Advise the Contractor/concessionaire through the PMU and PIUs on how to comply with requirements and address non-compliances; and
 - Report apparent unanticipated impacts and recommend mitigation measures to the PMU for advising IE/AE to issue necessary instructions to the respective contractor/concessionaire
 - Update the IEE report in situations of unanticipated impacts when deemed necessary
- (iv) **Authority/Independent Engineer.**²⁵The AE/IE will have a dedicated Environment Specialist to monitor the implementation of safeguards standards. The following are the responsibilities of the AE and IE:
- Review the IEE and EMP to understand the background environmental issues of the respective subproject
 - Review and approve the revised EMP and other required sub-plans such as traffic management plan, health and safety plan, waste management plan etc. prepared by the contractor/concessionaire
 - Conduct regular (at least weekly) site inspections and monitor implementation of the EMP and EMOP by the contractor/concessionaire
 - Provide on-site training and technical guidance to the contractor/concessionaire workers as necessary
 - Review the monthly/quarterly/annual reports prepared and submitted by the contractors/concessionaires
 - Prepare monthly reports on monitoring activities, training and other environment safeguard activities implemented
 - Where necessary, identify the need for corrective actions and issue official notices to the contractor/concessionaire to implement the corrective actions with clear timeline
 - Facilitate consultations with the complainant and ensure the grievances are addressed in accordance with the project's GRM system for complaints or grievances encountered onsite, whether through formal or informal channels; elevate issues or complaints to the PMC, as necessary
 - Regularly convene meetings to discuss progress or issues on environment safeguards to ensure that all parties (contractor/concessionaire, PMC, PIU, RPWD) are on the same page on requirements and milestones for environment safeguards
 - Based on the site inspections and review of reports submitted by the contractors/concessionaires, assist the PMC in preparing annual Environmental Monitoring Reports for review and approval by the RPWD. These reports will be further forwarded to ADB for disclosure on their website.
- (v) **Contractor/Concessionaire.** The Contractor/Concessionaire is the principal agent to implement the EMP and EMOP during the pre-construction, construction and operation stage. Specifically, the contractor/concessionaire will:
- Appoint the contractor's/concessionaire's environment focal person and

²⁵ The AE is the supervising authority for contractors that follow the EPC modality. They are also responsible for reviewing and approving the detailed engineering design prepared by the EPC contractor. The Independent Engineer is the supervising authority for contractors for annuity contracts. The AE/IE is not hired under ADB funding.

- attend the site induction workshop to be organized by the PMC;
- Obtain necessary environmental license(s), permits etc., from relevant agencies as specified by EARF (Table 3) for associated facilities for project road works, quarries, hot-mix plant etc. prior to commencement of civil works contracts;
- Implement all mitigation measures in the EMP and activities in the EMOP; Pollution monitoring will be done on a quarterly basis through NABL/MOEFCC²⁶ accredited testing laboratories. Other EMOP items will be monitored on a monthly basis
- Submit monthly, quarterly, and annual progress reports to for approval to the IE/AE and further submission to PIU and PMC for final submission to PMU;
- Ensure that all workers, site agents, including site supervisors and management participate in training sessions delivered by PMC;
- Acquire all environmental statutory requirements (permits, NOCs etc.) and fulfil contractual obligations;
- Ensure the collection of baseline data on environmental quality through accredited third-party laboratories before the start of physical works and ensure the continued collection of data as given in the EMOP during construction and operation;
- Participate in resolving issues as a member of the GRC;
- Respond promptly to grievances raised by the local community or any stakeholder and implement environmental corrective actions or additional environmental mitigation measures as necessary; and
- Based on the results of EMP monitoring, cooperate with the PMC, IE/AE and PIU to implement environmental corrective actions and corrective action plans, as necessary.

(vi) **ADB:** ADB is responsible for the following:

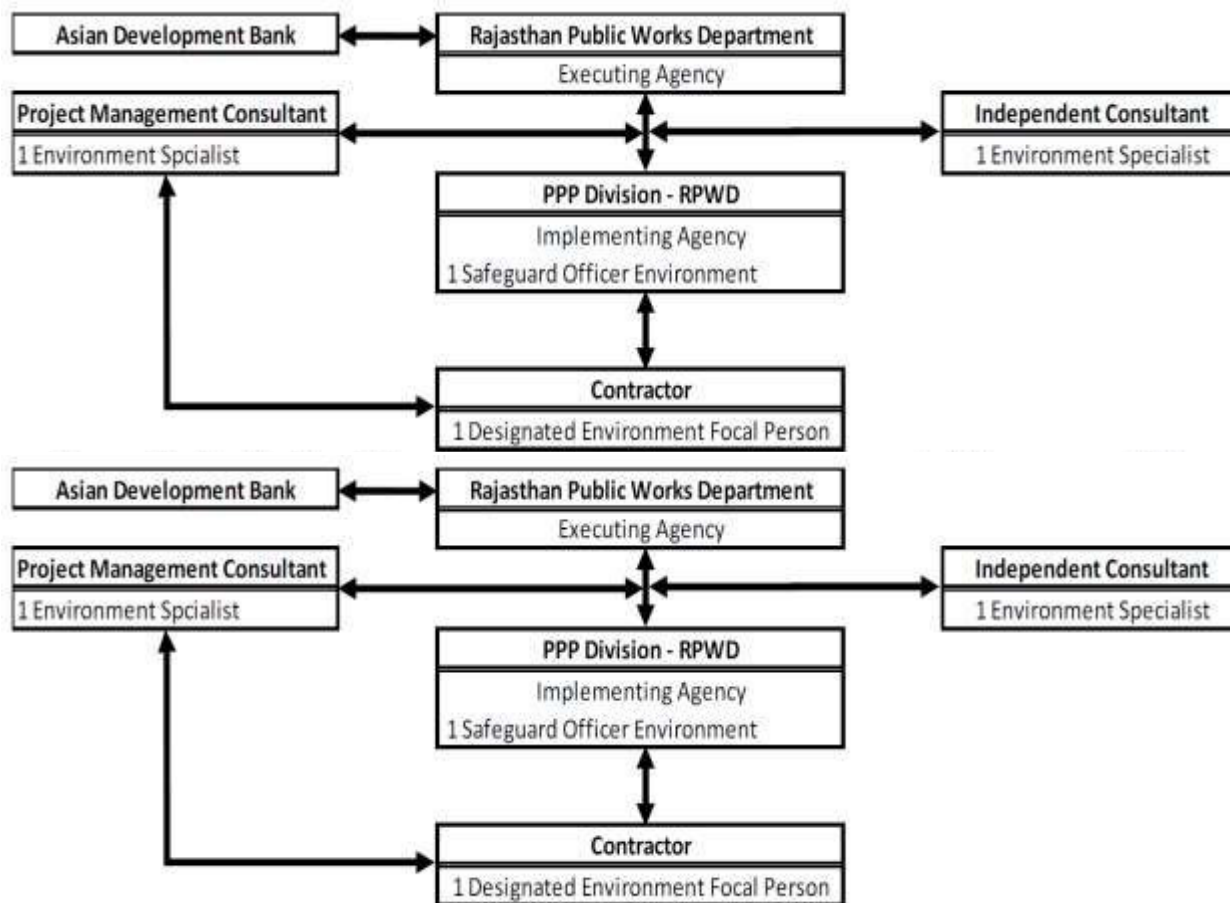
- Review REA checklist and endorse or modify the tranche classification proposed by the PMU
- Review IEE report and disclose the final reports on the ADB website as required;
- Issue tranche/subproject's approval based IEE report;
- Monitor implementation of the EMP through due diligence missions;
- Provide assistance to the RPWD, if required, in carrying out its responsibilities and for building capacity for safeguard compliance;
- Monitor overall compliance of the subprojects to this EARF; and
- If necessary provide further guidance to the RPWD on the format, content, and scope of the IEE report and annual monitoring reports for submission to ADB.

183. The main budgetary need for implementing this EARF is costs for screening and categorization and preparation of IEE reports including EMP and EMOP for subprojects under subsequent tranches. As done for tranche 1 and 2 the RPWD will use their own budgetary resources to recruit Detailed Project Report (DPR) consultants to prepare the subproject specific IEE reports and EMPs. ADB TA resources or staff consultant budget will be used to provide additional support

²⁶ NABL = National Accreditation Board for Testing and Calibration Laboratories; MOEFCC = Ministry of Environment Forests and Climate Change.

to RPWD for finalizing the IEE and EMP to meet the requirements of ADB's SPS if required.

Figure 21: Institutional Arrangement to Implement Environmental Management Plan



D. Environment Management Budget

184. The succeeding Table presents the total budget provided in the civil works contract and RPWD budget to implement the EMP and EMoP. The total cost of about INR 244 million is broken down to the following items:

- a) Mitigation cost which includes dust suppression,²⁷ installation of movable noise barriers,²⁸ connection of side drains to nearby ponds/tanks for water harvesting,²⁹ toll booth water harvesting,³⁰ compensatory plantation,³¹ additional plantation;³²
- b) Monitoring cost which includes air, water, noise, and soil quality; and
- c) Provision of 2 vehicles to the DFO of Barmer and Nokha to assist in the rescue of injured Chinkara from road crashes.

Table 31: Estimated Environment Management Cost as Part of Civil Works

S.No	SH /MDR No.	Name of Road	Design Length (km)	Project Cost (Rs in Cr.)	Environmental Management Cost			
					Mitigation Measures	Monitoring /training	Vehicle for Chinkara Rescue	Total
1	SH-58	Jodhpur- Sojat Road	75.700	230.80	19917500	1276000	500,000	21693500
2	MDR-169	Bhinmal – Pantheri Posana – Jeevana	51.580	130.04	7755000	1195000		8950000
3	MDR-38	Bidasar-Sri Dungargarh-Kalu	82.200	135.13	6634000	1021000		7655000
4	SH-76	Sadulshahar-Sangaria -Chaiya	95.300	136.79	5650000	1204000	500000	7354000
5	SH-07	Losal-Salasar-Ratangarh	78.603	183.37	28332500	1180000		29512500
6	SH-66	Siwana –Samdari-Balesar	90.65	320.14	142267386.3	1132000		143399386.3
		Sub-Total (1)	474.033	1136.27	210556386	7008000	1,000,000	218564386
7	MDR-57	Beawar-Masuda-Goyla	67.01	115.23	9293500	1180000		10473500
8	SH-7E;	Arain-Sarwar	44.260	83.25	3786590	1420000		5206590
9	Mining Road	NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha	49.500	86.53	1548000	898000		2446000
10	MDR	Nasirabad – Mangaliyawas-Padukalan	62.96	106.44	2200000	1006000		3206000
11	(SH-59,VR-64	Beawar-Pisangan, Tehla -kod- Alniyawas	56.7	99.37	2418000	994000		3412000
		Sub-Total (2)	280.43	490.82	19246090	5498000		24744090
Grand Total			754.463	1627.09	229802476		1000000	243308476

²⁷ 29Estimated based on the total length of built-up areas traversed by the road which needs to be sprinkled with water for 30 days, 2 passes per day using a 5.25m³ truck at a cost of INR1,000/truck load.

²⁸ 3mx3m movable noise barrier, metal with foam insulation @ INR 20,000. Total length of barrier is estimates at 30% of the longest continuous built-up area.

²⁹ Estimated at INR1.5M/100 km.

³⁰ Estimated at INR300,000/booth.

³¹ Cost borne by RPWD part of utility shifting cost

³² Beawar-Masuda-Goyla, Arain-Sarwar, NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha, Nasirabad –Mangaliyawas-Padukalan, Beawar–Pisangan, Tehla -kod- Alniyawas.

X. CONCLUSION AND RECOMMENDATION

185. The scope of works under Tranche 2 involves upgrading of existing and recently notified state highways through widening of existing roads into 2 lane with shoulders. All 11 roads with an aggregate length of 755 km are existing,³³ outside any legally protected, eco-sensitive, or critical habitat areas.³⁴ RSHIP Tranche 2 is classified as environment Category B in accordance with the ADB's SPS 2009. Most of the adverse impacts are co-terminus with the construction stage, site specific, limited within the RoW, and are easily mitigated through good engineering and housekeeping practices.

186. Potential significant environmental impacts identified are: i) pre-construction phase: permanent loss of trees, disturbance of national protected species, increase road crashes from inadequate road alignment and design, increase in animal-vehicle crashes from unregulated higher vehicular speed, and localized flooding from inadequate drainage design; ii) construction phase: loss of productive soil from new borrow areas, dust emissions, generation of noise, risks of accident from improper management of borrow areas, and inadequate clean-up operation, restoration and rehabilitation prior to decommissioning. Potential impacts during pre- construction is mitigated through design changes as permanent loss of trees is minimized through alignment selection including minor adjustments and eccentric widening and residual impacts are compensated through mandatory compensatory plantation and voluntary additional plantation. Disturbance of Chinkara and Nilgai is minimized by redesigning some of the pipe to box culverts and allow Chinkara movement and installation of animal crossing to warn drivers. Road crashes emanating from existing poor alignment will be corrected.

187. During construction phase, adequate guidance and resources are provided by RPWD to the Contractor to comply with the borrow area management requirements, suppress dust, control noise, and implement proper closure. A PMC will be engaged by the RPWD to ensure mitigation and monitoring measures are implemented. As the project will be implemented based on engineering, procurement, and construction (EPC) modality, a number of construction alternatives like location of camp and plant sites, borrow area, source quarries, and even minor geometric realignments to minimize the number of remains to be decided and from which a host of impacts will be assessed.

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

³³ Of the total length, 35.30 kms are by-passes to minimize resettlement and are located on agricultural lands.

³⁴ Critical habitat according to the SPS is an area with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for restricted range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers individuals of congregatory species; areas with unique assemblages of species or that area associated with key evolutionary processes or provide ecosystem services; and areas having biodiversity of significant social, economic or cultural importance to local communities.

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

APPENDIX A: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

ROADS AND
HIGHWAYS**Instructions:**

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

Country/Project Title: Rajasthan State Highways Improvement Program Tranche 2

Sector Division: Roads and Highways

Screening Questions	Yes	No	Remarks
A. Project siting			
Is the project area adjacent to or within any of the following environmentally sensitive areas?			
<input type="checkbox"/> Cultural heritage site		x	No cultural heritage site is located within the road ROW or vicinity.
<input type="checkbox"/> Protected area		x	None of the project road is inside or adjacent to any notified protected area.
<input type="checkbox"/> Wetland		x	None.
<input type="checkbox"/> Mangrove		x	None
<input type="checkbox"/> Estuarine		x	None
<input type="checkbox"/> Buffer zone of protected area		x	None
<input type="checkbox"/> Special area for protecting Biodiversity		x	No special biodiversity area is located within the Project area.
B. potential environmental impacts will the project cause...			
<input type="checkbox"/> Encroachment on Historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	x		No encroachment of historical places. However, some religious structures exist along the project road which may get partially impacted. Disfiguration of landscape is not envisaged since it is expansion/reconstruction of existing roads. Cut and fills are required only to improve the vertical profile of the road.

Screening Questions	Yes	No	Remarks
<input type="checkbox"/> Encroachment on precious ecology (e.g. sensitive or protected areas)?		x	<p>No National Parks, wildlife sanctuaries or similar eco-sensitive areas along the project road. Diversion of forestland (12 Ha) is involved in two sub-project roads (Beawar-Masuda-Goyla and NH 12-Laxmipura-Dora - Dabi-Rana ji ka Guda).</p> <p>Erratic and undefined movement of wild animals mainly that of Nilgai (Blue bull) is reported in most of the sub-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 Vermin category of Schedule V so that killing/hunting of such animals are outside purview of regulations. State govt. has nominated Tehsiladar, Ranger officers and other officer of same level to be competent authority for killing of such animals.</p> <p>Besides, movement of Chinkara (a schedule-1 animal as per Wildlife Act but least concern under IUCN classification) was also reported in few sub-projects (Sadulshahar-Sangaria –Chaiya , Bhinmal – Pantheri Posana – Jeevana and Jodhpur -Sojat)</p> <p>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.</p>
<input type="checkbox"/> Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		x	<p>There is no perennial waterway being crossed by the sub-project roads ,non perennial Rivers (Bandi, Banas, Jawai,Luni Mantha, Mashi ,Sukri, sagarmati,Saraswati,Khari,Dai , Rupangarh Kural, Mej ,Brahmani,Ghoda Pachhad, Kantli, Pawta and Kavant) cross Jodhpur –Sojat , Siwana –Samdari-Balesar and Bhinmal – Pantheri Posana – Jeevana -sub-project. 11 New 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 waterway.</p> <p>All culverts construction will be done during lean flow period. There is no waterway or water bodies near cut and fill locations.</p>
<input type="checkbox"/> Deterioration of surface water quality due to silt runoff and sanitary wastes from worker- based camps and chemicals used in construction?	x		<p>A temporary earthen bund or silt fencing will be provided around the construction site to avoid any sedimentation in nearby streams during rainfall.</p> <p>Adequate sanitary facilities and drainage in the workers camps will help to avoid this possibility.</p>

<input type="checkbox"/> 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 short duration during construction period. Appropriate distance from settlement area and wind direction may be taken into account to locate air polluting facility like stone crushing unit etc. use of environment friendly equipment/machineries will
Screening Questions	Yes	No	Remarks
			help to reduce air pollution.
<input type="checkbox"/> Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	x		Workers may 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 minimise 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 operation phase.
<input type="checkbox"/> Noise and vibration due to blasting and other civil works?	x		Blasting is not involved. Ambient noise level is expected to increase in the range of 80-90 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 new quarry, if needed will follow consent conditions of Pollution Control Board and clearance from State Environmental Impact Assessment Authority (SEIAA).
<input type="checkbox"/> dislocation or involuntary resettlement of people		x	Minimal since improvement work will mostly be accommodated within available ROW Except for few bypasses.
<input type="checkbox"/> Dislocation and compulsory resettlement of people living in right-of-way?		x	ROW encroachment in the project state is very uncommon.
<input type="checkbox"/> Disproportionate impacts on the poor, women and children, indigenous peoples or other vulnerable groups?		x	Extent of impact being assessed. Pls refer RP and IPDP.
<input type="checkbox"/> Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?	x		Deterioration in ambient air quality will be localized and temporarily during construction activity. Regular water sprinkling to reduce the dust emission up to negligible standard. Noise barriers at sensitive receptors and community place will be provided to avoid any stress. Extensive plantation along the highway and improved road conditions will improve the air quality of the area.
<input type="checkbox"/> Hazardous driving conditions where construction interferes with pre-existing roads?	x		Suitable traffic management plan will be designed and implemented by the contractor to prevent any hazardous driving condition in above situations.
<input type="checkbox"/> 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.

Screening Questions	Yes	No	Remarks
diseases from workers to local populations?			
<input type="checkbox"/> Creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?		x	No such risk anticipated. Borrow areas are mostly from upland and digging is minimal hence ponding of water is not envisaged.
<input type="checkbox"/> 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.
<input type="checkbox"/> Increased noise and air pollution resulting from traffic volume?	x		Increase in noise and air pollution is expected during construction phase from unpaved road travel, materials handling, earth moving, and fumes from heavy equipment and processing plants. During operation, increase in fumes from motor vehicles may increase.
<input type="checkbox"/> Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	x		This is expected from accidental spillage. Adequate safety provisions have been proposed to avoid such situation.
<input type="checkbox"/> 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.
<input type="checkbox"/> Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		x	Workers will be mostly from local villages. Worker from remote places will be provided with adequate facility.
<input type="checkbox"/> Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	x		Road construction involves handling of hazardous substances like fuel, lubricants, explosives, and bitumen which poses risk during transport and storage.
<input type="checkbox"/> Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.	x		Adequate measures have been adopted to mitigate such risks. Adequate awareness will be created amongst people and workers through information disclosure, safety signage and public consultation about safety aspects.

Checklist for Preliminary Climate Risk Screening

Country/Project Title: Rajasthan State Highway Improvement Program Tranche 2

Sector: Transport

Subsector: Road

Division/Department: SATC/SARD

Screening Questions		Score	Remarks ³⁵
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	The project area has a history of drought but this has very little impact on the road upgrading. The study area does not have flood problem. However, 9 project districts lie in flood prone regions. Flash flood had occurred only in one project district in 2006.
	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 bridge 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 problem or ponding due to over flow of rivers during.
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-third 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 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°C to 3.8°C from the historical monthly average of about 39°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.

³⁵ If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Screening Questions		Score	Remarks ³⁷
	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°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 concessionaires ensure continued good road quality.
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	The predicted increase in temperature is at levels that may cause rutting but not at a scale that can jeopardize the achieving the project objective of providing safe and efficient transport.

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

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

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

Other Comments: _____

Prepared by: Karma Yangzom, Environmental Specialist, SATC.

APPENDIX B: BASELINE AIR QUALITY STATUS IN PROJECT AREA

JODHPUR-SOJAT						
S. No	Locations	PM 10 µg/m3	PM 2.5 µg/m3	Sox µg/m3	NOx µg/m3	CO µg/m3
1	SH-58 Jn with	85.29	57.36	15.21	32.31	0.86
2	Hospital at Rajola	87.46	58.36	15.69	36.25	0.91
3	School, Rupwas.	83.54	54.12	19.57	29.87	0.81
4	Jodhpuria Gate Sojat	89.38	52.36	14.98	32.16	0.79
BHINMAL – PANTHERI POSANA – JEEVANA						
1	Daspan	76	30	5.2	13.6	BDI
2	Svavat	67	25	4.8	11.2	BDI
3	Jeevana Road	79	34	5.8	14.2	BDI
Bidasar-Sri Dungargarh-Kalu						
1	Bidasar	91.10	45.25	16.98	29.50	0.82
2	Dharmas	79.10	35.30	16.12	28.22	0.80
3	Bana	75.50	38.70	15.13	31.36	0.70
4	Sri Dungargarh	80.10	37.56	14.25	28.30	0.72
5	Gusainsar	78.20	40.20	14.55	29.10	0.76
6	Ladera	76.20	36.90	15.05	30.23	0.71
7	Adsar	82.70	41.54	16.54	33.10	0.72
8	Kalu	83.14	39.35	15.10	29.75	0.76
Sadulshahar- Sangaria -Chaiva						
1	Sadulshahar	82.5	47.5	16.5	29.5	0.91
2	Amargarh	82.53	44.87	13.89	29.95	0.7
3	Singhwala	78.1	37.23	16.43	26.5	0.75
4	Sangaria	70.5	40.3	13.97	29.2	0.61
5	Saliwala	70.95	34.88	18.04	28.3	0.68
6	Tandooriwali	81.6	36.98	17.12	31.48	0.77
7	Tibbi	76.35	42.1	15.89	30.9	0.71
8	Silwala	67.85	38.2	14.69	33.2	0.64
Losal-Salasar-Ratangarh						
1	Losal	73.17	39.80	9.26	14.79	0.09
2	Salasar	75.53	42.04	9.27	16.03	0.08
3	Ratangarh	64.21	41.29	9.17	15.81	0.094
Siwana –Samdari- Balesar						
1	Karmawas	61.66	40.04	12.05	19.85	0.79
2	Kalyanpur	79.66	45.01	14.02	24.00	0.80
3	Mandli	71.97	41.80	9.85	17.98	0.79
4	Rodua Khurd	75.84	44.61	11.85	21.86	0.80
5	Samadari (Common	71.16	40.29	8.01	16.66	0.71
Beawar –Masuda-Goyla						
1	Sanspura	59.8	40.5	13.4	10.5	0.10
Arain-Sarwar						
1	Arai	85.10	48.10	15.10	25.10	0.80
2	Jorawarpura	78.20	40.60	13.67	28.10	0.67
3	Borada	76.20	45.54	11.50	29.10	0.60
4	Fatehgarh	80.20	38.00	17.18	26.10	0.74
5	Sarwar	70.24	39.20	13.07	27.50	0.69
NH 12-Laxmipura-Dora-Dabi-Ranaji ka Gudha						
1	Laxmipura	111	63.3	<4	<5	<1
2	Ranajikaguda	158	99.2	<4	<5	<1
Nasirabad –Mangaliyawas- Padukalan						
1	Mangaliyawas	60	33	14.2	18.9	-
2	Sarasadi	56	34	15.1	20.5	-
3	Hanumantpura	60	36	15.9	20.7	-
4	Riya Badi	55	43	14.8	17.5	-
5	Padukalan	63	46	16.7	20.4	-
Beawar–Pisangan. Tehla -kod- Alniyawas						
1	Beawar City	118.50	59.20	24.50	35.85	0.9
2	Nagelao	78.40	39.17	15.19	30.93	0.71
4	Pisangan	75.25	40.56	13.55	32.8	0.7
5	Govindgarh	69.39	42.50	14.65	35.57	0.65
6	Tehla	78.10	35.55	14.52	29.40	0.71
7	Alniyawas	74.25	44.44	15.05	30.20	0.68

Appendix B (i) WORLD BANK AND GOI AMBIENT AIR QUALITY STANDARDS

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

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

APPENDIX C: NOISE LEVEL IN PROJECT AREA

JODHPUR -SOJAT			
S. No	Locations	Leq – Day in dB (A)	Leq – Night dB (A)
1	SH-58 Jn with Dangyabas Bypass	65	59.2
2	Hospital at Rajola Kallan	54.3	47.9
3	Adarsh Higher Secondary School, Rupwas.	56.4	47.1
4	Jodhpuria Gate Jn, Sojat	64.2	58.4
BHINMAL – PANTHERI POSANA – JEEVANA			
1	Daspan	56.70	43.9
2	Siyavat	52.6	43.8
3	Jeewana Road	55.8	47.4
BIDASAR-SRI DUNGARGARH-KALU			
1	Bidasar	53.80	43.10
2	Dharmas	50.15	41.15
3	Bana	51.30	42.10
4	Sri Dungargarh	52.90	43.20
5	Gusainsar	50.10	40.10
6	Ladera	51.55	41.86
7	Adsar	51.50	41.60
8	Kalu	52.10	42.20
SADULSHAHR- SANGARIA -CHAIYA			
1	Sadulsahar	50.2	41.2
2	Amargarh	54.8	42.36
3	Singhwala	53.12	42.55
4	Sangaria	49.18	40.26
5	Saliwala	53.33	41.65
6	Tandooriwali	51.21	40.2
7	Tibbi	50.2	41.2
8	Silwala	49.13	40.34
LOSAL-SALASAR-RATANGARH			
1	Losal	56.3	53.3
2	Salasar	58.9	54.3
3	Ratangarh	53.8	51.4
SIWANA –SAMDARI- BALESAR			
1	Karmawas	51.5	34.2
2	Kalyanpur	57.5	41.4
3	Mandli	46.7	34.7
4	Dhandhaniwas	50.8	38.3
5	Samadari (Common with SH 68)	58.7	42.6
BEAWAR –MASUDA-GOYLA			
1	Sanspura	59	35

S. No	Locations	Leq – Day in dB (A)	Leq – Night dB (A)
ARAIN-SARWAR			
1	Arai	55.20	44.20
2	Jorawarpura	50.20	41.26
3	Borada	51.80	42.54
4	Fatehgarh	52.10	40.50
5	Sarwar	52.10	40.50
NH 12-LAXMIPURA-DORA-DABI-RANAJI KA GUDHA			
1	Laxmipura	78.6	44.5
2	Ranagikaguda	77.5	44.7
NASIRABAD –MANGALIYAWAS- PADUKALAN			
1	Mangliyawas	60	52
2	Sarasadi	52	43
3	Hanumantpura	65	45
4	Riya Badi	72	54
5	Padukalan	62	53
6	Kalesara	65	52
7	Govindgarh	66	45
8	Padu Khurd	55	40
BEAWAR–PISANGAN, TEHLA -KOD- ALNIYAWAS			
1	Beawar City	59.20	46.20
2	Nagelao	53.10	42.50
3	Pisangan	52.80	41.54
4	Govindgarh	50.18	41.26
5	Tehla	54.10	43.20
6	Alniyawas	53.10	41.50

