Initial Environmental Examination

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India: Rajasthan Urban Sector Development Investment Program- Barmer Urban Transport and Roads Sub-project (Tr-03)

Prepared by Local Self Government Department

For the Government of Rajasthan
Rajasthan Urban Infrastructure Development Project

ABBREVIATION

ADB	-	Asian Development Bank
DSC	-	Design and Supervision Consultancy
EA	-	Executing Agency
EAC	-	Expert Appraisal Committee
FI	-	Financial Intermediary
GLSR	-	Ground Level Service Reservoir
GoI	-	Government of India
GoR	-	Government of Rajasthan
GSI	-	Geological Survey of India
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IPMC	-	Investment Programme Management Consultancy
IPMU	-	Investment Programme Management Unit
JNNURM	-	Jawaharlal Nehru National Urban Renewal Mission
LSGD	-	Local Self-Government Department
MFF	-	Multitranche Financing Facility
MoEF	-	Ministry of Environment and Forests
NAAQS	-	National Ambient Air Quality Standards
OD	-	Outer Diameter
OHSR	-	Over Head Service Reservoir
OM	-	Operations Manual
PHED	-	Public Health Engineering Department
PMU	-	Project Management Unit
RCC	-	Reinforced Cement Concrete
ROW	-	Right of Way
RPCB	-	Rajasthan State Pollution Control Board
RSPM	-	Respirable Suspended Particulate Matter
RUIDP	-	Rajasthan Urban Infrastructure Development Project
RUSDIP	-	Rajasthan Urban Sector Development Investment Program
SPM	-	Suspended Particulate Matter
STP	-	Sewerage Treatment Plant
ToR	-	Terms of Reference
UA	-	Urban Agglomeration
UIDSSMT	-	Urban Infrastructure Development Scheme for Small and Medium Towns
USEPA	-	United States Environmental Protection Agency

WEIGHTS AND MEASURES

Lakh	–	100 thousand = 100,000
Crore	–	100 lakhs = 10,000,000
$\mu g/m^3$	–	micrograms per cubic meter
Km	–	Kilometer
Lpd	–	liters per day
M	–	Meter
mg/l	–	milligrams per liter
Mm	–	Millimeter
Ppm	–	parts per million

NOTE{S}

(i) In this report, "$" refers to US dollars.
(ii) “INR” and “Rs” refer to Indian rupees

CONTENTS

Table

Figure

EXECUTIVE SUMMARY

1. Introduction and Regulatory Framework: Rajasthan Urban Sector Development Investment Program (RUSDIP) is intended to optimize social and economic development in 15 selected towns in the State, particularly district headquarters and towns with significant tourism potential. RUSDIP Phase II to be implemented over a seven year period beginning in 2008, and will be funded by a loan via the Multitranche Financing Facility (MFF) of the ADB. RUSDIP will improve infrastructure through the design and implementation of a series of subprojects, each providing improvements in a particular sector (water supply, sewerage, drainage, road, solid waste etc) in one town.

2. The impacts of subprojects prepared according to ADB Environment Policy (2009) and Indian National Law. Projects are screened for their expected environmental impacts and are assigned to Category A, B, C and F1. RUSDIP has been classified by ADB as environmental assessment category B (some negative impacts but less significant than category A).

3. This is the Initial Environmental Examination (IEE) report for the Barmer road-transport sector. It discusses the generic environmental impacts and mitigation measures relating to the location, design, construction and operation of physical works proposed under this subproject.

4. Project Description: The sub-project is located in Barmer, the headquarters town of Barmer district, in the north eastern part of Rajasthan. The main component of the sub-project is construction of road from Barmer-Jodhpur By Pass Road via R.T.O.office.(N.H.15 to Uttarlai Level Crossing).

5. Description of Environment: Barmer town is located in south western part of Rajasthan in the Thar Desert at the junction of 25°45' north latitude and 71°22' East longitude at an altitude of 250 meters above mean sea level. It is the border town of Western India and is located on National High-way No. 15, which connects it with Ahmedabad in the south & Jaisalmer, Bikaner and GangaNagar in the North. It is about 209 Kms. from Jodhpur and 550 Kms from Jaipur. It has got a rail connection from Jodhpur via Samdari, State Highway No. 16 Connects this town with Jodhpur. The site on which the town stands is of great significance in its natural setting. The old town was established on the eastern side of a hillock, which provided natural protection against the westerly sand storms. Its has a gradual slope towards south and the old town was located in a river valley namely 'khagal'. This locational advantage made this town to grow and prosper throughout its history. The climate of Barmer is a typical desert type i.e. hot and dry, with extreme conditions. The variation in day and night temperature is high. The mean monthly temperature varies from 44.5°C to 25.6°C in summer and 31°C to 9°C in winter. During the summer hot winds blow throughout the day but nights are cool and pleasant. The relative humidity varies from 15% to 50% in the evening and 45% to 82% in the morning. The predominant wind direction is from South-west and wind speed varies from 8 to 12 kms / hour during fine weather and 20 to 24 kms/hour during storms. It's mean annual rainfall is only 25 centimeter. The dust storms are common phenomenon especially during summer. Due to extremely low rainfall and high temperatures, & losses are high evaporation. Moisture accumulates to some extent during rainy season and a few scattered trees are found.

6. Economic base of a town reflects its prosperity. Barmer being district headquarter, has been functioning as administrative city with sustained growth in tertiary economic activities. The major economic activities are trade and commerce, thus it offers a number of wholesale and retail markets which act as a distribution center for nearby towns and villages. The state Government of Rajasthan Industrial Investment Corporation is providing various

incentive and facilities for promoting Industrial activities. There is no large scale Industry in Barmer. Only small scale industries such as Granite industry, plywood industry, dal and oil mill industry, and cattle feed industry industry are functioning with very little workforce. Barmer is the second largest district of Rajasthan. Recently, India's first offshore oil field after independence has been discovered and made functional in Barmer district.

7. Water supply: In Barmer town water is available from underground source. The water is drawn from 28 tube wells near NH-15 at Bhadka situated 38 Km. from Barmer city and is boosted through 300 mm AC / 200 mm CI conveyance mains to Barmer city with intermediate boosting at Harsani Phanta and Jalipa Head Works. The total production is 9 MLD and per capita supply is about 100 liters. Out of the 9 MLD available from current sources, PHED supplies around 0.22 MLD to Commercial Consumers, 0.88 MLD to Industrial consumers and 7.90 MLD to Domestic consumers. The city is divided into 11 water supply zones covering 35 municipal wards. The approximate total length of the existing water supply distribution network is 144 km and includes all localized distribution networks.

8. Barmer city has nearly 58% of total urban population of the district. In 2001 its population was 83591 persons. Growth rate has not been significant during last two decades because of lack of economic factor. During last decade (1991-2001) the growth rate was 21.8% only which was even less than the national population growth rate. Thus migration is negligible. Scheduled caste and Scheduled Tribe population is 10.10% and 0.5% respectively

9. Potential environmental impacts and mitigation measure: All pre-construction (design), construction, and operation activities that are likely to cause environmental impacts were identified, and evaluated to assess their magnitude, duration, and potential receptors in consultation with the stakeholders. Most of the individual elements of the subproject are relatively small and involve straightforward construction and operation, so impacts will be mainly localised and not greatly significant during design phase.

10. There is one temple i.e. Bharat Mata Temple comes in the vicinity of project; all preventive measures will be taken care off during construction phase. There is no settlement in Right of way (ROW) hence there is no need of compulsory resettlement.

11. During project implementation the impacts are consider on physical environment like water, air, soil, noise; on biological environment, like flora and socio-economic environment (which is positive in some extent) and sensitive receptors. All the impacts are temporary and for short duration. In all the cases mitigation measures i.e. control of air, dust pollution, checking of water and noise pollution, protection of biological environment and minimize the social impacts are taken care. Safety measures, both occupational and social are considered and those are depicted in this report. Traffic management plan will be implemented during construction of Road. During operation phases there are few positive socio-economic impacts will be anticipated.

12. **Institutional responsibility and Environmental management and monitoring plan:** LSGD is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan. Environmental issues will be coordinated by an Environmental Specialist within the IPMU/ IPMC, who will ensure that all subprojects comply with environmental safeguards. An Environmental Monitoring Specialist (EMS) who is part of the DSC team will implement the Environmental Monitoring Plan from each IEE, to ensure that mitigation measures are provided and protect the environment as intended.

13. Implementation of Environmental management plan and monitoring frequency will be taken care during construction phase. Most the mitigation activities are the responsibility of

the Construction Contractors (CC) employed to build the infrastructure during the construction stage, or the O&M Contractors employed to conduct maintenance or repair work when the system is operating. Responsibility for the relevant measures will be assigned to the Contractors via the contracts through which they are appointed (prepared by the DSC during the detailed design stage), so they will be legally required to take the necessary action. There are also some actions that need to be taken by LSGD in their role as project proponent, and some actions related to the design that will be implemented by the DSC. Mitigation measures are fairly standard methods of minimizing disturbance from building in urban areas (maintaining access, planning work to avoid sensitive times, finding uses for waste material, etc), and experienced Contractors should be familiar with most of the requirements. Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects. There will also be some surveys of residents, as most of the measures are aimed at preventing impacts on people and the human environment. Environmental management and monitoring cost for the sub-project has been estimated as 0.72 million Rupees i.e. 14,541.05US$.

14. **Public consultation, information disclosure and grievance redress mechanism:** Public consultation with primary and secondary stakeholders has been conducted to understanding the local issues and public views regarding the possible impact. The group discussion meeting was conduct by RUIDP after advertising in Local NEWS papers. The issues like, awareness and extent of the project and development components, benefits of project for the economic and social upliftment of community, labour availability in the project area or requirement of outside labour involvement, local disturbances due to project construction work, necessity of tree felling etc. at project sites, water logging and drainage problem if any, drinking water problem, forest and sensitive area nearby the project site etc. On the basis of outcome of consultation the action plan has been developed. LSGD will extend and expand the consultation and disclosure process significantly during implementation of RUSDIP. They will appoint an experienced NGO to handle this key aspect of the programme.

15. The project authority will establish a mechanism to receive and facilitate resolution of affected persons' concerns, complaints and grievances about the project's environmental performance.

16. **Recommendation and Conclusion:** There are two straightforward but essential recommendations that need to be followed to ensure that the environmental impacts of the project are successfully mitigated. These are that LSGD should ensure that, all mitigation, compensation and enhancement measures proposed in this IEE report and in the Resettlement Framework for the RUSDIP are implemented in full, as described in these two documents and the Environmental Monitoring Plan proposed in IEE and the internal and external monitoring proposed in the Resettlement Framework are also implemented in full.

17. This initial environmental examination (IEE) ascertains that the subproject is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed subproject, all of which are localized and temporary in nature and can be easily mitigated with minor to negligible residual impacts. There are no uncertainties in the analysis, and no additional work is required to comply with ADB procedure.

I. INTRODUCTION

A. Purpose of the report

1. Rajasthan Urban Sector Development Investment Program (RUSDIP) is intended to optimize social and economic development in 15 selected towns in the State, particularly district headquarters and towns with significant tourism potential. This will be achieved through investments in urban infrastructure (water supply; sewerage and sanitation; solid waste management; urban drainage; urban transport and roads), urban community upgrading (community infrastructure; livelihood promotion) and civic infrastructure (art, culture, heritage and tourism; medical services and health; fire services; and other services). RUSDIP will also provide policy reforms to strengthen urban governance, management, and support for urban infrastructure and services. The assistance will be based on the State-level framework for urban reforms, and institutional and governance reforms recommended by the Government of India (GoI) through the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT).

2. RUSDIP Phase II to be implemented over a seven year period beginning in 2008, and will be funded by a loan via the Multi-tranche Financing Facility (MFF) of the ADB. The Executing Agency (EA) is the Local Self-Government Department (LSGD) of the Government of Rajasthan (GoR); and the Implementing Agency (IA) is the Project Management Unit (PMU) of the Rajasthan Urban Infrastructure Development Project (RUIDP), which is currently in the construction stage.

3. RUSDIP will improve infrastructure through the design and implementation of a series of subprojects, each providing improvements in a particular sector (water supply, sewerage, solid waste etc) in one town. RUSDIP has been classified by ADB as environmental assessment category B (some negative impacts but less significant than category A). The impacts of subprojects prepared according to ADB Environment Policy (2009) and Environmental Assessment Guidelines (2003).

B. Extent of the IEE study

4. Indian law and ADB policy require that the environmental impacts of development projects are identified and assessed as part of the planning and design process, and that action is taken to reduce those impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

1 ADB Policy

5. ADB's Environment Policy (2009) requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in Operations Manual (OM) 20: Section F1/BP (2006) Environmental Considerations in ADB Operations. This states that ADB requires environmental assessment of all project loans, programme loans, sector loans, sector development programme loans, financial intermediation loans and private sector investment operations.

6. The nature of the assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-

effective mitigation measures. Projects are screened for their expected environmental impacts and are assigned to one of the following categories:

Category A: Projects that could have significant environmental impacts. An Environmental Impact Assessment (EIA) is required.

Category B: Projects that could have some adverse environmental impacts, but of less significance than those for category A. An Initial Environmental Examination (IEE) is required to determine whether significant impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

Category C: Projects those are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.

Category FI: Projects that involve a credit line through a financial intermediary (FI) or an equity investment in a FI. The FI must apply an environmental management system, unless all subprojects will result in insignificant impacts.

7. The Bank has categorised this program as Category B and following normal procedure for MFF loans has determined that one Environmental Examination will be conducted for each subproject, with a subproject being the infrastructure improvements in a particular sector (water supply, sewerage, etc) in one town.

2 National Law

8. The GoI EIA Notification of 2006 and 2009 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance (EC) is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorised as A or B depending on the scale of the project and the nature of its impacts.

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

10. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the EC based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

11. The only type of infrastructure provided by the RUSDIP that is specified in the EIA Notification is Common[1] Municipal Solid Waste Management Facility (CMSWMF), where EC is required.

3 Review and Approval Procedure

12. For Category B projects the Draft Environmental Status report and its summary (SIEE) are reviewed by ADB's Regional Department sector division and Environment and Social Safeguards Division, and by the Executing Agency, and additional comments may be sought from project affected people and other stakeholders. All comments are incorporated in preparing the final documents, which are reviewed by the Executing Agency. The EA then officially submits the IEE and SIEE reports to ADB for consideration by the Board of Directors. Completed reports are made available worldwide by ADB, via the depository library system and the ADB website.

4 Scope of Study

13. This is the IEE for the Barmer road sector. It discusses the generic environmental impacts and mitigation measures relating to the location, design, construction and operation of physical works proposed under this subproject.

[1] For the purpose of EIA Notification, common municipal solid waste management facilities may be referred as centralized MSW facility for an given town, city, region. It is further to mention a common facility need not have surrounding ULBs included.(Technical EIA Guidance Manual for CMSWMF)

II. DESCRIPTION OF THE SUB PROJECT

A. Type, Category and Need

14. This is a transportation sub-project, and as explained above it has been classified by ADB as Category B, because it is not expected to have major negative environmental impacts. Under ADB procedures such projects require an IEE to identify and mitigate the impacts, and to determine whether further study or a more detailed EIA may be required. The sub-project is needed to help alleviate road congestion in the town, where the capacity of the network has not expanded to cope with increased traffic demand. This is one of a series of subprojects designed by the RUSDIP that are intended to raise the standards of the municipal infrastructure and services of Barmer and the other urban centers to those expected of modern Asian towns.

B. Location, Size and Implementation Schedule

15. The sub-project is located in Barmer district, the headquarters town of Barmer district, in the north western India state of Rajasthan**.** The infrastructure will consist of construction of road from Barmer-Jodhpur by Pass Road via R.T.O.office (N.H.15 to Uttarlai Level Crossing) within the Barmer town **(Figure 2.1).**

16. Detailed design started in February 2012 and construction will be completed by the end of the 2013.

17. Photographs of the project area are attached as **Annexure I**

C. Description of the Sub-project

1 Existing Road and traffic at Barmer

18. Road network in Barmer city comprises of about 242.5 km of which 12.5 km (5.5%) is cement concrete roads, 170.0 km (70.10%) is black topped, 10km (4.13%) is WBM road and the rest 50.0 km (20.62%) is NH & State Highway roads. The road network maintained by PWD in Barmer is about 50.0 km.

2 Scope of Work:-

19. Construction of Road from Barmer-Jodhpur by Pass Road to Uttarlai via R.T.O. office. (N.H.15 to Uttarlai Level Crossing): The identified road connects Indira Circle to level crossing at Uttarlai railway station. Existing state Highway no. 112 section diverts from national Highway no. 15 just before the level railway crossing at Indira circle. The existing road is already carrying heavy traffic and considering the heavy vehicle movement between two important cities of western Rajasthan it is the urgent need of the hour to construct a bypass road of the existing road which passes through the level crossing at Uttarlai Railway station which has a long wait time causing long queues of trucks at both side of the railway crossing. The construction of 7300 meter bituminous road shall avoid level crossing.

20. Road inventory of proposed road are given in table below.

Table 2.1: Road inventory of proposed road

S.N.	Road Description	Length	Carriage way width	Drainage condition	Footpath	Right of way	Remarks
1	Barmer-Jodhpur By-	7300 M	7.0 m	Five causeway	Not available	9.0 m	

S.N.	Road Description	Length	Carriage way width	Drainage condition	Footpath	Right of way	Remarks
	Pass						

21. The following will be the key outcomes from the Subproject:

- Predominant traffic will be served
- Avoid any accident
- Saving of time
- Fuel saving
- Traffic congestion will be eased
- Social & Environmental hazards to be improved
- No psychological barrier

22. **Table 2.2** shows the nature of the subproject. The descriptions shown in Table 2.2 are based on the present proposals, which are expected to be substantially correct, although certain details may change as development of the subproject progresses.

Table 2.2: Improvements in transportation infrastructure proposed in Barmer

Infrastructure	Function	Description	Location
Road in Barmer	Reduction of traffic congestion above the present road	**Construction of road** • **Barmer-Jodhpur By Pass:** This road connects Indira Circle to level crossing at Uttarlai railway station. Existing state Highway no. 112 section diverts from national Highway no. 15 just before the level railway crossing at Indira circle. The existing road is already carrying heavy traffic and considering the heavy vehicle movement between two important cities of western Rajasthan it is the urgent need of the hour to construct a bypass road of the existing road which passes through the level crossing at Uttarlai Railway station which has a long wait time causing long queues of trucks at both side of the railway crossing. The construction of 7300 meter bituminous road shall avoid level crossing.	Barmer-Jodhpur By Pass

23. Expected Subproject Outputs: Construction of Barmer-Jodhpur By Pass from Kachha Road to Bituminous Road

3 Design Criteria: Pavement design (Design Parameters/Design life)

24. Classification of Road: This road carries through and continuous traffic but offering somewhat lower level of mobility and as such is classified as sub arterial road as per IRC : 86-1983 “Geometric Design Standards for Urban Roads in Plains” for the purpose of geometric design and space standard. The road passes through plain terrain.

