Initial Environmental Examination

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India: Rajasthan Urban Sector Development Investment Program - Nagaur Road Improvement 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
GSB	-	Granular Sub Base
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
msa	-	Million Standard Axles
NAAQS	-	National Ambient Air Quality Standards
OD	-	Outer Diameter
OHSR	-	Over Head Service Reservoir
OM	-	Operations Manual
PCU	-	Passenger Car Unit
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
SDBC	-	Semi Dense Bituminous Concrete
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

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 (2002, 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). The only type of infrastructure provided by the RUSDIP that is specified in the EIA Notification (2006) of Govt. Of India is solid waste management, where Environmental Clearance (EC) is required for all Common Municipal Solid Waste Management Facilities. EC is thus not required for Nagaur Road sub project and but subject to Environmental Examination. This is the Initial Environmental Examination (IEE) report for the Nagaur Road Project. It discusses the generic environmental impacts and mitigation measures relating to the location, design, construction and operation of physical works proposed under this subproject.

3. Project Description: The sub-project is located in Nagaur, the headquarters town of Nagaur district, in the North West part of Rajasthan. The main component of the sub-project is Improvement and Widening of road from Bikaner road (NH-89) to Jodhpur road (NH-65) by pass at Nagaur"

4. **Description of Environment:** Nagaur is the district headquarters. It is located at latitude (26º25' to 27º 40' and 23º3' to 30º12') north and longitude (73º18' to 75º15' and 69º30' to 78º17') east, at a height of about 327m above the mean sea level. The town is at a distance of 112 Km. from Bikaner and 262 Km. from Jaipur and 160 km approx from Jodhpur by rail and connected with Ajmer Pushkar by road. It is very well connected by road, as such State Highway No. 2 & No. 3 pass through here. It is situated amidst seven districts namely Bikaner, Churu, Sikar, Jaipur, Ajmer, Pali, Jodhpur. Because of its central situation in Rajasthan, it shares its border with several other districts of the state. In the north, it is bound by Bikaner and Churu districts, in the east by Sikar and Jaipur districts, in the south by Ajmer and Pali districts and in the west by Jodhpur district. The site on which the town stands is of great significance in its natural setting. Nagaur has a dry climate with a hot summer. Sand storms are common in summer. The climate of the district is conspicuous by extreme dryness, large variations of temperature & highly variable rainfall. The mercury keeps on rising intensely from March till June. These are the hottest months. The maximum temperature recorded in district is 47 ^{0}C with 0 ^{0}C as the lowest recorded temperature. The average temperature of the district is 23.5 ^{0}C. The winter season extends from mid November to till the beginning of March. Rainy season is of a short during from July to mid September. There are ten rain gauge stations, namely - Nagaur, Khinvsar, Didwana, Merta, Parbatsar, Makarana, Nawa, Jayal, Degana, and Ladnun in the district.

5. Economic base of a town reflects its prosperity. Nagaur being district headquarter, has been functioning as administrative city with sustained growth in tertiary economic activities. The Nagaur town is famous for its cottage and house hold industries. There are about 812 registered

industrial units in the town which in all, employ about 2820 workers. Only a few medium and small scale units like Plaster of Paris, Hand tools, Metal works and leather industries have been established on the western side of railway line and along Basni road where recently RIICO have developed and organized Industrial area. There is no large scale industry in the town. Small units of dying and printing, Cement work, auto parts etc. have come up along major roads of the town. Most of the famous hand tools making house hold industries are located within the commercial areas north east of the fort. The Multani Luharo, who migrated to the town from Multan now in Pakistan are mostly manufacturing the axe, evils, swords, knives, scissors and other iron hand tools.

6. Nagaur town is facing severe sewerage problem resulting unsanitary conditions through the year. The topography of the town is quite undulating and is evident from the contour map that the natural disposal of sewage of the town toward vacant disposal area out of the municipal limit is difficult. Due to the increasing demands of water, the supply has been substantially increased by augmentation schemes, resulting significant increase in the sewage gets accumulated in town areas. The problem gets aggravated when the wastewater remain stagnant for quite long time in the low lying area and cause hard ship to the inhabitants as well as creates unhygienic conditions. The present waste water flow system comprising of secondary drain (streams and artificial drains) and tertiary drains (mostly roadside drains), the most of town drain towards Dulaya Pond from South & East part of town and waste water of rest of town is accumulated at several low laying areas forming an unhygienic ponds is commonly called “Ginanies” in these areas. There are about 13 identified Ginanies out of which 3 are very minor, rest of 10 Ginanies creates unhygienic ponds full of wastewater smelling badly. These ponds expand their surface area tremendously during rainfall and water get entry in houses and shops. This situation continuous for hours in most of the areas and in other area it goes for 2-3 days, namely Samas Talab, Gaji Khada, Bacha Khada etc.