Appendix C (i): NOISE LEVEL STANDARDS OF WORLD BANK EHS AND GOI NAAQS

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

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

APPENDIX D: WATER QUALITY IN PROJECT AREA**JODHPUR-SOJAT**

S. No	Parameters	Unit	Rajola Kallan village	Rupwas village
1	pH at 25C	--	8.020C 8.420C	8.020C 8.420C
2	Colour	Hazen	BDL	BDL
3	Turbidity	NTU	BDL	BDL
4	Odour	--	Agreeable	Agreeable
5	Taste	--	Agreeable	Agreeable
6	Total Hardness (as CaCO ₃)	mg/l	389.23	376.46
7	Calcium as Ca	mg/l	59.52	85.62
8	Alkalinity as CaCO ₃	mg/l	321.06	316.52
9	Chloride (as Cl)	mg/l	89.56	76.35
10	Cyanide as CN	mg/l	BDL (DL 0.02 mg/l)	BDL (DL 0.02 mg/l)
11	Magnesium as Mg	mg/l	58.49	39.56
12	Total Dissolved Solids (as TDS)	mg/l	630	560
13	Sulphate as SO ₄	mg/l	75.63	74.12
14	Flouride (as F)	mg/l	1.02	0.89
15	Nitrate as NO ₃	mg/l	23.61	20.62
16	Iron (as Fe)	mg/l	0.26	0.29
17	Aluminum as Al	mg/l	BDL (DL 0.03 mg/l)	BDL (DL 0.03 mg/l)
18	Boron	mg/l	0.68	0.67
19	Hexa Chromium as Cr+6	mg/l	BDL (DL 0.01 mg/l)	BDL (DL 0.01 mg/l)
20	Phenolic Compound	mg/l	BDL (DL 0.001 mg/l)	BDL (DL 0.001 mg/l)
21	Mineral oil	mg/l	BDL (DL 0.01 mg/l)	BDL (DL 0.01 mg/l)
22	Anionic Detergent as MBAS	mg/l	BDL (DL 0.02 mg/l)	BDL (DL 0.02 mg/l)
23	Zinc as Zn	mg/l	0.28	0.19
24	Copper as Cu	mg/l	0.15	0.17
25	Manganese as Mn	mg/l	B(DL 0.10 mg/l)	B(DL 0.10 mg/l)
26	Cadmium as Cd	mg/l	BDL (DL 0.001 mg/l)	BDL (DL 0.001 mg/l)
27	Lead as Pb	mg/l	BDL (DL 0.01 mg/l)	BDL (DL 0.01 mg/l)
28	Selenium as Se	mg/l	BDL (DL 0.01 mg/l)	BDL (DL 0.01 mg/l)
29	Arsenic as As	mg/l	BDL (DL 0.01 mg/l)	BDL (DL 0.01 mg/l)
30	Mercury as Hg	mg/l	BDL (DL 0.001 mg/l)	BDL (DL 0.001 mg/l)
31	Total Coliform	MPN	<2/100 ml	<2/100 ml
32	E coli	per 100 ml	Absent	Absent

BHINMAL – PANTHERI POSANA – JEEVANA

S.No.	Parameters	Unit	Daspa	Syavat	Jeevana Road
1	pH	-	6.63	7.32	6.86
2	Conductivity	µmho s/cm	5180	2610	9700
3	Colour	Hazen Unit	Colourless	Colourless	Colourless
4	Odour	-	Unobjection	Unobjectionable	Unobjectionable
5	Taste	-	Agreeable	Agreeable	Agreeable
6	Turbidity	NTU	4	3	4
7	Total Dissolved Solids	mg/l	3384	1692	6680
8	Total Alkalinity	mg/l	430	330	350

S.No.	Parameters	Unit	Daspa	Syavat	Jeevana Road
9	Residual Chlorine	mg/l	NT	NT	NT
10	Total Hardness as CaCO ₃	mg/l	410	220	1560
11	Calcium as Ca	mg/l	120	56	288
12	Magnesium as Mg	mg/l	26.7	19.4	204
13	Chlorides as Cl	mg/l	790	660	1280
14	Sulphate as SO ₄	mg/l	340	130	360
15	Nitrates as NO ₃	mg/l	49.4	34.6	52.6
16	Fluoride as F	mg/l	1.52	1.34	1.62
17	Phenolic compound	mg/l	<0.001	<0.001	<0.001
18	Cyanide	mg/l	<0.01	<0.01	<0.01
19	Arsenic as As	mg/l	<0.001	<0.001	<0.001
20	Alluminium	mg/l	<0.01	<0.01	<0.01
21	Mercury as Hg	mg/l	<0.001	<0.001	<0.001
22	Cadmium as Cd	mg/l	<0.001	<0.001	<0.001
23	Chromium as Cr	mg/l	<0.005	<0.005	<0.005
24	Iron as Fe	mg/l	0.18	0.13	0.28
25	Copper as Cu	mg/l	0.09	0.04	0.11
26	Lead as Pb	mg/l	<0.001	<0.001	<0.001
27	Manganese as Mn	mg/l	<0.05	<0.05	<0.05
28	Zinc as Zn	mg/l	1.36	1.22	1.48
29	Selenium as Se	mg/l	<0.01	<0.01	<0.01
30	Boron	mg/l	<0.1	<0.1	<0.1
31	Detergent as MBAS	mg/l	<0.1	<0.1	Nil
32	Oil & Grease	mg/l	Nil	Nil	<0.1
33	Total coliform	MPN/100ml	Nil	Nil	Nil

BIDASAR-SIR DUNGARGARH-KALU

S. No.	Parameters	Unit	Bidasar	Dharmas	Bana	Dungargarh	Gusainsa	Ladera	Adsar	Kalu
2	pH	° C	7.38	7.20	7.42	7.85	7.46	7.55	7.27	7.58
3	Hardness (total)	mg/l	294.20	321.40	369.10	340.10	262.50	352.10	411.10	300.60
4	Iron	mg/l	0.31	0.29	0.33	0.28	0.32	0.33	0.35	0.30
5	Chloride	mg/l	98.12	95.85	84.66	91.92	100.10	108.14	104.50	80.52
6	TDS	mg/l	490.00	438.10	400.00	410.00	430.140	520.40	540.140	370.20
7	Calcium	mg/l	61.56	73.77	68.59	65.20	44.50	60.10	81.24	42.52
9	Magnesium	mg/l	34.17	33.37	48.11	43.11	36.81	49.12	50.64	47.27

S. No.	Parameters	Unit	Bidasar	Dharmas	Bana	Dungargarh	Gusainsa	Ladera	Adsar	Kalu
10	Copper (as Cu)	mg/l	0.21	0.26	0.20	0.33	0.24	0.23	0.21	0.21
11	Sulfate (as SO ₄)	mg/l	44.25	37.76	58.26	44.87	41.33	51.14	45.23	41.37
12	Fluoride (as F)	mg/l	0.90	0.74	0.81	0.78	0.91	1.03	0.88	0.74
13	Zinc (as Zn)	mg/l	0.24	0.23	0.26	0.24	0.32	0.19	0.26	0.25
14	Alkalinity-T	mg/l	177.36	162.65	172.10	124.66	150.78	188.50	185.44	123.50
15	Aluminum	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
16	Boron (as B)	mg/l	0.80	0.68	0.81	0.87	0.84	0.88	0.80	0.77
17	Selenium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
18	Barium as B ⁺⁺	mg/l	<1	<1	<1	<1	<1	<1	<1	<1

SADULSHAHAR- SANGARIA -CHAIYA

S. No.	Parameters	Unit	Sadulsahar	Amargarh	Singhwala	Sangaria	Saliwala	Tandooriwali	Tibbi	Silwala
1	Turbidity	NTU	>1	>1	>1	>1	>1	>1	>1	>1
2	PH		7.28	7.62	7.01	7.15	7.72	7.9	7.4	7.6
3	Hardness	mg/l	450.1	368.48	462	527.38	391.6	222.3	501.5	253.6
4	Iron	mg/l	0.3	0.32	0.35	0.34	0.28	0.3	0.37	0.36
5	Chloride	mg/l	217.5	97.97	212.36	193.63	91.24	47.5	210.9	144.37
6	TDS	mg/l	620	430	590.2	662.3	392.3	313	580.1	305.2
7	Calcium	mg/l	106.56	51.53	95.37	105.69	48.66	40	90.56	56.44
8	Odour	Un objectionable								
9	Magnesium	mg/l	44.77	58.29	54.44	64.07	65.66	0.05	66.95	27.41
10	Copper (as Cu)	mg/l	0.32	0.29	0.18	0.3	0.3	0.21	0.37	4
11	Sulfate (as SO ₄)	mg/l	31.45	31.76	49.23	54.25	37.16	35.43	32.83	26.35
12	Fluoride (as F)	mg/l	1.13	0.63	0.85	0.98	0.89	0.32	1.01	1.1
13	Zinc (as Zn)	mg/l	0.74	0.44	0.25	0.63	0.4	0.28	0.68	0.77
14	Alkalinity-T	mg/l	218	315.1	292.15	352.77	212.05	88	146.4	122.15
15	Aluminum	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
16	Boron (as B)	mg/l	0.73	0.65	0.9	0.91	0.96	0.28	0.78	0.5
17	Selenium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
18	Barium as B ⁺⁺	mg/l	<1	<1	<1	<1	<1	<1	<1	<1

TDS-Total Dissolved Solids.

LOSAL –SALASAR-RATANGARH

S.No.	Parameters	Unit	Losal	Salasar	Ratangarh
1	Specific Conductance	µS/cm	4250	6150	4020
2	pH value		7.1	7.7	7.3
3	Total hardness	mg/l	860	1100	820
4	Sulphate	mg/l	186.2	186.2	186.2
5	Chloride	mg/l	1600	2300	1236
6	Fluoride	mg/l	1.4	1.4	1.4
7	Total Dissolved Solids	mg/l	3240	4560	2960
8	Total Alkalinity	mg/l	420	586	410
9	Calcium	mg/l	184.0	259.2	174.4
10	Magnesium	mg/l	97.6	110.3	93.7
11	Nitrate	mg/l	8.7	9.5	9.0
12	Fixed Residue	mg/l	2560	3280	2370
13	Volatile Residue	mg/l	680	1280	590

SIWANA –SAMDARI- BALESAR

S. No.	Parameters	Unit	Locations				
			Karmawas	Kalyanpur	Mandli	Rodua Khurd	Samadari
1	pH		8.02	7.79	7.52	7.48	8.14
2	Temperature	°C	25.8	26.1	26.3	26.0	27.5
3	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0
4	Conductivity @25°C	µS/cm	758	772	1455	1467	1240.0
5	Sulphate (SO ₄)	mg/l	115.6	109.4	179.6	159.91	282.00
6	Nitrate (NO ₃)	mg/l	6.6	5.9	10.9	11.1	5.02
7	Total Hardness	mg/l	192.2	205.12	425	489	352.0
8	Chloride (as Cl)	mg/l	36.39	38.74	58.65	61.85	110.50
9	Fluoride (as F)	mg/l	1.72	1.65	1.76	1.58	1.30
10	COD (as O ₂)	mg/l	5.5	5.3	6.71	6.33	16.00
11	Iron (as Fe)	mg/l	0.09	0.12	0.13	0.14	0.14
12	Dissolve Oxygen	mg/l	7.6	7.8	6.8	7.1	7.40
13	Total Dissolved Solid	mg/l	500.16	513.18	960.21	968	716.0
14	BOD (3 days at 27°C)	mg/l	<2.0	<2.0	<2.0	<2.0	<2.00
15	Calcium (as Ca)	mg/l	54.8	62.15	98.3	108.3	122.50
16	Magnesium (as Mg)	mg/l	13.24	11.94	43.02	52.38	21.20
17	Arsenic (as As)	mg/l	BDL	BDL	BDL	BDL	BDL
18	Lead (as Pb)	mg/l	BDL	BDL	BDL	BDL	BDL
19	Copper (as Cu)	mg/l	BDL	BDL	BDL	BDL	BDL
20	Zinc (as Zn)	mg/l	0.15	0.13	1.12	0.97	3.57
21	Manganese (as Mn)	mg/l	BDL	BDL	BDL	BDL	BDL
22	Total Chromium (as	mg/l	BDL	BDL	BDL	BDL	BDL
23	Sodium (as Na)	mg/l	34.5	41.35	91.7	96.7	32.45
24	Potassium (as K)	mg/l	8.73	13.65	22.3	24.1	4.33
25	Total Alkalinity (as	mg/l	203.89	220.15	471.65	503.14	582.30
26	Total Solid	mg/l	<0.1	<0.1	<0.1	<0.1	526.45
27	Phosphate (as P)	mg/l	124	119	145.3	138.6	163.40
28	Nitrite (as NO ₂)	mg/l	BDL	BDL	BDL	BDL	BDL
29	Total Suspended	mg/l	1.62	1.58	2.13	2.5	4.26
30	Faecal Coliform		Absent				
31	Total Coliform	---	Absent				

BEAWAR –MASUDA-GOYLA

S.No	Parameters	Unit	Sanspura
1	Specific Conductance	μS/cm	2630
2	pH Value		7.8
3	Total Hardness, (as CaCO ₃),	mg/l	712
4	Sulphate (as SO ₄),	mg/ l	87.3
5	Chloride (as Cl),	mg/l	750
6	Fluoride (as F),	mg/l	1.2
7	Total Dissolved Solids	mg/l	1870
8	Total Alkalinity,	mg/l	440
9	Calcium (as Ca),	mg/l	148.8
10	Magnesium (as Mg),	mg/l	83.0
11	Nitrate (as NO ₃),	mg/l	7.5
12	Fixed Residue,	mg/l	1480
13	Volatile Residue,	mg/l	390

ARAIN-SARWAR

S. No.	Parameters	Unit	Locations				
			Arai	Jorawarpur	Borada	Fatehgarh	Sarwar
1	Turbidity	NTU	>1	>1	>1	>1	>1
2	pH	°C	7.52	7.54	7.3	7.54	7.48
3	Total Hardness(as CaCO ₃)	mg/l	520	384.9	392.2	464	297.45
4	Iron	mg/l	0.36	0.29	0.35	0.27	0.3
5	Chloride		340	98.56	139.97	115.47	89.24
6	Total Dissolved Solids (as TDS)	mg/l	580.1	350.5	640	360	360.8
7	Calcium	mg/l	126	67.25	56.88	72.72	81.54
8	Odour		Unobjectionable				
9	Magnesium	mg/l	49.97	52.76	60.82	68.66	22.84
	Copper (as Cu)	mg/l	.18	0.42	0.24	0.18	0.2
10	Sulfate (as SO ₄)	mg/l	27.45	46.87	34.93	57.93	42.78
11	Fluoride (as F)	mg/l	1.53	0.78	0.82	0.9	0.74
12	Zinc (as Zn)	mg/l	0.26	1.05	0.14	0.24	0.29
13	Alkalinity-T	mg/l	233.15	164.2	452.15	147.22	102.85
14	Aluminum	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
15	Boron (as B)	mg/l	0.68	0.72	0.71	0.69	0.82
16	Selenium <0.01	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
17	Barium as B ⁺⁺	mg/l	<1	<1	<1	<1	<1

NH 12-LAXMIPURA-DORA-DABI-RANAJI KA GUDHA

S.No	Parameters	Units	Laxmipura	Ranajikaguda
1	pH		7.12	7.41
2	Turbidity	NTU	2.1	2.5
3	Conductivity	µmhos/cm	121	215
4	Chlorides as Cl	mg/lit	62	60
5	Alkalinity	mg/lit	110	110
6	Total Hardness as CaCO ₃	mg/lit	111	111
7	Ca Hardness as CaCO ₃	mg/lit	321	322
8	Mg Hardness as CaCO ₃	mg/lit	212	321
9	Total Dissolved solids	mg/lit	151	331
10	Sulphat as SO ₄	mg/lit	68	77.5
11	Iron as Fe	mg/lit	0.9	0.9
12	Nitrate as NO ₃ -N	mg/lit	0.33	0.33
13	Nitrate as NO ₃ -N	mg/lit	0.4	0.4
14	Calcium as Ca	mg/lit	42.5	42.5
15	Magnesium as Mg	mg/lit	22.5	22.5
16	Phosphate as P	mg/lit	<0.3	<0.3
17	Sodium as Na	mg/lit	95.3	95.3
18	Potassium as K	mg/lit	36	22.6
19	Fluoride as F	mg/lit	3.5	3.5
20	Manganese as Mn	mg/lit	<0.1	<0.1
21	Copper as Cu	mg/lit	<0.1	<0.1
22	Chromium as Cr	mg/lit	<0.1	<0.1
23	Ammonia as	mg/lit	<0.1	<0.1
24	E- Coli	No. per 100 ml	<2	<2

NASIRABAD –MANGALIYAWAS- PADUKALAN

S. No.	Parameters	Unit	Locations				
			Mangliyawas	Sarasadi	Hanumantpura	Riya Badi	Padukalan
1	Temperature		20	19	20	19	18
2	pH	°C	8.1	7.8	7.6	7.5	7.4
3	Dissolved Oxygen		4.5	4.2	5.1	4.9	4.2
4	Conductivity	µmhos/cm	1100	1020	1060	1100	1140
5	Alkanity-T	mg/l	400	420	350	430	460
6	Total Dissolved Solids (as TDS)	mg/l	620	640	715	735	660
7	Calcium	mg/l	146	110	90	110	140
8	Magnesium	mg/l	140	146	176	130	180
9	Sulfate (as SO ₄)	mg/l	26	48	29	28	30
10	P	mg/l	BDL	BDL	BDL	BDL	BDL
11	NO ₃	mg/l	BDL	BDL	BDL	BDL	BDL
12	E- Coli	MPN/100 m	BDL	BDL	BDL	BDL	BDL

BEAWAR-PISANGAN, TEHLA -KOD- ALNIYAWAS

S. No.	Parameters	Unit	Locations					
			Beawar City	Nagelao	Pisangan	Govindgarh	Tehla	Alniyawas
1	Turbidity	NTU	>1	>1	>1	>1	>1	>1
2	pH	°C	7.57	7.04	7.32	7.48	7.95	7.68
3	Total Hardness(as	mg/l	853.1	784	382.2	2129.9	117.6	372.4
4	Iron	mg/l	0.36	0.35	0.34	0.35	0.3	0.32
5	Chloride		946.09	512.47	137.97	1793.63	98.55	93.62
6	Total Dissolved Solids (as TDS)	mg/l	1460	1260	580	2940.1	412.5	520.3
7	Calcium	mg/l	156.56	125.44	54.88	309.68	19.6	50.96
8	Odour	Unobjectionable						
9	Magnesium	mg/l	112.38	114.45	59.6	329.81	16.69	59.59
	Copper (as Cu)	mg/l	0.42	0.18	0.24	0.44	0.25	0.29
10	Sulfate (as	mg/l	29.45	79.25	34.92	99.35	61.88	47.44
11	Fluoride (as F)	mg/l	1.53	1.21	1.8	1.66	1.02	1.5
12	Zinc (as Zn)	mg/l	1.05	0.24	0.14	1.05	0.18	0.24
13	Alkanity-T	mg/l	233.15	492.45	452.15	552.75	462.3	412.05
14	Aluminum	mg/l	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01
15	Boron (as B)	mg/l	0.68	0.9	0.61	0.99	0.92	0.94
16	Selenium <0.01	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
17	Barium as B++	mg/l	<1	<1	<1	<1	<1	<1

APPENDIX E: INDIAN STANDARD SPECIFICATIONS FOR DRINKING WATER IS: 10500

S.NO.	Parameter	Requirement desirable Limit	Remarks
1.	Colour	5	May be extended up to 50 if toxic substances are suspected
2.	Turbidity	10	May be relaxed up to 25 in the absence of alternate
3.	pH	6.5 to 8.5	May be relaxed up to 9.2 in the absence
4.	Total Hardness	300	May be extended up to 600
5.	Calcium as Ca	75	May be extended up to 200
6.	Magnesium as Mg	30	May be extended up to 100
7.	Copper as Cu	0.05	May be relaxed up to 1.5
8.	Iron	0.3	May be extended up to 1
9.	Manganese	0.1	May be extended up to 0.5
10.	Chlorides	250	May be extended up to 1000
11.	Sulphates	150	May be extended up to 400
12.	Nitrates	45	No relaxation
13.	Fluoride	0.6 to 1.2	If the limit is below 0.6 water should be rejected, Max. Limit is extended to
14.	Phenols	0.001	May be relaxed up to 0.002
15.	Mercury	0.001	No relaxation
16.	Cadmium	0.01	No relaxation
17.	Selenium	0.01	No relaxation
18.	Arsenic	0.05	No relaxation
19.	Cyanide	0.05	No relaxation
20.	Lead	0.1	No relaxation
21.	Zinc	5.0	May be extended up to 10.0
22.	Anionic detergents (MBAS)	0.2	May be relaxed up to 1
23.	Chromium as Cr ⁺⁶	0.05	No relaxation
24.	Poly nuclear aromatic Hydrocarbons	--	--
25.	Mineral Oil	0.01	May be relaxed up to 0.03
26.	Residual free Chlorine	0.2	Applicable only when water is chlorinated
27.	Pesticides	Absent	--
28.	Radio active	--	--

APPENDIX F: General Standards for Discharge of Environmental Pollutants**Part – A: Effluents**

Sl.No.	Parameter	Standards			
		Inland Surface water	Public Sewers	Land of irrigation	Marine/Costal areas
1.	Colour and odour	See 6 of Annexure-1	--	See 6 of Annexure -1	See 6 of Annexure -1
2.	Suspended solids mg/1, max.	100	600	200	For process waste water 100 For cooling water effluent 10 per cent above total suspended mater of influent
3.	Particle size of suspended solids	Shall pass 850 micron IS Sieve	--		Floatable solids, solids max. 3 mm Settleable solids. Max 856 microns
4.	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	Shall not exceed 5 ^o C above the receiving water temperature	--	--	Shall not exceed 5 ^o C above the receiving water temperature
6.	Oil and grease, mg/1 max.	10	20	10	20
7.	Total residual chlorine, mg/1 max	1.0	--	--	1.0
8.	Ammonical nitrogen (as N), mg/l, max.	50	50	--	50
9.	Total nitrogen (as N), mg/l, max.	100	--	--	100
10.	Free ammonia (as NH ₃), mg/l, max	5.0	--	--	5.0
11.	Biochemical oxygen demand (3 days at 27 ^o C), mg/l, max	30	350	100	100
12.	Chemical oxygen demand, mg/l, max	250	--	--	250
13.	Arsenic (as As) mg/l, max	0.2	0.2	0.2	0.2

Sl.No.	Parameter	Standards			
		Inland Surface water	Public Sewers	Land of irrigation	Marine/Costal areas
14.	Mercury (as Hg), mg/l, max	0.01	0.01	--	0.01
15.	Lead (as Pb), mg/l, max	0.1	0.1	--	2.0
16.	Cadmium (as Cd), mg/l, max	2.0	1.0	--	2.0
17.	Hexavalent chromium (as Cr+6), mg/l, max	0.1	2.0	--	1.0
18.	Total chromium (as Cr), mg/l, max	2.0	2.0	--	2.0
19.	Copper (as Cu), mg/l, max	3.0	3.0	--	30
20.	Zinc (as Zn), mg/l, max	5.0	15	--	15
21.	Selenium (as Se), mg/l, max	0.05	0.05	--	0.05
22.	Nickel (as Ni), mg/l, max	3.0	3.0	--	50
23.	Cyanide (as CN), mg/l, max	0.2	2.0	0.2	0.2
24.	Fluoride (as F), mg/l, max	2.0	15	--	15
25.	Dissolved phosphates (as P), mg/l, max	5.0	--	--	--
26.	Sulphide (as S), mg/l, max	2.0	--	--	5.0
27.	Phenolic compounds (as C ₆ H ₅ OH), mg/l, max	1.0	5.0	--	5.0
28.	Radioactive materials				
	a. α emitters micro cure mg/l, max	10 ⁻⁷	10 ⁻⁷	10 ⁻⁸	10 ⁻⁷
	β emitters micro curemg/l, max	10 ⁻⁶	10 ⁻⁶	10 ⁻⁷	10 ⁻⁶

Sl.No.	Parameter	Standards			
		Inland Surface water	Public Sewers	Land of irrigation	Marine/Costal areas
29.	Bio-assay test	90 % survival of fish after 96 hours in 100 % effluent	90 % survival of fish after 96 hours in 100 % effluent	90 % survival of fish after 96 hours in 100 % effluent	90 % survival of fish after 96 hours in 100 % effluent
30.	Manganese (as Mn)	2 mg/l	2 mg/l	2 mg/l	2 mg/l
31.	Iron (as Fe)	3 mg/l	3 mg/l	3 mg/l	3 mg/l
32.	Vanadium (as V)	0.2 mg/l	0.2 mg/l	--	0.2 mg/l
33.	Nitrate Nitrogen	10 mg/l	--	--	20 mg/l

* These standards shall be applicable for industries, operations or processes other than those industries. Operations or process for which standards have been specified in Schedule of the Environment Protection Rules 1989.

APPENDIX G: Predominant Species of Trees Affected due to widening

Table 3:SpeciesWise Lst of Trees to be Felled			
Local Name	<i>Botanical Name</i>	Local Name	<i>Botanical Name</i>
Ardu	Ailanthus excelsaroxb.	Khejri	Prosopisspicigerallinn
Babul	Acacia arabicaroxb	Khair	Acacia catechu wild
Bahera	Terminalia belericaroxb	Leswa	Cordia Dichotoma
Bakain	Melia azidarachtalinn	Neem	Azadirachtaindica a. Juss.
Bargad	Ficusbegalensislinn	Nimboo	Citrus medicalinn
Ber	Zizyphus mauratianalamk	Pipal	Ficusreligiosalinn
Bel	Aegle marmeloscorrea	Safeda	Eucalyptus(Ganganagar)
Dhak	Butea monosperma (lank) taub	Semal	Salimaliainalabaria (d.c.) Schott&endt.
Gular	Ficusglomerataroxb	Senjna	Moringaoleiferalamk
Gunda	Cordia dichotomaforst. F.	Shahtoot	Morus alba linn
Imli	Tamarindus indianlinn.	Shisham	Dalbergiasissooroxb.
Jamun	Syzygium cumini (linn) skeets	Siris (Safed)	Albizziaprocerabenth
Kaith	Feronia limonia (linn)swingle	Siris (Kala)	Albiizialebbekbenth
Karanja	Pongamia pinnata (linn) pierre	Sitaphal	Anonasquamosalinn
Katechu	Acacia Catachu	Vilayati Babool	Prosopiajuliflorahk. F & t.
Khajur	Phoenix sylvestrisroxb		

APPENDIX H: ROAD SPECIFIC ENVIRONMENTAL MANAGEMENT AND MONITORING PLANS

ENVIRONMENT MANAGEMENT PLAN FOR JODHPUR- SOJAT (SH-58)

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions	<ul style="list-style-type: none"> CBR value of sub grade as per IRC guidelines Roadside drains to avoid water logging in built-up sections Provision of adequate no. of cross drainage structures. Increased size of existing structures with inadequate waterway Existing causeways to be replaced with CD structures 	Design Requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	Refer for list of proposed bridges and culverts (Supplementary Appendix-1) Roadside drains (both sides together) Covered=11.61 km Unlined=111.45 km Speed Breaker = 40 locations near built-up areas, school, and toll plazas	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	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 concessionaire	Design Consultant	RPWD
1.2 Safety along the proposed alignment	<ul style="list-style-type: none"> Vertical and horizontal geometrics in consistent to IRC/MORTH guidelines Speed breakers in habitat areas, junction, near sensitive receptors and curves to regulate speed. Provision of retro-reflective warning signboards near school, hospital, religious places and forests Informatory signage near habitated areas Ambulance and medical aid posts Checking for overloading at toll plazas Footpath over covered drain 	Design requirement IRC:SP:73-2007 IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 Horizontal geometry as per IRC: 38-1988 and vertical geometry based on IRC: SP 23-1993.	Speed Restrictions in all built-up sections Road Studs throughout the corridor Delineator=666 nos Footpaths in built-up section=5.95 kms	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	RPWD
2. Natural Hazards 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
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	<ul style="list-style-type: none"> Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders. 	IRC: 37- 2012 for flexible pavement design, IRC :81- 1997 for strengthening of flexible pavement	Entire stretch (Supplementary Appendix-2) Covered=11.61 km Unlined=111.45 km	<u>MI:</u> Pavement Surface and bridge expansion joints during extreme heat <u>PT:</u> 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		
2.2 Earthquake	<ul style="list-style-type: none"> 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	<u>MI:</u> Bridge and Culverts_ <u>PT:</u> 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	concessionaire	RPWD
2.3 Drought	<ul style="list-style-type: none"> The design of foundations and sub-structures shall conform to IRC guidelines and MORTH clause Ensure water availability for compaction work and consolidation of sub-structure 	IRC:78-2000 Standard Specifications and Code of Practice for Road Bridges	Minor bridge at 39.500	<u>MI:</u> Sub-structure of bridges <u>PI:</u> Sub-structures are consolidated and compacted	Design drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	concessionaire	

3. Loss of Land and Assets

[illegible]

[illegible]