25. Design Speed : Being a sub arterial, a design speed of 60 km/hour has been adopted as per IRC: 86-1983

26. Present Traffic Volume: Classified traffic volume count was carried on the project road on 21st -27th January 2012. The vehicular traffic was converted to equivalent passenger car unit (PCU). The equivalency factors for converting number of vehicles to PCU were used as given in IRC: 106- 1990. The maximum traffic was found in the peak hour between 17:00 to 18:00 hrs. The classified daily and peak hour traffic on the road is given in table 2.3

Table 2.3 Present Daily and Peak Hour Traffic of Proposed Road

	Daily Traffic		Peak Hour Traffic (17:00 to 18:00)	
	Numbers	**PCU**	**Numbers**	**PCU**
Cars, Jeeps and Vans	1414	1414	105	105
Motor Cycles	1220	610	96	48
Light Commercial Vehicles	359	359	41	41
Mini Buses	75	75	10	10
Standard Buses	80	240	9	27
Trucks	683	2049	55	165
Multi Axle Truck	340	1530	29	131
Agricultural Tractor	269	807	12	36
Cycles	690	345	65	33
Animal Driven carts	28	112	3	12
Cycle rickshaws	43	65	9	14
TOTAL	**5201**	**7606**	**434**	**622**

Traffic Projection & Justification

27. The road width in urban areas is designed to accommodate the design peak hour traffic. The design peak hour traffic is estimated based on a simple projection of present peak hour traffic for a design period of 15 years (adopted for arterial roads as per IRC-86:1984). The growth rate of different vehicles is estimated by Transport Demand Elasticity

Method considering past traffic data, vehicle registration data, change of socio-economic pattern in urban areas, future development plan etc. In absence of such data, it is very difficult to estimate the actual growth rate for different vehicles.

28. In general, the average traffic growth rate for this type of urban areas (Barmer) is around 5%. The growth rate as per IRC 37-2001 is 7.5% which is higher than the actual growth at present. The present traffic is projected for both the growth rates i.e. 7.5% for design period of 15 years.

29. Period of Construction: The construction of this road is being undertaken under Rajasthan Urban Infrastructure Development Project and the period of construction has being taken as one year.

30. Growth Rate: The classified traffic volume count was not undertaken in past on this road and it is not possible to extrapolate the growth rates from the past trends. The growth rate has been taken as 7.5 per cent per year as per IRC: 37-2001 for the fast moving vehicles such as Cars, Jeeps, Two wheelers, Light Commercial Vehicles, Buses, Trucks, Agricultural Tractor Trailers and Auto-rickshaws as given in the guidelines of the Indian Road Congress. However, the growth rate for cycles, and animal drawn Carts has been adopted as zero as per the prevalent trend in the country.

31. Design Traffic Volume:

Table 2.4 Design Traffic volume of Proposed Road

Peak Hour flow in January 2012	:	622 PCU
Peak Hour flow at the end of construction period	:	563X(1+0.075)+59=665 PCU
Peak Hour flow for 15 years design period	:	563X(1+0.075)^15+59=1725 PCU
Peak Hour flow for 5 years design period	:	563X(1+0.075)^5+59=868 PCU

32. Existing Crust: The existing road available is earthen road with available right of way equal to 9.0 meter The earthen road is available for a length of 7300 meter. The existing earthen road is found inadequate for the present day traffic and the growth of traffic in the next 15 years. The number of commercial vehicles per day as per classified traffic volume count survey carried out in the month of January 2012 is as under:

Trucks	1023 numbers
Buses	155 numbers
Light commercial vehicles	359 numbers
Total	**1537 numbers**

Total number of Commercial vehicles in both direction=1537 numbers

33. **Growth Rates:** Growth rates for the commercial vehicles has also been adopted as 7.5 per cent per year for the proposed pavement design as in the case of all fast

moving vehicles and as suggested vide paragraph 3.3.2.2 of guidelines for the design of flexible pavements by the Indian Roads Congress (IRC: 37-2001).

34. **Design Life:** The overall design life for urban roads as laid down in IRC: 86-1983 is 15 years. It is proposed that the pavement is designed to cater the design life of 15 years. However the crust thickness has been designed for 5 year as initial phase.

35. **Vehicle damage factor:** The vehicle damage factor has been adopted as recommended in table 1 of IRC: 37-2001. As the initial traffic in terms of commercial vehicles is more than 1500, vehicle damage factor of 4.5 has been adopted.

36. **Distribution Factor:** The proposed carriage way is single lane roads. The distribution factor has been taken as 75 percent of the total number of commercial vehicles in both directions as laid down in IRC: 37- 2001. The number of commercial vehicles in both directioons is 1537 vehicles per day.

37. **Design Traffic (msa):** The design for crust thickness has been considered in terms of million standard axles (msa) to be carried during the design life of the road. This has been commuted as below:-

Commercial vehicles as per traffic survey in January 2012	:	1537
Constructed period	:	One Year
Commercial vehicles at the end of construction	:	1537 X (1+0.075) = 1653 Nos.
The cumulative number of standard axles for the design life of 15 years	:	$=\frac{365 \times [(1.075)^{15}-1] \times 1653 \times 0.75 \times 4.5}{0.075}$ = 53.2 msa
The cumulative number of standard axles for the design life of 5 years	:	$=\frac{365 \times [(1.075)^{5}-1] \times 1653 \times 0.75 \times 4.5}{0.075}$ = 11.9 msa

38. Improvement of pavement : As explained earlier, the design life of 15 years has been considered for the design of pavement. For initial phase the life period is taken as 5 years. The total right of way available of existing earthen road is 9.0 meter width and carriageway on earthen road is proposed to be of 7.0 meter width. The cumulative figure of 11.9 million standard axles has been considered for the design. The CBR of the sub-grade soil is 8.00. The crust thickness for 11.9 msa and CBR of 8.00 works out to 555 mm, as per table 2 of IRC: 37-2001. So the following recommendations are made for crust thickness:

39. New/Widening Portion

GSB : 200 mm

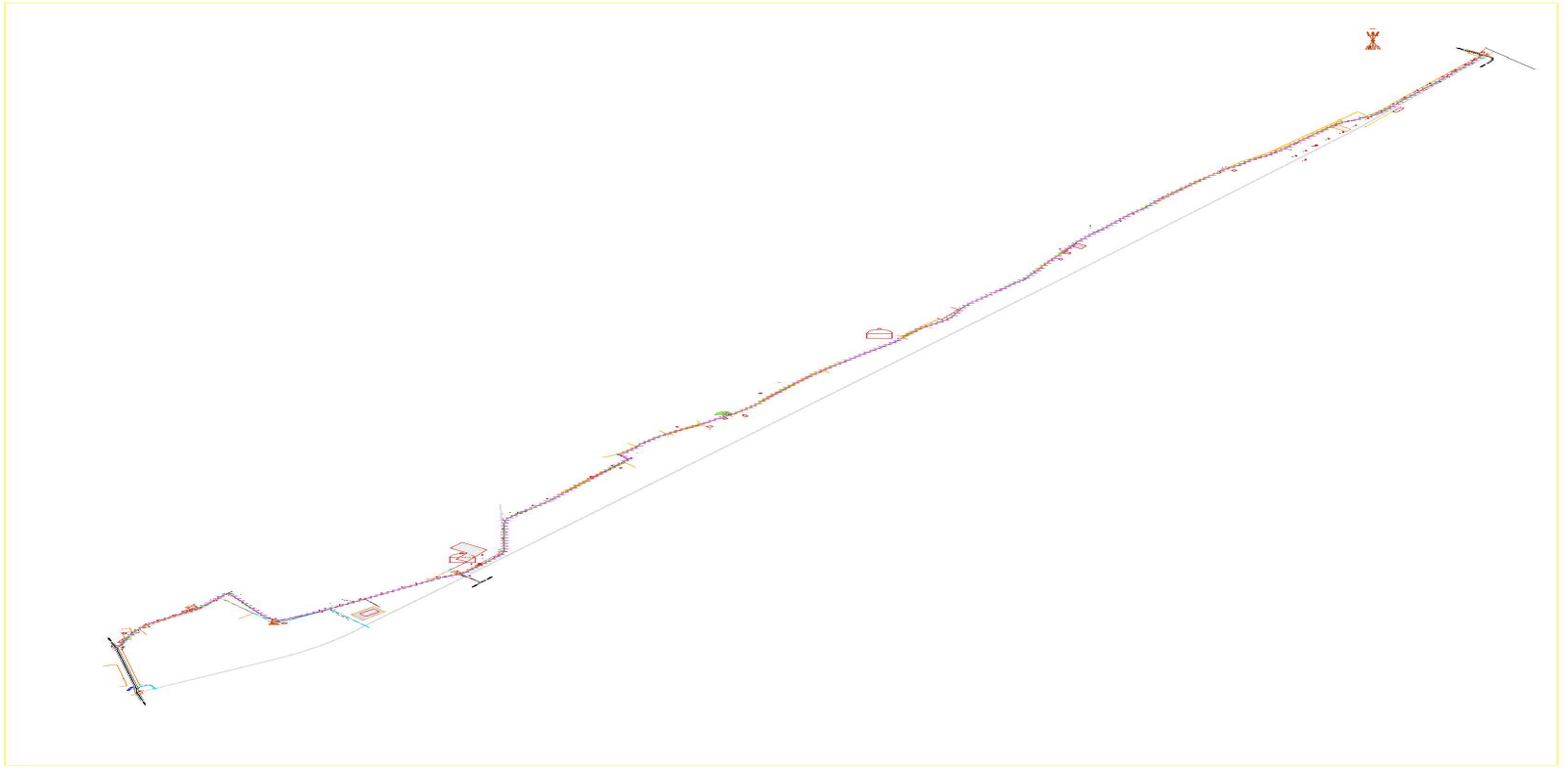
WMM	:	250 mm
DBM	:	65 mm
BC	:	40 mm

4 Geometric Design

40. Horizontal Alignment: There are no sharp curves on the existing alignment. The existing horizontal curves are considered adequate for the design speed of 60 km/hour. The achievable practical speed on road will be around 50 km/hour keeping in view of numerous cross-roads by the road side.

41. Vertical Alignment: The gradient of the existing road is fairly flat. No major change in the vertical alignment of the road is therefore proposed.

Figure 2.1: Map showing the location of the proposed project



III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Administrative Boundaries

42. The major sub-towns of the district are Chohtan, Baytu, Guda Malani, Jasol, Balotra and Siwana. Barmer town is located in the south western part of 'Thar' desert of Rajasthan. The district is well known for its dance and folk music. One can find the Bhopas or priest singers here. They are known for their music composition honoring war heroes and the deities of the region. Another type of folk musicians, the Muslim Dholis or drummers are also famous here. Barmer festival is held every here in the month of March which is a major tourist attraction of the district. Barmer once called Mallani (12th century AD) formed in 1949 upon the merger of Jodhpur state in States of Great Rajasthan, is a cluster of ancient parganas-Mallani shiv, Pachpara, Siwana and the Chautan area. .

43. Located in the north western India state of Rajasthan. Barmer district is well known for its hand block printing and carved wooden furniture. The head quarter of the district is Barmer town. The Barmer town is 224 Km from Jodhpur via Balotra and 198 Km via Panchpadra.

44. The city of Jaisalmer is 157 Km from here while Jaipur is 588 Km away. The city of Ahemdabad is 485 Km from Barmer. Barmer district is situated in the Thar district or the Great Indian Desert. District map of Barmer is as shown in **Figure 3.1.**

2. Topography, Natural hazard and Drought

45. **Topography**: Barmer town is located in south western part of Rajasthan in the Thar Desert at the junction of 25°45' north latitude and 71°22' East longitude at an altitude of 250 meters above mean sea level.

46. **Natural Hazards**- Earthquake: Barmer town lies in medium to high risk zone (III and IV). The area is prone to earthquakes as it is located on comparatively unstable geological plains based on evaluation of the available earthquake zone information. Figure 3.2 depicts the earthquake zones of Rajasthan. **Figure 3.2** depicts the earthquake zones of Rajasthan. **Figure 3.3** shows natural hazard zones of the Barmer district.

47. **Drought:** Low rainfall coupled with erratic behavior of the monsoon in the State makes Rajasthan the most vulnerable to drought. Based upon the discussion with PHED officials the water table in the City continuously decreases by 4-5 meter on an annual basis combined with significant drawdown conditions.

Figure 3.1: District Map of Barmer

Figure 3.2: Earthquake zones of Rajasthan

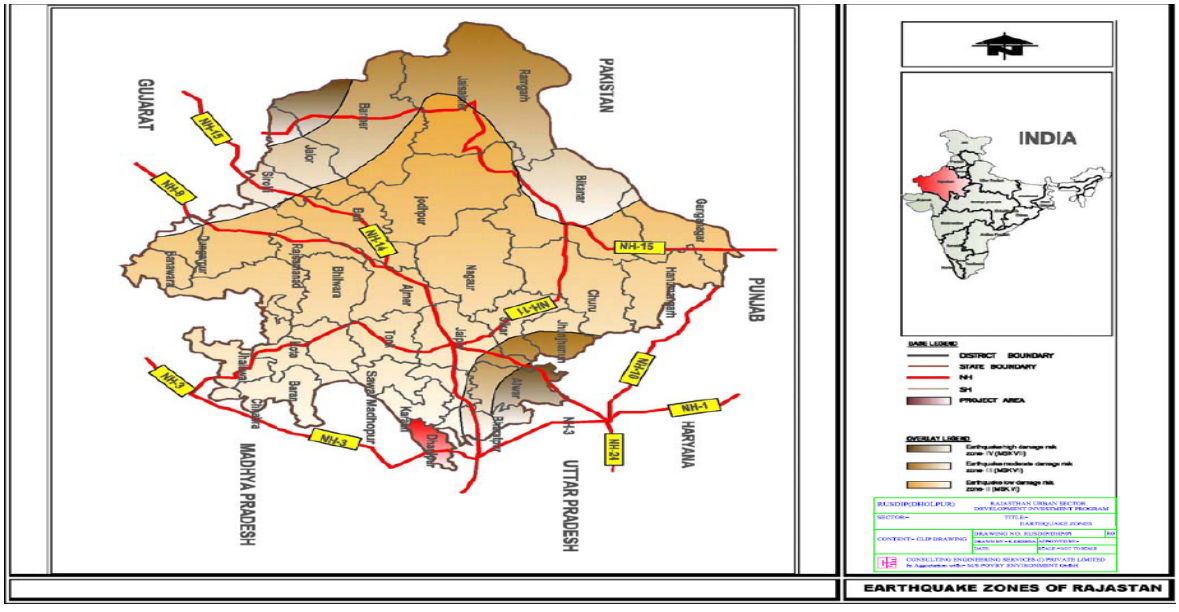
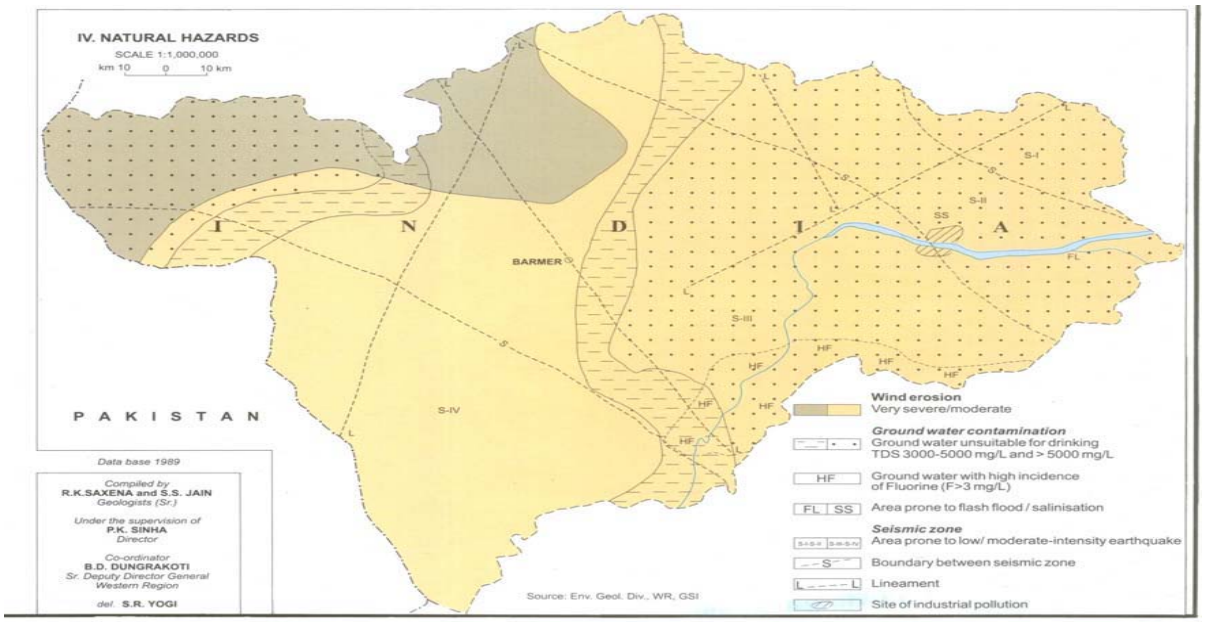


Figure 3.3: Natural Hazard map of Barmer (Source: Resource map GSI)



3. Geology, geomorphology, mineral resources and soil

48. Barmer district is situated in the western part of the state, bordering Pakistan. It occupies the area of 28,287 km2. Shiv, Baytu, Pachpadra, Barmer, Chauhtan, Siwana and Gudha Malani are the seven Tehsil in the district. The ephemeral Luni and Sukri rivers drains the eastern and southern part of the district. The district is having arid climate with average annual rainfall in the district is 27cm.

49. The district forming the part of the 'Thar desert' is mostly covered by Aeolian sand. The area however exposes a variety of rock types ranging in age from upper Proterozoic to Quaternary. The pre- Malani ligneous Suit comprise volcanic phase (rhyolite, agglomerate tuff), plutonic phase (granite) and dyke phase rhyolite, felsites, prophyrite,basalt). The Malani volcanic are dominated by acid volcanic flows. Three phases of acid volcanism, separated from each other by pyroclastic material, have been identified. The Birmania formation comprising limestone, chert, shale, sandstone, (Upper Proterzoic) overlite the Malani rocks the overlying Lathi formation (Jurassic) is represented by sandstone, siltstone, conglomerate and pockets of clay. Over most part of the area they are covered by Quaternary sediments and could be seen in dug well section. The Fategarh formation uncomfortably overlying the Lathi sandstone comprises sequences of conglomerate, gritty sandstone. phosphalic sandstone, siltstone and bentonite Outliers of the Fategarh Formation are also seen around Sarnu. The emplacement of alkaline suite of rocks (alkali olivine basalt, hawaiite, trachyte, trachyandesite. syenite) within the Malanis. in the area around Sarnu and Dandali marks another magnetic phase The Tertiary sequence, overlying the Fatehgarh Formation is represented by the Akli, the Mandai, and the Kapurdi Formations. The Akli Formation consisting of argrillaceous sandstone, lignite, bentonic clay grades upward into the arenaceous Mandai Formation which includes conglomerate, sandstone, etc. The Kapurdi Formation (Eocene) consists mainly of Fuller's earth, variegated clay and ferruginous and gypseous concretions. The Bandah Formation consisting of friable and variegated sandstone and clay, seen in the western part of the district, is considered time equivalent of the Kapurdi Formation.

50. The Phalsund and Shumar Formation (Pleistocene age) comprising grit, conglomerate, iron stone, pebble spread etc occur in isolated patches at several places.

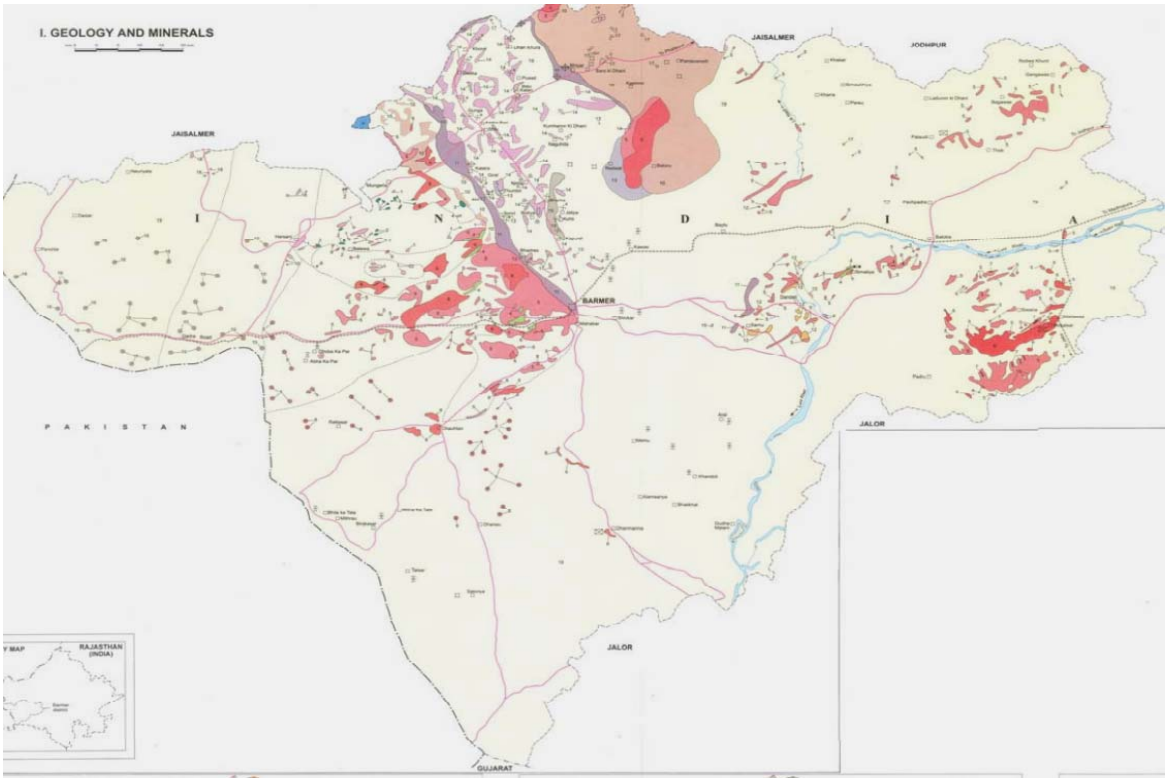
Quaternary sediments of aeolian and fiuvial phases conceal the older formations and cover large part of the district.

51. Geomorphology:- The district is classified into seven geomorphic units, namely, alluvial plain, obstacle dune, complex / composite dune, parabolic dune, sand sheet, rocky desert and denudational hill Geohydrologically, the district is classified into three hydrological domains (unconsolidated alluvium and pebble; semi consolidated formations; and consolidated fissured formations) with ground water potential ranging from <10 to 100 LPS. Natural hazards include mainly wind erosion which is moderate to very severe.

52. Mineral resources: The district abounds in mineral resources of bentonite, China clay, fuller's earth, glass sand, lignite phosphorus, salt, vermiculite and Kankar. Benotonitic clay deposits swelling and non – swelling type are reported from Akli, Amba Bari, Bisu Kalan, Gunga, Narguida, Khoral, Shiv, Thumbli, Sonri, Bhadres, Jalipa, and Mahabar, with the total of 7.15 million tones of proved reserves. China clay beds, up to 2.4 m in thickness occur near Gunga, Nimla and Botiya. Fuller's earth deposits are located around Bharka, Kaprudi, Botiya. Gypsum occurrences are reported from. Talsar, mith ka Tala, Binjkasar, Mithrau, Uttarlai, Kawas and Shivkar. Glass sand is suitable for glass industries are reported from Shiv. Lignite occurrences (from Mandai Formation) are reported from Kapurdi, Jalipa, Thumbli and Bharka areas. Mineral Exploration Corporation Limited estimated reserves of about 200 million tones form Kapurdi – Jalipa area. Phosphorite horizon, 1 to 4 m thick, Comprising aeolite, pellet, replaced fossil shell, is traceable from Bhiyar to Dharavi Khurd with 5.25 % P_2O_5 contents. Salt deposits are found around Pachpadra. Vermiculite has been reported from (west of) Simaliya. Kankar occurrences are reported from Saro – ki – Dhani, Kashmir, Redwali, salariya etc. where they are locally used as road material. Malani granite and rhyolite are extensively quarried for use as construction material near Mokalsar, Pataudi, Dharimanna, etc. They also possess vast reserves of road metal and railway ballast.

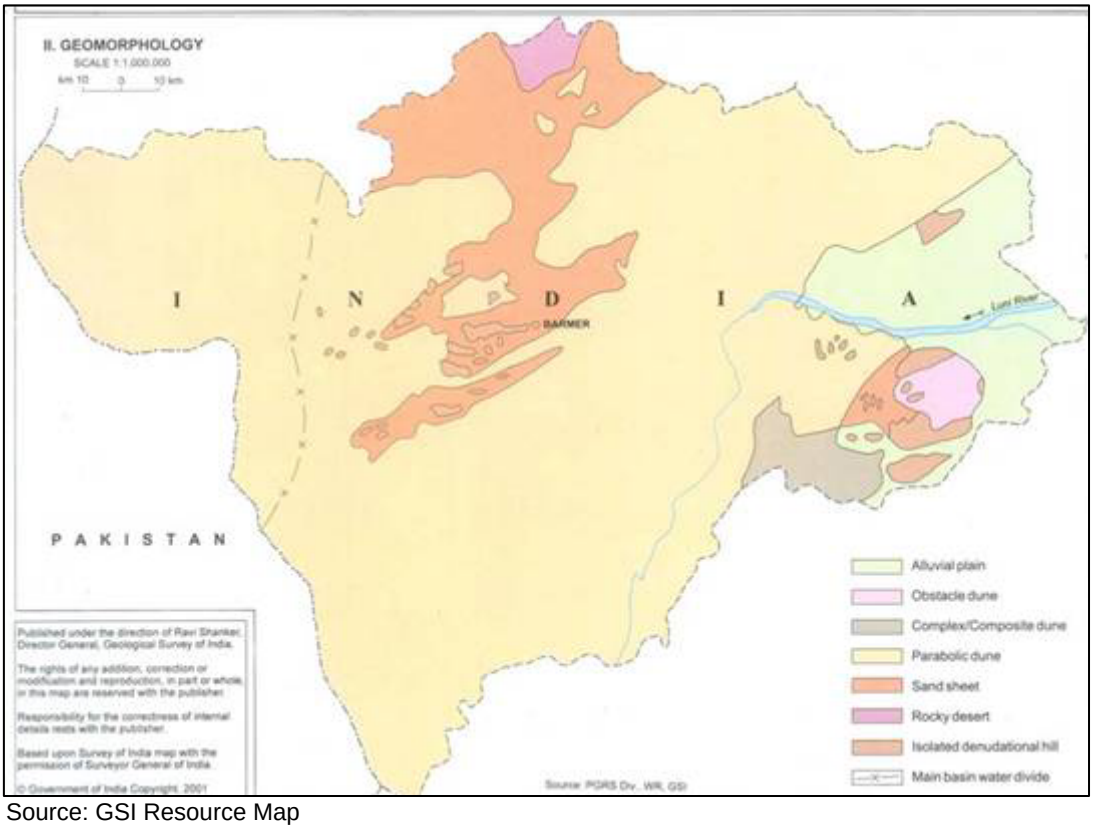
53. Geology and mineral map of the district is shown in **Figure 3.4** and geomorphologic map of the district is depicted in **Figure 3.5.**

Figure 3.4: Geology and Mineral Map of Barmer District



Source: GSI Resource Map

Figure 3.5: Geomorphology of Barmer District



Source: GSI Resource Map

54. Soil characteristics: 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. Table 3.1 shows nutrient level in the Barmer soil including area coverage of sodic soil. The nutrient status of the Barmer soil is graded as very low to medium level.

Table 3.1: Fertility Status – Major Nutrients and Problematic Soils of Barmer District

	Nutrient			Saline Soil(Ha)	Sodic or Alkali(Ha)
	N	P	K		
Status	VL	M	M	-	1989

(Source: Vital Agricultural Statistics 2004-05, Directorate of Agriculture, Rajasthan)

4. Rainfall and Climate

55. The temperature of Barmer varies between minimum of 9 degrees celsius to the maximum of 45 degrees celsius. The normal rainfall is 27.75 cms.

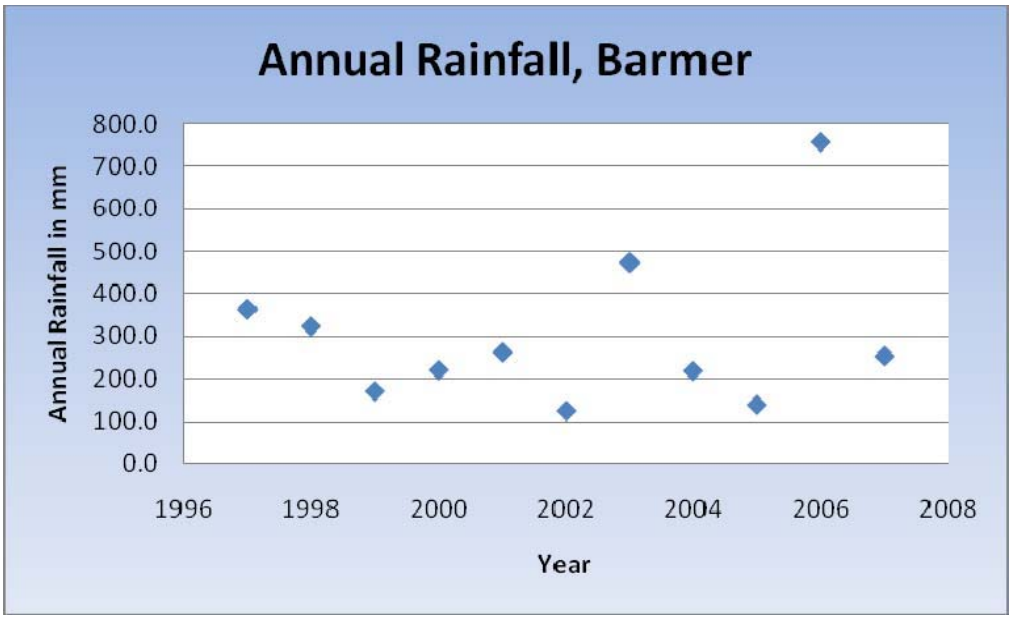
56. The rainfall over Barmer is scanty and is concentrated over four month i.e. from June to September. The rains are erratic and so is the distribution of the rainfall. However agriculture and the animal wealth are dependent on rains to large extent. Seasonal Rainfall data for the recent year (2011) is shown in **Table 3.2 & Figure 3.6** shows yearly variation (1997-2007) of rainfall at Barmer.

Table 3.2: Rainfall at Barmer in Recent Years (2011)

	Months	Rainfall (mm)
1	June	0
2	July	38
3	August	187
4	September	102
5	October	0
6	November	0
7	December	0
8	January	0
9	February	13
10	March	0
11	April	0
12	May	3
13	**Monsoon Rainfall**	**327**
14	**Non monsoon rainfall**	**16**
15	**Annual Rainfall**	**343**

(Source: Irrigation Department, Govt. of Rajasthan)

Figure 3.6: Rainfall at Barmer During 1997 to 2007.



Source: Deputy Director hydrology water resources ID and R, Jaipur

5. Air and Noise Quality

57. Ambient Air Quality Monitoring was done at four locations in Barmer town in May 2012 to establish the baseline conditions. The monitoring stations are within 0-2.5 km from the projects site. The results of monitoring are shown in **Table 3.3**. It may be observed from the table that Particulate Matter (**PM_{10}**) has been found higher than the permissible limit. Comparatively high level of **PM_{10}** is observed due to dry, arid climate and sand storm during the study period. Traffic is the only significant pollutant in Barmer, so levels of oxides of sulphur and nitrogen are well within the National Ambient Air Quality Standards (NAAQS). Similarly Noise Level Monitoring was done in the May 2012, as shown in **Table 3.4.**

Table 3.3: Ambient Air Quality at Barmer (Avg.:24 Hrs)

SN	Sampling Location	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO (mg/m^3)
A.	Near RTO Office, Barmer	189.9	17.4	5.7	8.4	< 1.15
B.	Near Bus Stand (RUIDP Office), Barmer	323.1	26.0	5.8	9.3	< 1.15
C.	Near Circuit House	197.2	21.7	5.5	8.9	< 1.15
D.	Jodhpur Road, Near Ashoka Hotel	256	17.4	4.6	6.7	< 1.15
Permissible limits as per CPCB Notification, New Delhi, 18th November, 2009 (24 Hours)		100	60	80	80	02*, 04#

NOTE: Sampling and Analysis done according to IS 5182(Pt- 2, 4, 5, 6, 10, 23)
Where: *= Maximum limits for 8 hourly monitoring, #= Maximum limits for 1 hourly monitoring

Table-3.4: The Result of Noise Monitoring

Location Name	Land Use	Noise Level Leq in dB(A)	
		Day	Night
Near RTO Office, Barmer	Commercial	54.1	50.6
Near Bus Stand (RUIDP Office), Barmer	Commercial	63.8	54.7
Near Circuit House	Residential	62.5	57.3
Jodhpur Road, Near Ashoka Hotel	Commercial	62.0	56.8
Standard Limits in dB(A) Leq, [THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000]	Commercial	65	55
	Residential	55	45

6. Surface Water

58. Water quality analysis was done in year 2010 for sample drawn from Jasder Nadi, located between Uttarlai and Barmer city. The results are as shown in **Table 3.5** below:-

Table-3.5: Water Quality Monitoring Report

SN	Water Quality Parameters	Jasder Nadi Near Uttarlai, Barmer
1.	Turbidity in (N.T.U)	3
2.	pH (at 28^0 C)	6.5
3.	Conductivity at 25^0C in ms/cm	5.3
4.	Total Suspended Solid (TSS) in mg/L	6
5.	Total Dissolved Solids in mg/L	3498
6.	Total Hardness (as $CaCO_3$) in mg/L	2706.8
7.	Sodium (as Na) in mg/L	391.25
8.	Potassium (as K) in mg/L	426.6
9.	Calcium (as Ca) in mg/L	900.24
10.	Magnesium (as Mg) in mg/L	109.28
11.	Dissolved Oxygen in mg/L	4.86
12.	Biochemical Oxygen Demand (for 3 days at 27^0 C) in mg/L	12.88
13.	Chemical Oxygen Demand in mg/L	51.52
14.	Chloride as Cl in mg/L	218.5
15.	Sulphate (as SO_4) in mg/L	90.6
16.	Nitrate (as NO_3) in mg/L	0.6
17.	Iron (as Fe) in mg/L	0.66
18.	Manganese (as Mn) in mg/L	<0.02
19.	Cadmium (as Cd) in mg/L	<0.002
20.	Arsenic (as As) in mg/L	<0.01
21.	Chromium (as Cr) in mg/L	<0.1

SN	Water Quality Parameters	Jasder Nadi Near Uttarlai, Barmer
22.	Copper (as Cu) in mg/L	<0.02
23.	Mercury (as Hg) in mg/L	<0.005
24	Lead (as Pb) in mg/L	0.028
25.	Selenium (as Se) in mg/L	<0.005
26.	Aluminium (as Al) in mg/L	<0.01
27.	Zinc (as Zn) in mg/L	<0.02
28.	Boron (as B) in mg/L	<0.5
29.	Fluoride (as F) in mg/L	0.12
30.	Chlorine in mg/L	NIL
31.	Phenolic Compounds (as C_6H_5OH) in mg/L	<0.001
32.	Cyanide (as CN) in mg/L	<0.01
33.	Phosaphate as PO_4 in mg/L	0.24
34.	Total Coliform Organism (MPN)/100 ml	1600
35.	Faecal Coliforms / 100 ml	PRESENT

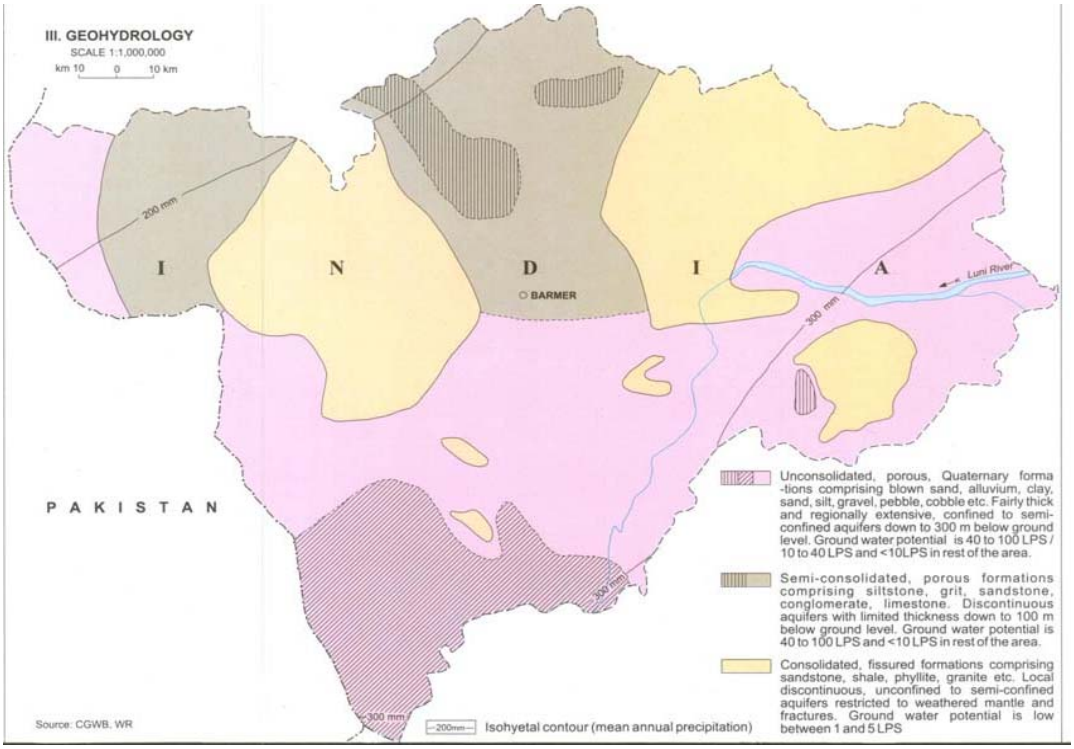
7. Geohydrology and Groundwater

59. Geohydrological map of the Barmer district is shown in **Figure 3 .7.** For broadly grouping geological formations from ground water occurrence and movement considerations, the various lithological units have been classified into three groups on the basis of their degree of consolidation and related parameters. These are,

- Unconsolidated porous, quaternary formation
- Semi consolidated porous formation
- Fissured formations – consolidated sedimentary rocks.