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.1 Preparatory activities	<ul style="list-style-type: none"> ▪ Submit appointment letter and resume of the 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 ▪ EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE ▪ Request PMC-ES copy of monthly monitoring formats and establish deadlines for submission. ▪ EFC 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. ▪ EFC will submit for approval of PMC-ES the construction camp layout before its establishment. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part of construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the contractor until the site induction training is carried out by the PMC Site induction training includes but not limited to: <ul style="list-style-type: none"> 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (Prevention and Control of Pollution) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<u>MI</u> : PM10 level measurements Complaints from locals due to dust <u>PT</u> : PM10 level < 100 ug/m ³ Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
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	<ul style="list-style-type: none"> Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the 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 RPWD 	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	<p><u>MI</u>: Levels of HC, SO₂, NO₂, and CO. Status of PUC certificates</p> <p><u>PT</u>: SO₂ and NO₂ levels are both less than 80ug/m³. PUC certificate of equipment and machinery is upto date</p>	<p>Standards CPCB methods</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Concessionaire	RPWD /CSC
3. Noise								
3.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during day time near residential areas Implement noisy operations intermittently to reduce the total noise generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Honking restrictions at built-up area PPEs to workers Noise monitoring as per EMoP. 	Legal requirement Noise Pollution (Regulation and Control) Amendment Rules, 2017 + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	<p>. Throughout project section especially at construction sites, residential and identified sensitive locations.</p> <p>Pls refer (Supplementary Appendix-4) for information on sensitive receptors</p>	<p><u>MI</u>: day and night Noise levels. Number of complaints from local people</p> <p><u>PT</u>: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas</p>	<p>As per Noise rule, 2017</p> <p>Consultation with local people</p> <p>Review of noise level monitoring data maintained by contractor</p> <p>Observation of construction site</p>	Included in civil works costs	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Land and Soil								
4.1 Land use Change and Loss of productive / topsoil	<ul style="list-style-type: none">Non-agricultural areas to be used as borrow areas to the extent possible.If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion.Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse	Project requirement	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	RPWD /CSC
4.2 Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none">Side slopes of all cut and fill areas will be graded. 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 and control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	MI: Occurrence of slope failure or erosion issues PT: No slope failures. Minimal erosion issues	Review of design documents and site observation	Included in civil works cost	Concessionaire	RPWD /CSC
4.3 Borrow area management	<ul style="list-style-type: none">Obtain EC from SEIAA and compliance to EC conditions of SEIAABarren and uncultivated land to be selected as borrows area.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 guidelines (IRC 10: 1961) for its operation and rehabilitationBorrow areas not to be dug continuously.To the extent borrow areas shall be sited away from habitated areas.Borrow areas shall be leveled in environmental friendly manner	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 Guidelines for Borrow Areas management	Borrow sites location	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management and No.of accidents. PT: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints	Review of design documents and site observations Compare site conditions with EC conditions by SEIAA	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 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	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Concessionaire	RPWD /CSC
4.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p><u>MI</u>: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p><u>PT</u>: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<p><u>MI</u>: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p><u>PT</u>: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>	Site observation	Included in civil work cost.	Concessionaire	RPWD /CSC
5. Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Provision of water harvesting structure to augment groundwater condition in the area 	CGWA Guidelines	<p>Throughout the Project section</p> <p>Toll Plaza and enhancement of existing roadside water harvesting structures being used by local peoples</p>	<p><u>MI</u>: Approval from competent authority Complaints from local people on water availability</p> <p><u>PT</u>: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil work cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.2 Disposal of water during construction	<ul style="list-style-type: none"> 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	<u>MI</u> : Presence /absence of water logging in project area. <u>PT</u> : No water logging	Standards methods Site observation and review of documents	Included in civil work cost	Concessionaire	RPWD /CSC
5.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc.	<u>MI</u> : Proper flow of water in existing streams and rivers <u>PT</u> : No record of overtopping/ water logging	Review of design documents Site observation	Included in civil works cost	Concessionaire	RPWD /CSC
5.4 Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Slopes to be modified suitably to restrict the soil debris entering water bodies/ existing water harvesting structures along the road such as /tanka/johads Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. 	Design requirement, Clause No 501.8.6.MORT &H Specification s for Road and Bridgeworks	Near all water bodies /waterway (Supplementary Appendix-5)	<u>MI</u> : Presence /absence of siltation in harvesting structures along roadside <u>PT</u> : quality confirm to turbidity and TSS limit	Field observation	Included in civil works cost	Concessionaire	RPWD /CSC
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	<ul style="list-style-type: none"> No vehicles or equipment should be parked or refueled near existing harvesting structures like tanka,Johad Road runoff shall be allowed only through oil interceptors Chemicals and oil shall be stored on concreted platform with catchment pit for spills collection. Construction camp to be sited away from existing water harvesting str. Wastes must be collected, stored and taken to approve disposal site only. 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Water harvesting structures present along the road, refueling stations, construction camps.	<u>MI</u> : Water quality of existing water harvesting structures present along the road <u>PT</u> : Surface water quality meets freshwater quality standards prescribed by CPCB	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6. Flora and Fauna								
6.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none">▪ Restrict tree cutting upto toe line considering safety to road users.▪ Obtain requisite permit for tree cutting.▪ Mandatory compensatory plantation at 1:3 basis▪ Additional plantation on 1:3 basis as per the IRC guidelines to be carried out by concessionaire▪ Regular maintenance of trees▪ 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 3m 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=360 Additional Plantation on1:3 basis	<u>MI</u> : ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. <u>PT</u> : Additional compensatory afforestation done on 1:3 basis by concessionaire.	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. Additional compensatory afforestation costs included in civil works costs	Mandatory Compensatory plantation by forest Department and additional plantation by concessionaire	RPWD /CSC
7. Construction Camps								
7.1 Impact associated with location	<ul style="list-style-type: none">▪ 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 #500 m from water bodies/harvesting structures # 500 m from through traffic route	Design Requirement The Water (Prevention and Control of Pollution) Act,1974and its amendments thereof	All construction camps	<u>MI</u> : Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps <u>PT</u> : Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included in civil works cost	Concessionaire and EO	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Worker's Health in construction camp	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved b EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste. The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. 	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	<p><u>MI</u>: Camp health records</p> <p>Existence of proper first aid kit in camp site</p> <p>Complaints from workers.</p> <p><u>PT</u>: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.</p>	<p>Camp records</p> <p>Site observation</p> <p>Consultation with contractor workers and local people living nearby</p>	Part of the civil works costs	Concessionaire	RPWD /CSC
8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	At all Dumping/ Disposal Sites	<p><u>MI</u>: Location of dumping sites Number of public complaints.</p> <p><u>PT</u>: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
8.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	<p><u>MI</u>: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p><u>PT</u>: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.	Concessionaire	RPWD /CSC
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	<ul style="list-style-type: none"> 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". <p>Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.</p>	The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document	Throughout the project corridor especially at intersections.	<p><u>MI</u>: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p><u>PT</u>: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever animal /cattle movement is expected. Construction activities in these sections to be done during night time to the extent feasible. Proper signage to be displayed near common resource properties guiding pedestrians access route. 	Same as above	Near habitation, on both sides of schools, temples, hospitals, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	RPWD /CSC
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites, Construction camps, crushers etc.	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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	<p><u>MI</u>: Safety signs and Incidence of accidents Complaints from local people</p> <p><u>PT</u>: Zero incident of accidents. Zero complaints.</p>	<p>Site inspection</p> <p>Consultation with local people</p>	Included in civil works cost	Concessionaire	RPWD /CSC
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<p><u>MI</u>: Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. <u>PT</u>: Clean and tidy sites. No trash or debris left on site. Site restored and leveled.</p>	<p>Site observation</p> <p>Interaction with locals</p> <p>Issue completion certificate after restoration of all sites are found satisfactory</p>	Included in civil works cost.	Concessionaire	RPWD /CSC
Operation and Maintenance stage								
1. Wildlife Movement								
1.1 Anticipated risk of vehicle-animal collision and human-animal conflict	<ul style="list-style-type: none"> Effectiveness of mitigative measures (rumble strips, informatory /cautionary signage, clearance of shrubs from right of way, maintaining 15m distance between 2 trees during avenue plantation etc.) recommended in design stage shall be monitored. RPWD to keep record of all accidents. Fresh assessment in case of future widening 	Project Requirement	At identified animal crossing locations	<p><u>MI</u>: Number, location and causes of vehicle - animal collision. Cause of collision.</p> <p><u>PT</u>: minimum vehicle – animal collisions. No of consultation done with forest department</p>	<p>Site Observation</p> <p>Discussion with local People</p> <p>Collection of information from Forestry Department</p>	Included in Operation / Maintenance cost	RPWD field offices/Forest Department	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Air Quality								
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none">Roadside tree plantations shall be maintained at least with 70% survival rate.Regular maintenance of the road will be done to ensure good surface conditionAmbient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.Signages shall be provided reminding 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 equipments	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<u>MI</u> : Ambient air quality (PM ₁₀ , CO,SO ₂ NO ₂) <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	RPWD	
3. Noise								
3.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation to 20 km/hour and honking restrictions near sensitive receptorsConstruction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution (Regulation and Control) Amendment Rules, 2017	Sensitive receptors as identified in IEE locations.	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	Noise monitoring as per noise rules ,2017 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Land and Soil								
4.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures.	Project requirement	At bridge location and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	RPWD	
5. Water resources/Flooding and Inundation								
5.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion and stabilization conditions for its effective maintenance.	Project requirement	Near existing water bodies/water harvesting structures near the road	<u>MI</u> : Water quality <u>PT</u> : No turbidity in harvesting structure present along road	Site observation	Included in Operation / Maintenance cost	RPWD	
5.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	RPWD	
6. Flora								
6.1 Vegetation	<ul style="list-style-type: none">Planted trees to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>PT</u> : Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	RPWD/Forest Department	
7. Maintenance of Right of Way and Safety								
7.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain ROW completely clear of shrubs.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures, including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented. 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. Clearance of shrubs from ROW annually to provide better lateral visibility to avoid collision with wild animals and cattles 	IRC:SP:55-2014	Throughout the Project route	<p><u>MI</u>: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law</p> <p><u>PT</u>: Fatal and non fatal accident rate is reduced after improvement</p>	<p>Review accident records</p> <p>Site observations</p>	Included in Operation / Maintenance cost	RPWD	
7.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	-	Throughout the project stretch	<p><u>MI</u>: Status of emergency system – whether operational or not</p> <p><u>PT</u>: Fully functional</p>	<p>Review of spill prevention and emergency response plan</p> <p>Spill accident records</p>	Included in Operation / Maintenance cost	RPWD	

SUPPLEMENT TO EMP**(Jodhpur- Sojat)****Supplementary Appendix-1: Improvement proposal for bridges and cross drainage structures**

S. No	Culvert Location Design Chainage (Km)	Type of Drainage Structure Proposed	Span Arrangement Proposed (m)
1	2.000	Major Bridge	3x21
2	4.960	HP	1x1.2
3	5.645	HP	1x1.2
4	13.780	HP	1x1.2
5	15.700	HP	1x1.2
6	17.150	HP	1x1.2
7	18.310	HP	1x1.2
8	20.446	Major Bridge	5x21
9	23.130	HP	1x1.2
10	24.000	HP	1x1.2
11	25.550	Major Bridge	7x20
12	27.210	HP	1x1.2
13	28.050	HP	1x1.2
14	28.920	HP	1x1.2
15	29.720	HP	1x1.2
16	30.950	HP	1x1.2
17	32.550	HP	1x1.2
18	33.900	HP	1x1.2
19	35.200	HP	1x1.2
20	36.390	HP	1x1.2
21	38.090	Box	1x2.0
22	39.190	Minor Bridge	2x21
23	40.578	Minor Bridge(retained)	2x8.2
24	41.660	HP	1x1.2
25	44.720	HP	1x1.2
26	44.836	Box	1x6.0
27	49.270	HP	1x1.2
28	51.760	HP	1x1.2
29	53.180	HP	1x1.2
30	54.490	HP	1x1.2
31	55.800	Box	1x2.0
32	56.600	Major Bridge	3x21
33	57.800	Minor Bridge	1x21
34	59.280	HP	1x1.2
35	60.860	HP	1x1.2
36	62.360	HP	1x1.2

S. No	Culvert Location Design Chainage (Km)	Type of Drainage Structure Proposed	Span Arrangement Proposed (m)
37	63.800	HP	1x1.2
38	65.340	HP	1x1.2
39	65.990	HP	1x1.2
40	67.500	HP	1x1.2
41	68.975	HP	1x1.2
42	70.130	HP	1x1.2
43	71.180	HP	1x1.2
44	72.680	HP	1x1.2
45	73.450	Major Bridge	7x17
46	74.800	Box	1x2.0
47	75.670	HP	1x1.2

Supplementary Appendix-2: Side Drains

S. No	Design chainage		Side	Design length	Type of Drain
	From	to		meters	
1	0.000	6.100	Both	6.100	Earthen/ Unlined
2	6.100	6.600	Both	0.500	Concrete
3	6.600	13.700	Both	7.100	Earthen/ Unlined
4	13.700	15.900	Both	2.200	Concrete
5	15.900	31.960	Both	16.060	Earthen/ Unlined
6	31.960	32.065	Both	0.105	Concrete
7	32.065	35.300	Both	3.235	Earthen/ Unlined
8	35.300	36.300	Both	1.000	Concrete
9	36.300	45.400	Both	9.100	Earthen/ Unlined
10	45.400	46.400	Both	1.000	Concrete
11	46.400	49.450	Both	3.050	Earthen/ Unlined
12	49.450	50.400	Both	0.950	Concrete
13	50.400	61.480	Both	11.080	Earthen/ Unlined
14	61.480	62.600	Both	1.120	Concrete
15	62.600	75.700	Both	13.100	Earthen/ Unlined

Supplementary Appendix-3: Curve Improvement

S. No.	Chainage	Length (km)	Speed	Remarks
1	19.140 to 19.600	0.460	100	Curve Improvement
2	28.760 to 29.920	1.160	100	Curve Improvement
3	32.065 to 32.230	0.165	100	Curve Improvement
4	45.125 to 45.400	0.275	100	Curve Improvement
5	45.815 to 46.300	0.485	100	Curve Improvement
6	46.470 to 46.800	0.330	100	Curve Improvement

Supplementary Appendix-4: List of Noise Sensitive Receptors

Sr. No.	Particulars	Chainage (Km)	Side (Left/ Right)	Approximate distance from Centre line	Physical Impact
1	Primary Health Centre Rajola Kalan	36.350	LHS	13.57m	yes
2	Hospital at Chhadwas	49.650	LHS	16.2m	yes
3	Hospital	62.700	RHS	13.2m	yes
Educational Institute					
4	School Fitkasni Rashida	6.200	LHS	15.38m	Partially
5	School Rashida Village	6.450	RHS	7.7m	Partially
6	Primary School Sarnada, Luni	9.415	RHS	6.74m	Partially
7	High School, kakelao	12.300	RHS	30m	no
8	Govt. School, Piplai	18.390	RHS	15m	Partially
9	Higher Secondary School, Lolavas	32.027	LHS	7.5m	no
10	School in Rajola	35.800	LHS	30m	no
11	School Rajola Kalan	36.200	LHS	13.57m	Partially
12	School at Nayagaon	45.500	LHS	12.9m	yes
13	Higher Secondary School, Chhadwas	49.850	LHS	30m	no
14	Adarsh Higher Secondary School Rupawas	61.720	LHS	4.75m	no
15	Pvt. School Higher Secondary, Charbhuj Ka Shikshan Sansthan	61.830	RHS	10.8m	no
16	Primary School	62.500	RHS	5m	Partially
17	Higher Secondary School, Sojat City	75.900	RHS	12m	Partially

Supplementary Appendix-5: List of Water Bodies/Waterways along the Project Road

S. No	Ch. Km	Type of Water body /Water ways	Distance from Centre Line(m)	Side (Left/Right)	Perennial / Non perennial
1	2.000	Jojari River	0.000	Crossing	Non perennial
2	20.446	Mithri River	0.000	Crossing	Non perennial
3	25.550	Luni River	0.000	Crossing	Non perennial
4	39.190	Radiya River	0.000	Crossing	Non perennial
5	56.60	Guhiya River	0.000	Crossing	Non perennial
6	57.800	New Tributary of Guhiya River	0.000	Crossing	Non perennial
7	73.450	Sukri River	0.000	Crossing	Non perennial
8	32.300	Pond	0.000	LHS	Pond
9	35.950	Pond	0.000	LHS	Pond
1	42.050	Pond	0.000	LHS	0.000

Besides, there are a number of nallah being crossed by the project mostly non-perennial

ENVIRONMENTAL MONITORING PLAN FOR JODHPUR- SOJAT

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Air Quality	Construction stage	PM ₁₀ PM _{2.5} SO ₂ , NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	1 sampling per km of built up area during active construction: Jodhpur (2), Dangiyabas (2), Sardaro ki Dhani (2), Kakelao(4), Miyasani(4), Peethasoni(4), Mortuka(4), Lolawas(4), Rajola Kalan(2), Chopra(2), Nayagaon(4), Chaddwas(4), Sojat(4), Total 42 Batching and hotmix plants sampling part of SPCB annual renewal of permits	During Active Construction	Air quality standard by CPCB	42X9000= 378,000	Concessionaire through approved monitoring agency	RPWD /CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3 =Rs 81,000	RPWD through approved monitoring agency	RPWD
Water Quality	Construction stage	Ground water: (IS:10500:1991)	Grab sample collected from source and analyzed as per Standard Methods prescribed by CPCB	Groundwater at Construction Camps	3 times in year for 2 years at 2 camp with 2 bore wells each	Water quality standard by CPCB	12x 5000x2 = Rs 120,000	Concessionaire through approved monitoring agency	RPWD /SC
	Operation stage			Groundwater at 2 locations and 2 river crossing	3/year for 1 year	Water quality standard by CPCB	3X4X5000 =Rs 60, 000	RPWD through approved monitoring agency	RPWD
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Same as air quality		National Ambient Noise Standard specified in Environment Protection Act, 1986	42x3000 =Rs.126,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	3/year for 1 year		3x3000x3 =Rs 27,000	RPWD through approved monitoring agency	RPWD
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 (4 locations)	Once during whole construction stage	ICAR standard	56,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	CPCB standard	28000	RPWD through approved agency	RPWD

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		cut and fill locations	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire	RPWD/CSC
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of 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	Concessionaire'	RPWD/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	RPWD	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire 's quote	Concessionaire with approval from RPWD	RPWD/CSC
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	RPWD/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD	Compensatory: RPWD/Local Forest Departments	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost	Additional Plantation: Concessionaire The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through Concessionaire will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	RPWD/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police	
Wildlife Vehicle Collisions	Construction Stage	Nature and cause of collision, season, Month and time of collision.		Animalcrossing locations as identified in IEE	occurrence of collision	As suggested by forest department	Civil Cost	Concessionaire	RPWD/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
	Operation stage	1. Success of road furnitures viz. rumble strip, cautionary signages etc. designed for safe movement 2. Nature and cause of collision, season, Month and time of collision 3. Monitoring of movement path based on informations available with forest department and local people.		Animal crossing Locations as identified in IEE	Random all through the year		Operation and Maintenance Cost	RPWD in coordination with forest department or through an specialized wildlife expert team	
Monitoring Costs: INR 0.876 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR BHINMAL – PANTHERI POSANA – JEEVANA (MDR-169)

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions	<ul style="list-style-type: none">Construction of concrete pavement in habitat areas considering alignment level and drainage.Raise road level above the nearby areas with provision of adequate side drains to evacuate the rain water an domestic discharges (drained by habitats occasionally to prevent damage to road and rain water entry to habitats' houses.Provision of adequate no. of cross drainage structures based on drainage pattern around alignment	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	2 Pipe culverts widened Reconstruction of 3 Slab culverts, and 3 new slab culverts proposed.. Reconstruction of 9 Causeway into pipe culverts , Reconstruction of 4 pipe culverts and 4 new pipe culverts proposed	<u>MI</u> : Design and number of cross and side drains, slab/box culverts, and Hume pipes <u>PT</u> : Design and numbers are in accordance with site needs	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 concessionaire	Design Consultant	RPWD
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Vertical and horizontal geometrics in consistent to IRC/MORTH guidelinesProvision 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 forestsSafety kerb at all bridgesInformatory signage on approach to school, Ambulance and medical aid postsChecking for over loading at toll plazasSpeed restrictions in built up sections curve locations etc	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 Speed Breakers Near schools & Temples and signages near built-up areas and toll plazas Road Studs, object Markers etc.	<u>MI</u> : number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc <u>PT</u> : numbers and location are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	Design Consultant	RPWD
2. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt.	<ul style="list-style-type: none">Asphalt binder specifications based on IS 73-2013 and IS 15462 -2004 for rubber modified binder and polymer modified binders.	IRC 37- 2012& IRC 81- 1997 for strengthening of flexible pavement	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening, rutting, asphalt migration/thermal expansion of joint	Review of design documents and drawings and comparison with site conditions	Detailed design cost to be borne by concessionaire	concessionaire	RPWD

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2.2 Flooding/Water-Logging	<ul style="list-style-type: none">Adequate number of CD structures.Additional culverts also proposed.CD structures designed for 50year return periodWater ways of bridges and culverts have been increased.Roadside drains also providedEmbankment height raised along low lying/ potential water logged areasImprovement in existing culverts/ Bridges to increase their carrying capacity	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	2 Pipe culverts widened Reconstruction of 3 Slab culverts, and 3 new slab culverts proposed.. Reconstruction of 9 Causeway into pipe culverts , Reconstruction of 4 pipe culverts and 4 new pipe culverts proposed	<u>MI</u> : Design and numbers of cross & side drains, slab/box culverts Hume pipes, road embankment height, design and number of bridges <u>PT</u> : Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	concessionaire	RPWD
2.3 Earthquake	<ul style="list-style-type: none">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	<u>MI</u> : Bridges and Culverts_ <u>PT</u> : 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	concessionaire	RPWD
2.4 Drought	<ul style="list-style-type: none">The design of foundations and sub-structures shall conform to IRC guidelines and MORTH clauseEnsure water availability for compaction work and consolidation of sub-structure	IRC:78-2000 Standard Specifications and Code of Practice for Road Bridges	Rain water Harvesting structures & unlined drains are Proposed in Rural Areas	<u>MI</u> : Sub-structure of bridges <u>PI</u> : Sub-structures are consolidated and compacted	Design and drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	concessionaire	
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none">Road improvement work to be accommodated within available ROW to the extent possible.Minimize resettlement impact due to heavily congested built-up sectionSocial 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 PlanIncome restoration as per RPPreference in employment and petty contracts during construction to APsConstitute GRC as per RP	<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.</p> <p>Contract Clause for preference to local people during employment.</p>	Throughout the corridor	<u>MI</u> : Payment of compensation and assistance to DPs as per RP Number of complaints/grievances related to compensation and resettlement <u>PT</u> : Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case referred to arbitrator/court.	<p>Check LA records; design drawings vs land plans;</p> <p>Interview with affected persons</p> <p>Check status of employment given to local people during construction</p>	Part of administrative and resettlement costs	RPWD and implementing NGO	RPWD

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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
1. Preparatory Activities								
1.1 Preparatory activities	<ul style="list-style-type: none">▪ Submit appointment letter and resume of the 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▪ EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE▪ Request PMC-ES copy of monthly monitoring formats and establish deadlines for submission.▪ EFC 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.▪ EFC will submit for approval of PMC-ES the construction camp layout before its establishment.	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part of construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

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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1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<u>MI</u> : PM ₁₀ level measurements Complaints from locals due to dust <u>PT</u> : PM ₁₀ level < 100 ug/m ³ Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Concessionaire	RPWD /CSC

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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	
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4.1 Landuse Change and Loss of productive / topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse 	Project requirement	<p>Throughout the project section and borrow areas</p> <p>Land identified for camp, storage areas etc.</p>	<p><u>MI</u>: Borrow pit locations/Top soil storage area</p> <p><u>PT</u>: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	RPWD /CSC
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Side slopes of all cut and fill areas will be graded and covered, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. The earth stockpiles to be provided with gentle slopes to soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	<p><u>MI</u>: Occurrence of slope failure or erosion issues</p> <p><u>PT</u>: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Concessionaire	RPWD /CSC
4.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from SEIAA before opening any new borrow area. Comply to EC conditions of SEIAA 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. Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation 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. 	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 Guidelines for Borrow Areas management	Borrow sites location	<p><u>MI</u>: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints</p> <p>No use of black cotton soil</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by SEIAA</p>	Included in civil works cost	Concessionaire	RPWD /CSC

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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4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 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	Existing quarries of project districts New Quarry if needed	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Concessionaire	RPWD /CSC
4.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p><u>MI</u>: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p><u>PT</u>: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<p><u>MI</u>: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p><u>PT</u>: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>	Site observation	Included in civil work cost.	Concessionaire	RPWD /CSC
5. Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Provision of water harvesting structure to augment groundwater condition in the area 	CGWA Guidelines	<p>Throughout the Project section Near CD structures</p> <p>Roof Top harvesting at Toll Plaza and enhancement of existing structures being used by local community</p>	<p><u>MI</u>: Approval from competent authority Complaints from local people on water availability</p> <p><u>PT</u>: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil work cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.2 Disposal of water during construction	<ul style="list-style-type: none"> 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	<p><u>MI</u>: Presence /absence of water logging in project area.</p> <p><u>PT</u>: No water logging in project area</p>	Standards methods Site observation and review of documents	Included in civil work cost	Concessionaire	RPWD /CSC
5.3.Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies.. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, ClauseNo501.8. 6.MORT&H Specifications for Road and Bridgeworks</p> <p>Worldwide best practices</p>	Near all water bodies /waterway close to project road Sukhari River at km 24.329 Water harvesting structures present along the road, refueling stations, construction camps.	<p><u>MI</u>: Presence /absence of siltation in, ponds and other water bodies Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities.</p>	Field observation	Included in civil works cost	Concessionaire	RPWD /CSC
6. Flora and Fauna								
6.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> Restrict tree cutting upto toe line considering safety to road users. Roadside trees to be removed with prior approval of competent authority. Mandatory compensatory plantation at 1:2 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. Controlled use of pesticides/ fertilizers 	Forest Conservation Act1980 + IRC:SP:21 and IRC:SP:66	<p>Throughout project corridor</p> <p>Estimated No. of affected tree=1411</p> <p>Additional Plantation on1:3 basis</p>	<p><u>MI</u>: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted.</p> <p><u>PT</u>: Additional compensatory afforestation done on a1:3 basis by concessionaire.</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy</p> <p>Field observations</p>	<p>Mandatory Compensatory afforestation cost is included in project costs under RPWD.</p> <p>Additional compensatory afforestation costs included in civil works costs</p>	<p>Mandatory Compensatory plantation by forest Department and additional plantation by concessionaire</p>	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7. Construction Camps								
7.1 Impact associated with location	<ul style="list-style-type: none">All camps should be established with prior permission from PCB. Camps to maintain minimum distance from following:<ul style="list-style-type: none"># 500 m from habitation# 500 m from forest areas where possible# 500 m from water bodies where possible# 500 m from through traffic route# 500 m from identified wildlife crossing areas# 500 from forest areas	Design Requirement The Water (Prevention and Control of Pollution) Act,1974and its amendments thereof	All construction camps	MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included in civil works cost	Concessionaire and EO	RPWD /CSC
7.2 Worker's Health in construction camp	<ul style="list-style-type: none">The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved b EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner.Adequate water and sanitary latrines with septic tanks with soak pits shall be provided.Preventive medical facilities in campWaste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations.No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community.Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases.	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act,1974 and amendments thereof	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Concessionaire	RPWD /CSC

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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8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	<ul style="list-style-type: none">Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA.Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water qualityUnproductive/wastelands shall be selected for dumping sites away from residential areas and water bodiesDumping sites must be having adequate capacity equal to the amount of debris generated.Public perception and consent from the village Panchayats has to be obtained before finalizing the location.	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	At all Dumping/Disposal Sites	<u>MI</u> : Location of dumping sites Number of public complaints. <u>PT</u> : 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.	Concessionaire .	RPWD /CSC
8.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none">The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes.All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping.Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority.The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed.Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	<u>MI</u> : Percentage of reuse of existing surface material Method and location of disposal site of construction debris <u>PT</u> : No public complaint and consent letters for all dumping sites available with contractor or CSC	Contractor records Field observation Interaction with local people	Included in civil works cost.	Concessionaire .	RPWD /CSC

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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9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	<ul style="list-style-type: none">Traffic Management Plan shall be submitted by the contractor and approved by the CSC.The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road.The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed.Restriction of construction activity to only one side of the existing roadThe contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer".Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	<p>Design requirement and IRC: SP: 27 -1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document</p>	Throughout the project corridor especially at intersections.	<p>MI: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p>PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Concessionaire	RPWD /CSC

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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9.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever 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, hospitals, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	RPWD /CSC
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Concessionaire	RPWD /CSC

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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9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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	<u>MI</u> : Safety signs and their location Incidents of accidents Complaints from local people <u>PT</u> : Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Concessionaire	RPWD /CSC
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<u>MI</u> : Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. <u>PT</u> : 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	Included in civil works cost.	Concessionaire	RPWD /CSC
Operation and Maintenance stage								
1. Wildlife Movement								
1.1 Anticipated risk of vehicle-animal collision and human-animal conflict	<ul style="list-style-type: none"> Effectiveness of mitigative measures (rumble strips, informatory /cautionary signage, clearance of shrubs from right of way, maintaining 15m distance between 2 trees during avenue plantation etc.) recommended in design stage shall be monitored. RPWD to keep record of all accidents. Fresh assessment in case of future widening 	Project Requirement	At identified animal crossing locations	<u>MI</u> : No, time, location and cause of collision. <u>PT</u> : minimum vehicle – animal collisions. No of consultation done with forest department	Site Observation Discussion with local People Collection of information from Forestry Department	Included in Operation / Maintenance cost	RPWD field offices/Forest Department	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Air Quality								
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none">▪ 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	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<u>MI</u> : Ambient air quality (PM ₁₀ , CO,SO ₂ NO ₂) <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	RPWD	
3. Noise								
3.1 Noise due to movement of traffic	<ul style="list-style-type: none">▪ Effective traffic management and good riding conditions shall be maintained▪ Speed limitation to 20 km/hour and honking restrictions near sensitive receptors▪ Construction of noise barriers near sensitive receptors with consent of local community▪ The effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.▪ Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution (Regulation and Control) Amendment Rules, 2017	Sensitive receptors as identified in IEE locations.	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	Noise monitoring as per noise rules ,2017 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Land and Soil								
4.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	RPWD	
5. Water resources/Flooding and Inundation								
5.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion and turfing 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	RPWD	
5.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	MI: Presence/absence of water logging along the road PT: No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	RPWD	
6. Flora								
6.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	RPWD/Forest Department	
7. Maintenance of Right of Way and Safety								
7.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo 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	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures, including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented. 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. 	IRC:SP:55-2014	Throughout the Project route	<p><u>MI</u>: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law</p> <p><u>PT</u>: Fatal and non fatal</p>	<p>Review accident records</p> <p>Site observations</p>	Included in Operation / Maintenance cost	RPWD	
7.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	Project Requirement	Throughout the project stretch	<p><u>MI</u>: Status of emergency system – whether operational or not</p> <p><u>PT</u>: Fully functional emergency system</p>	<p>Review of spill prevention and emergency response plan</p> <p>Spill accident records</p>	Included in Operation / Maintenance cost	RPWD	

ENVIRONMENTAL MONITORING PLAN FOR BHINMAL – PANTHERI POSANA – JEEVANA (MDR-169)

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
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	2 sampling per km of built up area during active construction: Bhinmal (4), Kushalpura (2), Daspan (4), Pantheri (10), Unari (1), Posana (2), Siyawat (2), Mandavpur (2), Taaliyan (2), Jeewana (2) Total 31 Batching and hot mix plants sampling part of SPCB annual renewal of permits	During Active Construction	Air quality standard by CPCB	31X9000= 279,000	Concessionaire through approved monitoring agency	RPWD /CSC
	Operation stage			Representative sample 2 each for residential, commercial and sensitive (6 Locations)-	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	6X9000x3 =Rs 162,000	RPWD through approved monitoring agency	RPWD
Water Quality	Construction stage	Ground water: (IS:10500:1991)	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyzed as per Standard Methods for Examination of Water and Wastewater	Groundwater at 4 locations including each at construction camps 3 times in year (except monsoon) surface water at 2 location	Water quality standard by CPCB	6x 5000x3 = Rs 90,000	Concessionaire through approved monitoring agency	RPWD /SC
	Operation stage			Groundwater at 2 locations and 2 river crossing	3/year for 1 year	Water quality standard by CPCB	4X3X5000 =Rs 60, 000	RPWD through approved monitoring agency	RPWD
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	During Active Construction		National Ambient Noise Standard specified in Environment Protection Act, 1986	31x3000 =Rs.93,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	3/year for 1 year		3000x3x3 =Rs 27,000	RPWD through approved monitoring agency	RPWD

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
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 (4 locations)	Once during whole construction stage	ICAR standard	56000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	CPCB standard	28000	RPWD through approved agency	RPWD
	Soil Erosion	Construction Stage		Visual check for Soil erosion and siltation	Cut and fill locations	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire
Operation Stage		Once during operation of 1st year	Visual Checks			Routine Engineering Work	Engineering Team of 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	Concessionaire'	RPWD/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	RPWD	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire 's quote	Concessionaire with approval from RPWD	RPWD/CSC
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	RPWD/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD	Compensatory: RPWD/Local Forest Departments	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost	Additional Plantation: Concessionaire The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through Concessionaire will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	RPWD/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Wildlife Vehicle Collisions	Construction Stage	Nature and cause of collision, season, Month and time of collision.		Animal crossing locations as identified in IEE	occurrence of collision	As suggested by forest department	Civil Cost	Concessionaire	RPWD/CSC
	Operation stage	1. Success of road furniture viz. rumble strip, cautionary signages etc. designed for safe movement 2. Nature and cause of collision, season, Month and time of collision 3. Monitoring of movement path based on information available with forest department and local people.		Animal crossing Locations as identified in IEE	Random all through the year		Operation and Maintenance Cost	RPWD in coordination with forest department or through an specialized wildlife expert team	
Monitoring Costs: INR 0.795 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR BIDASAR-SRI DUNGARGARH-KALU

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions	<ul style="list-style-type: none"> Construction of concrete pavement in habitat areas considering alignment level and drainage. Raise road level above the nearby areas with provision of adequate side drains to evacuate the rain water and domestic discharges (drained by habitats occasionally to prevent damage to road and rain water entry to habitats' houses. Provision of adequate no. of cross drainage structures based on drainage pattern around the alignment 	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	The embankment height varies from 0.0 m to 3.0 m comprising 58 km 0.0 m height, 19 km 1.0 m height, 8 km 2.0 m height and remaining 3 km 3.0 m height. 9 existing culverts are purposed for repairing ,increase of water way and retaining Drain Length=9.8	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	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 concessionaire	Design Consultant	RPWD
1.2 Safety along the proposed alignment	<ul style="list-style-type: none"> 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 bridge s Informatory signage on approach to school, Ambulance and medical aid posts Checking for overloading at toll plazas Speed restrictions in built up sections curve locations etc. 	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	Entire Stretch.	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	RPWD
2. Natural Hazards and Climate Change risks								

[illegible]

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.1 Disruption of utility services to local community	<ul style="list-style-type: none"> 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	<u>MI</u> : Number of complaints from local people, Shifting plan and status of utility services <u>PT</u> : No. of complaints should be 0. Minimal time for utility shifting	Interaction with concerned utility authorities and local public	Included under RPWD's costs	Contractor/ RPWD/utility company	RPWD /CSC
B. Construction Stage								
1. Preparatory Activities								
1.1 Preparatory activities	<ul style="list-style-type: none"> Submit appointment letter and resume of the 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 EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE request PMC-ES copy of monthly monitoring formats and establish deadlines for submission. EFC 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, 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	and prevention of communicable diseases will also be included in the action plan. <ul style="list-style-type: none"> EFC will submit for approval of PMC-ES the construction camp layout before its establishment. 							
1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the 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. 	Project requirements	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials agreed by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	MI: PM ₁₀ level measurements Complaints from locals due to dust PT: PM ₁₀ level < 100 g/m ³ Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Concessionaire	RPWD /CSC

[illegible]

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.1 Land use Change and Loss of productive / topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing 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	<p>Throughout the project section and borrow areas</p> <p>Land identified for camp, storage areas etc.</p>	<p><u>MI</u>: Borrow pit locations/Top soil storage area</p> <p><u>PT</u>: Zero complaints or disputes registered against contractor by</p>	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	RPWD /CSC
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Side slopes of all cut and fill areas will be graded and covered, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. The earth stockpiles to be provided with gentle slopes to soil erosion. 	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control. Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	<p><u>MI</u>: Occurrence of slope failure or erosion issues</p> <p><u>PT</u>: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Concessionaire	RPWD /CSC
4.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from SEIAA before opening any new borrow area. Comply to EC conditions of SEIAA 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 shall be leveled with salvaged material or other filling materials which do not contaminate soil. Else, it shall be converted into fish pond. 	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act)+Clause 305.2.2 MORT&H Specifications for Road and Bridgeworks Guidelines for Borrow Areas management	Borrow sites location	<p><u>MI</u>: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints. No use of black cotton soil</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by SEIAA</p>	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 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	Existing quarries of project districts New Quarry if needed	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Concessionaire	RPWD /CSC
4.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p><u>MI</u>: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p><u>PT</u>: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<p><u>MI</u>: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p><u>PT</u>: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>	Site observation	Included in civil work cost.	Concessionaire	RPWD /CSC
5. Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Provision of water harvesting structure to augment groundwater condition in the area 	CGWA Guidelines	<p>Throughout the Project section Near CD structures</p> <p>Roof top harvesting at Toll Plaza and enhancement of existing structures being used by local community</p>	<p><u>MI</u>: Approval from competent authority Complaints from local people on water availability</p> <p><u>PT</u>: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil work cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.2 Disposal of water during construction	<ul style="list-style-type: none"> 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	<p><u>MI</u>: Condition of drainage system in construction site. Presence /absence of water logging in project area.</p> <p><u>PT</u>: Existence of proper drainage system. No water logging in project area</p>	Standards methods Site observation and review of documents	Included in civil work cost	Concessionaire	RPWD /CSC
5.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Culverts reconstruction shall be done during lean flow period. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	No water body close to alignment	<p><u>MI</u>: Proper flow of water in existing streams and rivers</p> <p><u>PT</u>: No complain of water shortage by downstream communities. No record of overtopping/ water logging</p>	Review of design documents Site observation	Included in civil works cost	Concessionaire	RPWD /CSC
5.4 Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	Design requirement, ClauseNo501.8. 6.MORT&H Specifications for Road and Bridgeworks Worldwide best practices	<p>Near all water bodies /waterway There are only 9 slab culverts No river</p> <p>Note: one dry and one waste water storage pond at km 49.000 and km 64.200 respectively Both not impacted</p>	<p><u>MI</u>: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities Surface water quality tests confirm to turbidity and</p>	Field observation	Included in civil works cost	Concessionaire	RPWD

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	<ul style="list-style-type: none"> No vehicles or equipment should be parked or refueled near existing harvesting structures like tanka, Johad Road runoff shall be allowed only through oil interceptors Chemicals and oil shall be stored on 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 existing water harvesting str. Wastes must be collected, stored and taken to approve disposal site only. 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Water harvesting structures present along the road, in refueling stations and construction camps.	<p><u>MI</u>: Water quality of existing water harvesting structures present along the road</p> <p><u>PT</u>: Surface water quality meets freshwater quality standards prescribed by CPCB</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Concessionaire	RPWD /CSC
6. Flora and Fauna								
6.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> 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 1:2 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. Controlled use of pesticides/ fertilizers 	Forest Conservation Act 1980 + IRC:SP:21 and IRC:SP:66	<p>Throughout project corridor</p> <p>Estimated No. of affected tree=318</p> <p>Additional Plantation on 1:3 basis</p>	<p><u>MI</u>: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted.</p> <p><u>PT</u>: Additional compensatory afforestation done on a 1:3 basis by concessionaire.</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy</p> <p>Field observations</p>	<p>Mandatory Compensatory afforestation cost is included in project costs under RPWD.</p> <p>Additional compensatory afforestation costs included in civil works costs</p>	Mandatory Compensatory plantation by forest Department and additional plantation by concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7. Construction Camps								
7.1 Impact associated with location	<ul style="list-style-type: none">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	Design Requirement The Water (Prevention and Control of Pollution) Act, 1974 and its amendments thereof	All construction camps	MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included in civil works cost	Concessionaire and EO	RPWD /CSC
7.2 Worker's Health in construction camp	<ul style="list-style-type: none">The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved b EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner.Adequate water and sanitary latrines with septic tanks with soak pits shall be provided.Preventive medical facilities in campWaste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations.No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community.Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases.	The Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Concessionaire	RPWD /CSC

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

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	<ul style="list-style-type: none">Traffic Management Plan shall be submitted by the contractor and approved by the CSC.The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road.The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.	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.	<u>MI</u> : Traffic management plan. Presence/absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents <u>PT</u> : No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site	Review traffic management plan Field observation of traffic management and safety system Interaction with people in vehicles using the road	Included in civil works cost.	Concessionaire	RPWD /CSC
	<ul style="list-style-type: none">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 roadThe contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from “Engineer”.Use of adequate signage’s to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	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
9.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever 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, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/absence of access routes for pedestrians. Road signage</p> <p>Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	RPWD /CSC
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage</p> <p>Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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	<p><u>MI</u>: Safety signs and their location Incidents of accidents Complaints from local people</p> <p><u>PT</u>: Zero incident of accidents. Zero complaints.</p>	<p>Site inspection</p> <p>Consultation with local people</p>	Included in civil works cost	Concessionaire	RPWD /CSC
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<p><u>MI</u>: Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site.</p> <p><u>PT</u>: Clean and tidy sites. No trash or debris left on site. Site restored and leveled.</p>	<p>Site observation</p> <p>Interaction with locals</p> <p>Issue completion certificate after restoration of all sites are found satisfactory</p>	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
C. Operation and Maintenance stage								
1. Air Quality								
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none">Roadside tree plantations shall be maintained at least with 70% survival rate.Regular maintenance of the road will be done to ensure good surface conditionAmbient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.Signages shall be provided reminding 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	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<u>MI</u> : Ambient air quality (PM ₁₀ , CO,SO ₂ NO ₂) <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	RPWD	
2. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation to 20 km/hour and honking restrictions near sensitive receptorsConstruction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution (Regulation and Control) Amendment Rules, 2017	Sensitive receptors as identified in IEE locations.	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	Noise monitoring as per noise rules ,2017 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	RPWD	
4. Water resources/Flooding and Inundation								
4.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion and turfing conditions for its effective maintenance.	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation / Maintenance cost	RPWD	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	RPWD	
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>PT</u> : Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	RPWD/Forest Department	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures, including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented. 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. 	IRC:SP:55-2014	Throughout the Project route	<p><u>MI</u>: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law</p> <p><u>PT</u>: Fatal and non fatal accident rate is reduced after improvement</p>	<p>Review accident records</p> <p>Site observations</p>	Included in Operation / Maintenance cost	RPWD	
6.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	Project Requirement	Throughout the project stretch	<p><u>MI</u>: Status of emergency system – whether operational or not</p> <p><u>PT</u>: Fully functional emergency system</p>	<p>Review of spill prevention and emergency response plan</p> <p>Spill accident records</p>	Included in Operation / Maintenance cost	RPWD	

**SUPPLEMENT TO EMP
(BIDASAR-SRI DUNGARGARH-KALU)**

Supplementary Appendix-1: Noise Receptors

S.No.	Chaiange	Name of Noise Receptors	Side	Distance From Road Centerline	Length (m)
1	2.000	Temple	LHS	12	60
2	2.000	Gooshala	LHS	12	60
3	3.220	Temple	LHS	9	50
4	8.400	Govt School	RHS	17	250
5	10.600	Govt. School	LHS	8.5	50
6	10.61	Dol Paliya Temple	RHS	16	20
7	13.300	Hanuman Temple Dharmas Village	RHS	7	40
8	15.550	Govt. School Mata Ji Ka Mod, Mingasaria	LHS	13.8	20
9	19.950	Govt. School Dharmash	RHS	11	95
10	25.425	Bus Stand	LHS	8.5	10
11	25.55	Public Health Center	LHS	15	15
12	26.6	Govt. Primary Girls School Ridi	LHS	10	50
13	26.6	Govt. Veterinary Hospital, Ridi	LHS	10	75
14	27.000	Gaushala	RHS	7	40
15	27.220	Temple	RHS	12	
16	27.9	Sekhawati Public School, Ridi	LHS	9	40
17	33.600	Dharamshala	LHS	9	
18	45.200	Aggricuture Market	RHS	10	
19	45.800	Power House . Temple	RHS	7	45
20	46.050	Temple of Veer Tejaji, Dungargarh	RHS	9	20
21	46.1	Jat Hostle	RHS	13	60
22	46.220	PWD office	RHS	16	85
23	48.450	Mosque and Grave Yard	LHS	4.8	
24	49.2	Grave Yard	LHS	6	
25	56.400	Goshala . Water Tap	RHS	13	150
26	58.500	Seating Place . Goshala	RHS	15	150
27	66.8	Goshala	LHS	20	
28	72.000	Bus Stand	RHS	11	20
29	84.8	Temple & Gaushala	RHS	13	100

ENVIRONMENTAL MONITORING PLAN FOR BIDASAR-SRI DUNGARGARH-KALU

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs.)	Implementation	Supervision
Air Quality	Construction stage	PM 10 PM2.5 SO ₂ , NO _x , CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	2 sampling per km of built up area during active construction: Bidasar (3), Dharmas(2), Ridi(4), Bana(2), Sri Dungargarh (2), Kaluvaas(2), Gusainsar(2), Ladera (2), Adsar(2) and Kalu(2) Total 22 Batching and hot mix plants sampling part of SPCB annual renewal of permits	During Active Construction	Air quality standard by CPCB	22X9000=198,000	Concessionaire through approved monitoring agency	RPWD /CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3=Rs 81,000	RPWD through approved monitoring agency	RPWD
Water Quality	Construction stage	Ground water: (IS:10500:1991)	Grab sample collected from source and analyzed as per Standard Methods prescribed by CPCB	Groundwater at Construction Camps	3 times in year for 2 years at 2 camp with 2 bore wells each	Water quality standard by CPCB	12x 5000x2= Rs 120,000	Concessionaire through approved monitoring agency	RPWD /SC
	Operation stage			Groundwater at 2 locations and surface water at 1 location	3/year for 1 year	Water quality standard by CPCB	3X3X5000=Rs 45, 000	RPWD through approved monitoring agency	RPWD
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Same as air quality	During Active Construction	National Ambient Noise Standard specified in Environment Protection Act, 1986	22x3000=Rs.66,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	3/year for 1 year		3x3000x3=Rs 27,000	RPWD through approved monitoring agency	RPWD
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 (4 locations)	Once during whole construction stage	ICAR standard	56,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	CPCB standard	28000	RPWD through approved agency	RPWD
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		cut and fill locations	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire	RPWD/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs.)	Implementation	Supervision
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of 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	Concessionaire'	RPWD/CSC
	Once in a year before rainy season				None Specific	Routine Engineering Work	RPWD		
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire 's quote	Concessionaire with approval from RPWD	RPWD/CSC
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	RPWD/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD	Compensatory: RPWD/Local Forest Departments	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost	Additional Plantation: Concessionaire The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through Concessionaire will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	RPWD/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police	
Monitoring Costs: INR 0.621 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR SADULSHAHAR-SANGARIA –CHAIYA

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions	<ul style="list-style-type: none">Construction of concrete pavement in habitat areas considering alignment level and drainage.Raise road level above the nearby areas with provision of adequate side drains to evacuate the rain water an domestic discharges (drained by habitats occasionally to prevent damage to road and rain water entry to habitats' houses.Provision of adequate no. of cross drainage structures based on drainage pattern around the alignment	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	One major bridge is proposed for reconstruction and one will be retain. Out of 4 minor bridges 2 are proposed for reconstruction and remain 2 for extension. 9 nos. culverts are proposed for reconstruction, and 152 nos. culverts & 2 nos. minor bridges are proposed for widening. Drains 9.2km (Supplementary Appendix-1)	<u>MI</u> : Design and number of cross and side drains, slab/box culverts, and Hume pipes <u>PT</u> : Design and numbers are in accordance with site needs	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 concessionair e	Design Consultant	RPWD
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Vertical and horizontal geometrics in consistent to IRC/MORTH guidelinesProvision 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 forestsSafety kerb at all bridge sInformatory signage on approach to school,Ambulance and medical aid postsChecking for overloading at toll plazasSpeed restrictions in built up sections curve locations etc	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	Speed breakers near schools, built-up areas, and toll plazas. Signboards Particularly in major intersections	<u>MI</u> : number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc. <u>PT</u> : numbers and location are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionair e	Design Consultant	RPWD

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	<u>MI</u> : Pavement Surface and bridge expansion joints during extreme heat <u>PI</u> : 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		
2.2 Flooding/Water-Logging	<ul style="list-style-type: none">Adequate number of CD structures.Additional culverts also proposed.CD structures designed for 50year return periodWater ways of bridges and culverts have been increased.Roadside drains also providedEmbankment height raised along low lying/ potential water logged areasImprovement in existing culverts/ Bridges to increase their carrying capacity.	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	Ponds at some location (Supplementary Appendix-2)	<u>MI</u> : Design and numbers of cross & side drains, slab/box culverts Hume pipes, road embankment height, design and number of bridges <u>PT</u> : Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	concessionaire	RPWD
2.3 Earthquake	<ul style="list-style-type: none">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	<u>MI</u> : Bridges and Culverts_ <u>PT</u> : 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	concessionaire	RPWD
2.4 Drought	<ul style="list-style-type: none">The design of foundations and sub-structures shall conform to IRC guidelines and MORTH clauseEnsure water availability for compaction work and consolidation of sub-structure	IRC:78-2000 Standard Specifications and Code of Practice for Road Bridges	Entire Stretch	<u>MI</u> : Sub-structure of bridges <u>PI</u> : Sub-structures are consolidated and compacted	Design and drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	concessionaire	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none">Improvement to be accommodated within ROW to the extent possible.Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines.Complete all necessary land and property acquisition procedures prior to the commencement of civil work.Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework.Compensation and assistance as per project Resettlement PlanIncome restoration as per RPPreference in employment and petty contracts during construction to APsConstitute GRC as per RP	<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.</p> <p>Contract Clause for preference to local people during employment.</p>	land acquisition for wayside amenities and toll plaza.	<p><u>MI</u>: Payment of compensation and assistance to DPs as per RP Number of complaints/grievances related to RP</p> <p><u>PT</u>: Minimal number of grievances. All cases of resettlement and rehabilitation are resolved at GRC level. No case referred to arbitrator/court.</p>	<p>Check LA records; design drawings vs land plans;</p> <p>Interview with affected persons</p> <p>Check status of employment given to local people during construction</p>	Part of administrative and resettlement costs	RPWD and implementing NGO	RPWD
4. Diversion of Forest Land and Cutting of Trees								
3.1 Need for cutting of trees and diversion of forest land	<ul style="list-style-type: none">Geometric adjustments to minimize tree cutting and diversion of forest landObtain tree cutting permission from forest departmentProvision for mandatory compensatory afforestation (1:2) for deposit of payment to Forestry DepartmentProvision for additional compensatory plantation on 1: 3 basis to be implemented by concessionaire	Forest Conservation Act, 1980	Forest Land Diversion=nil Tree cutting throughout the corridor Total number of affected trees=1613	<p><u>MI</u>: Number and location of geometric adjustments made to avoid forestland and tree cutting, budget amount allocated for compensatory afforestation and additional plantation (1:3)</p> <p><u>PT</u>: Unnecessary tree felling on forest land avoided. Budget allocation is adequate</p>	Review final design. Check budget provision for compensatory afforestation and additional plantation.	<p>Covered under preliminary design preparation by F/S consultant</p> <p>Detailed design cost to be borne by concessionaire</p>	RPWD, Design consultants forest department	SHAH/Forest department

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5. Wildlife Movement (Chinkara-Black Bucks and Blue bulls)								
4.1 Road design causing accidents of wild animals and disruption in their movement	<ul style="list-style-type: none">Provision of rumble strip, cautionary and informatory sign boards near potential wildlife crossing locationsSpeed restriction in the sections where wildlife movement is reportedClearance of all shrubs grown inside the ROW once in a year after monsoon to provide better lateral visibility to driversMaintain 15 m distance between two trees during avenue plantation	Project Requirement	Nilgai crossing signpost every 3 km uninterrupted stretch of uninhabited area	<u>MI</u> : budget allocation for rumble strips, cautionary and informatory sign boards, <u>PT</u> : Budget adequate to fulfill the installation of recommended facilities and structures	Review of bid documents and project budget plan	Covered under costs for F/S Consultant	RPWD, Design Consultant	RPWD/CS C in coordination with Forest Department
6. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none">All telephone and electrical poles/wires and underground cables should be shifted before start of constructionNecessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility servicesLocal 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	<u>MI</u> : Number of complaints from local people, Shifting plan and status of utility services <u>PT</u> : No. of complaints should be 0. Minimal time for utility shifting	Interaction with concerned utility authorities and local public	Included under RPWD's costs	Contractor/ RPWD/utility company	RPWD /CSC
B. Construction Stage								
1. Preparatory Activities								
1.1 Preparatory activities	<ul style="list-style-type: none">Submit appointment letter and resume of the Contractor's Environmental Focal Person (EFP) to PMUEFP 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 necessaryEFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> request PMC-ES copy of monthly monitoring formats and establish deadlines for submission. EFC 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. EFC will submit for approval of PMC-ES the construction camp layout before its establishment. 							
1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none">Concessionaire to submit location and layout plan for storage areas of construction materials agreed by CSCTransport, loading and unloading of loose and fine materials through covered vehicles.Paved approach roads.Storage areas to be located downwind of the habitation area.Water spraying on earthworks, unpaved haulage roads and other dust prone areas.Provision of PPEs to workers.	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<u>MI</u> : PM10 level measurements Complaints from locals due to dust <u>PT</u> : PM10 level < 100 g/m ³ Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Concessionaire	RPWD /CSC
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	<ul style="list-style-type: none">Regular maintenance of machinery and equipment.Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement.Only crushers licensed by the PCB shall be usedDG sets with stacks of adequate height and use of low sulphur diesel as fuel.LPG should be used as fuel source in construction camps instead of woodAmbient air quality monitoringContractor to prepare traffic management and dust suppression plan duly approved by RPWD	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	<u>MI</u> : Levels of HC, SO ₂ , NO ₂ , and CO. Status of PUC certificates <u>PT</u> : SO ₂ and NO ₂ levels are both less than 80ug/m ³ . PUC certificate of equipment and machinery is up to date	Standards CPCB methods Review of monitoring data maintained by contractor	Included in civil works cost	Concessionaire	RPWD /CSC
3. Noise								
3.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none">All equipment to be timely serviced and properly maintained.Construction equipment and machinery to be fitted with silencers and maintained properly.Only IS approved equipment shall be used for construction activities.Timing of noisy construction activities shall be done during night time and weekend near schools,Implement noisy operations intermittently to reduce the total noise generated	Legal requirement Noise Pollution (Regulation and Control) Amendment Rules, 2017 + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations Provision of movable sound barriers to shield sensitive area and separate	<u>MI</u> : day and night Noise levels. Number of complaints from local people <u>PT</u> : Zero complaints or no repeated complaints by local people. Average day and night time noise	As per Noise rule, 2017 Consultation with local people Review of noise level monitoring data maintained by contractor Observation of construction site	Included in civil works costs	Concessionaire	RPWD /CSC