60. On an average 60-70 % of the district area (mostly south and eastern part of the district) covered with unconsolidated porous formations.

Figure 3.7: Geohydrological Map of Barmer



Source: GSI Resource Map

61. There are number of National Hydrographic monitoring stations of Central Ground Water Board in and around Barmer. Fluctuation of ground water level is shown in **Table 3.6.** In most of the cases ground water table ranged between 20-60 m bgl.

Table 3.6: Number and Percentage of National Hydograph Network Station (Barmer) With Water Fluctuation Range

Period	No of wells analyzed	Range		0-2 m		2-5 m		5-10m		10-20m		20-60m		>60 m	
		Min	Max	No	%	No	%	No	%	No	%	No	%	No	%
Jan-06	58	5.13	76.55	0	0	0	0	9	15.52	11	18.97	31	53.45	7	12.07
Nov-05	58	5.49	76.5	0	0	0	0	9	15.52	11	18.97	31	53.45	7	12.07
Aug-05	58	5.45	101.24	0	0	0	0	10	17.24	11	18.97	33	56.9	6	10.34
May-05	59	5.67	76.5	0	0	0	0	9	15.25	10	16.95	34	57.63	6	10.34

Source: Ground water year book 2005-06 Rajasthan, Central Ground Water Board, Jaipur (2007)

Table 3.7: Ground Water Quality In and Around Barmer

Parameters	Maximum Level	Minimum Level	Standard of Drinking water (IS: 10500: 1991)	
			Desirable limit (mg/l)	Maximum Permissible limit (mg/l)
pH	8.7	7.45		
EC (micro-mhos/cm at 25 °C)	17520	835		
Cl (mg/l)	8130	50	250	1000
SO_4(mg/l)	1825	20	200	400 (if Mg does not exceeds 30 ppm)

Parameters	Maximum Level	Minimum Level	Standard of Drinking water (IS: 10500: 1991)	
			Desirable limit (mg/l)	Maximum Permissible limit (mg/l)
NO_3(mg/l)	745	0	-	100
PO_4(mg/l)	0.44	0		
Total Hardness(mg/l)	3060	70	300	600
Ca(mg/l)	412	4	75	200
Mg(mg/l)	554	5	30	100
Na(mg/l)	4750	4	-	-
K(mg/l)	125	1	-	-
F(mg/l)	5.34	0.36	1.0	1.5
Fe(mg/l)	3.18	0	0.3	1.0
SiO_2(mg/l)	56	12		
TDS (mg/l)	11388	543	500	2000

Note: Total – 18 nos. samples0
Source: Ground water year book 2005-06 Rajasthan, Central Ground Water Board, Jaipur (2007)

62. As per PHED TDS level is more than 2020 mg/l and Fluoride between 1.4 to 1.7 mg/l. Groundwater quality of Barmer city is not in conformity with the set norms of Government of Rajasthan. Consumption of this high fluoride content has resulted in bone deformity and joint pains (as evident from Public perception).

Table 3.8: Present Supply Water Quality at Barmer

Total supply per day (lac liter)	Type of Sources Surface / Ground	Ground	Surface	No. of CWR	No. of SR	F- Min	F- Max	TDS Min	TDS Max	NO_3 Min	NO_3 Max
16	Ground	100	0	9	7	1.9	2.2	2020	2460	10	10

B. Ecological Resources

63. Barmer Town is, surrounded by a harsh desert environment of wind-blown sand and dunes. The municipal area includes large swathes of uninhabited rocky hills and sand dunes, with alluvial soil and sand in the intervening valleys, which are cultivated where there is enough rain. Natural vegetation is very limited, and consists of mainly sparse, scattered shrubs and grasses The fauna of the town comprises mainly domesticated animals (camels, cows, oats,pigs and chickens), plus other species able to live close to man (urban birds, rodents and some insects). In the desert away from the inhabited area there is a more natural fauna, which includes hyaenas (Hyaena hyaena), desert fox (Vulpes pusilla), jackal (Conis aures) and hinkara gazelle (Gazella gazella pallas).

64. There is no forest area nearby the city. Therefore no endangered floral and faunal species are expected.

C. Economic Development

65. Barmer being a desert district generally faces famines & drought. The bulk of population depends upon agriculture & animal husbandry. Being district headquarter, Barmer town is the main regional centre for the entire district and is working as service centre for

providing services like trade and commerce, transport, commercial and other higher level public facilities for the entire district.

66. The economic condition of people in Barmer is not satisfactory. As per information in 1998 about 28% population comprised of families below poverty line. These people are mostly labour class working in industries, shops, restaurant, construction, transport and certain other. This aspect has to be given due consideration while designing the housing projects.

67. Work force: In 1991 the total working force was 17,943, which was 26.15% of total population. In 2001 the total workers were 24,360, which was about 29.14% of total population. Out of the total workers 21,871 were main workers and 2560 marginal workers. The male workers participation rate was 48.41% while in the case of females 6.5% were workers.

68. The occupational structure as per 2001 census is assessed as follows:

Table 3.9: Distribution of Work Force 2001

Category		Numbers	% of Total
Main Workers	Male	20,419	93.67
	Female	1,381	6.33
	Total	**21,800**	**100.00**
Marginal Workers	Male	1452	56.72
	Female	1108	43.28
	Total	**2,560**	**100.00**
Total Workers	Male	21,871	89.78
	Female	2,489	10.22
	Total	**0**	**100.00**

69. The occupational structure data for 2001 census has not been given in category wise details. Therefore, 2001 occupational data are based on estimates of data for 1971 to 1991 census. The economic structure of the town is associated with the regional character. Being the seat of district administration, about 31% of the total workers are employed in other services category. Trade and commerce is the next important function where 28.5% workers are engaged. Barmer is also a centre of household and small industries like furniture making and dying and printing. About 21% workers are employed in various industrial units. It is also a transport terminus and 7.5% workers are engaged in this activity. The agriculture and allied activities also provide employment to about 4.5% workers. The following table and figure 3-5 shows the occupational structure of the total population in 1981 to 2001.

Table 3.10: Occupational Structure of Barmer Town

S. No.	Occupation	1981		1991		2001	
		Persons	% of Total Workers	Persons	% of Total Workers	Persons	% of Total Workers
1.	Agriculture and Allied activities	1238	7.85	981	5.47	609	2.50
2.	Industry	2998	19.02	3734	20.81	5480	22.50
3.	Trade and Commerce	3348	21.24	4909	27.36	6943	28.50
4.	Construction	726	4.61	1424	7.94	1949	8.00

S. No.	Occupation	1981		1991		2001	
		Persons	% of Total Workers	Persons	% of Total Workers	Persons	% of Total Workers
5.	Transport and Communication	1108	7.03	1276	7.11	1827	7.50
6.	Other service	6343	40.25	5619	31.32	7552	31.00
	Total	**15761**	**100.00**	**17943**	**100.00**	**24360**	**100.00**

Source: Census of India and estimates

70. **Power status of the area:** There is no power generation unit at Barmer. The consumption of electricity by different sectors is shown in Table below.

Table 3.11: Consumption of Electricity in Million KWH (2003-04)

District	Domestic	Non-Domestic (Commercial)	Industrial	Public Lighting	Public Water Works	District	Domestic
			Small	Medium	Large		
Barmer	39.833	15.172	8.41	22.326	3.20	1.566	44.137

(Source: District Statistics Book)

1 Land use

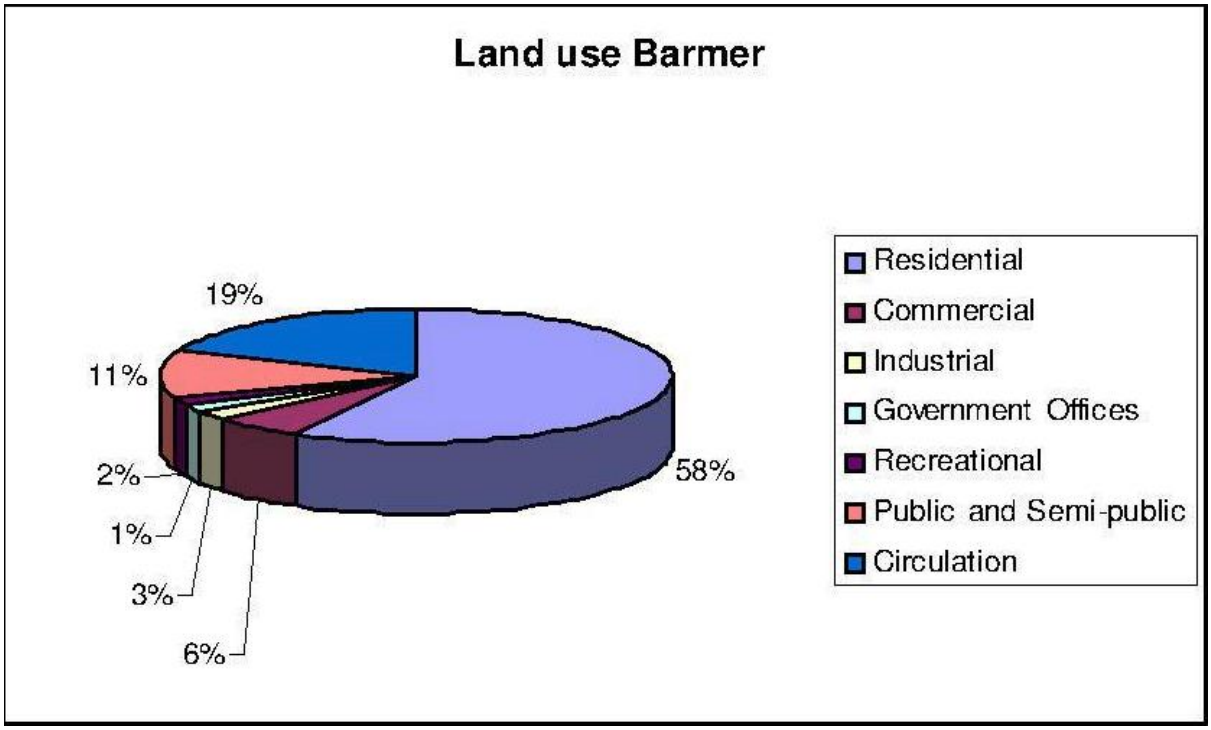
71. The municipal limits of Barmer encompass an area of about 3,290 acres, out of which about 2,100 acres can be called urban area. The remaining is undeveloped vacant land, forest and hilly. About 130 acres of land contiguous to the municipal limit in the east is also developed urban area. Thus total urban area of Barmer town is 2,230 acres. Out of the total urban area, about 1,540 acres is developed area, the remaining land is either government land, reserved or vacant land. Residential use is the most dominant urban component, which constitutes about 57.80% of the developed area, which is high in comparison to other towns. This is due to lack of industrial areas, parks and open spaces and other community facilities in the town. The area under public and semi public use comprising educational, medical facilities, public utilities etc. is about 11.36% of developed area. Circulation covers about 18.84% of the total developed area. Table shows the existing land use analysis of Barmer town based on survey conducted in 1985.

Table 3.12: Land Use of Barmer City

S.No.	Land use	Area in acres	%
1.	Residential	890	57.79
2.	Commercial	90	5.84
3.	Industrial	40	2.60
4.	Government Offices	20	1.30
5.	Recreational	35	2.27
6.	Public and Semi-public	175	11.36
7.	Circulation	290	18.83
	Total Developed Area	**1540**	**100.00**
8.	Government Reserved	370	
9.	Other vacant un-developed land	320	

Source: Town Planning Department

Figure 3.8: Land Use Proportion for Barmer Developed Area



72. It is noted that along the transmission areas the major land use is the commercial/ residential areas. There is no major impact anticipated on residential areas and religious places. Details are discussed in Social impact assessment report.

2 Commerce, Industry and Agriculture

73. Most of the business activities are carried out along roads namely station road, Chohtan road, Panghat road, Dhani Bazar, Laxmi Bazar, Sadar Bazar, Ratan Singh Bazar, Subhash Chowk, Gandhi Chowk, Hanumanji Ka Chowk and Pratapji Ki Pole. The business in cloth is generally carried out in Laxmi bazaar. Station road and Ahinsa Chowk constitute the main markets of the town where retail business in cloth, watches, books and stationary and general merchandise is carried out. A small shopping centre has been developed in Mahaveer Nagar residential scheme. Except this scheme new developments generally lack in organised shopping facilities. There is no shopping centre for the localities in the north. Due to this unauthorised construction of shops have taken place in scattered manner, mostly along main roads like NH-15, Defence road and Jodhpur road. A wholesale grain market Covering an area of 63 acres has been developed along Defence road. FCI godowns have been built along Jodhpur road. Some warehouses have also been constructed near industrial area

74. The desertic climatic conditions and lack of infrastructure such as water supply and electricity, industrial development in Barmer town is not very much. As per 1991 census, there were 3734 industrial workers which was about 21% of total workers. There has been increase in workers percentage from 16.7% in 1971 to about 22.5% by 2001. Household industries play a significant role in Barmer and out of the total industrial employments 50% are engaged in household industries. The household industries mostly consists of dying and printing of textile, shoe making, iron goods, black smithy, woollen carpet etc.

75. In RIICO industrial area out of 271 plots in 240 plots industrial units are functioning mostly dealing with guar gum, gypsum, bentonite powder, iron and steel utensils, dying and printing of cotton textile. The industrial prospects of the town are brighter in view of availability of water from IGNP and power supply from recent petroleum / gas investigations.

76. In and around the Barmer city area there are about 80% of lands used for agricultural purpose. Crop production statistics as depicted in **Table 3.13** indicates more crop production at Kharif season in compared to Rabi season.

Table 3.13: Crop Production In Around Barmer (Prod in Tonnes)

Type of Crops	Under Rabi Crops	Under Kharif Crops
Cereals	10157	130300
Pulses	18	27476
Food Grains	**10175**	**157776**
Oilseeds	10801	18585
Others	17073	24712
Total	**38049**	**201073**

(Source: Rajasthan Agricultural Statistics at a Glance 2009-10)

3 Infrastructure

77. Water supply: In Barmer town water is available from underground source. The water is drawn from 28 tube wells near NH-15 at Bhadka situated 38 Km. from Barmer city and is boosted through 300 mm AC / 200 mm CI conveyance mains to Barmer city with intermediate boosting at Harsani Phanta and Jalipa Head Works. The total production is 9 MLD and per capita supply is about 100 liters. Out of the 9 MLD available from current sources, PHED supplies around 0.22 MLD to Commercial Consumers, 0.88 MLD to Industrial consumers and 7.90 MLD to Domestic consumers. The city is divided into 11 water supply zones covering 35 municipal wards. The approximate total length of the existing water supply distribution network is 144 km and includes all localized distribution networks.

78. **Sewerage System:** As is the case with all medium towns in Rajasthan, Barmer too does not have any sewerage system. Water Closets (WC) are connected to septic tanks in most of the houses, while some houses, due to lack of space, discharge WC effluent directly in to open drains. In some households, especially in slum areas, open defecation is still a common practice. Sullage generated from houses is directly discharged in to open drains, forming pools. The open drains carrying wastewater and the resultant pools are causing unsanitary conditions, which are threat to public health.

79. Scarcity of water, undulated topography and above all the lack of financial resources restrained planning of underground sewerage system. At present there is no plan for a sewerage system. It is necessary that feasibility and detailed project reports be prepared by experienced consulting agencies for the comprehensive scheme covering topographic survey, designing of conveyance system, treatment and disposal of treated effluent and its reuse. The city lies on both sides of railway track. The natural slope is from west to east. According to natural slope at present the sewerage of Northern Zone is flowing near Jodhpur road causing nuisance and ugly appearance. For southern zone outfall of sewer is likely to be behind Saint Paul's school at Shivkar road.

80. **Sanitation:** Only 50-60 % of the households reportedly has septic tanks and soaks well as the system of sewerage disposal. The remaining accounted for cases of open defecation which is an unacceptable and unhygienic practice. The raw settled sewage from

septic tank is periodically flushed out by sanitary workers of the Municipal Board and discharge to open spaces, agricultural lands in an indiscriminate manner. Slum areas were also not equipped with requisite sanitation (LCS etc.) resulting in open defecation.

81. **Drainage:** The topography of Barmer city is cup shaped, the town being surrounded by sand dunes. Due to scanty rains in the region, natural drainage system has not been so far evolved. In fact there is no river/rivulet in the entire Barmer district. In Barmer town itself no natural drainage system exists to drain away the rainwater or wastewater from the town. Presently there exists a minimal network of storm water drains in the city. The existing network of (roadside) storm water drains in Barmer has been identified under three broad categories as follows: (i) open pucca (ii) closed pucca and, (iii) Kutchha

82. **Industrial Effluents.** Small industries exists in under RIICO, which is out side the city area and small amount of effluent disposed scattered in local nallahs. As reported by the local MC, the responsibility of effluent disposal is under RIICO's own and could not be connected to the proposed sewer network. The individual industry should treat their effluent to bring it to the required standard before final disposal.