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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	<ul style="list-style-type: none"> Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential, built up and forest areas construction today light hours. Honking restrictions near sensitive areas PPEs to workers Noise monitoring as per EMoP. 		pedestrian from active construction front. Estimated at 300m total length (Supplementary Appendix-3)	levels are within permissible limits for work zone areas				
4. Land and Soil								
4.1 Land use Change and Loss of productive / topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing 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	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	<u>MI</u> : Borrow pit locations/Top soil storage area <u>PT</u> : Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	RPWD /CSC
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Side slopes of all cut and fill areas will be graded and covered, 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	<u>MI</u> : Occurrence of slope failure or erosion issues <u>PT</u> : No slope failures. Minimal erosion issues	Review of design documents and site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from SEIAA before opening any new borrow area. Comply to EC conditions of SEIAA 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 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. 	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 Guidelines for Borrow Areas management	Borrow sites location	<p><u>MI</u>: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints</p> <p>No use of black cotton soil</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by SEIAA</p>	Included in civil works cost	Concessionaire	RPWD /CSC
4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 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	<p>Existing quarries of project districts</p> <p>New Quarry if needed</p>	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	<p>Review of design documents, contractor documents and site observation</p> <p>Compliance to EC conditions in case of opening new quarries</p>	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<u>MI</u> : Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition <u>PT</u> : Zero occurrence of destroyed/compacted land and undestroyed land	Site observation	Included in civil works cost	Concessionaire	RPWD /CSC
4.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<u>MI</u> : Quality of soil near storage area Presence of spilled oil or bitumen in project area <u>PT</u> : Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site	Site observation	Included in civil work cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5. Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none">Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority.Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected.Water intensive activities not to be undertaken during summer season.Provision of water harvesting structure to augment groundwater condition in the area	CGWA Guidelines	Throughout the Project section Near CD structures Roof top harvesting at Toll Plaza and enhancement of existing structures being used by local community	<u>MI</u> : Approval from competent authority Complaints from local people on water availability <u>PT</u> : Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local people	Included in civil work cost	Concessionaire	RPWD /CSC
5.2 Disposal of water during construction	<ul style="list-style-type: none">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	<u>MI</u> : Condition of drainage system in construction site. Presence /absence of water logging in project area. <u>PT</u> : Existence of proper drainage system. No water logging in project area	Standards methods Site observation and review of documents	Included in civil work cost	Concessionaire	RPWD /CSC
5.3 Alteration in surface water hydrology	<ul style="list-style-type: none">Existing drainage system to be maintained and further enhanced.Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment.Culverts reconstruction shall be done during lean flow period.	Design requirement, Clause 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/nallah crossings etc.	<u>MI</u> : Proper flow of water in existing streams and rivers <u>PT</u> : No complain of water shortage by downstream communities. No record of overtopping/ water logging	Review of design documents Site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.4 Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, Clause No 501.8. 6.MORT&H Specifications for Road and Bridgeworks</p> <p>Worldwide best practices</p>	Near all water bodies/waterway Refer Table 15 .	<p><u>MI</u>: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Concessionaire	RPWD
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	<ul style="list-style-type: none"> No vehicles or equipment should be parked or refueled near existing harvesting structures like tanka, Johad Road runoff shall be allowed only through oil interceptors Chemicals and oil shall be stored on 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 existing water harvesting str. Wastes must be collected, stored and taken to approve disposal site only. 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Water harvesting structures present along the road, refueling stations, construction camps.	<p><u>MI</u>: Water quality of existing water harvesting structures present along the road</p> <p><u>PT</u>: Surface water quality meets freshwater quality standards prescribed by CPCB</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6. Flora and Fauna								
6.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none">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 1:2 basis by Forestry DepartmentAdditional plantation on 1:3 basis as per the IRC guidelines to be carried out by concessionaireRegular 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.Controlled use of pesticides/ fertilizers	Forest Conservation Act1980 + IRC:SP:21 and IRC:SP:66	Throughout project corridor Estimated No. of affected tree=1613 Additional Plantation on1:3 basis	MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. PT: Additional 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	Mandatory Compensator y 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 concessionaire	RPWD /CSC
7. Construction Camps								
7.1 Impact associated with location	<ul style="list-style-type: none">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	Design Requirement The Water (Prevention and Control of Pollution) Act,1974and its amendments thereof	All construction camps	MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included in civil works cost	Concessionaire and EO	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Worker's Health in construction camp	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste. The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. 	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	<p>MI: Camp health records</p> <p>Existence of proper first aid kit in camp site</p> <p>Complaints from workers.</p> <p>PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.</p>	<p>Camp records</p> <p>Site observation</p> <p>Consultation with contractor workers and local people living nearby</p>	Part of the civil works costs	Concessionaire	RPWD /CSC
8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	At all Dumping/Disposal Sites	<p>MI: Location of dumping sites</p> <p>Number of public complaints.</p> <p>PT: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
8.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORTH and General Conditions of Contract Document	Throughout the project corridor	<p>MI: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p>PT: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.		
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. 	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.	<p>MI: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p>PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	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	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever 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, hospitals, graveyards, construction sites, haulage roads, diversion sites. Nilgai crossing signpost every 3 km uninterrupted stretch of uninhabited area	<p><u>MI</u>: Presence/absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents <u>PT</u> : 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 Concessionaire	RPWD /CSC
9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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 <u>PT</u> : Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none">Contractor will prepare site restoration plans, which will be approved by the 'Engineer'.The clean-up and restoration operations are to be implemented by the contractor prior to demobilization.All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer.All the opened borrow areas will be rehabilitated and 'Engineer' will certify	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<u>MI</u> : Condition of camp, borrow areas and construction sites, Presence/absence of construction material/debris after completion of construction works on site. <u>PT</u> : 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	Included in civil works cost.	Concessionaire	RPWD /CSC
C. Operation and Maintenance stage								
1. Wildlife Movement								
1.1 Anticipated risk of vehicle-animal collision and human-animal conflict	<ul style="list-style-type: none">Effectiveness of mitigative measures (rumble strips, informatory /cautionary signage, clearance of shrubs from right of way, maintaining 15m distance between 2 trees during avenue plantation etc.) recommended in design stage shall be monitored.RPWD to keep record of all accidents.Fresh assessment in case of future widening	Project Requirement	Nilgai crossing signpost every 3 km uninterrupted stretch of uninhabited area	<u>MI</u> : No. of vehicle - animal collision. Time (day or night, season/month and location of collision. Cause of collision. No of incidence of human – animal conflict. <u>PT</u> : minimum vehicle – animal collisions. No of consultation done with forest department	Site Observation Discussion with local People Collection of information from Forestry Department	Included in Operation / Maintenance cost	RPWD field offices/Forest Department	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Air Quality								
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none">Roadside tree plantations shall be maintained at least with 70% survival rate.Regular maintenance of the road will be done to ensure good surface conditionAmbient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.Signages shall be provided reminding 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	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<u>MI</u> : Ambient air quality (PM ₁₀ , CO,SO ₂ NO ₂) <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	RPWD	
3. Noise								
3.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation to 20 km/hour and honking restrictions near sensitive receptorsConstruction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution (Regulation and Control) Amendment Rules, 2017	Sensitive receptors as identified in IEE locations.	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	Noise monitoring as per noise rules ,2017 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Land and Soil								
4.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	RPWD	
5. Water resources/Flooding and Inundation								
5.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion and turfing conditions for its effective maintenance.	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation / Maintenance cost	RPWD	
5.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	RPWD	
6. Flora								
6.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>PT</u> : Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	RPWD/Forest Department	
7. Maintenance of Right of Way and Safety								
7.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures, including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented. 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. 	IRC:SP:55-2014	Throughout the Project route	<p><u>MI</u>: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law</p> <p><u>PT</u>: Fatal and non fatal accident rate is reduced after improvement</p>	<p>Review accident records</p> <p>Site observations</p>	Included in Operation / Maintenance cost	RPWD	
7.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	Project Requirement	Throughout the project stretch	<p><u>MI</u>: Status of emergency system – whether operational or not</p> <p><u>PT</u>: Fully functional emergency system</p>	<p>Review of spill prevention and emergency response plan</p> <p>Spill accident records</p>	Included in Operation / Maintenance cost	RPWD	

**SUPPLEMENT TO EMP
(SADULSHAHAR-SANGARIA -CHAIYA)**

Supplementary Appendix-1: Proposed Drains

S.No	Chainage in Km		Village Name	Side	
	From	To		LHS	RHS
Sadulshahar to Sangaria					
1	6.500	7.000	Amargarh	0.500	0.500
2 2	17.900	18.200	Chak Hira Singhwala	0.300	0.300
3	30.600	31.600	Sangaria	1.000	1.000
Sangaria to Chaiya					
1	6.80	8.00	Saliwala Village	1.200	1.200
2	16.90	17.90	Tandoorwali	1.000	1.000
3	23.70	25.90	Tibbi	2.200	2.200
4	34.60	35.60	Silwala Khurd	1.000	1.000
5	44.90	45.70	Dabali Khurd	0.800	0.800
6	52.40	52.80	Mirjiwali Mere	0.400	0.400
7	54.70	55.50	Bhompura	0.800	0.800
Total Length in Km				9.200	9.200

Supplementary Appendix-2: Surface water bodies along the road

S. No.	Type of Structure	Chainage (km)	Distance from Centre Line(m)	Side	Impact	Relocation
1	Canal	10+100	Crossing	-	No	No
2	Canal	14+500	Crossing	-	No	No
3	Canal	19+500	Crossing	-	No	No
4	Canal	28+300	Crossing	-	No	No
5	Canal	51+300	Crossing	-	No	No
6	River	59.100	Crossing	-	No	No
7	Canal	74.100	Crossing	-	No	No
8	Pond	79.900	150	RHS	No	No
9	Pond	80.100	40	RHS	No	No
10	Canal	81.100	Crossing	-	No	No
11	Canal	82.710	Crossing	-	No	No

S. No.	Type of Structure	Chainage (km)	Distance from Centre Line(m)	Side	Impact	Relocation
12	Canal	87.400	Crossing	-	No	No
13	Pond	91.910	8	LHS	Yes	Yes
14	Canal	95.200	Crossing	-	No	No

Supplementary Appendix-3: Noise Receptors along the road

Sl.No.	Receptor	Side	Km	From	To	Width
1	Sri Shyam Temple	RHS	0.200	0.190	0.210	3.500
2	Shrines	LHS	7.200	7.175	7.225	5.000
3	Bus Stand	LHS	10.600	10.590	10.610	5.000
4	Govt. School	LHS	14.100	14.075	14.125	7.000
5	Guru Dwara	RHS	14.150	14.125	14.175	10.000
6	Bus Stand	RHS	19.710	19.700	19.710	5.000
7	Crematorium	LHS	25.100	25.000	25.200	10.000
8	Jammeshwar Temple	LHS	25.150	25.140	25.160	7.000
9	Gram Panchayat	LHS	25.300	25.275	25.325	10.000
10	Schhol	LHS	25.350	25.250	25.450	7.000
11	K.R School	RHS	28.900	28.875	28.925	8.000
12	Temple	LHS	44.600	44.590	44.610	10.000
13	Sub Health Center	LHS	45.000	44.980	45.020	3.000
14	School	RHS	49.600	49.450	49.650	3.000
15	Play Ground	RHS	61.490	61.400	61.600	7.000
16	Crematorium Boundary	RHS	70.950	70.925	70.975	5.000
17	Hospital	RHS	72.550	72.525	72.575	5.000
18	Guru Dwara	RHS	74.500	74.750	74.725	5.000

ENVIRONMENTAL MONITORING PLAN FOR SADULSHAHAR-SANGARIA -CHAIYA

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
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	2 sampling per km of built up area during active construction: Sadul Shahar (2), Karadwala (2), Amargarh, (2), Chak Hira Singhwala(2), Bolanwali(2), Sangaria(2), Saliwal Village(10), Tandoor Wali(4), Tibbi(2), Silwala(2), Dabali Khurd(2),, Mirjiwali mere(2), and Bhoompura(2) Total 36 Batching and hot mix plants sampling part of SPCB annual renewal of permits	During Active Construction	Air quality standard by CPCB	36X9000= 324,000	Concessionaire through approved monitoring agency	RPWD /CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3 =Rs 81,000	RPWD through approved monitoring agency	RPWD
Water Quality	Construction stage	Ground water: (IS:10500:1991)	Grab sample collected from source and analyse as per Standard Methods prescribed by CPCB	Groundwater at Construction Camps	3 times in year for 2 years at 2 camp with 2 bore wells each	Water quality standard by CPCB	12x 5000x2 = Rs 120,000	Concessionaire through approved monitoring agency	RPWD /SC
	Operation stage			Groundwater at 2 locations and surface water at 2 location	3/year for 1 year	Water quality standard by CPCB	3X4X5000 =Rs 60, 000	RPWD through approved monitoring agency	RPWD
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	During Active Construction	National Ambient Noise Standard specified in Environment Protection Act, 1986	36x3000 =Rs. 108,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	3/year for 1 year		3x3000x3 =Rs 27,000	RPWD through approved monitoring agency	RPWD
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer RPWD /	Camp, Dumping/storage areas and HMP sites (4 locations)	Once during whole construction stage	ICAR standard	56,000	Concessionaire through approved monitoring agency	RPWD/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
	Operation stage	Oil and grease	supervision consultant	At oil spillage locations and other probable soil contamination location	Once for the first year of operation	CPCB standard	28000	RPWD through approved agency	RPWD
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		cut and fill locations	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire	RPWD/CSC
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of 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	Concessionaire'	RPWD/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	RPWD	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire 's quote	Concessionaire with approval from RPWD	RPWD/CSC
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	RPWD/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD	Compensatory: RPWD/Local Forest Departments Additional Plantation: Concessionaire The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through Concessionaire will be responsible for monitoring	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost		
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	RPWD/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police	
	Construction Stage	Nature and cause of collision, season, Month and time of collision.		Animal crossing locations as identified in IEE	occurrence of collision		Civil Cost	Concessionaire	RPWD/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Wildlife Vehicle Collisions	Operation stage	1. Success of road furniture viz. rumble strip, cautionary signages etc. designed for safe movement 2. Nature and cause of collision, season, Month and time of collision 3. Monitoring of movement path based on information available with forest department and local people.		Animal crossing Locations as identified in IEE	Random all through the year	As suggested by forest department	Operation and Maintenance Cost	RPWD in coordination with forest department or through an specialized wildlife expert team	
Monitoring Costs: INR 0.804 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR LOSAL-SALASAR-RATANGARH

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions	<ul style="list-style-type: none">CBR value of sub grade as per IRC guidelinesRoadside drains to avoid water logging in buildup-sectionsProvision of adequate no. of cross drainage structures.Increased size of existing structures with inadequate waterwayExisting causeways to be replaced with CD structures	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	Throughout the habitated areas Side drains provided for 77.222 km length	<u>MI</u> : Design and number of cross and side drains, slab/box culverts, and Hume pipes <u>PT</u> : Design and numbers are in accordance with site needs	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 concession aire	Design Consultant	RPWD
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Vertical and horizontal geometrics in consistent to IRC/MORTH guidelinesSpeed breakers in habitat areas, junction , near sensitive receptors and curves to regulate speed.Provision of retro-reflective warning signboards near school, hospital ,religious places and forestsInformatory signage near habitated areasAmbulance and medical aid postsChecking for overloading at toll plazasFootpath over covered drain	Design requirement IRC:SP:73-2007 IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 Horizontal geometry as per IRC: 38-1988 and vertical geometry based on IRC: SP 23-1993 “.	Speed Restrictions in all built-up sections Road Studs throughout the corridor	<u>MI</u> : number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc <u>PT</u> : numbers and location are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concession aire	Design Consultant	RPWD
2. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch Roadside drains	<u>MI</u> : Pavement Surface and bridge expansion joints during extreme heat <u>PI</u> : 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 concession aire		

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2.2 Earthquake	<ul style="list-style-type: none"> 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	<u>MI</u> : Bridge and Culverts_ <u>PT</u> : 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	concessionaire	RPWD
2.3 Drought	<ul style="list-style-type: none"> The design of foundations and sub-structures shall conform to IRC guidelines and MORTH clause Ensure water availability for compaction work and consolidation of sub-structure 	IRC:78-2000 Standard Specifications and Code of Practice for Road Bridges	Minor bridge at 39.500	<u>MI</u> : Sub-structure of bridges <u>PI</u> : Sub-structures are consolidated and compacted	Design and drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	concessionaire	
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none"> Improvement to be accommodated within ROW to the extent possible. Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. Complete all necessary land and property acquisition procedures prior to the commencement of civil work. Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. Compensation and assistance as per project Resettlement Plan Income restoration as per RP Preference in employment and petty contracts during construction to APs Constitute GRC as per RP 	<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.</p> <p>Contract Clause for preference to local people during employment.</p>	Land acquisition mainly for toll plaza and bypasses Bypass at: Losal (5.000Km), Singrawata(1.67 Km) , Mourdanga (2.0 Km), Shahpura (2.300Km), Nechwa (2.700km), Gudawar(1.70Km)i, Shobhasar (2.700 Km) , Khuri (3.000 km), Dhakawali (2.000Km), Kanwari & Mainasar (4.000 Km),Bhinchari(1.640 km), Sangasar(1.450Km) & Loonch(1.610 Km).	<u>MI</u> : Payment of compensation and assistance to DPs as per RP Number of complaints/grievances related to RP <u>PT</u> : Minimal number of grievances. All cases of resettlement and rehabilitation are resolved at GRC level. No case referred to arbitrator/court.	Check LA records; design drawings vs land plans; Interview with affected persons Check status of employment given to local people during construction	Part of administrative and resettlement costs	RPWD and implementing NGO	RPWD

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Diversion of Forest Land and Cutting of Trees								
4.1 Need for cutting of trees and diversion of forest land	<ul style="list-style-type: none">▪ Geometric adjustments to minimize tree cutting▪ Obtain tree cutting permission from forest department/district collector▪ 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 Land Diversion=nil Tree cutting throughout the corridor Total number of affected trees=300	MI: Number and location of geometric adjustments made to avoid tree cutting, PT: Budget adequacy for afforestation and additional plantation (1:3)	Review final design. Check budget provision for compensatory afforestation and additional plantation.	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
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none">▪ 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	Included under RPWD's costs	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
B. Construction Stage								
1. Preparatory Activities								
1.1 Preparatory activities	<ul style="list-style-type: none">▪ Submit appointment letter and resume of the 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▪ EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE▪ request PMC-ES copy of monthly monitoring formats and establish deadlines for submission.▪ EFC 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.▪ EFC will submit for approval of PMC-ES the construction camp layout before its establishment.	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<u>MI</u> : PM10 level measurements Complaints from locals due to dust <u>PT</u> : PM10 level < 100 ug/m ³ Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
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	<ul style="list-style-type: none"> Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the 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 RPWD 	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	<p><u>MI</u>: Levels of HC, SO₂, NO₂, and CO. Status of PUC certificates</p> <p><u>PT</u>: SO₂ and NO₂ levels are both less than 80ug/m³. PUC certificate of equipment and machinery is up to date</p>	<p>Standards CPCB methods</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Concessionaire	RPWD /CSC
3. Noise								
3.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during day time near residential areas Implement noisy operations intermittently to reduce the total noise generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Honking restrictions at built-up area PPEs to workers Noise monitoring as per EMoP. 	Legal requirement Noise Pollution (Regulation and Control) Amendment Rules, 2017 + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations.	<p><u>MI</u>: day and night Noise levels. Number of complaints from local people</p> <p><u>PT</u>: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas</p>	<p>As per Noise rule, 2017</p> <p>Consultation with local people</p> <p>Review of noise level monitoring data maintained by contractor</p> <p>Observation of construction site</p>	Included in civil works costs	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Land and Soil								
4.1 Land use Change and Loss of productive / topsoil	<ul style="list-style-type: none">Non-agricultural areas to be used as borrow areas to the extent possible.If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing 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	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	<u>MI</u> : Borrow pit locations/Top soil storage area <u>PT</u> : Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	RPWD /CSC
4.2 Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none">Side slopes of all cut and fill areas will be graded. 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 and 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 Near all water bodies close to project road Pond at Km 32.700 and at km 85.150	<u>MI</u> : Occurrence of slope failure or erosion issues <u>PT</u> : No slope failures. Minimal erosion issues	Review of design documents and site observation	Included in civil works cost	Concessionaire	RPWD /CSC
4.3 Borrow area management	<ul style="list-style-type: none">Obtain EC from SEIAA and compliance to EC conditions of SEIAABarren and uncultivated land to be selected as borrows area.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 guidelines (IRC 10: 1961) for its operation and rehabilitationBorrow areas not to be dug continuously.To the extent borrow areas shall be sited away from habitated areas.Borrow areas shall be leveled in environmental friendly manner	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 Guidelines for Borrow Areas management	Borrow sites location	<u>MI</u> : Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management and No.of accidents. <u>PT</u> : No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints	Review of design documents and site observations Compare site conditions with EC conditions by SEIAA	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 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	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Concessionaire	RPWD /CSC
4.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p><u>MI</u>: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p><u>PT</u>: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<p><u>MI</u>: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p><u>PT</u>: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>	Site observation	Included in civil work cost.	Concessionaire	RPWD /CSC
5. Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Provision of water harvesting structure to augment groundwater condition in the area 	CGWA Guidelines	<p>Throughout the Project section</p> <p>Toll Plaza and enhancement of existing roadside water harvesting structures being used by local people</p>	<p><u>MI</u>: Approval from competent authority Complaints from local people on water availability</p> <p><u>PT</u>: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil work cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.2 Disposal of water during construction	<ul style="list-style-type: none"> 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	<u>MI</u> :. Presence /absence of water logging in project area. <u>PT</u> :. No water logging	Standards methods Site observation and review of documents	Included in civil work cost	Concessionaire	RPWD /CSC
5.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc.	<u>MI</u> :. Proper flow of water in existing streams and rivers <u>PT</u> :. No record of overtopping/ water logging	Review of design documents Site observation	Included in civil works cost	Concessionaire	RPWD /CSC
5.4 Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Slopes to be modified suitably to restrict the soil debris entering water bodies/ existing water harvesting structures along the road such as /tanka /johads Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. 	Design requirement, ClauseNo501.8 .6.MORT&H Specification s for Road and Bridgeworks	Near all water bodies close to project road Pond at Km 32.700 and at km 85.150 Water harvesting structures present along the road, refueling stations, construction camps.	<u>MI</u> :. Presence /absence of siltation in harvesting structures along roadside <u>PT</u> :. quality confirm to turbidity and TSS limit	Field observation	Included in civil works cost	Concessionaire	RPWD /CSC
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	<ul style="list-style-type: none"> No vehicles or equipment should be parked or refueled near existing harvesting structures like tanka ,Johad Road runoff shall be allowed only through oil interceptors Chemicals and oil shall be stored on concreted platform with catchment pit for spills collection. Construction camp to be sited away from existing water harvesting str. Wastes must be collected, stored and taken to approve disposal site only. 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Water harvesting structures present along the road, refueling stations, construction camps.	<u>MI</u> :. Water quality of existing water harvesting structures present along the road <u>PT</u> :. Surface water quality meets freshwater quality standards prescribed by CPCB	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility		
							Implementation	Supervision	
6. Flora and Fauna									
6.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none">Restrict tree cutting up to toe line considering safety to road users.Obtain requisite permit for tree cutting.Mandatory compensatory plantation at 1:3 basisAdditional plantation on 1:3 basis as per the IRC guidelines to be carried out by concessionaireRegular maintenance of treesProvision 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 3m 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=300 Additional Plantation on1:3 basis	<u>MI</u> : ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. <u>PT</u> : Additional 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	Mandatory Compensatory ory 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 concessionaire	RPWD /CSC	
7. Construction Camps									
7.1 Impact associated with location	<ul style="list-style-type: none">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 # 500 m from water bodies/harvesting structures # 500 m from through traffic route	Design Requirement The Water (Prevention and Control of Pollution) Act,1974and its amendments thereof	All construction camps	<u>MI</u> : Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps <u>PT</u> : Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included in civil works cost	Concessionaire and EO	RPWD /CSC	

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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
8.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	At all Dumping/ Disposal Sites	<p><u>MI</u>: Location of dumping sites Number of public complaints.</p> <p><u>PT</u>: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Concessionaire	RPWD /CSC
8.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	<p><u>MI</u>: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p><u>PT</u>: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.		

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	<ul style="list-style-type: none">Traffic Management Plan shall be submitted by the contractor and approved by the CSC.The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road.The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed.Restriction of construction activity to only one side of the existing roadThe contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from “Engineer”.Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	<p>Design requirement and IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948 +Section 6 of Employer's Requirement of Bid Document</p>	Throughout the project corridor especially at intersections.	<p><u>MI</u>: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p><u>PT</u>: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever animal /cattle movement is expected. Construction activities in these sections to be done during night time to the extent feasible. Proper signage to be displayed near common resource properties guiding pedestrians access route. 	Same as above	Near habitation, on both sides of schools, temples, hospitals, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	RPWD /CSC
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites, Construction camps, crushers etc.	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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	<u>MI</u> : Safety signs and Incidence of accidents Complaints from local people <u>PT</u> : Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Concessionaire	RPWD /CSC
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<u>MI</u> : Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. <u>PT</u> : 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	Included in civil works cost.	Concessionaire	RPWD /CSC
C. Operation and Maintenance stage								
1. Air Quality								
1.1 Air pollution due to vehicular movement	<ul style="list-style-type: none"> 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. Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipment 	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<u>MI</u> : Ambient air quality (PM10, CO,SO2 NO2) <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation to 20 km/hour and honking restrictions near sensitive receptorsConstruction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution (Regulation and Control) Amendment Rules, 2017	Sensitive receptors as identified in IEE locations.	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	Noise monitoring as per noise rules ,2017 Discussion with people at sensitive receptor sites	Included in Operation / Maintenance cost	RPWD	
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures.	Project requirement	At bridge location and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	RPWD	
4. Water resources/Flooding and Inundation								
4.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion and stabilization conditions for its effective maintenance.	Project requirement	Near existing water bodies/water harvesting structures near the road	<u>MI</u> : Water quality <u>PT</u> : No turbidity in harvesting structure present along road	Site observation	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	RPWD	
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>PT</u> : Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	RPWD/Forest Department	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain ROW completely clear of shrubs.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation / Maintenance cost	RPWD	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be enforced strictly.Further encroachment of squatters within the ROW will be prevented.Monitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.Clearance of shrubs from ROW annually to provide better lateral visibility to avoid collision with wild animals and cattleTow-way facility for the breakdown vehicles if possible.	IRC:SP:55-2014	Throughout the Project route	<u>MI</u> : Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law <u>PT</u> : Fatal and non fatal accident rate is reduced after improvement	Review accident records Site observations	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	-	Throughout the project stretch	<u>MI</u> : Status of emergency system – whether operational or not <u>PT</u> : Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	Included in Operation / Maintenance cost	RPWD	

ENVIRONMENT MONITORING PLAN FOR LOSAL-SALASAR-RATANGARH

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
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	2 sampling per km of built up area during active construction: Losal (2) , Singrawata(2) , Mordunga(2) , Shahpura (2), Jhanjhar(2), Nechwa(2), Ganeri(2), Salasar(2), Gudawari(2), Shobhasar(2), Khuri(2), Malasi(2), Kanwari, (2) Menasar(2), Bhinchari(2), Sangasar(2), Loonch(2). Total=34 Samples Batching and hot mix plants sampling part of SPCB annual renewal of permits	During Active Construction	Air quality standard by CPCB	34X9000=306,000	Concessionaire through approved monitoring agency	RPWD /CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3 =Rs 81,000	RPWD through approved monitoring agency	RPWD
Water Quality	Construction stage	Ground water: (IS:10500:1991)	Grab sample collected from source and analyze as per Standard Methods prescribed by CPCB	Groundwater at Construction Camps	3 times in year for 2 years at 2 camp with 2 bore wells each	Water quality standard by CPCB	12x 5000x2 = Rs 120,000	Concessionaire through approved monitoring agency	RPWD /SC
	Operation stage			Groundwater at 4 locations	3/year for 1 year	Water quality standard by CPCB	3X4X5000 =Rs 60, 000	RPWD through approved monitoring agency	RPWD
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale	IS:4954-1968 as adopted by CPCB for	Same as air quality	During Active Construction	National Ambient Noise	34x3000 =Rs.102,000	Concessionaire through approved	RPWD/CS C

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
		for day and night	Identified Study Area CPCB/IS:4954-1968Using Noise level meter			Standard specified in Environment Protection Act, 1986		monitoring agency	
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	3/year for 1 year		3x3000x3 =Rs 27,000	RPWD through approved monitoring agency	RPWD
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 (4 locations)	Once during whole construction stage	ICAR standard	56,000	Concessionaire through approved monitoring agency	RPWD/CS C
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	CPCB standard	28000	RPWD through approved agency	RPWD
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		cut and fill locations	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire	RPWD/CS C
	Operation Stage		Once during operation of 1st year		Visual Checks	Routine Engineering Work	Engineering Team of 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	Concessionaire'	RPWD/CS C
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	RPWD	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire's quote	Concessionaire with approval from RPWD	RPWD/CS C
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	RPWD/CS C
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in	As suggested	Compensatory: RPWD	Compensatory: RPWD/Local Forest Departments	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
					construction phase	by Forest Dept.	Additional Plantation: Provisional sum under Civil Cost	Additional Plantation: Concessionaire	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years			The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through Concessionaire will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	RPWD/CS C
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police	
Monitoring Costs: INR 0.78 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR SIWANA –SAMDARI- BALESAR

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions	<ul style="list-style-type: none"> CBR value of sub grade as per IRC guidelines Roadside drains to avoid water logging in builtup-sections Provision of adequate no. of cross drainage structures. Increased size of existing structures with inadequate waterway Existing causeways to be replaced with CD structures 	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	Throughout the habitated areas Unlined side drains provided for 179.928 Km and lined drains is 1.360 Km (including both side)	<u>MI</u> : Design and number of cross and side drains, slab/box culverts, and Hume pipes <u>PT</u> : Design and numbers are in accordance with site needs	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 concessionaire	Design Consultant	RPWD
1.2 Safety along the proposed alignment	<ul style="list-style-type: none"> Vertical and horizontal geometrics in consistent to IRC/MORTH guidelines Speed breakers in habitat areas, junction, near sensitive receptors and curves to regulate speed. Provision of retro-reflective warning signboards near school, hospital, religious places and forests Informatory signage near habitated areas Ambulance and medical aid posts Checking for overloading at toll plazas Footpath over covered drain 	Design requirement IRC:SP:73-2007 IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 Horizontal geometry as per IRC: 38-1988 and vertical geometry based on IRC: SP 23-1993 “.	Crash barriers ,Rumble strips, Speed Restriction sign posts. Road Object Markers and Delineators are provided as recommended as per IEE	<u>MI</u> : number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc <u>PT</u> : numbers and location are in accordance with site needs	Review of design documents and comparison with site conditions	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	Design Consultant	RPWD
2. Natural Hazards and Climate Change risks								

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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
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> 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	<p>MI: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p>PT: No. of complaints should be 0. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under RPWD's costs	Contractor/ RPWD/utility company	RPWD /CSC
B. Construction Stage								
1. Preparatory Activities								
1.1 Preparatory activities	<ul style="list-style-type: none"> Submit appointment letter and resume of the 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 EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE request PMC-ES copy of monthly monitoring formats and establish deadlines for submission. EFC 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan.</p> <ul style="list-style-type: none"> EFC will submit for approval of PMC-ES the construction camp layout before its establishment. 							
1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	<p>MI: PM10 level measurements Complaints from locals due to dust</p> <p>PT: PM10 level < 100 ug/m³ Number of complaints should be zero.</p>	<p>Standards CPCB methods Observations Public consultation</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Concessionaire	RPWD /CSC

[illegible]

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.1 Land use Change and Loss of productive / topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing 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	<p>Throughout the project section and borrow areas</p> <p>Land identified for camp, storage areas etc.</p>	<p><u>MI</u>: Borrow pit locations/Top soil storage area</p> <p><u>PT</u>: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	RPWD /CSC
4.2 Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> Side slopes of all cut and fill areas will be graded. 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 and 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 Near all water bodies close to project road	<p><u>MI</u>: Occurrence of slope failure or erosion issues</p> <p><u>PT</u>: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Concessionaire	RPWD /CSC
4.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from SEIAA and compliance to EC conditions of SEIAA Barren and uncultivated land to be selected as borrows area. 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 guidelines (IRC 10: 1961) for 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 in environmental friendly manner 	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 Guidelines for Borrow Areas management	Borrow sites location	<p><u>MI</u>: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management and No.of accidents.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by SEIAA</p>	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 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	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Concessionaire	RPWD /CSC
4.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p><u>MI</u>: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p><u>PT</u>: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<p><u>MI</u>: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p><u>PT</u>: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>	Site observation	Included in civil work cost.	Concessionaire	RPWD /CSC
5. Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Provision of water harvesting structure to augment groundwater condition in the area 	CGWA Guidelines	<p>Throughout the Project section</p> <p>Toll Plaza and enhancement of existing roadside water harvesting structures being used by local people</p>	<p><u>MI</u>: Approval from competent authority Complaints from local people on water availability</p> <p><u>PT</u>: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil work cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.2 Disposal of water during construction	<ul style="list-style-type: none"> 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	<u>MI</u> : Presence /absence of water logging in project area. <u>PT</u> : No water logging	Standards methods Site observation and review of documents	Included in civil work cost	Concessionaire	RPWD /CSC
5.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river(Luni bet km 26.000 to km 27.000) nallah crossings etc. Water body at km 22.400, km 50.300, km 69.400, km 75.800, km 79.500, km 80.500, km 83.500, km 90.000, km 90.300	<u>MI</u> : Proper flow of water in existing streams and rivers <u>PT</u> : No record of overtopping/ water logging	Review of design documents Site observation	Included in civil works cost	Concessionaire	RPWD /CSC
5.4 Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Slopes to be modified suitably to restrict the soil debris entering water bodies/ existing water harvesting structures along the road such as /tanka/ johads Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridgeworks	Near all water bodies close to project road Near all drainage channels, river(Luni bet km 26.000 to km 27.000) nallah crossings etc. Water body at km 22.400, km 50.300, km 69.400, km 75.800, km 79.500, km 80.500, km 83.500, km 90.000, km 90.300	<u>MI</u> : Presence /absence of siltation in harvesting structures along roadside <u>PT</u> : quality confirm to turbidity and TSS limit	Field observation	Included in civil works cost	Concessionaire	RPWD /CSC

[illegible]

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.1 Management of existing traffic and safety	<ul style="list-style-type: none"> ▪ Traffic Management Plan shall be submitted by the contractor and approved by the CSC. ▪ The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. ▪ The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. ▪ On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. ▪ Restriction of construction activity to only one side of the existing road ▪ The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". ▪ Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	<p>Design requirement and IRC: SP: 27 - 1984, Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948 +Section 6 of Employer's Requirement of Bid Document</p>	Throughout the project corridor especially at intersections.	<p>MI: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever animal /cattle movement is expected. Construction activities in these sections to be done during night time to the extent feasible. Proper signage to be displayed near common resource properties guiding pedestrians access route. 	Same as above	Near habitation, on both sides of schools, temples, hospitals, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	RPWD /CSC
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites, Construction camps, crushers etc.	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Concessionaire	RPWD /CSC

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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
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures.	Project requirement	At bridge location 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	RPWD	
4. Water resources/Flooding and Inundation								
4.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion and stabilization conditions for its effective maintenance.	Project requirement	Near existing water bodies/water harvesting structures near the road	MI: Water quality PT: No turbidity in harvesting structure present along road	Site observation	Included in Operation / Maintenance cost	RPWD	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.	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	RPWD	
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees 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	RPWD/Forest Department	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain ROW completely clear of shrubs.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo 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	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures, including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented. 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. Clearance of shrubs from ROW annually to provide better lateral visibility to avoid collision with wild animals and cattle Tow-way facility for the breakdown vehicles if possible. 	IRC:SP:55-2014	Throughout the Project route	<p>MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law</p> <p>PT: Fatal and non fatal accident rate is reduced after improvement</p>	<p>Review accident records</p> <p>Site observations</p>	Included in Operation / Maintenance cost	RPWD	
6.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	-	Throughout the project stretch	<p>MI: Status of emergency system – whether operational or not</p> <p>PT: Fully functional emergency system</p>	<p>Review of spill prevention and emergency response plan</p> <p>Spill accident records</p>	Included in Operation / Maintenance cost	RPWD	

ENVIRONMENT MONITORING PLAN FOR SIWANA –SAMDARI- BALE SAR

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Air Quality	Construction stage	PM ₁₀ PM _{2.5} SO ₂ , NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	2 sampling per km of built up area during active construction: Meli(2), Karmawas(4), Kalyanpur(4), Mandli (2), Dhandhaniw(4), Samadari(6), Loharo Ki Dhani(2), Nagana Phanla(2), Rohra Khurd(2), Godasar(2). Total=30 Samples Batching and hot mix plants sampling part of SPCB annual renewal of permits	During Active Construction Period	Air quality standard by CPCB	30X9000=270,000	Concessionaire through approved monitoring agency	RPWD /CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3 =Rs 81,000	RPWD through approved monitoring agency	RPWD
Water Quality	Construction stage	Ground water: (IS:10500:1991)	Grab sample collected from source and analyzed as per Standard Methods prescribed by CPCB	Groundwater at Construction Camps	3 times in year for 2 years at 2 camp with 2 bore wells each	Water quality standard by CPCB	12x 5000x2 = Rs 120,000	Concessionaire through approved monitoring agency	RPWD /SC
	Operation stage			Groundwater at 2 locations and surface water at 2 location	3/year for 1 year	Water quality standard by CPCB	3X4X5000 = Rs. 60, 000	RPWD through approved monitoring agency	RPWD
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Same as air quality	During Active Construction Period	National Ambient Noise Standard specified in Environment Protection Act, 1986	30x3000 =Rs.90,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage			Representative sample each for residential, commercial and sensitive (3 Locations)	3/year for 1 year		3x3000x3 = Rs. 27,000	RPWD through approved monitoring agency	RPWD
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 (4 locations)	Once during whole construction stage	ICAR standard	56,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	CPCB standard	28000	RPWD through approved agency	RPWD
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		cut and fill locations	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire	RPWD/CSC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of 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	Concessionaire'	RPWD/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	RPWD	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire 's quote	Concessionaire with approval from RPWD	RPWD/CSC
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	RPWD/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD	Compensatory: RPWD/Local Forest Departments	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost	Additional Plantation: Concessionaire The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through Concessionaire will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	RPWD/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police	
Monitoring Costs: INR 0.732 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR BEAWAR-MASUDA-GOYLA

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions	<ul style="list-style-type: none">▪ CBR value of sub grade as per IRC guidelines▪ Bottom of crust shall be at least 600mm above HFL to prevent any capillary action due to black cotton/expansive/cohesive soil▪ Raised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also inconvenience caused to▪ Provision of adequate no. 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	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	The details of culverts available on the project road are given in Feasibility report. There are no Major bridges in the alignment	<u>MI</u> : Design and number of cross and side drains, slab/box culverts, and Hume pipes <u>PT</u> : Design and numbers are in accordance with site needs	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 concessionaire	Design Consultant	RPWD

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.2 Safety along the proposed alignment	<ul style="list-style-type: none"> 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 sign boards near school, hospital, religious places and forests Safety kerb at all bridges Informatory signage on approach to school, Ambulance and medical aid posts Checking for overloading at toll plazas Speed restrictions in built up sections curve locations etc 	<p>Design requirement</p> <p>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</p> <p>Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 “.</p> <p>IRC: SP: 67-2012</p>	<p>Curve locations</p> <p>Crash barriers at bri sharp curves and high embankments</p> <p>Speed Breakers and signages near built-up areas and toll plazas</p> <p>Road Studs, object Markers etc</p>	<p><u>MI</u>: number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc</p> <p><u>PT</u>: numbers and location are in accordance with site needs</p>	<p>Review of design documents and drawings and comparison with site conditions</p>	<p>Covered under preliminary design preparation by F/S consultant</p> <p>Detailed design cost to be borne by concessionaire</p>	Design Consultant	RPWD
2. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	<ul style="list-style-type: none"> Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders. 	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	<p><u>MI</u>: Pavement Surface and bridge expansion joints during extreme heat</p> <p><u>PI</u>: No softening, rutting, asphalt migration/thermal expansion of joint</p>	Review of design documents and drawings and comparison with site conditions	<p>preliminary design cost of F/S consultant</p> <p>Detailed design cost to be borne by concessionaire</p>		

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2.2 Flooding/Water-Logging	<ul style="list-style-type: none"> 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/ Bridges to increase their carrying capacity. 	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	See severely flood prone areas.	<u>MI</u> : Design and numbers of cross & side drains, slab/box culverts Hume pipes, road embankment height, design and number of bridges <u>PT</u> : Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	concessionaire	RPWD
2.2 Earthquake	<ul style="list-style-type: none"> 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	<u>MI</u> : Bridges and Culverts <u>PT</u> : 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	concessionaire	RPWD
2.3 Drought	<ul style="list-style-type: none"> The design of foundations and sub-structures shall conform to IRC guidelines and MORTH clause 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	<u>MI</u> : Sub-structure of bridges <u>PI</u> : Sub-structures are consolidated and compacted	Design and drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	concessionaire	
2.4 Forest Fires	<ul style="list-style-type: none"> Measures to avoid accident followed by fuel accumulation 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 	Design requirement	Project road is close to forest area for a length of 3.86 km	<u>MI</u> : Damage to roadside flora and spillage /fuel accumulation induced accident <u>PI</u> : Zero incidence of forest fire		Covered under F/S consultant cost	concessionaire	
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none"> Road improvement work to be accommodated within available ROW to the extent possible. 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. 	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.	Throughout the corridor The total area of land required to be acquired under the project is approximately 60.868 ha.No private structures (residential	<u>MI</u> : Payment of compensation and assistance to DPs as per RP Number of complaints/grievances related to compensation	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	RPWD

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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
5.1 Road design causing accidents of wild animals and disruption in their movement	<ul style="list-style-type: none"> Provision of rumble strip, cautionary and informatory sign boards near potential wildlife accident locations Speed restriction in the sections where wildlife movement is reported Expansion of existing pipe culverts to slab culverts in areas where wildlife movement is reported Live fencings by thorn species Solar Street lighting at vulnerable areas 		Intermittently through the forest stretch	<p><u>MI</u>: budget allocation for rumble strips, cautionary and informatory sign boards,</p> <p><u>PT</u>: Budget adequate to fulfill the installation of recommended facilities and structures</p>	Review of bid documents and project budget plan	Covered under costs for F/S Consultant	RPWD, Design Consultant	RPWD/CS C in coordination with Forest Department
6. Shifting of Utilities								
3.1 Disruption of utility services to local community	<ul style="list-style-type: none"> 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	<p><u>MI</u>: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p><u>PT</u>: No. of complaints should be 0. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under RPWD's costs	Contractor/ RPWD/utility company	RPWD /CSC
B. Construction Stage								
1. Preparatory Activities								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.1 Preparatory activities	<ul style="list-style-type: none"> ▪ Submit appointment letter and resume of the 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 ▪ EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE ▪ request PMC-ES copy of monthly monitoring formats and establish deadlines for submission. ▪ EFC 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. ▪ EFC will submit for approval of PMC-ES the construction camp layout before its establishment. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials approved by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor, as required by the progress of construction activities at locations- Beawar, Andheri Deori, Pakhariyawas, Kheempura, Haldwaniya, Masuda, Begaliyawas, Jheepiya, Bandanwara, Keetap, Kalyanpura, Tantoti, Bhagwanpura, Chandma, Jawla, Goyla	<p><u>MI</u>: PM₁₀ level measurements Complaints from locals due to dust</p> <p><u>PT</u>: PM₁₀ level < 100 ug/m³ Number of complaints should be zero.</p>	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Concessionaire	RPWD /CSC

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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
4.1 Land use Change and Loss of productive /topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, topsoil 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	<p>Throughout the project section and borrow areas</p> <p>Land identified for camp, storage areas etc.</p>	<p><u>MI</u>: Borrow pit locations/Top soil storage area</p> <p><u>PT</u>: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	RPWD /CSC
4.2 Borrow area management	<ul style="list-style-type: none"> EC from SEIAA for new borrow area. Comply to EC conditions of SEIAA Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions. 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) Borrow areas not to be dug continuously. To the extent borrow areas shall be sited away from habitated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond. 	IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act) + Clause 305.2.2 MORT H Specifications for Road and Bridge works Guidelines for Borrow Areas management	Existing borrow areas in the nearby locations	<p><u>MI</u>: Existence of borrow areas in unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by SEIAA in EC letter. Zero accidents. Zero complaints. No use of black cotton soil</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by SEIAA</p>	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.3 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 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	Existing quarries in the nearby areas	<p><u>MI</u>: Existence of licensed quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Concessionaire	RPWD /CSC
4.4 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p><u>MI</u>: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not been restored to its original condition</p> <p><u>PT</u>: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.5 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<p><u>MI</u>: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p><u>PT</u>: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>	Site observation	Included in civil work cost.	Concessionaire	RPWD /CSC
5. Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Provision of water harvesting structure to augment groundwater condition in the area 	CGWA Guidelines	Throughout the Project section. Construction of johads and other related structures	<p><u>MI</u>: Approval from competent authority Complaints from local people on water availability</p> <p><u>PT</u>: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil work cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.2 Disposal of water during construction	<ul style="list-style-type: none"> Provisions shall be made to connect roadside drains with existing nearby natural drains. 	Clause No. 1010E P Act 1986 MORT & H Specifications for Road and Bridge works	Throughout the Project section	<p><u>MI</u>: Condition of drainage system in construction site. Presence/absence of water logging in project area.</p> <p><u>PT</u>: Existence of proper drainage system. No water logging in project area</p>	Standards methods Site observation and review of documents	Included in civil work cost	Concessionaire	RPWD /CSC
5.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be brought back to its original course immediately after construction. 	Design requirement, Clause 501.8.6. MORT & H Specifications for Road and Bridge	Near all drainage channels, nallah crossings etc.	<p><u>MI</u>: Proper flow of water in existing streams and rivers</p> <p><u>PT</u>: No complaint of water shortage by downstream communities. No record of overtopping/ water logging</p>	Review of design documents Site observation	Included in civil work cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.4 Siltation in water bodies due to construction activities/earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, ClauseNo501.8. 6.MORT&H Specifications for Road and Bridgeworks</p> <p>Worldwide best practices</p>	No water body /crossing.	<p><u>MI</u>: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Concessionaire	RPWD /CSC
6. Flora and Fauna								
6.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> 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 1:2 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 	ForestConservationAct1980 + IRC:SP:21andIRC:SP:66	<p>Throughout project corridor</p> <p>Estimated No. of affected tree=327</p> <p>Additional Plantation on1:3 basis</p>	<p><u>MI</u>: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted.</p> <p><u>PT</u>: Additional compensatory afforestation done on a 1:3 basis by concessionaire.</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy</p> <p>Field observations</p>	<p>Mandatory Compensatory afforestation cost is included in project costs under RPWD.</p> <p>Additional compensatory afforestation costs included in civil works costs</p>	Mandatory Compensatory plantation by forest Department and additional plantation by concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7. Construction Camps								
7.1 Impact associated with location	<ul style="list-style-type: none">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	Design Requirement The Water(Prevention and Control of Pollution) Act,1974and its amendments thereof	All construction camps	<u>MI</u> : Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps <u>PT</u> : Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included in civil works cost	Concessionaire And EO	RPWD /CSC
7.2 Worker's Health in construction camp	<ul style="list-style-type: none">The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved b EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner.Adequate water and sanitary latrines with septic tanks with soak pits shall be provided.Preventive medical facilities in campWaste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations.No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community.Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases.	The Building and Other Construction workers(Regulation of Employment and Conditions of service)Act1996 and The Water (Prevention and Control of Pollution) Act,1974 and amendments thereof	All construction camps	<u>MI</u> : Camp health records Existence of proper first aid kit in camp site Complaints from workers. <u>PT</u> : No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Concessionaire	RPWD /CSC

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

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	<ul style="list-style-type: none">Traffic Management Plan shall be submitted by the contractor and approved by the CSC.The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road.The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed.Restriction of construction activity to only one side of the existing roadThe contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from “Engineer”.Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	<p>Design requirement and IRC: SP: 27 - 1984,Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014</p> <p>The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document</p>	Throughout the project corridor especially at intersections.	<p>MI: Traffic management plan. Presence/absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p>PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever 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	Habitation, school, temples, hospitals, construction sites, haulage roads, diversion sites. signpost every 3 kms uninterrupted stretch of uninhabited forest area	<u>MI</u> : Presence/absence of access routes for pedestrians. Road signage Number of complaints from local people <u>PT</u> : Easy access to schools, temples and public places. Zero complaints	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	RPWD /CSC
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage ,in local language at the construction sites Training to workers on safety procedures and precautions. Mandatory appointment of safety officer/ Accident Prevention Officer All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. Provision of PPEs to workers. Provision of a readily available first aid unit including an adequate supply of dressing materials. The contractor will not employ any person below the age of 18 years Use of hazardous materials should be minimized and/or restricted. Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. 	Same as above	Construction sites	<u>MI</u> : Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents <u>PT</u> : 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 Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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 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	Concessionaire	RPWD /CSC
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	MI: Condition of camp, borrow areas and construction sites, Presence 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/leveled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found satisfactory	Included in civil works cost.	Concessionaire	RPWD /CSC
C. Operation and Maintenance stage								
1. Wildlife Movement								
1.1 Anticipated risk of vehicle-animal collision and human-animal conflict	<ul style="list-style-type: none"> Effectiveness of mitigative measures (rumble strips, informatory /cautionary signage, solar street lighting, etc.) recommended in design stage shall be monitored. Effectiveness of habitat enhancement measures shall be evaluated RPWD to keep record of all accidents. Fresh assessment in case of future widening 	Project Requirement	In Forest Blocks	MI: Number, time, season, location and cause of collision. No of incidence of human – animal conflict. PT: minimum vehicle –animal collisions. No of consultation done with forest department	Site Observation Discussion with local People Collection of information from Forestry Department	Included in Operation/Main tenance cost	RPWD field offices/Forest Department	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Air Quality								
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none">Roadside tree plantations shall be maintained at least with 70% survival rate.Regular maintenance of the road will be done to ensure good surface conditionAmbient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.Signages shall be provided reminding 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	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	<u>MI</u> : Ambient air quality (PM10, CO,SO2 NO2) <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection	Included in Operation/Main tenance cost	RPWD	
3. Noise								
3.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation to 20 km/hour and honking restrictions near sensitive receptorsConstruction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution (Regulation and Control) Amendment Rules, 2017	Sensitive receptors as identified in IEE	<u>MI</u> : Noise levels <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	Noise monitoring as per noise rules ,2017 Discussion with people at sensitive receptor sites	Included in Operation/Main tenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Land and Soil								
4.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/Main tenance cost	RPWD	
5. Water resources/Flooding and Inundation								
5.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion and turfing 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/Main tenance cost	RPWD	
5.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/ streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging	Site observation	Included in Operation/Main tenance cost	RPWD	
6. Flora								
6.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/Main tenance cost	RPWD/Forest Department	
7. Maintenance of Right of Way and Safety								
7.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo 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/Main tenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented. 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. 	IRC:SP:55-2014	Throughout the Project route	<p><u>MI</u>: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law</p> <p><u>PT</u>: Fatal and non fatal accident rate is reduced after improvement</p>	<p>Review accident records</p> <p>Site observations</p>	Included in Operation/Main tenance cost	RPWD	
7.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	-	Throughout the project stretch	<p><u>MI</u>: Status of emergency system – whether operational or not</p> <p><u>PT</u>: Fully functional emergency system</p>	<p>Review of spill prevention and emergency response plan</p> <p>Spill accident records</p>	Included in Operation/Main tenance cost	RPWD	

ENVIRONMENTAL MONITORING PLAN FOR BEAWAR-MASUDA-GOYLA (MDR-57)

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
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	2 sampling per km of built up area during active construction: - Beawar(2), Andheri Deori (2) , Pakhariyawas(2), Kheempura(2), Haldwaniya(2), Masuda(2), Begaliyawas(2), Jheepiya(2), Bandanwara(2), Keetap(2), Kalyanpura(2), Tantoti(2), Bhagwanpura(2), Chandma(2), Jawla(2), Goyla(2) Total 34 Samples Batching and hot mix plants sampling part of SPCB annual renewal of permits	During Active Construction Period	Air quality standard by CPCB	34x9000 =Rs 306,000	Concessionaire through approved monitoring agency	RPWD /CSC
	Operation stage			Representative sample each for residential, commercial and sensitive/forest area (3 Locations)-	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3 =Rs 81,000	RPWD through approved monitoring agency	RPWD
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyzed as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps	Thrice in a year for 2 years, 2 camps with 2 bore wells each	Water quality standard by CPCB	6x 5000x2x2 = Rs 120,000	Concessionaire through approved monitoring agency	RPWD /SC
	Operation stage			Groundwater at 4 locations	3/year for 1 year	Water quality standard by CPCB	3X4X5000 =Rs 60, 000	RPWD through approved monitoring agency	RPWD
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968 Using Noise level meter	Same as air quality	During Active Construction Period	National Ambient Noise Standard specified in Environment Protection Act, 1986	34x3000 =Rs.102,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage			Representative sample each for residential, commercial and sensitive/forest area (3 Locations)-	3/year for 1 year		3x3000x3 =Rs 27,000	RPWD through approved monitoring agency	RPWD

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision	
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 (2 locations)	Once during whole construction stage	ICAR standard	56,000	Concessionaire through approved monitoring agency	RPWD/CSC	
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	CPCB standard	28000	RPWD through approved agency	RPWD	
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	Concessionaire	RPWD/CSC	
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of 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	Concessionaire'	RPWD/CSC	
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	RPWD		
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire 's quote	Concessionaire with approval from RPWD	RPWD/CSC	
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	RPWD/CSC	
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD	Compensatory: RPWD/Local Forest Departments		
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost	Additional Plantation: Concessionaire The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through Concessionaire will be responsible for monitoring		
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	RPWD/CSC	
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police		
	Construction Stage	Nature and cause of collision, season, Month and time of collision.		Animal crossing locations as identified in IEE	occurrence of collision		Civil Cost	Concessionaire	RPWD/CSC	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Wildlife Vehicle Collisions	Operation stage	1. Success of road furniture viz. rumble strip, cautionary signages etc. designed for safe movement 2. Nature and cause of collision, season, Month and time of collision 3. Monitoring of movement path based on information available with forest department and local people.		Animal crossing Locations as identified in IEE	Random all through the year	As suggested by forest department	Operation and Maintenance Cost	RPWD in coordination with forest department or through an specialized wildlife expert team	
Monitoring Costs: INR 0.78 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR ARAIN-SARWAR (SH-7E; H-IV)

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	<ul style="list-style-type: none">▪ CBR value of sub grade as per IRC guidelines▪ Bottom of crust shall be at least 600mm above HFL to prevent any capillary action due to black cotton/expansive/cohesive soil▪ Raised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also inconvenience caused to▪ Provision of adequate no. 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	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	Total Culverts :=79, HP=37, Box=3 Refer DPR/IEE , For list of bridges and culverts with increased waterways Roadside drains (both sides together) Covered=13.4 km Unlined=126.4 km	<u>MI</u> : Design and number of cross and side drains, slab/box culverts, and Hume pipes <u>PT</u> : Design and numbers are in accordance with site needs	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 concessionaire	Design Consultant	IE/PMC/RPW D

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
			<p>1 Minor bridge proposed for widening at 6+0675Km</p> <p>Embankment height >3.0 m Rumble strip near the location of schools, hospital and small villages along the road Near Govt. School Chhota Lamba (RHS) at km 6.550</p> <p>Toll Plazas=One Toll Plaza has been proposed at km 30.650 (Existing Chainge) (Borada village).</p> <p>Lined drains= In the habitation area/urban areas RCC covered 3.5 km in LHS and 3.5 km in RHS Total 13 T-Junctions and 1 Cross-Junction Improvements</p> <p>Bus bays/Shelters= 16 on LHS & RHS</p>					

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1.2 Safety along the proposed alignment	<ul style="list-style-type: none"> 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 bridge s Informatory signage on approach to school, Ambulance and medical aid posts Checking for overloading at toll plazas Speed restrictions in built up sections curve locations etc 	<p>Design requirement</p> <p>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</p> <p>Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 “.</p> <p>IRC: SP: 67-2012</p>	<p>Speed Restrictions locations</p> <p>Crash barriers at bridges and Object Marker</p> <p>Speed Breaker at locations near built-up areas, school, and toll plazas</p> <p>Road Studs</p>	<p><u>MI</u>: number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc.</p> <p><u>PT</u>: numbers and location are in accordance with site needs</p>	<p>Review of design documents and drawings and comparison with site conditions</p>	<p>Covered under preliminary design preparation by F/S consultant</p> <p>Detailed design cost to be borne by concessionaire</p>	Design Consultant	IE/PMC/RPW D
2. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	<ul style="list-style-type: none"> Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders. 	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch, as given in the 1.1	<p><u>MI</u>: Pavement Surface and bridge expansion joints during extreme heat</p> <p><u>PI</u>: No softening, rutting, asphalt migration/thermal expansion of joint</p>	Review of design documents and drawings and comparison with site conditions	<p>preliminary design cost of F/S consultant</p> <p>Detailed design cost to be borne by concessionaire</p>		
2.2 Flooding/Water-Logging	<ul style="list-style-type: none"> 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/ Bridges to increase their carrying capacity. 	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	Entire stretch. Same as given in the 1.1.	<p><u>MI</u>: Design and numbers of cross & side drains, slab/box culverts Hume pipes, road embankment height, design and number of bridges</p> <p><u>PT</u>: Design and numbers are in accordance with site needs</p>	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	concessionaire	IE/PMC/RP WD

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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2.3 Earthquake	<ul style="list-style-type: none"> 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	<u>MI:</u> Bridges and Culverts_ <u>PT:</u> 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	concessionaire	IE/PMC/RP WD
2.4 Drought	<ul style="list-style-type: none"> The design of foundations and sub-structures shall conform to IRC guidelines and MORTH clause 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	<u>MI:</u> Sub-structure of bridges <u>PI:</u> Sub-structures are consolidated and compacted	Design and drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	concessionaire	IE/PMC/RP WD
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	<ul style="list-style-type: none"> Road improvement work to be accommodated within available ROW to the extent possible. 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 Preference in employment and petty contracts during construction to APs Constitute GRC as per RP 	<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy.</p> <p>Contract Clause for preference to local people during employment.</p>	<p>Throughout the corridor</p> <p>Total 2.056 hectare land will be Acquired in the Arai and Sarwar Tehsil, 27 structures will be impacted. Out of 27 impacted structures 3 are up 10% to 25% impacted, 12 are up to 50% impacted About 24nos. private structures (residential + commercial) will be impacted Refer SIA/RAP for more details</p>	<u>MI:</u> Payment of compensation and assistance to DPs as per RP Number of complaints/grievances related to compensation and resettlement <u>PT:</u> Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case referred to arbitrator/court.	Check LA records; design drawings vs land plans; Interview with affected persons Check status of employment given to local people during construction	Part of administrative and resettlement costs	RPWD and implementing NGO	IE/PMC/RP WD
4. Diversion of Forest Land and Cutting of Trees								
4.1 Need for cutting of trees and diversion of forest land	<ul style="list-style-type: none"> Geometric adjustments to minimize tree cutting and diversion of forest land Obtain tree cutting permission from forest department Provision for mandatory compensatory afforestation (1:2) for deposit of payment to Forestry Department 	Forest Conservation Act, 1980	<p>Tree cutting throughout the corridor</p> <p>Total number of affected trees=151</p> <p>No forest land required</p>	<u>MI:</u> Number and location of geometric adjustments made to avoid forestland and tree cutting, budget amount allocated for	Review final design. Check budget provision for compensatory afforestation and additional plantation.	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by	RPWD, Design consultants forest department	SHAH/Forest department/ IE/PMC/RP WD

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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	<ul style="list-style-type: none"> Provision for additional compensatory plantation on 1: 3 basis to be implemented by concessionaire 			compensatory afforestation and additional plantation (1:3) <u>PT</u> : Unnecessary tree felling on forest land avoided. Budget allocation is adequate,		concessionaire		
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> 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 Transformers(170) Telephone Pole (157)	<u>MI</u> : Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities <u>PT</u> : No. of complaints should be 0. Minimal time for utility shifting	Interaction with concerned utility authorities and local public	Included under RPWD's costs	Contractor/ RPWD/utility company	IE/PMC/RP WD
B. Construction Stage								
1.0 Preparatory activities								
1.1 Preparatory activities	<ul style="list-style-type: none"> Submit appointment letter and resume of the 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 EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	IE/PMC/RP WD