83. **Solid Waste:** MBB's jurisdiction is spread over an area of 10.29 sq.km, which includes core old city area and some rural parts at the fringes. 30 tons of solid waste is collected daily. In addition to household (domestic) solid waste, the main waste generation sources in the town are vegetable and fruit markets, commercial and institutional establishments including hotels and eateries, construction activities, and other tourism related activities. MBB jurisdiction includes core old city area and slum area at fringes. The entire area is divided in to 35 wards.

84. **Waste Collection -** The MSW generated in the Barmer city (including slum area) mainly consist of domestic refuses, waste from Commercial Area, Vegetable-Fruit market, bio-medical waste, waste from Hotels and Restaurants, Industries etc. The waste collection system being followed is quite primitive, individual households/units throw the garbage on road side/open drains close to their houses and the sweepers collect the garbage in the form of small heaps on road sides. Similarly the open drains are also cleaned periodically and the sludge is heaped adjacent to the drain where it is left for 2-3 days to get dried and lifted. Tractor trolleys then lift these dumps the heaped garbage once or twice a day. In the process, part of the garbage gets dispersed on the road or finds it way into to the open drains or open low lying pits (Ginanis)

85. The Municipality owns five tractors, 3 taxis for door to door collection of solid waste.Capacity of five tractors is approximately 7 cum. The waste material is lifted by a loader and placed on trolleys for transportation to disposal site. Details of quantity of garbage collected and disposed off are not available. However based on the information gathered from the concerned engineer, an approximate quantity of MSW generated has been assessed as 25 tonnes / day. An estimated quantity of MSW generated from different sections of the town is given in the following table:

Table 3.14: Waste Generation In 2006

Type of waste generation	Quantity of waste in TPD
Residential Area (Domestic)	17
Commercial Area	4
Industrial	2
Bio-medical and Hospital	2
Total	**25**

86. This gives per capita generation of MSW as 300 gms/day, which is in line with garbage generated in similar towns, e.g. Pushkar, in Rajasthan.

87. As regards quality of MSW, there is no data available. Physical inspection carried out during the visits indicates very little presence of organic matter. Presence of plastic bags and wrappers of pan masala / tobacco pouches are source of nuisance around the points of garbage collection and along the roads and disposal sites. The garbage as such cannot be used for composting and is primarily being disposed off as landfill at a site near Somaaniyon Ki Dhani.

4 Transportation

88. Road Transport: The district is linked by road with Jaisalmer, Jodhpur, Pali, Jalore, Jaipur, Ajmer and Ahmedabad. The total length of roads in the district was 5,109 kms as on 31 March 2000.

89. Rail Transport: The district is linked with neighbouring districts of Jodhpur, Jalore and Jaipur in the State and with Agra in UP and Munawa in Pakistan, by railway line. The total length of rail line in the district is 254 kms with 30 railway stations.

90. Important roads of the town are NH-15, State Highway No.-16 (Jodhpur road). The NH-15 runs in north-south direction making the eastern boundary of the town and is known as defence road. A number of developments have taken place on other side of the road such as RIICO area, dairy as well as katchi basties. These are creating problems on free movement of traffic on this important road. The station road, which is an important road connecting old town with railway station, is narrow on both sides and is subject to mixed traffic. All streets of old town are narrow ranging from 5' to 30'. The town does not have organised bus stand or truck stand. The bus stand is located near railway crossing, but it does not have adequate land for proper functioning. Trucks are parked by the side of the road on carriage way creating traffic congestion.

91. The **Table 3.15** provides a breakdown of road surface composition in physical growth of the city has resulted in a corresponding increase in vehicular traffic greater than that of the city's population growth due to improving economic status of the city

Table 3.15: Jurisdiction of Authorities Responsible For the Road of the City

Type	Maintaining Authority	Length in km	%
Bitumen road	MBB	170	70.10
Cement-concrete road	MBB	12.5	5.15
WBM (Metalled)	MBB	10	4.13
NH & State Highway	PWD	50	20.62
Total		**242.50**	

Source: PWD Barmer

D. Social and Cultural Resources

1 Demography

92. Barmer city has nearly 58% of total urban population of the district. In 2001 its population was 83591 persons. Growth rate has not been significant during last two decades because of lack of economic factor. During last decade (1991-2001) the growth rate was 21.8% only which was even less then the national population growth rate. Thus migration is negligible. Scheduled caste and Scheduled Tribe population is 10.10% and 0.5% respectively. **Table 3.16** gives the features of the city. Projected population growth of the city is shown in **Table 3.17.**

Table 3.16: Demographic Features of Barmer

Details	Barmer City	District
Total Population	83,5	1,964,835
Urban Population	83,5	1,45,404
Urban Area (sq.km.)	10.	59.29
Population Density (persons / sq. km.)	81	2107
SC	12,009 (10.10%)	3,08,996 (15.70%)
ST	1,298 (0.50%)	1,18,688 (6.00%)
Sex Ratio (Females per 1000 Males)	8	892
Literacy Rate (%)	76.	59.00
Female Literacy Rate (%)	61.	43.40

Source: Compiled from Primary Census Abstract Data 2001

Table 3.17: Population and Growth Rate

Year	Population
1901	6064
1911	6380
1921	7184
1931	9240
1941	12051
1951	20812
1961	27600
1971	38630
1981	55554
1991	68625
2001	83591
2011	104,113
2021	129,253
2031	160,230
2041	198,640

Source: District Census Handbook Data 2001

2 Health and educational facilities

93. There are good educational facilities in Barmer district, which serve both townspeople and inhabitants of surrounding villages and towns in the hinterland. There are 2714 primary schools, 130 secondary and higher secondary schools, plus 2 general degree colleges and 2 industrial training institutes (ITI).

Table 3.18: Educational Facility of Barmer District

Facility	No.
Primary Schools	2,714
Middle Schools	451
Higher Secondary and Secondary Schools	130
Colleges	2
Polytechnics	1
ITI	2

Facility	No.
STC	1

(Source: Official website of District)

94. In Barmer district, numbers of private and government hospital and health centers are recorded.

3 History, culture and tourism

95. Barmer has moderate tourist inflows with main attractions being Juna Barmer is important from heritage point of view. There are number of festivals held in Barmer, the most famous of which is cattle fair held every year at Talwara village situated on the banks of the Luni river. The fair goes on for a fortnight in the months of March- April. The other predominant festival is the Barmer Thar Festival, started as a practice to enhance the tourism potential of the town. During the annual Barmer Festival in March, the town is at its colourful best and that is the best time to visit Barmer. 'Safed Akra Mahadev Mela' is celebrated on Mahashivratri.

96. Projects in Line for development of tourism in Barmer: Municipal Board Barmer have framed following schemes to promote tourism.

- **Development of Son Nadi:** Development of Son Nadi is proposed to promote tourism. This will include construction of CC road near protection wall, development of park, providing and furnishing play ground equipments, installation of fountains and development of Ghats.
- **Development of Veensar Nadi:** The area of Veensar Nadi has also been included in Tourist Development Plan. This includes development of park, providing and furnishing play ground equipment
- **Construction of Cement Concrete road** from Peepla Devi Temple to Tourist Point: A cement concrete road is proposed from Peepla Devi Temple to Venasar and tourist point. This will facilitate easy transportation of tourist.
- **Development of Karali Nadi;** Karali Nadi area is proposed to be developed for tourists.

4 Traffic Management

97. The road network capacity has not expanded commensurate with increased traffic demand, resulting in frequent traffic congestion. The congestion is worsened due to poor road conditions coupled with the absence of effective traffic management and enforcement measures. Certain busy intersections are managed by traffic rotaries / roundabouts, which are often controlled by traffic police. Most junctions lack adequate free left turn facilities due to improper closure of drainage system. Additionally, most intersections are occupied by cycle-rickshaws and auto-rickshaws in a disorganized fashion due to inadequate parking and stopping facilities.

98. Parking:- Significant on-street parking is also observed on narrow streets in the city. Traffic carrying capacity of the streets has reduced due to on-street parking at shops and other commercial areas. There is a need to provide adequate off-street parking facilities to restore capacity of streets in old city area. Bus and Railway terminals are provided with adequate parking facilities. Railway station area has auto rickshaw and cycle rickshaw parking facilities. Additionally, two-wheeler and cycle parking lots are available in the railway station area.

IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES

99. ADB Environmental Assessment Guidelines require that an IEE should evaluate impacts due to the location, design, construction and operation of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes therefore, all potential impacts of the project are identified, and mitigation is devised for any negative impacts. This has been done in Sections V and VI later on and no other impacts are expected.

100. In many environmental assessments there are certain effects that, although they will occur during either the construction or operation stage, should be considered as impacts primarily of the location or design of the project, as they would not occur if an alternative location or design was chosen.

101. However in the case of this subproject it is not considered that there are any impacts that can clearly be said to result from either the design or location. This is because:

- Most of the individual elements of the subproject are relatively small and involve straightforward construction and operation, so impacts will be mainly localised and not greatly significant;
- Most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other excavation. However, the routine nature of the impacts means that most can be easily mitigated;
- In one of the major fields in which there could be significant impacts (archaeological), those impacts are clearly a result of the construction process rather than the project design or location, as they would not occur if this did not involve trenching or other ground disturbance.

A. Pre Construction Phase-Screening out areas of no significant impact

102. From the descriptions given in Section II, it is clear that implementation of the subproject should not have major negative impacts because it will affect only one site, at which all construction will be conducted within a relatively small area.

103. Because of this there are several aspects of the environment that are not expected to be affected by the construction process and these can be screened out of the assessment at this stage as required by ADB procedure. These are shown in **Table 4.1**, with an explanation of the reasoning in each case

Table 4.1: Fields in which construction is not expected to have significant impacts

Field	Rationale
Climate	Short-term production of dust is the only effect on atmosphere
Geology and seismology	Excavation will not be large enough to affect these features
Fisheries & aquatic biology	No rivers or lakes will be affected by the construction work
Wildlife and rare or endangered species	No wildlife and endangered species nearby
Coastal resources	Barmer is not located in a coastal area
Development of agriculture, minerals and tourism	There are none of these developments near the site

Field	Rationale
Population and communities	Construction will not affect population numbers, location or composition If there any impact that will be deal in social impact assessment report

104. These environmental factors have thus been screened out presently but will be assessed again before implementation.

105. Rapid Environmental Impact Assessment checklist along with mitigation measures is given in **Annexure- II.**

B. Road Construction

1. Construction method

106. Road construction is generally started with Clearing and Grubbing of the area of construction. Thereafter Survey work will be carried out including fixing of TBM. After survey earthwork will be done including items like excavation, cutting, loosening & re-compacting, filling vide embankment /sub grade. Then Sub base will be prepared i.e. Granular sub base / Drainage layer. Thereafter Base course will be prepared i.e. Wet Mix Macadam /Water Bound Macadam. Dense Bituminous Macadam and finally wearing course will be laid. Then finally road marking, road signage, road furniture is fixed.

107. The operation will be conducted by a team of around one hundred men, roughly 50% unskilled labour and 50% with various skills including truck drivers, vehicle and machine operatives, surveyors, foremen and supervisors, etc. The operation should be completed in around 18 months.

2. Physical Resources

108. Although all work will be conducted at a single, relatively small site, construction will involve a great deal of excavation and earth moving over a period of approximately six months, so physical impacts could be quite considerable.

109. During construction time great deal of material, which could cause significant changes in topography, drainage, air quality (dust), soil quality and other features at the extraction site if it were sourced from adjacent land. However these impacts can be avoided relatively easily by utilizing readily available source of waste sand and stone, which is:

- Material excavated to create the sub base of the road

110. Using these sources would have the additional benefit of providing a beneficial use for what would otherwise be large quantities of waste material, so it will be very important to coordinate these activities to enable this to be done.

111. Moving such a large quantity of material could cause further physical impacts, including the creation of dust during dry weather and silt-laden runoff during rainfall, both of which would affect people who live and work near the site and reduce the quality of adjacent land. The Contractor will almost certainly plan the work to ensure that all earthworks are conducted during the dry season to avoid the difficult working conditions that prevail during the monsoon, so this will avoid any problems from runoff. It will however be necessary to prevent dust, so the Contractor should be required to:

- Excavate the earth through cutting and filling up for embankment should be done at the same time for using the earth materials, avoiding the need to stockpile on site;

- Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather;

- Use tarpaulins to cover sand and other loose material when transported by truck.

112. Conducting the work in the dry season should avoid any drainage problems from rainfall during excavation, and although groundwater often collects in deeper voids, this should also not be a problem at this site because of the very low water table in Barmer.

3. Ecological Resources

113. There are no protected areas or locations of any ecological interest at or near any of the sites affected by these works, so it is unlikely that the construction process will have any ecological impacts. The only concern would be if trees were removed unnecessarily. To avoid this, the Contractor should be required to plant and maintain three new trees for every one that is removed.

4. Economic Development

114. Although there is no land acquisition proposed for the sub-project and work will be conducted within the ROW of the existing roads, but in some un-avoidable circumstances if there is a need to acquire some land at the periphery of the site and for the construction of temporary access roads, it will be obtained through the relevant line agency involved in the project. As such RUIDP is not directly acquiring land in any of the sub projects. However, after acquiring land (if required), the line agency would hand over the unencumbered land to RUIDP for its implementation works. ADB policy on Involuntary Resettlement requires that no-one should be worse-off as a result of the project, so a Resettlement Plan and Resettlement Framework have been prepared to examine these issues. If any business premises have to be removed, the owners or tenants should be provided with:

- Compensation equivalent to the amount of business income lost;

- Compensation at replacement cost for any income-generating assets (eg. shop premises) that have to be removed.

115. Certain roadside shops that are not purchased may still lose income because the presence of the construction site will deter customers, and access will be impeded by road closures, the presence of heavy vehicles and machinery, etc. These issues are also dealt with by the Resettlement Plan and Framework, which indicate that these impacts will be mitigated by:

- Keeping road closures to the minimum in terms of frequency, duration and extent;

- Maintaining vehicle and pedestrian access to roadside businesses wherever possible;

- Providing owners and tenants with financial compensation equivalent to the amount of business income lost.

116. Transportation is the other principal economic activity that will be impeded by this work, as the existing road will be removed at the location of the access ramps and gradually replaced by the new embankments. These impacts will need to be mitigated by careful

planning of the construction program, in conjunction with the road, and municipal authorities and the police, in order to:

- Maintain safe passage for vehicles and pedestrians throughout the construction period;
- Provide effective, well signposted diversions and alternative routes when required;
- Conduct work that requires the closure of roads at times of low traffic volume;
- Schedule truck deliveries of soil to the site for periods of low traffic volume.

117. Excavation could also damage existing infrastructure (such as water distribution pipes, electricity pylons, etc) located alongside the roads. It will be particularly important to avoid damaging existing water pipes as these are mainly manufactured from Asbestos Cement (AC), which can be carcinogenic if inhaled, so there are serious health risks for both workers and citizens (see below). It will be important therefore to avoid these impacts by:

- Obtaining details from the Municipal Council of the nature and location of all existing infrastructure, and planning excavation carefully to avoid any such sites if possible;
- Integrating construction of the various infrastructure subprojects conducted in Barmer (transport, water supply, sewerage) so that:
  - Different infrastructure is located on opposite sides of the road where feasible;
  - Roads and inhabitants are not subject to repeated disturbance by construction in the same area at different times for different purposes.

5. Social and Cultural Resources

118. Rajasthan is an area with a rich and varied cultural heritage that includes many forts and palaces from the Rajput and Mughal periods, and large numbers of temples and other religious sites, so there is a risk that any work involving ground disturbance could uncover and damage archaeological and historical remains. In this case the excavation will occur in and around an existing roadway, so it could be that there is a low risk of such impacts. Nevertheless this should be ascertained by consulting the appropriate authorities and steps should be taken according to the nature of the risk. This should involve:

- Consulting historical and archaeological authorities at both national and state level to obtain an expert assessment of the archaeological potential of the site;
- Considering an alternative transportation sub-project if the site is found to be of medium or high risk;
- Including state and local archaeological, cultural and historical authorities and interest groups in consultation forums as project stakeholders so that their expertise can be made available to the project;
- Developing a protocol for use by the Contractor in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. This should involve:
  - Having excavation observed by a person with archaeological field training;

- Stopping work immediately to allow further investigation if any finds are suspected;
- Calling in the state archaeological authority if a find is suspected, and taking any action they require ensuring its removal or protection in situ.

119. There are no modern-day social and cultural resources (such as schools and hospitals) near the site, and no areas that are used for religious or other purposes, so there is no risk of other impacts on such community assets.

120. Although this is not a major residential area, there are some living quarters in the vicinity of the site, so action should be taken to minimise disturbance as far as possible. This will require:

- o Consultation with the local community to inform them of the nature, duration and likely effects of the construction work, and to identify any local concerns so that these can be addressed;
- o Involving the community in planning the work programme so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times;
- o Avoiding conducting noise-generating activities at night;
- o Implementing the measures described in Section V.B.2 above to reduce dust;
- o Utilising modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensuring that these are maintained to manufacturers' specifications at all times.

121. There is invariably a safety risk when any construction is conducted in an urban area, and precautions will thus be needed to ensure the safety of both workers and citizens. The Contractor will be required to produce and implement a site Health and Safety Plan, and this should include such measures as:

- o Excluding the public from the site;
- o Ensuring that all workers are provided with and use appropriate Personal Protective Equipment;
- o Health and Safety Training for all site personnel;
- o Documented procedures to be followed for all site activities;
- o Accident reports and records; etc.

122. During construction of roads green house gas (GHG) emission may result from burning of fuel in hot/spot mix plant. Proper safety arrangement, measurement of GHG emitted and moreover plantation in and around the road site is necessary for protection of environment and control of global warming.

123. An additional, particularly acute health risk derives from the fact that, as mentioned above, the existing water supply system comprises mainly AC pipes, so there is a risk of contact with carcinogenic material if these pipes are uncovered in the course of the work. Precautions have already been introduced into the design of the project to avoid this, of which the most important is that:

- The locations of all new infrastructures will be planned to avoid locations of existing AC pipes so AC pipes should not be discovered accidentally.