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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
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials agreed by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor, as required by progress of construction activities at locations - Arai (0.600 Km,) , Lamba (2.100 Km) , Ankodiya (9.900 Km), Jorawarpura (16.000Km), Kasir (18.00Km) , Shri Rampura (Laapda, 21.800 Km), Borada (24.800Lm), Dhanwa (32.550Lm), Fatehgarh (36+100Km), Indrapura (39.850Km), Daulatpura (41.550Km) , Sarwar (43.250Lm) Town(54 samples)	<p>MI: PM10 level measurements Complaints from locals due to dust</p> <p>PT: PM10 level < 100 g/m³ Number of complaints should be zero.</p>	<p>Standards CPCB methods Observations Public consultation</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Concessionaire	IE/PMC/RP WD
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	<ul style="list-style-type: none"> Regular maintenance of machinery and equipment. Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. Only crushers licensed by the 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 RPWD 	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	<p>MI: Levels of HC, SO₂, NO₂, and CO. Status of PUC certificates</p> <p>PT: SO₂ and NO₂ levels are both less than 80ug/m³. PUC certificate of equipment and machinery is up to date</p>	<p>Standards CPCB methods</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Concessionaire	IE/PMC/RP WD
3.0 Noise								
3.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and	<ul style="list-style-type: none"> All equipment to be timely serviced and properly maintained. Construction equipment and machinery to be fitted with silencers and maintained properly. 	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and	Throughout project section especially at construction sites, residential and identified	MI: day and night Noise levels. Number of complaints from local people	<p>As per Noise rule, 2000</p> <p>Consultation with local people</p>	Included in civil works costs	Concessionaire	IE/PMC/RP WD

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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operation of equipment and machinery	<ul style="list-style-type: none"> Only IS approved equipment shall be used for construction activities. Timing of noisy construction activities shall be done during night time and weekend near schools, Implement noisy operations intermittently to reduce the total noise generated Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. Restrict construction near residential, built up and forest areas construction today light hours. Honking restrictions near sensitive areas PPEs to workers Noise monitoring as per EMoP. 	amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	<p>sensitive locations.</p> <p>Pls refer DPR/IEE for information on sensitive receptors.</p>	<p><u>PT</u>: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas</p>	<p>Review of noise level monitoring data maintained by contractor</p> <p>Observation of construction site</p>			
4.0 Land and Soil								
4.1 Land use Change and Loss of productive / topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing 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	<p>Throughout the project section and borrow areas</p> <p>Land identified for camp, storage areas etc.</p>	<p><u>MI</u>: Borrow pit locations/Top soil storage area</p> <p><u>PT</u>: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	IE/PMC/RP WD
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> 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	<p><u>MI</u>: Occurrence of slope failure or erosion issues</p> <p><u>PT</u>: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Concessionaire	IE/PMC/RP WD

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	<ul style="list-style-type: none"> Obtain EC from SEIAA/DEIAA before opening any new borrow area. Comply to EC conditions of SEIAA/DEIAA 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 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. 	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 Guidelines for Borrow Areas management	Borrow sites /locations	<p><u>MI</u>: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints</p> <p>No use of black cotton soil</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by SEIAA</p>	Included in civil works cost	Concessionaire	IE/PMC/RP WD
4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 MORTH Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	New Quarry if needed	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	<p>Review of design documents, contractor documents and site observation</p> <p>Compliance to EC conditions in case of opening new quarries</p>	Included in civil works cost	Concessionaire/	IE/PMC/RP WD

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 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<u>MI</u> : Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition <u>PT</u> : Zero occurrence of destroyed/compacted land and undestroyed land	Site observation	Included in civil works cost	Concessionaire/	IE/PMC/RP WD
4.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<u>MI</u> : Quality of soil near storage area Presence of spilled oil or bitumen in project area <u>PT</u> : Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site	Site observation	Included in civil work cost.	Concessionaire/	IE/PMC/RP WD

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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5.0 Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none">▪ Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority.▪ Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected.▪ Water intensive activities not to be undertaken during summer season.▪ Provision of water harvesting structure to augment recharging of groundwater conditions (aquifers) in the project area	CGWA Guidelines	<p>Throughout the Project section</p> <p>Check Dam at suitable locations</p>	<p><u>MI</u>: Approval from competent authority Complaints from local people on water availability</p> <p><u>PT</u>: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil work cost	Concessionaire/	IE/PMC/RP WD
5.2 Disposal of water during construction	<ul style="list-style-type: none">▪ 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	<p><u>MI</u>: Condition of drainage system in construction site. Presence /absence of water logging in project area.</p> <p><u>PT</u>: Existence of proper drainage system. No water logging in project area</p>	Standards methods Site observation and review of documents	Included in civil work cost	Concessionaire/ Contractor	IE/PMC/RP WD

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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5.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction. 	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc.	<p><u>MI</u>: Proper flow of water in existing streams and rivers</p> <p><u>PT</u>: No complain of water shortage by downstream communities. No record of overtopping/ water logging</p>	<p>Review of design documents</p> <p>Site observation</p>	Included in civil works cost	Concessionaire/	IE/PMC/RP WD
5.4 Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, ClauseNo501.8. 6.MORT&H Specifications for Road and Bridgeworks</p> <p>Worldwide best practices</p>	<p>Near all water bodies /waterways</p> <p>Protection wall at km 6.300 (LHS) for pond Protection. Near other water bodies / Waterways & Retaining wall</p>	<p><u>MI</u>: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Concessionaire/	IE/PMC/RP WD

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
6.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> 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 1:2 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 Act 1980 + IRC:SP:21 and IRC:SP:66	<p>Throughout project corridor</p> <p>Estimated No. of affected tree=151</p> <p>Additional Plantation near Sensitive receptors, borrow areas on 1:3 basis</p>	<p><u>MI</u>: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted.</p> <p><u>PT</u>: Additional compensatory afforestation done on a 1:3 basis by concessionaire.</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy</p> <p>Field observations</p>	<p>Mandatory Compensatory afforestation cost is included in project costs under RPWD.</p> <p>Additional compensatory afforestation costs included in civil works costs</p>	Mandatory Compensatory plantation by forest Department and additional plantation by concessionaire	IE/PMC/RP WD
7.0 Construction Camps								
7.1 Impact associated with location	<ul style="list-style-type: none"> 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 	Design Requirement The Water (Prevention and Control of Pollution) Act, 1974 and its amendments thereof	All construction camps	<p><u>MI</u>: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps</p> <p><u>PT</u>: Distance of campsite is less than 500m from listed locations</p>	<p>On site observation</p> <p>Interaction with workers and local community</p>	Included in civil works cost	Concessionaire and EO	IE/PMC/RP WD

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
7.2 Worker's Health in construction camp	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved b EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. 	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	<p><u>MI</u>: Camp health records</p> <p>Existence of proper first aid kit in camp site</p> <p>Complaints from workers.</p> <p><u>PT</u>: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.</p>	<p>Camp records</p> <p>Site observation</p> <p>Consultation with contractor workers and local people living nearby</p>	Part of the civil works costs	Concessionaire/	IE/PMC/RP WD
8.0 Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	At all Dumping/Disposal Sites	<p><u>MI</u>: Location of dumping sites Number of public complaints.</p> <p><u>PT</u>: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Concessionaire	IE/PMC/RP WD

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
8.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORTH guidelines and General Conditions of Contract Document	Throughout the project corridor	<p><u>MI</u>: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p><u>PT</u>: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.		
9.0 Traffic Management and Safety								
9.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. 	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.	<p><u>MI</u>: Traffic management plan. Presence/ absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p><u>PT</u>: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Concessionaire/	IE/PMC/RP WD

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
	<ul style="list-style-type: none"> On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	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	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever 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, hospitals, graveyards, construction sites, haulage roads, diversion sites.	<p><u>MI</u>: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	IE/PMC/RP WD

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
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Concessionaire	IE/PMC/RP WD
9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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	<p><u>MI</u>: Safety signs and their location</p> <p>Incidents of accidents</p> <p>Complaints from local people</p> <p><u>PT</u>: Zero incident of accidents. Zero complaints.</p>	<p>Site inspection</p> <p>Consultation with local people</p>	Included in civil works cost	Concessionaire	IE/PMC/RP WD

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	<ul style="list-style-type: none">Contractor will prepare site restoration plans, which will be approved by the 'Engineer'.The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer.All the opened borrow areas will be rehabilitated and 'Engineer' will certify	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<u>MI</u> : Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. <u>PT</u> : 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	Included in civil works cost.	Concessionaire	IE/PMC/RP WD
C. Operation and Maintenance stage								
1. Wildlife Movement								
1.1 Anticipated risk of vehicle-animal collision and human-animal conflict	<ul style="list-style-type: none">Effectiveness of mitigative measures (rumble strips, informatory /cautionary signage, solar street lighting, etc.) recommended in design stage shall be monitored.Effectiveness of habitat enhancement measures shall be evaluatedRPWD to keep record of all accidents.Fresh assessment in case of future widening	Project Requirement	At identified animal crossing locations	<u>MI</u> : No. of vehicle - animal collision. Time (day or night, season/month and location of collision. Cause of collision. No of incidence of human – animal conflict. <u>PT</u> : minimum vehicle – animal collisions. No of consultation done with forest department	Site Observation Discussion with local People Collection of information from Forestry Department	Included in Operation / Maintenance cost	RPWD/PMC/ field offices/Forest Department	

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. Air Quality								
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none">Roadside tree plantations shall be maintained at least with 70% survival rate.Regular maintenance of the road will be done to ensure good surface conditionAmbient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.Signages shall be provided reminding 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, ,as required at locations Arai (0.600 Km,) , Lamba (2.100 Km) , Ankodiya (9.900 Km), Jorawarpura (16.000Km), Kasir (18.00Km) , Shri Rampura (Laapda, 21.800 Km), Borada (24.800Lm), Dhanwa (32.550Lm), Fatehgarh (36+100Km), Indrapura (39.850Km), Daulatpura (41.550Km) , Sarwar (43.250Lm) (27 samples)	<u>MI</u> : Ambient air quality (PM10, CO,SO2 NO2) <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	Concessionnaire/ IE/PMC/RPWD	
3. Noise								
3.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation to 20 km/hour and honking restrictions near sensitive receptorsConstruction of noise barriers near sensitive receptors with consent of local communityThe effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed.Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution (Regulation and Control) Rules,2000 and amendments thereof	Sensitive receptors as identified in IEE locations pf Air Quality Monitoring(27 Samples)	<u>MI</u> : Noise levels <u>PT</u> : 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	Concessionnaire/ IE/PMC/RPWD	

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. Land and Soil								
4.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	
5. Water resources/Flooding and Inundation								
5.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion and turfing conditions for its effective maintenance.	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	
5.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/ absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	
6. Flora								
6.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>PT</u> : Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	RPWDPMC//Forest Department	
7. Maintenance of Right of Way and Safety								
7.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	

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
7.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures, including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented. 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. 	IRC:SP:55-2014 And IRC:SP:88-2010	Throughout the Project route	<p><u>MI</u>: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law</p> <p><u>PT</u>: Fatal and non-fatal accident rate is reduced after improvement</p>	<p>Review accident records</p> <p>Site observations</p>	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	
7.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	-	Throughout the project stretch	<p><u>MI</u>: Status of emergency system – whether operational or not</p> <p><u>PT</u>: Fully functional emergency system</p>	<p>Review of spill prevention and emergency response plan</p> <p>Spill accident records</p>	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	

ENVIRONMENTAL MONITORING PLAN FOR ARAIN-SARWAR (SH-7E; H-IV)

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/ Monitoring
Air Quality	Construction stage	PM 10 PM2.5 SO ₂ , NO _x , CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	, as required by progress of construction activities at locations Arai (2) , Lamba (4) , Ankodiya (6) , Jorawarpura (6), Kasir (8) , Shri Rampura (6), Borada (6), Dhanwa (4), Fatehgarh (4), Indrapura (4), Daulatpura (2) , Sarwar (2) (54 samples))	During Active Construction Stage	Air quality standard by CPCB	54X9000=Rs 486,000	Concessionaire through approved monitoring agency	IE/PMC/RP WD
	Operation stage			Representative sample each for residential, commercial and sensitive/forest area (3 Locations)	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3 =Rs 81,000	RPWD through approved monitoring agency	Concession aire/ IE/PMC/RP WD
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyzed as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps	Total 3 times in a year baring monsoon), 1 camps with 2 bore wells	Water quality standard by CPCB/IS1050 0:2012	6x 5000x2 = Rs 60,000	Concessionaire through approved monitoring agency	IE/PMC/RP WD
	Operation stage			Groundwater at 2 locations and surface water at 2 locations	3/year for 1 year	Water quality standard by CPCB//IS1050 0:2012	3X4X5000 =Rs 60, 000	RPWD through approved monitoring agency	IE/PMC/RP WD
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	During Active Construction Stage	National Ambient Noise Standard specified in Environment Protection Act, 1986	54x3000 =Rs.162,000	Concessionaire through approved monitoring agency	IE/PMC/RP WD
	Operation stage			Representative sample each for residential, commercial and sensitive/forest area (3 Locations)	3/year for 1 year		3x3000x3 =Rs 27,000	RPWD through approved monitoring agency	Concession aire/ IE/PMC/RP WD
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 (2 locations)	Once during whole construction stage	ICAR standard	56,000	Concessionaire through approved monitoring agency	Concession aire/ IE/PMC/RP WD
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	ICAR Standards	28000	RPWD through approved agency	Concession aire/ IE/PMC/RP WD
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		Throughout the Project Corridor especially at River banks, bridge	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire	Concession aire/

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision/ Monitoring
				locations and river training structures					IE/PMC/RP WD
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of 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	Concessionaire'	RPWD/PMC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	Concessionaire/ IE/PMC/RPWD	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire 's quote	Concessionaire with approval from RPWD	RPWD/CSC
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	/IE/PMC/RP WD
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	Compensatory: RPWD/Local Forest Departments	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost	Additional Plantation: / Concessionaire/ IE/PMC/RPWD The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through PMC/IE/Concessionaire will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	IE/PMC/RP WD
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD/PMC with support from local police	
Monitoring Costs: INR 1.02 Million									

PWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR NH 12-LAXMIPURA-DORA-DABI-RANAJI KA GUDHA

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions	<ul style="list-style-type: none">▪ CBR value of sub grade as per IRC guidelines▪ Bottom of crust shall be at least 600mm above HFL to prevent any capillary action due to black cotton/expansive/cohesive soil▪ Raised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also inconvenience caused to▪ Provision of adequate no. 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	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	7 Minor Bridges Lined Drains=14 Total Culvert =18.	<u>MI</u> : Design and number of cross and side drains, slab/box culverts, and Hume pipes <u>PT</u> : Design and numbers are in accordance with site needs	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 concessionaire	Design Consultant	RPWD

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.2 Safety along the proposed alignment	<ul style="list-style-type: none"> 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 bridge s 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 	<p>Design requirement</p> <p>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</p> <p>Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 “. IRC: SP: 67-2012</p>	<p>Curve locations</p> <p>Crash barriers at bridge embankments</p> <p>Speed Breakers and signages near built-up areas and toll plazas</p> <p>Road Studs, object Markers etc.</p>	<p><u>MI</u>: number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc</p> <p><u>PT</u>: numbers and location are in accordance with site needs</p>	Review of design documents and drawings and comparison with site conditions	<p>Covered under preliminary design preparation by F/S consultant</p> <p>Detailed design cost to be borne by concessionaire</p>	Design Consultant	RPWD
2. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	<ul style="list-style-type: none"> Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders. 	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	<p><u>MI</u>: Pavement Surface and bridge expansion joints during extreme heat</p> <p><u>PI</u>: No softening, rutting, asphalt migration/thermal expansion of joint</p>	Review of design documents and drawings and comparison with site conditions	<p>preliminary design cost of F/S consultant</p> <p>Detailed design cost to be borne by concessionaire</p>		
2.2 Flooding/Water-Logging	<ul style="list-style-type: none"> 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/ Bridges to increase their carrying capacity. 	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	<p>7 Miner Bridges</p> <p>Lined Drains=14 Total Culvert =18</p>	<p><u>MI</u>: Design and numbers of cross & side drains, slab/box culverts Hume pipes, road embankment height, design and number of bridges</p> <p><u>PT</u>: Design and numbers are in accordance with site needs</p>	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	concessionaire	RPWD

[illegible]

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.1 Need for cutting of trees and diversion of forest land	<ul style="list-style-type: none"> 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	Throughout the corridor Total number of affected trees=47 no acquisition of forest land is envisaged	<u>MI</u> : Number and location of geometric adjustments made to avoid forestland and tree cutting, budget amount allocated for compensatory afforestation and additional plantation (1:3) <u>PT</u> : Unnecessary tree felling on forest land avoided. Budget allocation is adequate,	Review final design. Check budget provision for compensatory afforestation and additional plantation.	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
5. Wildlife Movement								
5.1 Road design causing accidents of wild animals and disruption in their movement	<ul style="list-style-type: none"> Provision of rumble strip, cautionary and informatory sign boards near potential wildlife accident locations Speed restriction in the sections where wildlife movement is reported Live fencings by thorn species 	Project Requirement	Intermittently throughout the stretch	<u>MI</u> : budget allocation for rumble strips, cautionary and informatory sign boards, <u>PT</u> : Budget adequate to fulfill the installation of recommended facilities and structures	Review of bid documents and project budget plan	Covered under costs for F/S Consultant	RPWD, Design Consultant	RPWD/CS C in coordination with Forest Department
6. 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
6.1 Disruption of utility services to local community	<ul style="list-style-type: none"> 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	<p><u>MI</u>: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p><u>PT</u>: No. of complaints should be 0. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under RPWD's costs	Contractor/ RPWD/utility company	RPWD /CSC
B. Construction Stage								
1. Preparatory activities								
1.1 Preparatory activities	<ul style="list-style-type: none"> Submit appointment letter and resume of the 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 EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE request PMC-ES copy of monthly monitoring formats and establish deadlines for submission. EFC 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan.</p> <ul style="list-style-type: none"> EFC will submit for approval of PMC-ES the construction camp layout before its establishment. 							
1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials agreed by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor, as required by the progress of construction activities in locations - Sitapura, Bharta Baodi, Laxmipura, Dora, Dabi, Bewadiya, Patpadiya, Ranagikaguda	<p>MI: PM₁₀ level measurements Complaints from locals due to dust</p> <p>PT: PM₁₀ level < 100 g/m³ Number of complaints should be zero.</p>	<p>Standards CPCB methods Observations Public consultation</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Concessionaire	RPWD /CSC

[illegible]

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.1 Land use Change and Loss of productive / topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing 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	<p>Throughout the project section and borrow areas</p> <p>Land identified for camp, storage areas etc.</p>	<p><u>MI</u>: Borrow pit locations/Top soil storage area</p> <p><u>PT</u>: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	RPWD /CSC
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> 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	<p><u>MI</u>: Occurrence of slope failure or erosion issues</p> <p><u>PT</u>: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from SEIAA before opening any new borrow area. Comply to EC conditions of SEIAA/DEIAA 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 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. 	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 Guidelines for Borrow Areas management	Borrow sites location	<p><u>MI</u>: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints</p> <p>No use of black cotton soil</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by SEIAA</p>	Included in civil works cost	Concessionaire	RPWD /CSC
4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	<p>Review of design documents, contractor documents and site observation</p> <p>Compliance to EC conditions in case of opening new quarries</p>	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p><u>MI</u>: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p><u>PT</u>: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Concessionaire	RPWD /CSC
4.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<p><u>MI</u>: Quality of soil near storage area Presence of spilled oil or bitumen in project area</p> <p><u>PT</u>: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>	Site observation	Included in civil work cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5. Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none">▪ Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority.▪ Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected.▪ Water intensive activities not to be undertaken during summer season.▪ Provision of water harvesting structure to augment recharging of groundwater conditions (aquifers) in the project area	CGWA Guidelines	<p>Throughout the Project section</p> <p>Water harvesting structure at toll plaza</p>	<p><u>MI</u>: Approval from competent authority Complaints from local people on water availability</p> <p><u>PT</u>: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil work cost	Concessionaire	RPWD /CSC
5.2 Disposal of water during construction	<ul style="list-style-type: none">▪ 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	<p><u>MI</u>: Condition of drainage system in construction site. Presence /absence of water logging in project area.</p> <p><u>PT</u>: Existence of proper drainage system. No water logging in project area</p>	<p>Standards methods</p> <p>Site observation and review of documents</p>	Included in civil work cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction. 	Design requirement, Clause 501.8.6. No MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc.	<p><u>MI</u>: Proper flow of water in existing streams and rivers</p> <p><u>PT</u>: No complain of water shortage by downstream communities. No record of overtopping/ water logging</p>	<p>Review of design documents</p> <p>Site observation</p>	Included in civil works cost	Concessionaire	RPWD /CSC
5.4 Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, ClauseNo501.8. 6.MORT&H Specifications for Road and Bridgeworks</p> <p>Worldwide best practices</p>	Near all water bodies /waterway	<p><u>MI</u>: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> 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	<p>Throughout project corridor</p> <p>Estimated No. of affected tree=47</p> <p>Additional Plantation on 1:3 basis</p>	<p><u>MI</u>: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted.</p> <p><u>PT</u>: Additional compensatory afforestation done on a 1:3 basis by concessionaire.</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy</p> <p>Field observations</p>	<p>Mandatory Compensatory afforestation cost is included in project costs under RPWD.</p> <p>Additional compensatory afforestation costs included in civil works costs</p>	Mandatory Compensatory plantation by forest Department and additional plantation by concessionaire	RPWD /CSC
7. Construction Camps								
7.1 Impact associated with location	<ul style="list-style-type: none"> 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 	Design Requirement As identified in IEE, All applicable laws ,rules and regulations including Contract Labour laws aswell as , EHS policy and rules, except EC and FCs	All construction camps	<p><u>MI</u>: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps</p> <p><u>PT</u>: Distance of campsite is less than 500m from listed locations</p>	<p>On site observation</p> <p>Interaction with workers and local community</p>	Included in civil works cost	Concessionaire and EO	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Worker's Health in construction camp	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste. The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. 	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	<p><u>MI</u>: Camp health records</p> <p>Existence of proper first aid kit in camp site</p> <p>Complaints from workers.</p> <p><u>PT</u>: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.</p>	<p>Camp records</p> <p>Site observation</p> <p>Consultation with contractor workers and local people living nearby</p>	Part of the civil works costs	Concessionaire	RPWD /CSC
8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	At all Dumping/Disposal Sites	<p><u>MI</u>: Location of dumping sites Number of public complaints.</p> <p><u>PT</u>: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
8.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORTH guidelines and General Conditions of Contract Document	Throughout the project corridor	<p>MI: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p>PT: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.		
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. 	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.	<p>MI: Traffic management plan. Presence/absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p>PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	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	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever 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.	<p><u>MI</u>: Presence/absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage</p> <p>Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Concessionaire	RPWD /CSC
9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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	<p>MI: Safety signs and their location</p> <p>Incidents of accidents</p> <p>Complaints from local people</p> <p><u>PT</u>: Zero incident of accidents. Zero complaints.</p>	<p>Site inspection</p> <p>Consultation with local people</p>	Included in civil works cost	Concessionaire	RPWD /CSC

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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
2.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none">▪ 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 As required in locations - Sitapura , Bharta Baodi , Laxmipura , Dora, Dabi , Bewadiya , Patpadiya, Ranagikaguda	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	RPWD	
3. 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
3.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation to 20 km/hour and honking restrictions near sensitive receptorsMonitoring of Performance of Noise Barriers constructed and New Construction of any further required noise barriers near sensitive receptors with consent of local communityCreate 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 location locations. of air quality monitoring	<u>MI</u> : Noise levels <u>PT</u> : 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	RPWD	
4. Land and Soil								
4.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	RPWD	
5. Water resources/Flooding and Inundation								
5.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion conditions for its effective maintenance.	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	RPWD	
6. Flora								
6.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>PT</u> : Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	RPWD/Forest Department	
7. Maintenance of Right of Way and Safety								
7.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009/	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation / Maintenance cost	RPWD	
7.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be enforced strictly.Further encroachment of squatters within the ROW will be prevented.Monitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.Tow-way facility for the breakdown vehicles if possible.Road Safety Audit should be conducted on regular basis	IRC:SP:55-2014/ And IRC:SP:88-2010	Throughout the Project route	<u>MI</u> : Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law <u>PT</u> : Fatal and non fatal accident rate	Review accident records Site observations	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	-	Throughout the project stretch	<u>MI</u> : Status of emergency system – whether operational or not <u>PT</u> : Fully functional	Review of spill prevention and emergency response plan Spill accident records	Included in Operation / Maintenance cost	RPWD	

ENVIRONMENTAL MONITORING PLAN FOR NH 12-LAXMIPURA-DORA-DABI-RANAJI KA GUDHA

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Air Quality	Construction stage	PM 10, PM2.5 SO ₂ , NO _x , CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	As required by progress of construction activities in locations Sitapura(2) , Bharta Baodi (2), Laxmipura (2) , Dora(2), Dabi (2), Bewadiya(2) , Patpadiya (2), Ranagikaguda (2) Total Sample(18) Batching and hot mix plants sampling part of SPCB annual renewal of permits	During Active Construction Phase	Air quality standard by CPCB	18x9000=Rs 162,000	Concessionaire through approved monitoring agency	RPWD /CSC
	Operation stage			Representative sample each for residential, commercial and sensitive/forest area (3 Locations)	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3 =Rs 81,000	RPWD through approved monitoring agency	RPWD
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and	Grab sample collected from source and analyzed as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps	3/year , 1 camps with 2 bore wells	Water quality standard by CPCB	5000x3x2 = Rs 30,000	Concessionaire through approved monitoring agency	RPWD /SC
	Operation stage	Surface water criteria for freshwater classification		Groundwater at 2 locations and surface water at 2 locations	3/year for 1 year	Water quality standard by CPCB	3X4X5000 =Rs 60, 000	RPWD through approved monitoring agency	RPWD
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	During Active Construction Phase	National Ambient Noise Standard specified in Environment Protection Act, 1986	18x3000 =Rs.54,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage			Representative sample each for residential, commercial and sensitive/forest area (3 Locations)	3/year for 1 year		3x3000 x3 =Rs 27,000	RPWD through approved monitoring agency	RPWD
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 (2 locations)	Once during whole construction stage	ICAR standard	56,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	CPCB standard	28000	RPWD through approved agency	RPWD
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	Concessionaire	RPWD/CSC
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of RPWD	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Concessionaire'	RPWD/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	RPWD	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire 's quote	Concessionaire with approval from RPWD	RPWD/CSC
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	RPWD/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD	Compensatory: RPWD/Local Forest Departments Additional Plantation: Concessionaire The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through Concessionaire will be responsible for monitoring	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost		
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	RPWD/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police	
Wildlife Vehicle Collisions	Construction Stage	Nature and cause of collision, season, Month and time of collision.		Animal crossing locations as identified in IEE	occurrence of collision	As suggested by forest department	Civil Cost	Concessionaire	RPWD/CSC
	Operation stage	1. Success of road furniture viz. rumble strip, cautionary signages etc. designed for safe movement 2. Nature and cause of collision, season, Month and time of collision 3. Monitoring of movement path based on information available with forest department and local people.		Animal crossing Locations as identified in IEE	Random all through the year		Operation and Maintenance Cost	RPWD in coordination with forest department or through an specialized wildlife expert team	
Monitoring Costs Construction Phase: INR 0.498 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR NASIRABAD –MANGALIYAWAS- PADUKALAN-(MDR-39)

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	<ul style="list-style-type: none">CBR value of sub grade as per IRC guidelinesBottom of crust shall be at least 600mm above HFL to prevent any capillary action due to black cotton/expansive/cohesive soilRaised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also inconvenience caused toProvision of adequate no. of cross drainage structures.Increased (vent and height) in waterway of existing structures.Roadside drains have been proposed with suitable outfalls.Additional culverts and bridgesCauseway and submerged bridges to be replaced with high level bridges	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	34 nos. culverts are proposed to prevent water logging and flooding Toll Plazas = 2 Nos Bye passes - 3 Major bridge=1(One major bridge is proposed in place of Flush causeway) Minor Bridge=5 (04 nos. of bridges shall be retained with various degrees of widening, repair and rehabilitation 01 minor bridge is proposed for reconstruction, schemes)	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	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 concessionaire	Design Consultant	IE/PMC/RPWD
1.2 Safety along the proposed alignment	<ul style="list-style-type: none">Vertical and horizontal geometrics in consistent to IRC/MORTH guidelinesProvision 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 forestsSafety kerb at all bridge sInformatory signage on approach to built-up sectionAmbulance and medical aid postsChecking for overloading at toll plazasSpeed restrictions in built up sections curve locations etc	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 Crash barriers at bridge embankments Speed Breakers and signages near built-up areas and toll plazas 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	IE/PMC/RPWD

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. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	<ul style="list-style-type: none">Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening, rutting, asphalt migration/thermal expansion of joint	Review of design documents and drawings and comparison with site conditions	preliminary design cost of F/S consultant Detailed design cost to be borne by concessionaire		IE/PMC/RP WD
2.2 Flooding/Water-Logging	<ul style="list-style-type: none">Adequate number of CD structures. Additional culverts also proposed.CD structures designed for 50year return periodWater ways of bridges and culverts have been increased.Roadside drains also providedEmbankment height raised along low lying/ potential water logged areasImprovement in existing culverts/ Bridges to increase their carrying capacity.	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	concessionaire	IE/PMC/RP WD
2.2 Earthquake	<ul style="list-style-type: none">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: Bridges and 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	concessionaire	IE/PMC/RP WD
2.3 Drought	<ul style="list-style-type: none">The design of foundations and sub-structures shall conform to IRC guidelines and MORTH clauseEnsure 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: Sub-structure of bridges PI: Sub-structures are consolidated and compacted	Design and drawings of foundations, substructure and superstructure of structures	Covered under F/S consultant cost	concessionaire	IE/PMC/RP WD
2.4 Forest Fires	<ul style="list-style-type: none">Measures to avoid accident followed by fuel accumulationRemoval of maintenance slash or management by controlled burning.Plant fire-resistant species in RoWThinning slashing during non-dry seasonNo construction camp within 500m	Design requirement	There is no forest along proposed road	MI: Damage to roadside flora and spillage /fuel accumulation induced accident PI: Zero incidence of forest fire		Covered under F/S consultant cost	concessionaire	