124. Given the dangerous nature of this material for both workers and the public, additional precautions should be taken to protect the health of all parties in the event (however unlikely) that AC pipes are encountered. The design consultant should therefore develop a protocol to be applied in any instance that AC pipes are found, to ensure that appropriate action is taken. This should be based on the approach recommended by the United States Environmental Protection Agency (USEPA)[2], and amongst other things, should involve:

- Training of all personnel (including manual labourers) to enable them to understand the dangers of AC pipes and to be able to recognise them in situ;
- Reporting procedures to inform management immediately if AC pipes are encountered;
- Development and application of a detailed H&S procedure to protect both workers and citizens. This should comply with national and international standards for dealing with asbestos, and should include:
    - Removal of all persons to a safe distance;
    - Usage of appropriate breathing apparatus and protective equipment by persons delegated to deal with the AC material;
    - Procedures for the safe removal and long-term disposal of all asbestos-containing material encountered.

125. Finally, there could be some short-term socio-economic benefits from the construction work if local people are able to gain employment in the construction workforce. To direct these benefits to the communities directly affected by the work, the Contractor should be required to employ at least 50% of his labour force from communities in the vicinity of the site. This will have the added benefit of avoiding social problems that sometimes occur when workers are imported into host communities, and avoiding environmental and social problems from workers housed in poorly serviced camp accommodation.

C. Operation and maintenance of new widened road

126. During the design life of the widened road it should require no major repair or refurbishment, beyond routine maintenance, which will include:

- Small scale *ad hoc* repairs of surface damage caused by traffic use or accidents;
- Repairs and replacement of damaged safety barriers and signs;
- Regular unblocking of drains to prevent damage from flooding in the monsoon.

[2] In the USA, standards and approaches for handling asbestos are prescribed by the Occupational Health and Safety Administration (OHSA) and the Environmental Protection Agency (EPA) and can be found at http://www.osha.gov/SLTC/asbestos

127. These operations will be the responsibility of the municipal highway department, who will be given training by this programme and provided with an operating budget for these purposes.

D. Environmental impacts and benefits of the operating road

1. Physical Resources

128. Once the new road (after widening to 3 to 4-6 lane) is completed and operating it will improve the physical environment by removing the severe traffic congestion that is such a feature of this location at present, with the resulting concentration of vehicle noise and pollution.

129. This would be necessary of planting large-growing native trees at the road periphery which would also provide a natural barrier to noise, dust and exhaust gases so the planting of trees should be incorporated into the scheme.

130. When routine repairs are conducted to the road and ancillary facilities (signage, etc), the work will be very small in scale, and conducted manually by small teams of men with simple equipment (shovels, wheelbarrows, tarmac blender, etc). Even if larger vehicles are used to refurbish larger portions of the road, the work will be very short in duration and will not cause significant physical impacts.

131. Although the road is located in an area of seismic risk, it will be designed according to standard Indian Engineering Design Codes, which include measures to allow the structure to withstand tremors of the expected magnitude and above. There should therefore be little risk of the structure failing, even if the area is subject to seismic events of greater magnitude than those that have occurred over recent years.

2. Ecological Resources

132. As there are no significant ecological resources in or around the town, the operation of the road and the routine maintenance and repair of the road and surroundings will have no ecological impacts. In fact by planting trees near the road, there would be some small ecological gain from the planting of trees to improve aesthetic environment.

3. Economic Development

133. The sub project will improve the infrastructure of the town by providing a more efficient and effective transportation route, and this should have positive impacts on the overall economy by reducing time spent idle in stationary traffic by delivery vehicles, employees and customers. It may also make further positive contributions to the development of particular sectors, for example by making the area more attractive to tourists and allowing the more efficient transportation of agricultural produce and other goods to and from the town.

134. Traffic may be interrupted temporarily if the road is repaired and maintained, but this work will be very small in scale, infrequent, and short in duration, so there should be no economic or other implications. To maintain the safety of workers and road-users, such work should be coordinated with the local police department so that adequate warning signs and traffic diversions can be set up when necessary.

4. Social and Cultural Resources

135. Effects of the operating road on social and cultural resources in the town will be relatively small in scale and intangible in nature, and are thus difficult to assess and quantify.

136. The citizens of the town will benefit from a more effective transportation route as they will spend less time in stationary traffic exposed to noise, pollution and the associated physical and psychological stresses. Since people commuting on this road will save time, they will socially much better off than before. People may also benefit from an improvement in the economy of the town, although it would require much larger improvements in transportation and other infrastructure for this to be recordable.

137. Repairs to the road will not be physically invasive so there will be no risk to historical remains, and as there are no areas or resources of social or cultural importance in the vicinity there will be no risk to such features

V. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project stakeholders

138. Most of the main stakeholders have already been identified preliminary. If any other stakeholders that are identified during project implementation will be brought into the process in the future. Primary stakeholders are:

- Residents, shopkeepers and businesspeople who live and work alongside the roads in which improvements will be provided and near sites where facilities will be built
- Custodians and users of socially and culturally important buildings in affected areas;
- State and local authorities responsible for the protection and conservation of archaeological relics, historical sites and artefacts;
- State and local tourism authorities.

139. Secondary stakeholders are:

- LSGD as the Executing Agency;
- Other government institutions which handle areas or issues affected by the project (state and local planning authorities, Department of Public Health Engineering, Local Government Dept, Ministry of Environment and Forests, Roads and Highways Division, etc);
- NGOs and CBOs working in the affected communities;
- Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- The beneficiary community in general; and
- The ADB and the Government of India, Ministry of Finance.

B. Consultation and disclosure to date

140. Some informal discussion was held with the local people during site visit. Issues discussed are

- o Awareness and extent of the project and development components
- o Benefits of Project for the economic and social Upliftment of Community
- o Labour availability in the Project area or requirement of outside labour involvement
- o Local disturbances due to Project Construction Work
- o Necessity of tree felling etc. at project sites
- o Water logging and drainage problem if any
- o Drinking water problem

- Forest and sensitive area nearby the project site
- Movement of wild animal etc.

141. Local populations are very much interested on the project and they will help project authorities in all aspects. Issue discussed and feedback received along with details of date, time, location and list of participant of the Public consultation held on 04 March 2012 for the proposed sub-project, specifically on environmental issues are given in **Annexure-III.**

142. The major outcomes from the public consultation were related to traffic interference during construction and the possible dust and noise problems during constructional phase. Some comments made on the construction vehicles which may create some disturbances to their day to day activities. Also some concerns made on the necessity of proper safety arrangements at constructional site and widening of road before starting constriction.

143. Hence necessary provisions shall be provided to avoid the traffic snarl during the construction. Sprinkling of water at frequent intervals will avoid and curtail the dust emission. Good constructional practices and proper work timings shall avoid noise disturbances to the neighborhood.

144. The public Consultation and group discussion meeting were conduct by RUIDP on 07 June 2008 in Barmer town. The objective of the meeting was to appraise the stakeholders about the environmental and social impacts of the proposed program and the safeguards provided in the program to mitigate the same. In the specific context of Barmer, the environmental and social impacts of the proposed subprojects were discussed.

145. Meetings and individual interviews were held at potentially temporarily affected areas; and local informal interviews were conducted to determine the potential impacts of sub-project construction to prepare the sample Environmental Framework. A town-wise stakeholder consultation workshop was conducted which provided an overview of the Program and sub-projects to be undertaken in Barmer; and discussed the Government and ADB's Environment policies acts and potential environment impacts of the sub-projects in Barmer. During the workshop, Hindi versions of the Environmental Framework were provided to ensure participants understood the objectives, policy principles and procedures related to Environment, English and Hindi versions of the Environmental Framework have been placed in the Urban Local Body (ULB) office and Environmental Framework will be provided later on. The NGO to be engaged to implement the Mitigation Measures will continue consultations, information dissemination, and disclosure. The Environmental Framework will be made available in the ULB office, Investment Program Project Management Unit and Implementation Unit (IPMU and IPIU) offices, and the town library. The finalized IEE containing Mitigation Measures will also be disclosed in ADB's website, the State Government website, the local government website, and the IPMU and IPIU websites. ADB review and approval of the RP is required prior to award of civil works contracts.

C. Major Issues discussed during Public consultation are

- Proposed road sub project is to ensure proper movement of city traffic round the clock
- Executive agency should give preference to engage internationally reputed contractor like Gammon, HCC, etc as people do not faith about the local contractors in respect of quality of works as well as timely completion of work;
- Livelihood affected households should be given assistance in the mode of cash compensation;

- Local people should be employed by the contractor during construction work;
- Adequate safety measures should be taken during construction work;
- Mobile kiosks/vendors/hawkers have shown willingness to shift in nearby places without taking any compensation and assistance from the Executing Agency;
- Local people have appreciated the road widening proposal of the government and they have ensured that they will cooperate with the Executing Agency during project implementation.

D. Future consultation and disclosure

146. LSGD will extend and expand the consultation and disclosure process significantly during implementation of RUSDIP. They will appoint an experienced NGO to handle this key aspect of the programme, who will conduct a wide range of activities in relation to all subprojects in each town, to ensure that the needs and concerns of stakeholders are registered, and are addressed in project design, construction or operation where appropriate. The programme of activities will be developed during the detailed design stage, and is likely to include the following:

147. Consultation during detailed design:

- Focus-group discussions with affected persons and other stakeholders (including women's groups, NGOs and CBOs) to hear their views and concerns, so that these can be addressed in subproject design where necessary;
- Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project.

148. Consultation during construction:

- Public meetings with affected communities to discuss and plan work programmes and allow issues to be raised and addressed once construction has started;
- Smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation;

149. Project disclosure:

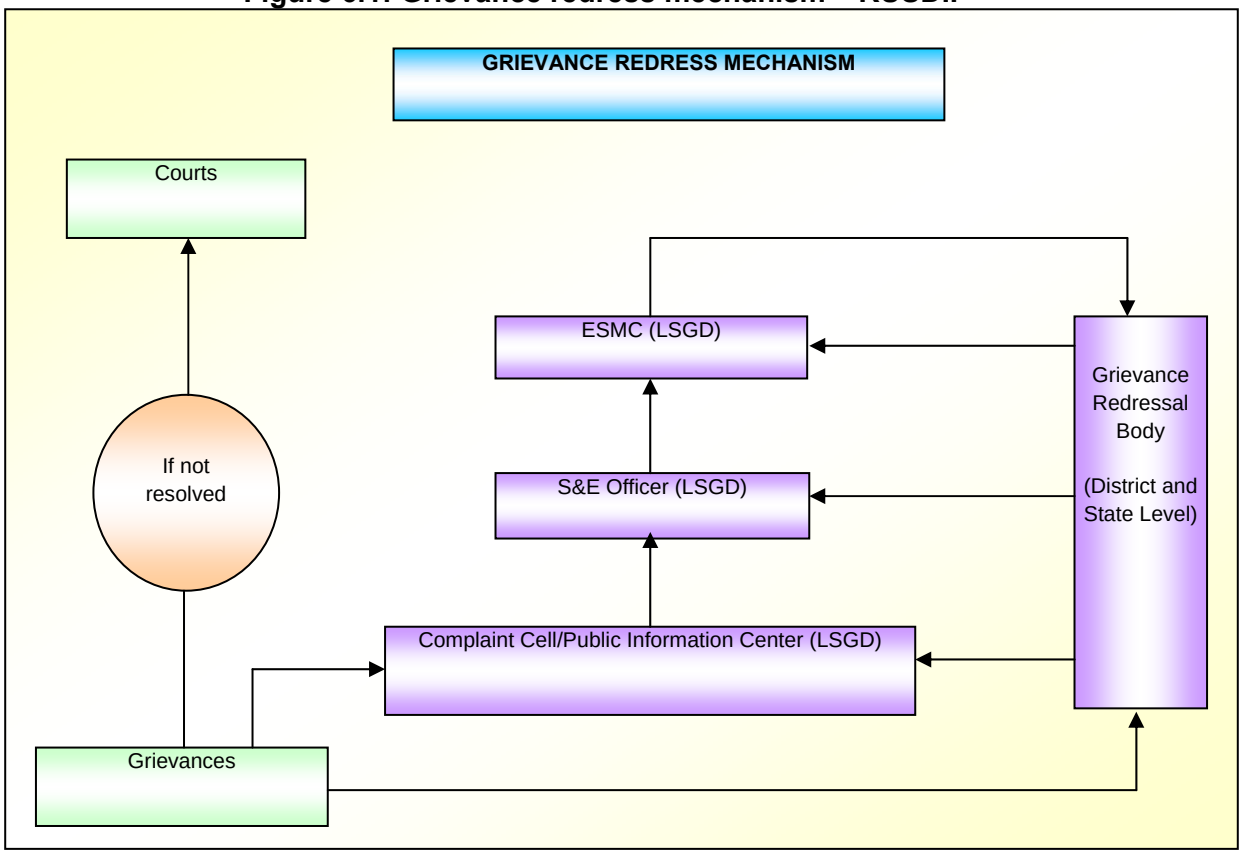
- Public information campaigns (via newspaper, TV and radio) to explain the project to the wider city population and prepare them for disruption they may experience once the construction programme is underway;
- Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in Hindi;
- Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and providing a mechanism through which comments can be made

VI. GRIEVANCE REDRESS MECHANISM

150. The project authority will establish a mechanism to receive and facilitate resolution of affected persons' concerns, complaints and grievances about the project's environmental performance. The grievances mechanism should be scaled to the risks and adverse impacts of the project. It will be addressed affected peoples' concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all the affected people at no cost and without retribution. The affected people will be informed by appropriate mechanism. The figure given below indicates the grievance redress mechanism for this purpose.

151. During implementation process performance monitoring fact sheet will be prepared against each possible environmental impacts.

Figure 6.1: Grievance redress mechanism – RUSDIP



Environment and Social Management Committee (ESMC)

VII. ENVIRONMENTAL MONITORING PLAN

A. Institutional arrangements for project implementation

152. The main agencies involved in managing and implementing the subproject are,

- LSGD is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan.

- The Implementing Agency (IA) is the Project Management Unit of the ongoing RUIDP, which will be expanded to include a broader range of skills and representation from the Urban Local Bodies (ULB, the local government in each town). Assigned as the RUSDIP Investment Program Management Unit (IPMU), this body will coordinate construction of subprojects across all towns, and ensure consistency of approach and performance.

- The IPMU will be assisted by Investment Program Management Consultants (IPMC) who will manage the program and assure technical quality of design and construction; and Design and Supervision Consultants (DSC), who will design the infrastructure, manage tendering of Contractors and supervise the construction process.

- Investment Program Implementation Units (IPIU) will be established in seven zones across the State to manage implementation of subprojects in their area. IPIUs will be staffed by professionals seconded from government departments (PHED, PWD), ULBs, and other agencies, and will be assisted by consultants from the IPMC and DSC as necessary.

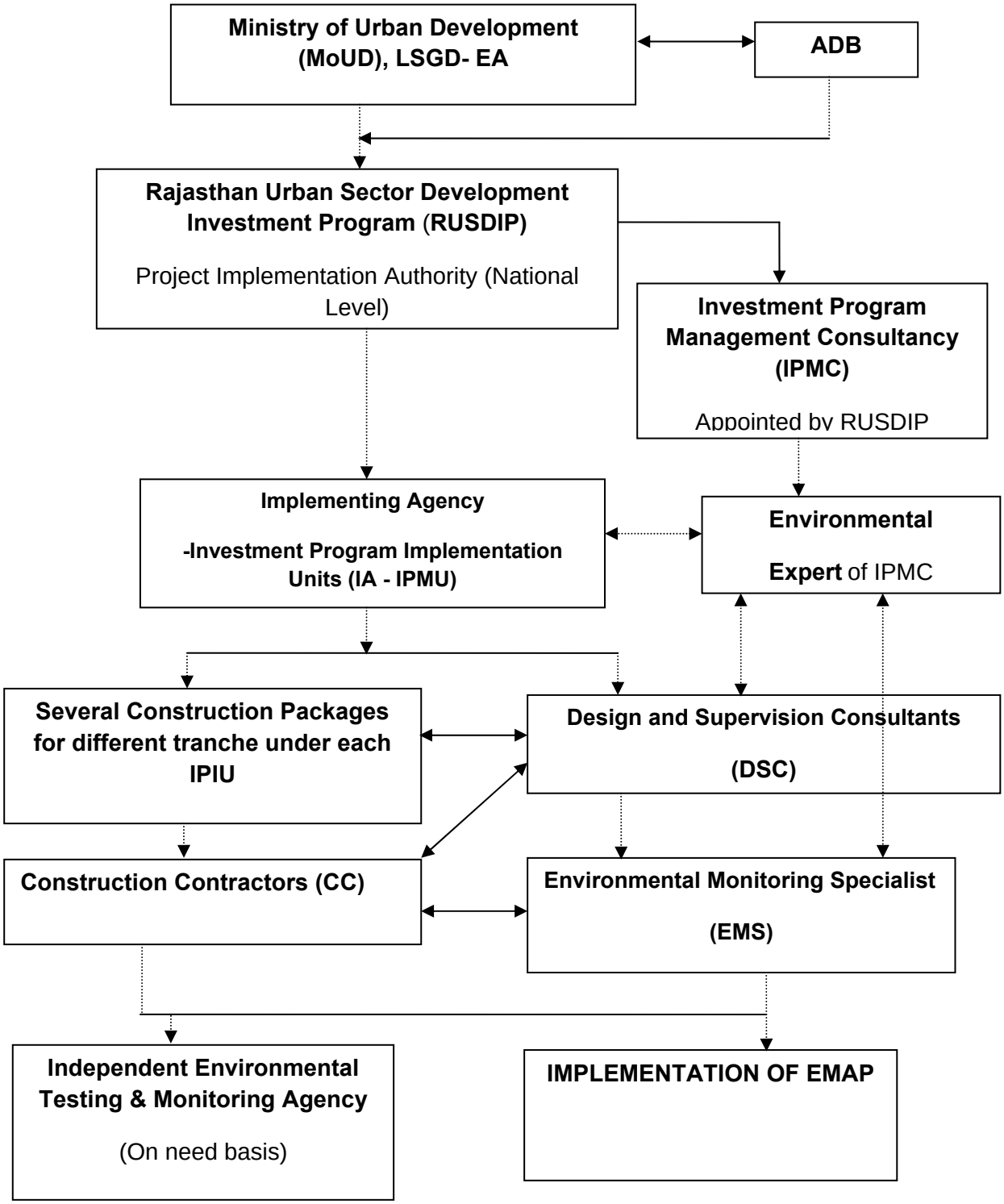
- The IPMU will appoint Construction Contractors (CC) to build elements of the infrastructure in a particular town. The CCs will be managed by the IPIU, and construction will be supervised by the DSC.

- LSGD will be assisted by an inter-ministerial Empowered Committee (EC), to provide policy guidance and coordination across all towns and subprojects. The EC will be chaired by the Minister of Urban Development and LSG, and members will include Ministers, Directors and/or representatives of other relevant Government Ministries and Departments.

- City Level Committees (CLCs) have also been established in each town, chaired by the District Collector, with members including officials of the ULB, local representatives of state government agencies, the IPIU, and local NGOs and CBOs. The CLCs will monitor project implementation in the town and provide recommendations to the IPIU where necessary.

153. **Figure 7.1** shows institutional responsibility for implementation of environmental safeguard at different level.

Figure 7.1: Institutional Responsibly- RUSDIP



B. Environmental Mitigation Plan

154. **Tables 7.1 to 7.3** shows the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and estimated cost of implementation. This EMP will be included in the bid documents and will be further reviewed and updated during implementation.

C. Environmental Monitoring Program

155. **Tables 7.4 to 7.5** show the proposed environmental monitoring program for this sub-project. It includes all relevant environmental parameters, description of sampling stations, applicable standards, and responsible parties. Monitoring activities during the detailed engineering design stage will from part of the baseline conditions of the subproject sites and will be used as the reference for acceptance of restoration works by the construction contractors.

Table:-7.1 Anticipated Impacts and Mitigation Measures – Pre-construction Environmental Mitigation Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Environmentally-sensitive Areas	A few trees will be cut and vegetation (mostly shrubs and grasses) will be cleared in the sub-project area	(i) Inventory the trees to be cut; (ii) Obtain tree-cutting permit from Municipal Board/Council and/or District Collector; and (iii) Include in the bid documents provisions on replacement of 3 trees for every one tree cut during construction.	Design and Supervision Consultants (DSC) in close coordination with the Municipal Board/ Council Investment Program Implementation Unit (IPIU)	(i) Inventory of trees; (ii) Tree-cutting permit; (iii) Location and number of trees replaced for every one tree cut
Utilities	Telephone lines, electric poles and wires, water and sewer lines within the existing bridge right-of-way (ROW) will be removed.	(i) Integrate utility ducts to the proposed road designs; (ii) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (iii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	DSC	(i) design specification showing utility ducts if necessary; (ii) list of affected utilities and operators; (iii) bid document to include requirement for a contingency plan for service interruptions
Access Roads	Disruption to traffic flow and sensitive receptors	(i) Include entry and exit points plan drawings; and (ii) Consult affected communities prior to finalizing subproject lay-out and design. (iii) plan in such a manner that access should not be hindered by any construction activity/ material/equipment	DSC and Non-government Organization in charge of public consultation and disclosure	(i) plan drawings showing entry and exit points; (ii) records of future public consultations
Social and Cultural Resources	Ground disturbance can uncover and damage archaeological and historical remains	(i) Consult Archaeological Survey of India (ASI) to obtain an expert assessment of the archaeological potential of the site; (ii) Consider alternatives if the site is found to be of medium or high risk; (iii) Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can be made available; and (iv) Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.	IPIU and DSC	Chance Finds Protocol

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the subproject sites; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to *nallah/water body* or in areas which will inconvenience the community.	IPIU and DSC to determine locations prior to award of construction contracts.	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	(i) Prioritize sites already permitted by the Mining Department; (ii) If other sites are necessary, inform construction contractor that it is their responsibility to verify the suitability of all material sources and to obtain the approval of IPIU; and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from IPMU.	IPIU and DSC to prepare list of approved quarry sites and sources of materials	(i) list of approved quarry sites and sources of materials; (ii) bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.

Table:-7.2 Anticipated Impacts and Mitigation Measures – Construction Environmental Mitigation Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Sources of Materials	Extraction of rocks and material from *nallah* may cause general scouring resulting in endangerment of bridges and continuous degradation of *nallah* regime.	(i) Use quarry sites and sources permitted by government; (ii) Verify suitability of all material sources and obtain approval of investment Program Implementation Unit (IPIU); (iii) If additional quarries will be required after construction has started, obtain written approval from IPMU; and; (iv) Submit to DSC on a monthly basis documentation of sources of materials.	Construction Contractor	Construction Contractor documentation

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Air Quality	Emissions from construction vehicles, equipment, and machinery used for excavation and construction resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons)	(i) Consult with IPIU/DSC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; (ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; (iii) Carry out air quality monitoring for ambient air for respirable particulate matter (RPM) and PM 2.5, Sox, NOx and CO; (iv) Use tarpaulins to cover sand and other loose material when transported by trucks; and (v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.	Construction Contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices (iii) ambient air for respirable particulate matter (RPM) and PM 2.5; (iv) vehicular emissions such as sulphur dioxide (SO_2), nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons
Surface water quality	Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate downstream surface water quality.	(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with IPIU/DSC on designated disposal areas; (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; (v) Dispose any wastes generated by construction activities in designated sites;	Construction Contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) number of silt traps installed along drainages leading to water bodies;
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with IPIU/DSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; (ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach; (iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and (iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.(v)	Construction Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers; (iii) equivalent day and night time levels

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		monitoring of noise level		
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure located alongside roads, in particular water supply pipes and sewer lines.	(i) Obtain from IPIU and/or DSC the list of affected utilities and operators; (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of services; and (iii) Develop and implement an Asbestos Cement Pipes Management Plan	Construction Contractor	(i) Existing Utilities Contingency Plan; (ii) Asbestos Cement Pipes Management Plan
Flora and Fauna	Land-clearing activities and presence of workers in the sites can damage or cause loss of existing flora	(i) Minimize removal of vegetation and disallow cutting of trees if not required for the construction activities; (ii) If tree-removal will be required, obtain tree-cutting permit from the Municipal Council or District Collector; (iii) Earth-ball trees and transplant to IPIU-approved areas; (iv) Require to plant three native trees for every one that is removed; and (v) Prohibit employees from cutting of trees for firewood.	Construction Contractor	(i) tree-cutting permit for affected trees; (ii) number of replanted trees
Landscape and Aesthetics	solid wastes as well as excess construction materials	(i) Prepare and implement Waste Management Plan; (ii) Recover used oil and lubricants and reuse or remove from the sites; (iii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (iv) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (v) Request IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.	Construction Contractor	(i) Waste Management Plan; (ii) complaints from sensitive receptors; (iii) IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.
Transportation – Accessibility	traffic problems and conflicts in right-of-way (ROW)	(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites; (ii) Schedule transport and hauling activities during non-peak hours; (iii) Locate entry and exit points in areas where there is low potential for traffic congestion; (iv) Keep the site free from all unnecessary obstructions; (v) Drive vehicles in a considerate manner; (vi) Coordinate with Municipal Traffic Office for temporary road diversions and with for provision of traffic aids if transportation	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors; (iii) number of signages placed at subproject sites.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		activities cannot be avoided during peak hours; and (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. (Viii)Provide wooden or metal sheet across the trenches for easy access wherever is required (ix) plan in such a manner that access should not be hindered by any construction activity/ material/equipment		
Socio-Economic	generation of contractual employment and increase in local revenue	(i) Employ at least 50% of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and (ii) Secure construction materials from local market.	Construction Contractor	(i) employment records; (ii) records of sources of materials
Occupational Health and Safety	occupational hazards which can arise from working in infrastructures like roads and bridges	(i) Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; (iii) Provide medical insurance coverage for workers; (iv) Secure all installations from unauthorized intrusion and accident risks; (v) Provide supplies of potable drinking water; (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; (viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; (x) Ensure moving equipment is outfitted with audible back-up alarms; (xi) Mark and	Construction Contractor	(i) site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H and S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and (xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.		
Community Health and Safety.	traffic accidents and vehicle collision with pedestrians	(i) Plan routes to avoid times of peak-pedestrian activities. (ii) Liaise with IPIU/DSC in identifying high-risk areas on route cards/maps. (iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure. (iv) Provide road signs and flag persons to warn of dangerous conditions.	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors
Work Camps	temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants	(i) Consult with IPIU/DSC before locating project offices, sheds, and construction plants; (ii) Minimize removal of vegetation and disallow cutting of trees; (iii) Provide water and sanitation facilities for employees; (iv) Prohibit employees from poaching wildlife and cutting of trees for firewood; (v) Train employees in the storage and handling of materials which can potentially cause soil contamination; (vi) Recover used oil and lubricants and reuse or remove from the site; (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ix) Request IPIU/DSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.	Construction Contractor	(i) complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) IPIU/DSC report in writing that the camp has been vacated and restored to pre-project conditions
Social and Cultural	(i)risk of archaeological chance finds; (ii)access lose or hindrance of	(i) Strictly follow the protocol for chance finds in any excavation work; (ii) Request IPIU/DSC or any authorized person with archaeological field training to observe excavation; (iii) Stop work	Construction Contractor	(i) records of chance finds (ii)visual inspection (iii) complaints from sensitive

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Resources	sensitive receptors	immediately to allow further investigation if any finds are suspected; and (iv) Inform IPIU/DSC if a find is suspected, and take any action they require ensuring its removal or protection in situ.(v)access to any sensitive receptors close to the site should not be stuck		receptors

Table:-7.3 Anticipated Impacts and Mitigation Measures – Operation and Maintenance Environmental Mitigation Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Noise Level	noise levels tend to increase with vehicular traffic	Put signages and implement "no blowing of horns" zones where there are sensitive receptors	Municipal Road Department (MRD)	complaints from sensitive receptors
Accessibility	Portions of the roads may be affected during routine repairs	Coordinate with the Municipal Police Department so that warning signs and traffic diversions can be set up when necessary	MRD	complaints from sensitive receptors
Ecological Resources	ecological gain from the planting of replacement trees	Coordinate with the Municipal Council for the continuous care of the planted trees.	MRD	% survival of planted trees

Table:-7.4 Pre-construction Environmental Monitoring Program

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Permits – Trees and Vegetation	not applicable	Design and Supervision Consultants (DSC) in close coordination with the town	(i) Inventory of trees; (ii) Tree-cutting permit; (iii) Location and number of trees replaced for every one tree cut	checking of records	(i) Inventory of trees prepared; (ii) Tree-cutting permit obtained from Municipal Council or District Collector; (iii) Location identified and number of	once	IPMU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
		Investment Project Implementation Unit (IPIU)			trees estimated		
Utilities		DSC	(i) design specification showing utility ducts if necessary; (ii) list of affected utilities and operators; (iii) bid document to include requirement for a contingency plan for service interruptions	checking of records	(i) utility ducts included in the design; (ii) list of affected utilities and operators prepared; (iii) requirement for a contingency plan for service interruptions included in bid documents	once	IPMU
Access Roads	not applicable	DSC and Non-government Organization in charge of public consultation and disclosure	(i) plan drawings showing entry and exit points; (ii) records of future public consultations	checking of records	(i) plan drawings include entry and exit points; (ii) stakeholders consulted; (iii) updated IEE and EMP disclosed	once	IPMU
Social and Cultural Resources	not applicable	IPIU and DSC	Chance Finds Protocol	checking of records	Chance Finds Protocol provided to construction contractors prior to commencement of activities	once	IPMU
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	not applicable	IPIU and DSC to determine locations prior to award of construction contracts.	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	checking of records	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas provided to construction contractors prior to commencement of works.	once	IPMU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Sources of Materials	not applicable	IPIU and DSC to prepare list of approved quarry sites and sources of materials	(i) list of approved quarry sites and sources of materials; (ii) bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	checking of records	(i) list of approved quarry sites and sources of materials provided to construction contractors (ii) bid document included requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	once	IPMU
Baseline Environmental Condition – Ambient Air Quality	Subproject sites	DSC	Establish baseline values of respirable particulate matter (RPM) and (ii) PM 2.5 (iii) oxide of sulphur (SO_x), nitrogen (NOx), carbon monoxide (CO)	Air sample collection and analyses by in-house laboratory or accredited 3rd party laboratory	GOI Ambient Air Quality Standards	Once prior to start of construction	IPMU

Table:-7.5 Construction Environmental Monitoring Program

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Sources of Materials	quarries and sources of materials	Construction Contractor	Construction Contractor documentation	(i) checking of records; (ii) visual inspection of sites	(i) sites are permitted; (ii) report submitted by construction contractor monthly (until such time there is excavation work)	Monthly submission for construction contractor as needed for DSC	DSC
Air Quality	construction sites and areas designated	Construction Contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery	(i) checking of records; (ii) review of generated air	(i) stockpiles on designated areas only; (ii) complaints from sensitive receptors satisfactorily	monthly for checking records	DSC

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	for stockpiling of materials		with air pollution control devices (iii) monitoring of ambient air quality for respirable particulate matter (RPM) and PM2.5, SOx, NOx and CO at baseline monitoring locations at a frequency of 1 day 24 Hrs. basis-Semi-annually; (iv) vehicular emissions such as sulphur dioxide (SO_2), nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons (HC)	quality data	addressed; (iii) air pollution control devices working properly; (iv) GOI Ambient Quality Standards for ambient air quality; (iv) GOI Vehicular Emission Standards for SO_2, NOx, CO and HC.		
Water Quality	(i) construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials;	Construction Contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) number of silt traps installed along drainages leading to water bodies; (iii)	visual inspection	(i) designated areas only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and silt from construction activities	monthly	DSC
Noise Levels	(i) construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials;	Construction Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers; (iii) equivalent day and night time levels at a frequency of 1 day 24 Hrs. basis-Semi-annually	(i) checking of records; (ii) review of generated data	(i) complaints from sensitive receptors satisfactorily addressed; and (ii) silencers in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary	Monthly	DSC

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	(iii) work camps						
Existing Infrastructure and Facilities	(i) construction sites; (ii) alignment of affected utilities	Construction Contractor	(i) Existing Utilities Contingency Plan; (ii) Asbestos Cement Pipes Management Plan	(i) checking of records; (ii) visual inspection	implementation according to Utilities Contingency Plan and Asbestos Cement Plan	as needed	DSC
Flora and Fauna	(i) construction sites; (ii) location where replacement trees will be planted	Construction Contractor	(i) tree-cutting permit for affected trees; (ii) number of replanted trees	(i) checking of records; (ii) visual inspection	number of trees cut, replanted and location according to the tree-cutting permit	as needed	DSC
Landscape and Aesthetics	(i) construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	Construction Contractor	(i) Waste Management Plan; (ii) complaints from sensitive receptors; (iii) IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.	(i) checking of records; (ii) visual inspection	(i) No accumulation of solid wastes on-site; (ii) implementation of Waste Management Plan; (iii) complaints from sensitive receptors satisfactorily addressed.	Monthly	DSC

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Transportation – Accessibility	(i) construction sites; (ii) traffic routes	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors; (iii) number of signages placed at subproject sites.	visual inspection	(i) implementation of Traffic Management Plan; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) signages visible and located in designated areas	Monthly	DSC
Socio-Economic	construction sites	Construction Contractor	(i) employment records; (ii) records of sources of materials	checking of records	number of employees from town equal or greater than 50% of total workforce	Quarterly	DSC
Occupational Health and Safety	construction sites	Construction Contractor	(i) site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H and S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.	(i) checking of records; (ii) visual inspection	(i) implementation of H and S plan; (ii) number of work-related accidents; (iii) % usage of personal protective equipment; (iv) number of first-aid stations, frequency of potable water delivery, provision of clean eating area, and number of sign boards are according to approved plan; (v) % of moving equipment outfitted with audible back-up alarms	Quarterly	DSC
Community Health and Safety.	construction sites	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors	visual inspection	(i) implementation of Traffic Management Plan; (ii) complaints from sensitive receptors	Quarterly	DSC

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
					satisfactorily addressed		
Work Camps	work camps	Construction Contractor	(i) complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) IPIU/DSC report in writing that the camp has been vacated and restored to pre-project conditions	visual inspection	(i) designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	DSC
Social and Cultural Resources	construction sites	Construction Contractor	(i)records of chance finds; (ii) complaints from sensitive receptors	checking of records	Implementation of Chance Finds Protocol	as needed	DSC

Table:-7.6 Operation and Maintenance Environmental Monitoring Program

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Noise Levels	subproject sites	Municipal Road Department (MRD)	complaints from sensitive receptors	checking of records	complaints from sensitive receptors satisfactorily addressed	as needed	PMU
Accessibility	subproject sites	MRD	complaints from sensitive receptors	checking of records	complaints from sensitive receptors satisfactorily addressed	as needed	PMU
Ecological Resources	subproject sites	MRD	% survival of planted trees	checking of records	at least 80% survival rate	quarterly	PMU

156. Resettlement issues will be coordinated centrally by a Resettlement Specialist within the IPMU, who will ensure consistency of approach between towns. A local Resettlement Specialist will also be appointed to IPIUs of zones in which there are resettlement impacts and they will prepare and implement local Resettlement Plans following the framework established in Tranche 1.

157. Environmental issues will be coordinated by an Environmental Specialist within the IPMU/ IPMC, who will ensure that all subprojects comply with environmental safeguards. An Environmental Monitoring Specialist (EMS) who is part of the DSC team will implement the Environmental Monitoring Plan from each IEE, to ensure that mitigation measures are provided and protect the environment as intended. Domestic Environmental Consultants (DEC) will be appointed by each IPIU to update the existing IEEs in the detailed design stage, and to prepare IEEs or EIAs for new subprojects, where required to comply with national law and/or ADB procedure.

158. A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. This will be conducted by a qualified Environmental Monitoring Specialist (EMS) from the DSC. The EMS will be responsible for all monitoring activities and reporting the results and conclusions to the IPMU, and will recommend remedial action if measures are not being provided or are not protecting the environment effectively. The EMS may be assisted by environmental specialists in particular technical fields, and junior or medium-level engineers who can make many of the routine observations on site. Post-construction monitoring will be conducted by the relevant Government Agency (GA) to whom responsibility for the infrastructure will pass once it begins to operate[3].

159. The EMP shows that most of the mitigation measures are fairly standard methods of minimising disturbance from building in urban areas (maintaining access, planning work to avoid sensitive times, finding uses for waste material, etc), and experienced Contractors should be familiar with most of the requirements. Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects. There will also be some surveys of residents, as most of the measures are aimed at preventing impacts on people and the human environment.

160. The proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies the various monitoring activities to be conducted during all phases. The EMP describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring). Most of the measures will be checked by simple observation, by checking of records, or by interviews with residents or workers.

B. Environmental Management and Monitoring Costs

161. Most of the mitigation measures require the Construction Contractors (CC) to adopt good site practice, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. Regardless of this, any costs of mitigation by the CC or DSC are included in the budgets for the civil works and do not need to be estimated separately here. Mitigation that is the responsibility of LSGD will be provided as part of their management of the project, so this also does not need to be duplicated here. Costs of compensating businesses for loss of income during the construction period are

[3] In the operational period some infrastructure will be the responsibility of the Municipal Boards/Councils, whilst others will be the responsibility of the appropriate branch of the State government (such as PWD, PHED, etc)

calculated separately in the budgets for the Resettlement Framework and Resettlement Plans so are also excluded from this analysis.