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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
5.1 Disruption of utility services to local community	<ul style="list-style-type: none"> 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	<p>MI: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities</p> <p>PT: No. of complaints should be 0. Minimal time for utility shifting</p>	Interaction with concerned utility authorities and local public	Included under RPWD's costs	Contractor/ RPWD/utility company	IE/PMC/RP WD
B. Construction Stage								
1. Preparatory activities								
1.1 Preparatory activities	<ul style="list-style-type: none"> Submit appointment letter and resume of the 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 EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE request PMC-ES copy of monthly monitoring formats and establish deadlines for submission. EFC 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	IE/PMC/RP WD

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
	<p>Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan.</p> <ul style="list-style-type: none"> EFC will submit for approval of PMC-ES the construction camp layout before its establishment. 							
1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	IE/PMC/RP WD
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials agreed by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor as required during construction activities , 15 key locations i.e. Mangliyawas . Jethana, Sarasadi, Kalesara , Hanumantpura, Pisangan, Fatehpura, Sethan , Akhepura , Govindgarh , Alniyawas , Riya Badi , Sensda , Padu Khurd , Padukalan	<p>MI: PM10 level measurements Complaints from locals due to dust</p> <p>PT: PM10 level < 100 g/m³ Number of complaints should be zero.</p>	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost	Concessionaire	IE/PMC/RP WD

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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
4.1 Land use Change and Loss of productive / topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing 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	<p>Throughout the project section and borrow areas</p> <p>Land identified for camp, storage areas etc.</p>	<p><u>MI</u>: Borrow pit locations/Top soil storage area</p> <p><u>PT</u>: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	IE/PMC/RP WD
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> 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	<p><u>MI</u>: Occurrence of slope failure or erosion issues</p> <p><u>PT</u>: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Concessionaire	IE/PMC/RP WD

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	<ul style="list-style-type: none"> Obtain EC from SEIAA before opening any new borrow area. Comply to EC conditions of SEIAA/DEIAA 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 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. 	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 Guidelines for Borrow Areas management	Borrow sites /locations	<p><u>MI</u>: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints</p> <p>No use of black cotton soil</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by SEIAA</p>	Included in civil works cost	Concessionaire	IE/PMC/RP WD
4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 MORTH Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	New Quarry if needed	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Concessionaire	IE/PMC/RP WD

[illegible]

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 Sourcing of water during Construction	<ul style="list-style-type: none"> Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. Water intensive activities not to be undertaken during summer season. Provision of water harvesting structure to augment recharging of groundwater conditions (aquifers) in the project area 	CGWA Guidelines	<p>Throughout the Project section</p> <p>Water harvesting structure at toll plazas</p>	<p><u>MI</u>: Approval from competent authority Complaints from local people on water availability</p> <p><u>PT</u>: Valid approval from competent authority. Zero complaints from local people.</p>	<p>Checking of documentation</p> <p>Talk to local people</p>	Included in civil work cost	Concessionaire	IE/PMC/RP WD
5.2 Disposal of water during construction	<ul style="list-style-type: none"> 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	<p><u>MI</u>: Condition of drainage system in construction site. Presence /absence of water logging in project area.</p> <p><u>PT</u>: Existence of proper drainage system. No water logging in project area</p>	<p>Standards methods</p> <p>Site observation and review of documents</p>	Included in civil work cost	Concessionaire	IE/PMC/RP WD

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
5.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction. 	Design requirement, Clause 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc.	<p><u>MI</u>: Proper flow of water in existing streams and rivers</p> <p><u>PT</u>: No complain of water shortage by downstream communities. No record of overtopping/ water logging</p>	<p>Review of design documents</p> <p>Site observation</p>	Included in civil works cost	Concessionaire	IE/PMC/RP WD
5.4 Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	<p>Design requirement, ClauseNo501.8. 6.MORT&H Specifications for Road and Bridgeworks</p> <p>Worldwide best practices</p>	Near all water bodies /waterway	<p><u>MI</u>: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Concessionaire	IE/PMC/RP WD

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
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	<ul style="list-style-type: none"> 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 approved 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.	<p><u>MI</u>: Water quality of ponds, streams, rivers and other water bodies in project</p> <p>Presence of oil floating in water bodies in project area</p> <p><u>PT</u>: Surface water quality meets freshwater quality standards prescribed by CPCB</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Concessionaire	IE/PMC/RP WD

6. Flora and Fauna

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
6.1 Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> 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 	Forest Conservation Act 1980 + IRC:SP:21 and IRC:SP:66	<p>Throughout project corridor</p> <p>Estimated No. of affected tree=324</p> <p>Additional Plantation on 1:3 basis</p>	<p><u>MI</u>: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted.</p> <p><u>PT</u>: Additional compensatory afforestation done on a 1:3 basis by concessionaire.</p>	<p>Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy</p> <p>Field observations</p>	<p>Mandatory Compensatory afforestation cost is included in project costs under RPWD.</p> <p>Additional compensatory afforestation costs included in civil works costs</p>	Mandatory Compensatory plantation by forest Department and additional plantation by concessionaire	IE/PMC/RP WD
7. Construction Camps								
7.1 Impact associated with location	<ul style="list-style-type: none"> 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 	Design Requirement As identified in IEE, All applicable laws ,rules and regulations including Contract Labour laws as well as , EHS policy and rules, except EC and FCs	All construction camps	<p><u>MI</u>: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps</p> <p><u>PT</u>: Distance of campsite is less than 500m from listed locations</p>	<p>On site observation</p> <p>Interaction with workers and local community</p>	Included in civil works cost	Concessionaire and EO	IE/PMC/RP WD

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
7.2 Worker's Health in construction camp	<ul style="list-style-type: none"> The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved b EA. The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. Preventive medical facilities in camp Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. 	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	<p><u>MI</u>: Camp health records</p> <p>Existence of proper first aid kit in camp site</p> <p>Complaints from workers.</p> <p><u>PT</u>: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.</p>	<p>Camp records</p> <p>Site observation</p> <p>Consultation with contractor workers and local people living nearby</p>	Part of the civil works costs	Concessionaire	IE/PMC/RP WD
8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	<ul style="list-style-type: none"> Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies Dumping sites must be having adequate capacity equal to the amount of debris generated. Public perception and consent from the village Panchayats has to be obtained before finalizing the location. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	At all Dumping/Disposal Sites	<p><u>MI</u>: Location of dumping sites Number of public complaints.</p> <p><u>PT</u>: No public complaints. Consent letters for all dumping sites available with contractor</p>	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Concessionaire	IE/PMC/RP WD

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
8.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site. 	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	<p><u>MI</u>: Percentage of reuse of existing surface material</p> <p>Method and location of disposal site of construction debris</p> <p><u>PT</u>: No public complaint and consent letters for all dumping sites available with contractor or CSC</p>	<p>Contractor records</p> <p>Field observation</p> <p>Interaction with local people</p>	Included in civil works cost.		
9. Traffic Management and Safety								
9.1 Management of existing traffic and safety	<ul style="list-style-type: none"> Traffic Management Plan shall be submitted by the contractor and approved by the CSC. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. 	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.	<p><u>MI</u>: Traffic management plan. Presence/absence of safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents</p> <p><u>PT</u>: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site</p>	<p>Review traffic management plan</p> <p>Field observation of traffic management and safety system</p> <p>Interaction with people in vehicles using the road</p>	Included in civil works cost.	Concessionaire	IE/PMC/RP WD

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
	<ul style="list-style-type: none"> On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. Restriction of construction activity to only one side of the existing road The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	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	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever 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.	<p><u>MI</u>: Presence/absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	IE/PMC/RP WD

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
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents <u>PT</u> : 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 Concessionaire	IE/PMC/RP WD
9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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 <u>PT</u> : Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Concessionaire	IE/PMC/RP WD

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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
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">Effective traffic management and good riding conditions shall be maintainedSpeed limitation to 20 km/hour and honking restrictions near sensitive receptorsMonitoring of Performance of Noise Barriers constructed and New Construction of any further required noise barriers near sensitive receptors with consent of local communityCreate 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 location locations of air quality monitoring	<u>MI</u> : Noise levels <u>PT</u> : 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	Concessionaire/ IE/PMC/RPWD	
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	
4. Water resources/Flooding and Inundation								
4.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion conditions for its effective maintenance.	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/ absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	

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. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>PT</u> : Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD /Forest Department	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009/	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none">Traffic control measures, including speed limits, will be enforced strictly.Further encroachment of squatters within the ROW will be prevented.Monitor/ensure that all safety provisions included in design and construction phase are properly maintainedHighway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.Tow-way facility for the breakdown vehicles if possible.Road Safety Audit should be conducted on regular basis	IRC:SP:55-2014/ And IRC:SP:88-2010	Throughout the Project route	<u>MI</u> : Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law <u>PT</u> : Fatal and non fatal accident rate	Review accident records Site observations	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	
6.3.Transport of Dangerous Goods	<ul style="list-style-type: none">Existence of spill prevention and control and emergency responsive systemEmergency plan for vehicles carrying hazardous material	-	Throughout the project stretch	<u>MI</u> : Status of emergency system – whether operational or not <u>PT</u> : Fully functional	Review of spill prevention and emergency response plan Spill accident records	Included in Operation / Maintenance cost	Concessionaire/ IE/PMC/RPWD	

ENVIRONMENTAL MONITORING PLAN FOR NASIRABAD –MANGALIYAWAS- PADUKALAN

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	Mangliyawas , Jethana, Sarasadi, Kalesara , Hanumantpura, Pisangan, Fatehpura, Sethan , Akhepura , Govindgarh , Alniyawas , Riya Badi , Sensda , Padu Khurd , Padukalan Total =27 Samples Batching and hot mix plants sampling part of SPCB annual renewal of permits	During Active Construction Phase	Air quality standard by CPCB	27x9000=Rs 243,000	Concessionaire through approved monitoring agency	IE/PMC/RP WD
	Operation stage			Representative sample each for residential, commercial and sensitive/forest area (3 Locations)	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3 =Rs 81,000	RPWD through approved monitoring agency	IE/PMC/RP WD
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps	3/year til the end of construction activities (Total 3 times in a year baring monsoon), 1 camp with 1 bore well each	Water quality standard by CPCB	6x 5000x1 = Rs 30,000	Concessionaire through approved monitoring agency	IE/PMC/RP WD
	Operation stage			Groundwater at 2 locations and surface water at 2 locations	3/year for 1 year	Water quality standard by CPCB	3X4X5000 =Rs 60, 000	RPWD through approved monitoring agency	IE/PMC/RP WD
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	During Active Construction Phase	National Ambient Noise Standard specified in Environment Protection Act, 1986	3000x27 =Rs.81,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage			Representative sample each for residential, commercial and sensitive/forest area (3 Locations)	3/year for 1 year		3x3000x3 =Rs 27,000	RPWD through approved monitoring agency	IE/PMC/RP WD
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 (2 locations)	Once during whole construction stage	ICAR standards	56,000	Concessionaire through approved monitoring agency	IE/PMC/RP WD
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	ICAR Standards	28,000	RPWD through approved agency	IE/PMC/RP WD

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	Concessionaire	RPWD/CSC
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of RPWD/ IE/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	Concessionaire'	IE/PMC/RP WD
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	RPWD	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Concessionaire	Concessionaire with approval from RPWD	IE/PMC/RP WD
	Operation Stage	Visual Checks	Rehabilitation asper IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	IE/PMC/RP WD
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	Compensatory: RPWD/Local Forest Departments	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost	Additional Plantation: Concessionaire/ IE/PMC/RPWD The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through PMC/Concessionaire will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	IE/PMC/RP WD
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police and PMC	
Monitoring Costs: INR 0.606 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR BEAWAR-PISANGAN, TEHLA -KOD- ALNIYAWAS (SH-59)

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions	<ul style="list-style-type: none">CBR value of sub grade as per IRC guidelinesBottom of crust shall be at least 600mm above HFL to prevent any capillary action due to black cotton/expansive/cohesive soilRaised embankment and provision of roadside drainage to prevent damage to pavement due to water logging on the road and also inconvenience caused toProvision of adequate no. of cross drainage structures.Increased (vent and height) in waterway of existing structures.Roadside drains have been proposed with suitable outfalls.Additional culverts and bridgesCauseway and submerged bridges to be replaced with high level bridges	Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007	24 Culverts to be, 3 Causeways to be widened , widened 1 minor bridge to be upgraded to Box Culvert Covered=2.3 km	<u>MI</u> : Design and number of cross and side drains, slab/box culverts, and Hume pipes <u>PT</u> : Design and numbers are in accordance with site needs	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 concessionaire	Design Consultant	RPWD

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.2 Safety along the proposed alignment	<ul style="list-style-type: none"> 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 bridge s 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 	<p>Design requirement</p> <p>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</p> <p>Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 “. IRC: SP: 67-2012</p>	<p>Curve locations</p> <p>Crash barriers at bridge embankments</p> <p>Speed Breakers and signages near built-up areas and toll plazas</p> <p>Road Studs, object Markers etc.</p>	<p><u>MI</u>: number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc</p> <p><u>PT</u>: numbers and location are in accordance with site needs</p>	<p>Review of design documents and drawings and comparison with site conditions</p>	<p>Covered under preliminary design preparation by F/S consultant</p> <p>Detailed design cost to be borne by concessionaire</p>	Design Consultant	RPWD
2. Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embrittlement, softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	<ul style="list-style-type: none"> Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders. 	IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	<p><u>MI</u>: Pavement Surface and bridge expansion joints during extreme heat</p> <p><u>PI</u>: No softening, rutting, asphalt migration/thermal expansion of joint</p>	Review of design documents and drawings and comparison with site conditions	<p>preliminary design cost of F/S consultant</p> <p>Detailed design cost to be borne by concessionaire</p>		
2.2 Flooding/Water-Logging	<ul style="list-style-type: none"> 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/ Bridges to increase their carrying capacity. 	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments	<p>24 Culverts to be, 3 Causeways to be widened , widened</p> <p>1 minor bridge to be upgraded to Box culvert</p>	<p><u>MI</u>: Design and numbers of cross & side drains, slab/box culverts Hume pipes, road embankment height, design and number of bridges</p> <p><u>PT</u>: Design and numbers are in accordance with site needs</p>	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultants and PPTA consultants	concessionaire	RPWD

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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
1.1 Preparatory activities	<ul style="list-style-type: none"> ▪ Submit appointment letter and resume of the 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 ▪ EFC will prepare Contractors Environmental Implementation Plan based on the approved EMP, EMOP, and agreements reach during the meeting with PMC-ES and PMU-SOE ▪ request PMC-ES copy of monthly monitoring formats and establish deadlines for submission. ▪ EFC 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. ▪ EFC will submit for approval of PMC-ES the construction camp layout before its establishment. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.2 Site induction	<ul style="list-style-type: none"> No works will be initiated by the 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. 	Project requirement	All contractors and sub-contractors	Approvals, attendance	PMC accomplishment report	Part construction cost for Contractor and PMC Contract	Contractor/ RPWD/utility company	RPWD /CSC
2. Air Quality								
2.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	<ul style="list-style-type: none"> Concessionaire to submit location and layout plan for storage areas of construction materials agreed by CSC Transport, loading and unloading of loose and fine materials through covered vehicles. Paved approach roads. Storage areas to be located downwind of the habitation area. Water spraying on earthworks, unpaved haulage roads and other dust prone areas. Provision of PPEs to workers. 	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor, as required by progress of construction activities at locations BeawarKhas,Naya Badiya, Gola, Alipura, Nagleo, Nad, Pisangan, Govindgarh, Ladpura, NarsinghBasni, Tehla,Kod, Alniyawas	<p><u>MI</u>: PM₁₀ level measurements Complaints from locals due to dust</p> <p><u>PT</u>: PM₁₀ level < 100 g/m³ Number of complaints should be zero.</p>	<p>Standards CPCB methods Observations Public consultation</p> <p>Review of monitoring data maintained by contractor</p>	Included in civil works cost	Concessionaire	RPWD /CSC

[illegible]

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.1 Land use Change and Loss of productive / topsoil	<ul style="list-style-type: none"> Non-agricultural areas to be used as borrow areas to the extent possible. If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing 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	<p>Throughout the project section and borrow areas</p> <p>Land identified for camp, storage areas etc.</p>	<p><u>MI</u>: Borrow pit locations/Top soil storage area</p> <p><u>PT</u>: Zero complaints or disputes registered against contractor by land owner</p>	Review borrow area plan, site visits	Included in civil works cost	Concessionaire	RPWD /CSC
4.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> 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	<p><u>MI</u>: Occurrence of slope failure or erosion issues</p> <p><u>PT</u>: No slope failures. Minimal erosion issues</p>	Review of design documents and site observation	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.3 Borrow area management	<ul style="list-style-type: none"> Obtain EC from SEIAA before opening any new borrow area. Comply to EC conditions of SEIAA/DEIAA 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 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. 	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 Guidelines for Borrow Areas management	Borrow sites location	<p><u>MI</u>: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people.</p> <p><u>PT</u>: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints</p> <p>No use of black cotton soil</p>	<p>Review of design documents and site observations</p> <p>Compare site conditions with EC conditions by SEIAA</p>	Included in civil works cost	Concessionaire	RPWD /CSC
4.4 Quarry Operations	<ul style="list-style-type: none"> Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to 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 MORTH Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules	New Quarry if needed	<p><u>MI</u>: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan</p> <p><u>PT</u>: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit</p>	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. Land taken for construction camp and other temporary facility shall be restored to its original conditions 	Design requirement	Parking areas, Haulage roads and construction yards.	<p><u>MI</u>: Location of approach and haulage roads</p> <p>Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p> <p><u>PT</u>: Zero occurrence of destroyed/compacted land and undestroyed land</p>	Site observation	Included in civil works cost	Concessionaire	RPWD /CSC
4.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. Fuel storage and refueling sites to be kept away from drainage channels. Unusable debris shall be dumped in ditches and low lying areas. To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board 	Design requirement	Fueling station, construction sites, and construction camps and disposal location.	<p><u>MI</u>: Quality of soil near storage area</p> <p>Presence of spilled oil or bitumen in project area</p> <p><u>PT</u>: Soil test conforming to no – contamination. No sighting of spilled oil or bitumen in construction site or camp site</p>	Site observation	Included in civil work cost.	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5. Water Resources								
5.1 Sourcing of water during Construction	<ul style="list-style-type: none">Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority.Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected.Water intensive activities not to be undertaken during summer season.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 plaza	<u>MI</u> : Approval from competent authority Complaints from local people on water availability <u>PT</u> : Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local people	Included in civil work cost	Concessionaire	RPWD /CSC
5.2 Disposal of water during construction	<ul style="list-style-type: none">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	<u>MI</u> : Condition of drainage system in construction site. Presence /absence of water logging in project area. <u>PT</u> : Existence of proper drainage system. No water logging in project area	Standards methods Site observation and review of documents	Included in civil work cost	Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.3 Alteration in surface water hydrology	<ul style="list-style-type: none"> Existing drainage system to be maintained and further enhanced. Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. Road level shall be raised above HFL level wherever road level is lesser than HFL. Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction. 	Design requirement, Clause 501.8.6. MORT&H Specifications for Road and Bridge	Near all drainage channels, river/ nallah crossings etc.	<p><u>MI</u>: Proper flow of water in existing streams and rivers</p> <p><u>PT</u>: No complain of water shortage by downstream communities. No record of overtopping/ water logging</p>	<p>Review of design documents</p> <p>Site observation</p>	Included in civil works cost	Concessionaire	RPWD /CSC
5.4 Siltation in water bodies due to construction activities /earthwork	<ul style="list-style-type: none"> Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. Provision of Silt fencing shall be made at water bodies. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. Retaining walls at water bodies /ponds to avoid siltation near ponds 	Design requirement, ClauseNo501.8. 6.MORT&H Specifications for Road and Bridgeworks Worldwide best practices	Near all water bodies /waterway	<p><u>MI</u>: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels</p> <p><u>PT</u>: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit</p>	Field observation	Included in civil works cost	Concessionaire	RPWD /CSC
5.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	<ul style="list-style-type: none"> 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. 	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof./ as well as IS-10500:2012	Water bodies, refueling stations, construction camps.	<p><u>MI</u>: Water quality of ponds, streams, rivers and other water bodies in project</p> <p>Presence of oil floating in water bodies in project area</p> <p><u>PT</u>: Surface water quality meets</p>	<p>Conduction of water quality tests as per the monitoring plan</p> <p>Field observation</p>	Included in civil works cost	Concessionaire	RPWD /CSC

[illegible]

[illegible]

8. Management of Construction Waste/Debris

[illegible]

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.1 Management of existing traffic and safety	<ul style="list-style-type: none"> ▪ Traffic Management Plan shall be submitted by the contractor and approved by the CSC. ▪ The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. ▪ The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. 	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 signs, demarcation lines etc. present in appropriate locations on site	Review traffic management plan Field observation of traffic management and safety system Interaction with people in vehicles using the road	Included in civil works cost.	Concessionaire	RPWD /CSC
	<ul style="list-style-type: none"> ▪ On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. ▪ Restriction of construction activity to only one side of the existing road ▪ The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". ▪ Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures. 	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
9.2 Pedestrians, animal movement	<ul style="list-style-type: none"> Temporary access and diversion, with proper drainage facilities. Access to the schools, temples and other public places must be maintained when construction takes place near them. Fencing wherever 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.	<p><u>MI</u>: Presence/absence of access routes for pedestrians. Road signage Number of complaints from local people</p> <p><u>PT</u>: Easy access to schools, temples and public places. Zero complaints</p>	Field observation Interaction with local people	Included in civil works cost.	Concessionaire	RPWD /CSC
9.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> Contractors to adopt and maintain safe working practices. Usage of fluorescent and retro refractory signage, in local language at the construction sites Training to workers on safety procedures and precautions. 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 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. 	Same as above	Construction sites	<p><u>MI</u>: Availability of Safety gears to workers</p> <p>Safety signage Training records on safety</p> <p>Number of safety related accidents</p> <p><u>PT</u>: Zero fatal accidents. Zero or minor non-fatal accidents.</p>	<p>Site observation</p> <p>Review records on safety training and accidents</p> <p>Interact with construction workers</p>	Included in civil works cost	Obligation of Concessionaire	RPWD /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.4 Accident risk to local community	<ul style="list-style-type: none"> Restrict access to construction sites only to authorized personnel. Physical separation must be provided for movement of vehicular and human traffic. 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	<u>MI</u> : Safety signs and their location Incidents of accidents Complaints from local people <u>PT</u> : Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Concessionaire	RPWD /CSC
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. All the opened borrow areas will be rehabilitated and 'Engineer' will certify 	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	<u>MI</u> : Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. <u>PT</u> : 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	Included in civil works cost.	Concessionaire	RPWD /CSC
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
1.1 Air pollution due to due to vehicular movement	<ul style="list-style-type: none">▪ 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 as required in locations Beawarkhas,Naya Badiya, Gola, Alipura, Nagleo, Nad, Pisangan, Govindgarh, Ladpura, NarsinghBasni, Tehla,Kod, Alniyawas	<u>MI</u> : Ambient air quality (PM10, CO,SO2 NO2) <u>PT</u> : Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	RPWD	
2. Noise								
2.1 Noise due to movement of traffic	<ul style="list-style-type: none">▪ Effective traffic management and good riding conditions shall be maintained▪ Speed limitation 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 location locations of air quality monitoring	<u>MI</u> : Noise levels <u>PT</u> : 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	RPWD	
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
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none">Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc.Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	<u>MI</u> : Existence of soil erosion sites Number of soil erosion sites <u>PT</u> : Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	RPWD	
4. Water resources/Flooding and Inundation								
4.1 Siltation	<ul style="list-style-type: none">Regular checks shall be made for soil erosion conditions for its effective maintenance.	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality <u>PT</u> : No turbidity of surface water bodies due to the road	Site observation	Included in Operation / Maintenance cost	RPWD	
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none">Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams.Monitoring of water borne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	<u>MI</u> : Presence/ absence of water logging along the road <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation / Maintenance cost	RPWD	
5. Flora								
5.1 Vegetation	<ul style="list-style-type: none">Planted trees, shrubs, and grasses to be properly maintained.The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act 1980	Project tree plantation sites	<u>MI</u> : Tree/plants survival rate <u>PT</u> : Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Included in Operation / Maintenance cost	RPWD/Forest Department	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none">Maintain shoulder completely clear of vegetation.Minimum offset as prescribed in IRC:SP:21-2009 to be maintainedRegular maintenance/trimming of plantation along the road sideNo invasive plantation near the road.	Project requirement IRC: SP:21-2009/	Throughout the Project route	<u>MI</u> : Presence and extent of vegetation growth on either side of road. Number of accidents. <u>PT</u> : No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation / Maintenance cost	RPWD	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"> Traffic control measures, including speed limits, will be enforced strictly. Further encroachment of squatters within the ROW will be prevented. 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 	IRC:SP:55-2014/ And IRC:SP:88-2010	Throughout the Project route	<p><u>MI</u>: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law</p> <p><u>PT</u>: Fatal and non-fatal accident rate is reduced after improvement</p>	<p>Review accident records</p> <p>Site observations</p>	Included in Operation / Maintenance cost	RPWD	
6.3.Transport of Dangerous Goods	<ul style="list-style-type: none"> Existence of spill prevention and control and emergency responsive system Emergency plan for vehicles carrying hazardous material 	-	Throughout the project stretch	<p><u>MI</u>: Status of emergency system – whether operational or not</p> <p><u>PT</u>: Fully functional emergency system</p>	<p>Review of spill prevention and emergency response plan</p> <p>Spill accident records</p>	Included in Operation / Maintenance cost	RPWD	

Notes: **EA**: Executing Agency, **PWD, RAJASTHAN**: **SQC**: Supervision Quality Controller, **EO**: Environmental Officer,

IRC: Indian Road Congress

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

ENVIRONMENTAL MONITORING PLAN FOR BEAWAR-PISANGAN, TEHLA -KOD- ALNIYAWAS (SH-59)

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Air Quality	Construction stage	PM ₁₀ , PM _{2.5} SO ₂ , NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	As required by progress of construction activities in locations BeawarKhas, NayaBadiya, Gola, Alipura, Nagleo, Nad, Pisangan, Govindgarh, Ladpura, NarsinghBasni, Tehla, Kod, Alniyawas Total Samples =26	During Active Construction Phase	Air quality standard by CPCB	26x9000 =Rs 234,000	Concessionaire through approved monitoring agency	RPWD /CSC
	Operation stage			Batching and hot mix plants sampling part of SPCB annual renewal of permits (30 samples) Representative sample each for residential, commercial and sensitive/forest area (3 Locations)-	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X9000x3 =Rs 81,000	RPWD through approved monitoring agency	RPWD
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps	3 /years, 1camps with 2 bore wells	Water quality standard by CPCB	5000x3x2 = Rs 30,000	Concessionaire through approved monitoring agency	RPWD /SC
	Operation stage			Groundwater at 2 locations and surface water at 2 locations	3/year for 1 year	Water quality standard by CPCB	3X4X5000 =Rs 60, 000	RPWD through approved monitoring agency	RPWD
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	During Active Construction Phase	National Ambient Noise Standard specified in Environment Protection Act, 1986	26x3000 =Rs.78,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage			Representative sample each for residential, commercial and sensitive/forest area (3 Locations)-	3/year for 1 year		3x3000x3 =Rs 27,000	RPWD through approved monitoring agency	RPWD
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 (2 locations)	Once during whole construction stage	ICAR standard	56,000	Concessionaire through approved monitoring agency	RPWD/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil contamination location	Once for the first year of operation	CPCB standard	28,000	RPWD through approved agency	RPWD

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (Rs)	Implementation	Supervision
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		Throughout the Project Corridor especially at River banks, bridge locations and river training structures	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire	RPWD/CSC
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of 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	Concessionaire'	RPWD/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	RPWD	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of SEIAA	Part of the Concessionaire 's quote	Concessionaire with approval from RPWD	RPWD/CSC
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			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	Concessionaire with approval from RPWD, RPWD	RPWD/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept.	Compensatory: RPWD	Compensatory: RPWD/Local Forest Departments	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	Once in a year for years		Additional Plantation: Provisional sum under Civil Cost	Additional Plantation: Concessionaire The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period RPWD through Concessionaire will be responsible for monitoring	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by RPWD		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Concessionaire	RPWD/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of RPWD with support from local police	
Monitoring Costs Construction Phase: INR 0.594 Million									

RPWD: Rajasthan State Public Works Department, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, PMC: Project Management Consultant, IEE: Initial Environmental Examination, IRC: Indian Road Congress, SEIAA: State Environmental Impact Assessment Authority, CPCB: Central Pollution Control Board, IS: Indian Standard