162. The remaining actions in the Environmental Management Plan are the various environmental monitoring activities to be conducted by the EMS. These have not been budgeted elsewhere, and their costs are shown in **Table 7.8**. The figures show that the total cost of environmental management and monitoring for this subproject as a whole (covering design and construction) is INR 0.72 million.

Table 7.8: Estimated Environmental management and monitoring costs (INR)- as per Initial Environmental Examination

Item	Quantity	Unit Cost	Total Cost	Sub-total	Source of Funds
1. Implementation of EMP (2 years)					
Environmental Monitoring Specialist of DSC	1 x 3 month	140,000[4]	420,000		DSC
Survey and monitoring expenses - air and noise quality	Lump Sum	100,000	100,000	520,000	Contractor
2. Improvement of aesthetics along the bridge including plantation	Lump Sum	200,000	200,000	200,000	Contractor
TOTAL				720,000	

(Air Quality- Once in a week for 2 weeks 2 locations , semi-annually for the parameters like RSPM, SO_2 NOx, CO, H_2S; Noise level- Once (6 times in a day in 6 working hours for 2 days at 2 locations, measurement semi-annually)

[4] Unit costs of domestic consultants include fee, travel, accommodation and subsistence

VIII. FINDINGS AND RECOMMENDATIONS

A. Findings

163. The Project is designed to improve the quality of life of small town residents and enhance the small towns' roles as market, services, and manufacturing centers. It has a strong community development focus reinforced by integrated poverty reduction, health and hygiene improvement investment projects. Moreover, urban residents including nearby the rural residents in surrounding hinterland will benefit from improved roads and bridges allowing better access to urban markets and social services provided in the Project towns. The towns' economies will benefit from enhanced productivity as a result of health improvement, time savings in collecting water, as well as from increased urban efficiency arising from improved roads, bridges, drainage, drinking water and sanitation.

164. During project design, community meetings were held with beneficiaries to discuss sanitation, poverty, resettlement, affordability issues, and environmental concerns. Socioeconomic surveys obtained information and individual views on current situations and future preferences. Potential environmental impacts of urban infrastructure improvements are mainly short-term during the construction period and can be minimized by the proposed mitigating measures and environmentally sound engineering and construction practices.

165. The process described in this document has assessed the environmental impacts of the road proposed under the Barmer Urban Transport and Road Subproject. Potential negative impacts were identified in relation to both construction and operation of the improved infrastructure, but no impacts were identified as being due to either the project design or location. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the outline designs for the infrastructure. These include:

- Locating all activities within the ROW of existing roads, to avoid the need to acquire land or relocate people;

166. This means that the number of impacts and their significance has already been reduced by amending the design.

167. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the road is built and when it is operating.

168. The proposed work will inevitably cause some disruption to road traffic. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. These include:

- Covering soil during transportation and when stored on site;
- Watering exposed soil during dry and windy weather;
- Planning work with the appropriate authorities to minimize disruption of road traffic.

169. One field in which impacts are much less routine is archaeology, and here a series of specific measures have been developed to avoid damaging important remains. These include:

- Assessing the archaeological potential of the site, and selecting an alternative subproject if the site is considered to be of medium or high risk;

- Including archaeological, cultural and historical authorities and interest groups as project stakeholders to benefit from their expertise;

- Developing a protocol for use in conducting all excavation to ensure that any chance finds are recognized, protected and conserved.

170. Special measures were also developed to protect workers and the public from exposure to carcinogenic asbestos fibres in the event that Asbestos Cement pipes used in the existing water supply system are uncovered accidentally during excavation work. These are to:

- Avoid all known sites of AC pipes when the locations of new infrastructure are planned in the detailed design stage;

- Train all construction personnel to raise awareness of the dangers of AC and enable early recognition of such pipes if encountered;

- Develop and apply a protocol to protect workers and the public if AC pipes are encountered (including evacuation of the immediate area, use of protective equipment by workers, and safe removal and disposal of AC material).

171. There were limited opportunities to provide environmental enhancements, but certain measures were included. For example, it is proposed that the project will:

- Employ in the workforce people who live in the vicinity of the construction site to provide them with a short-term economic gain;

- Plant large-growing trees at the periphery of the site to mask it from view and give it a more natural and pleasing appearance.

172. These and the other mitigation and enhancement measures are summarised in Table 7.1 to 7.3**,** which also shows the location of the impact, the body responsible for the mitigation, and the programme for its implementation.

173. Once the road widening is completed, it will operate with routine maintenance (such as occasional repairs of the road, safety barriers and signs), which will be small-scale, infrequent and short in duration and should not affect the environment. The only mitigation required in this period is to plan any maintenance work with the town authorities and police to ensure adequate precautions are taken to maintain the safety of workers and road users.

174. The main impacts of the operating road will be beneficial in improving the infrastructure of the town by providing a more efficient and effective transport route, which should improve the overall economy by reducing time spent idle in traffic by delivery vehicles, employees and customers. The general environment will also be improved at this location as the daily concentration of vehicular noise and pollution from exhaust gases will be removed.

175. Table 7.1 to 7.3 also assesses the effectiveness of each mitigation measure in reducing each impact to an acceptable level.

176. Mitigation will be assured by a programme of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the IPMU.

B. Recommendations

177. There are two straightforward but essential recommendations that need to be followed to ensure that the environmental impacts of the project are successfully mitigated. These are that LSGD should ensure that:

- All mitigation, compensation and enhancement measures proposed in this IEE report and in the Resettlement Framework for the RUSDIP are implemented in full, as described in these two documents;

- The Environmental Monitoring Plan proposed in this report and the internal and external monitoring proposed in the Resettlement Framework are also implemented in full.

IX. CONCLUSIONS

178. The environmental status of the proposed improvements in urban transport and road sector in Barmer Town has been assessed. Issues related to Involuntary Resettlement were assessed by a parallel process of resettlement planning and will be compensated by measures set out in detail in the Resettlement Framework for the subproject.

179. The overall conclusion of both processes is that providing the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the subproject. There should in fact be some small benefits from recommended mitigation and enhancement measures, and major improvements in quality of life and individual and public health once the scheme is in operation.

180. There are no uncertainties in the analysis, and no further studies are required to comply with ADB procedure or national law.

ANNEXURE– I

PHOTOGRAPH PUBLIC CONSULTATION

Near Circuit House

Near Circuit House

SITE PHOTOGRAPHS

Proposed Road

Proposed Road

Proposed Road

Proposed Road

ANNEXURE- II

Rapid Environmental Assessment (REA) Checklist

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: **India/Rajasthan Urban Sector Development Investment Programme**

Sector Division: **Widening of roads at Barmer**

Screening Questions	Yes	No	Remarks
A. PROJECT SITING **IS THE PROJECT AREA ADJACENT TO OR WITHIN ANY OF THE FOLLOWING ENVIRONMENTALLY SENSITIVE AREAS?**			
▪ **CULTURAL HERITAGE SITE**		√	
▪ **PROTECTED AREA**		**√**	There is no protected / environmental sensitive area along the road.
▪ **WETLAND**		**√**	
▪ **MANGROVE**		**√**	
▪ **ESTUARINE**		**√**	
▪ **BUFFER ZONE OF PROTECTED AREA**		**√**	
▪ **SPECIAL AREA FOR PROTECTING BIODIVERSITY**		**√**	
B. POTENTIAL ENVIRONMENTAL IMPACTS **WILL THE PROJECT CAUSE…**			

Screening Questions	Yes	No	Remarks
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		√	There is one temple i.e. Bharat Mata Temple but away (approx. 15 m) from our project area, all preventive measures will be taken care off during construction phase.
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?		√	No such area has been identified nearby proposed roads.
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		√	There is one seasonal river near Bharat Mata temple that flourishes only in rainy season. The river is away from the impact zone of the project area.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		√	No worker camp is proposed and the surface water resources (one seasonal river near Bharat Mata temple) is away from the impact zone of the project area
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	√		During construction phase there will be increased air pollution due to asphalt processing and rock cutting. The location of asphalt processing and rock cutting machinery will be established far from human settlements and any environmental sensitive location to avoid impacts from increased air pollution.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?		√	
▪ noise and vibration due to blasting and other civil works?		√	No blasting work will be involved in the project.
▪ dislocation or involuntary resettlement of people?		√	Involuntary resettlement or dislocation of people will not be there
▪ dislocation and compulsory resettlement of people living in right-of-way?		√	There is no settlement in Right of way (ROW) hence no need of compulsory resettlement.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		√	

Screening Questions	Yes	No	Remarks
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		√	project site is away from the human settlement
▪ hazardous driving conditions where construction interferes with pre-existing roads?	√		Contractor will provide alternate road during construction phase and will maintain traffic management to avoid any hazardous driving condition. Barricades, posters etc will be used during the construction activities to avoid any mishap.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?		√	Local labour will be employed for this work if required then contractor will provide all necessary facilities in workers camp to avoid any sanitation and solid waste disposal problem.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?		√	Climate of this area is dry and desert. Also this is a water scare area. There are no chances of creation of temporary breeding habitat for mosquito vectors during construction phase of Road project.
▪ accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	√		Pre-existing traffic may result accidents due to construction vehicle therefore proper management plan to be followed
▪ increased noise and air pollution resulting from traffic volume?	√		Pre-existing traffic and future construction activities may increase noise and air pollution for very short period; preventive measures will be adopted.
▪ increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?		√	There is no surface and ground water resource in this area except one Nadi which is filled only in rainy season and away from project area.
▪ social conflicts if workers from other regions or countries are hired?		√	Local labour will be employed for this work
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		√	Improvement in the existing road will not result in large population influx
▪ 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?		√	

Screening Questions	Yes	No	Remarks
▪ 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.		√	

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	**Yes**	**No**	**REMARKS**
• Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)	√		Barmer town lies in medium to high risk zone (III and IV).
▪ Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (eg., increased erosion or landslides could increase maintenance costs, permafrost melting or increased soil moisture content could affect sub0-grade).		√	
▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (eg., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		√	
▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by encouraging settlement in areas that will be more affected by floods in the future, or encouraging settlement in earthquake zones)?		√	

Appendix I: Environments, Hazards and Climate Changes

Environment	Natural Hazards and Climate Change	Example Impact on Roads and Highways
Arid/Semi-arid and desert environment	Low erratic rainfall of up to 500 mm rainfall per annum with periodic droughts and high rainfall variability. Low vegetative cover. Resilient ecosystems & complex pastoral and systems, but medium certainty that 10–20% of drylands degraded; 10-30% projected decrease in water availability in next 40 years; projected increase in drought duration and severity under climate change. Increased mobilization of sand dunes and other soils as vegetation cover declines; likely overall decrease in agricultural productivity, with rain-fed agriculture yield reduced by 30% or more by 2020. Earthquakes and other geophysical hazards may also occur in these environments.	Reduced availability of water for compaction during construction, increased sand on carriageways reduce road safety, road alignment may need to be reviewed where, for example, agriculturally productive zones are shifting.
Humid and sub-humid plains, foothills and hill country	More than 500 mm precipitation/yr. Resilient ecosystems & complex human pastoral and cropping systems. 10-30% projected decrease in water availability in next 40 years; projected increase in droughts, heatwaves and floods; increased erosion of loess-mantled landscapes by wind and water; increased gully erosion; landslides likely on steeper slopes. Likely overall decrease in agricultural productivity & compromised food production from variability, with rain-fed agriculture yield reduced by 30% or more by 2020. Increased incidence of forest and agriculture-based insect infestations. Earthquakes and other geophysical hazards may also occur in these environments.	Increased landslides and mudflows disrupt road networks, Increased moisture content in the subsurface can result in increased penetration of water into the fill, which may also collapse, Reduced effectiveness of drainage which results in a reduction in the bearing capacity of the soils which become saturated
River valleys/ deltas and estuaries and other low-lying coastal areas	River basins, deltas and estuaries in low-lying areas are vulnerable to riverine floods, storm surges associated with tropical cyclones/typhoons and sea level rise; natural (and human-induced) subsidence resulting from sediment compaction and ground water extraction; liquefaction of soft sediments as result of earthquake ground shaking. Tsunami possible/likely on some coasts. Lowland agri-business and subsistence farming in these regions at significant risk.	Same as above
Small islands	Small islands generally have land areas of less than 10,000km^2 in area, though Papua New Guinea and Timor with much larger land areas are commonly included in lists of small island developing states. Low-lying islands are especially vulnerable to storm surge, tsunami and sea-level rise and, frequently, coastal erosion, with coral reefs threatened by ocean warming in some areas. Sea level rise is likely to threaten	Increased salinity increases corrosion of materials which can break-down, Road is eroded by increased wave action, Increased flooding from overtopping of sea-water over road or salt-water intrusion in to groundwater,

Environment	Natural Hazards and Climate Change	Example Impact on Roads and Highways
	the limited ground water resources. High islands often experience high rainfall intensities, frequent landslides and tectonic environments in which landslides and earthquakes are not uncommon with (occasional) volcanic eruptions. Small islands may have low adaptive capacity and high adaptation costs relative to GDP.	
Mountain ecosystems	Accelerated glacial melting, rockfalls/landslides and glacial lake outburst floods, leading to increased debris flows, river bank erosion and floods and more extensive outwash plains and, possibly, more frequent wind erosion in intermontane valleys. Enhanced snow melt and fluctuating stream flows may produce seasonal floods and droughts. Melting of permafrost in some environments. Faunal and floral species migration. Earthquakes, landslides and other geophysical hazards may also occur in these environments.	Damage to infrastructure from landslides and mudflows, permafrost melting causes damage to roads, glacial lake outbursts wash out river-crossings.
Volcanic environments	Recently active volcanoes (erupted in last 10,000 years – see www.volcano.si.edu). Often fertile soils with intensive agriculture and landslides on steep slopes. Subject to earthquakes and volcanic eruptions including pyroclastic flows and mudflows/lahars and/or gas emissions and occasionally widespread ashfall.	Damage and loss of roads, insecuirity for roadworks crew and maintenance

ANNEXURE- III: PUBLIC CONSULTATION- ENVIRONMENT

ROAD AT BARMER

Issues discussed

- Awareness and extent of the project and development components
- Benefits of Project for the economic and social Upliftment of Community
- Labour availability in the Project area or requirement of outside labour involvement
- Local disturbances due to Project Construction Work
- Necessity of tree felling etc. at project sites
- Water logging and drainage problem if any
- Drinking water problem
- Forest and sensitive area nearby the project site
- Movement of wild animal if any

Date & time of Consultation **04.03.2012, 12:30 PM**

Location **NEAR CIRCUIT HOUSE, BARMER**

Table: issues of the Public Consultation- Design Phase

Sr. No.	Key issues/Demands	Perception of community	Action to be Taken
1.	Awareness of the project – including Project Coverage area	Some People are aware of the proposed Project	An NGO is appointed for awareness programme in this town
2.	In what way they may associate with the project	They want to engage with the project as a job opportunity	
3.	Presence of any forest, wild life or any sensitive/ unique environmental components nearby the project	There is no such environmental sensitive components in the vicinity of project area	
4	Presence of historical/cultural/ religious sites nearby	There is one Bharat Mata Temple nearby the proposed project but away from project area.	Bharat Mata Temple is approx 15m away from the project road alignment. All preventive measure to avoid impact will be taken care during construction
5	Un favorable climatic condition	Barmer is dry area with very high temperature during summer creating unfavouable condition for work	Contractor should make the working schedule as per climatic conditions of the area
6	Occurrence of flood	No flood is reported in this town till date	

Sr. No.	Key issues/Demands	Perception of community	Action to be Taken
7	Drainage and sewerage problem facing	Drainage and Sewerage are major problems in this area. These should be sort out immediately.	Sewerage problem will be solved because this project is already been taken in the scope.
8	Present drinking water problem- quantity and quality	Present water supply is from tube wells. The quality of water is poor, fluoride and TSS content is high.	The Water Supply project is proposed in this town and scarcity of water will be solved after completion of this project.
9	Present solid waste collection and disposal problem	Solid waste collection facility is poor in this area, Line department is not serious about the solid waste collection in this area	Municipal Board, Barmer is establishing a compost plant near village Gehun, Barmer and supplying of machinery and equipments is under RUIDP scope. The problem will be solved shortly.
10	Availability of Labour during construction time	Sufficient labour is available in nearby communities.	Contractor will engage 50 % labour from nearby community.
11	Access road to project site	The proposed road project is along Jodhpur by pass to Uttarlai road.	
12	Perception of villagers on tree felling and a forestation	People are against the tree felling	There will be no need of tree cutting but if it happens then 3 trees will planted at cost of one tree.
13	Dust and noise pollution and disturbances during construction work	Contractor should use modern machinery to control dust and noise during construction phase.	All preventive measures will be taken to control dust and noise during construction phase. Regular maintenance of Noise producing machinery will be done.
14	Setting up worker camp site within the village/ project locality	There is enough space available nearby our project area to establish labour camp.	The locals will provide land for temporary set up of labour camp if necessary.
15	Safety of residents during construction phase and applying of vehicle for construction activities	The contractor should take care of the safety arrangement during construction phase and should provide traffic diversion routes to avoid the vehicle congestion	Contractor should appoint a safety officer for looking after the Safety aspects during construction work.
16	Requirement of enhancement of other facilities	The locals feels that Parks, and Community halls are required in this town in addition to additional traffic management system	
17	Whether local people agreed to sacrifice their lands (cultivable of not) for beneficial project after getting proper compensation	Locals are not agree to sacrifice their land for benefits of the project if needed	

NAME AND POSITION OF PERSONS CONSULTED

Sr. No.	Name	Designation
1.	Suresh Kumar	Labor
2.	Raju Vaishnav	Labor
3.	Brij Pal	Shopkeeper
4.	Raja Ram Choudhary	Business
5.	Dinesh Kumar	Student
6.	Ashutosh	Student
7.	Vijender Kumar	Business
8.	Dharama Ram	Shopkeeper
9.	Amit Kumar	Shopkeeper
10.	Chotu Ram	Shopkeeper
11.	Guman Singh	Service

Summary of out come

Some Locals are aware of the project. The Barmer Town is heavily developed with industries & infrastructure facilities so population of this town is increasing. This results in heavy vehicle congestion in town. The old city area is very congested and traffic is mostly light vehicle. The proposed project is a need to this town. Locals are very much in favor of the project and they wants that this should be completed as early as possible. These local people are suffering from present water supply, sewerage and solid waste disposal management in this town. The quality and quantity of present water supply is very poor. People are ready to extend all types of support to during execution of the project. Projects of Water Supply, Wastewater, Railway Over Bridge, Road and improvement of solid waste collection have been taken under RUIDP project. The local people in favor all type of co-operation for concerned project which should be finish as early as possible.