Nagaur city has nearly 20% of total urban population of the district. In 2011 its population was 637204 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 26.65% only which was even less than the national population growth rate.

7. **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 localized and not greatly significant during design phase.

8. There is one temple i.e. sheetla mata Temple and temple boundary comes in the vicinity of project; all preventive measures will be taken care off during construction phase. There is no settlement hence there is no need of compulsory resettlement.

9. 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

work. During operation phases there are few positive socio-economic impacts will be anticipated.

10. **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.

11. 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 INR 16.5 Lakh,

12. **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.

13. 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.

14. **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.

15. 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 (2002) 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 Safeguard Policy Statement (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 sub-project, 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 summary of environmental regulations and mandatory requirements for the proposed subproject is shown in **Table 1.1.**

Table 1.1: Applicable Environmental Regulations & Legislations and its applicability

Acts/Guidelines	Purpose	Applicability to subproject
The EIA notification, 2006 (and its subsequent amendments in 2009) provides for categorization of projects into category A and B, based on extent of impact	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 categorized as A or B depending on the scale of the project and the nature of its impacts. Categories A projects require Environmental Clearance from the National Ministry of Environment and Forests (MoEF). Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA).	Not applicable The sub project is not included in schedule of environmental impact assessment notification 2006 and its subsequent amendments till dates so it is not categories as either Category A or Category B. As a result, environmental clearance is not required, either from the state or the central Government.
The Wildlife Conservation Act, 1972,	Clearance from state and national wildlife boards, Central Empowered Committee of Hon'ble Supreme Court of India and the State Wildlife Department, as applicable.	Not Applicable
Rajasthan Forest (Conservation) Act, 1953	Clearance from Forest department for cutting of trees, if any Clearance from ULB for cutting of road side trees	Applicable for road side tree cut only
The Ancient Monuments and Archaeological Sites and Remains Act, 1958, and the rules, 1959 provide guidance for carrying out activities, including conservation, construction and reuse in and around the protected monuments.	Permission from the Archaeological Survey of India for carrying out any construction activities within the prohibited and regulated areas of the ancient monuments and archaeologically protected sites.	Not Applicable
Water (Prevention and control of pollution) Act, 1974, as amended Air (prevention and control of pollution) Act, 1981, as amended	Consent to Establish (CTE) and Consent to Operate (CTO) from the RSPCB for setting up hot mix plants, wet mix plants, stone crushers and diesel generators (if installed for construction). To be obtained by the Contractor, prior to construction.	Applicable
Water (Prevention and Control of Pollution) Cess Act, 1977 including Rules	Applicable to all activities, which discharge effluents as a result of process or operations	Not Applicable
Public Liability and Insurance Act 1991	Protection form hazardous materials and accidents.	Applicable
Noise Pollution (Regulation and Control Act) , 2000	The standards for noise for day and night have been promulgated by the MoEF for various land uses. DG sets at construction sites should be provided with acoustics enclosures.	Applicable
Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules1989	To check vehicular air and noise pollution. All vehicles in Use shall obtain Pollution Under Control (PUC) certificates by the contractor	Applicable

Acts/Guidelines	Purpose	Applicability to subproject
Child Labour Act 1986	No child shall be employed or permitted to work in any of the scheduled occupations	Applicable
Ground Water (Regulation, Development and Management) Rules, 2007	For development and withdrawal of ground water	Applicable in few locations in case of non availability of ground water

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 Nagaur Road subproject. It discusses the generic environmental impacts and mitigation measures relating to the location, design, construction and operation of physical works proposed under this subproject.

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 Nagaur 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 Nagaur district, the headquarters town of Nagaur district, in the north western India state of Rajasthan. The main component of the sub-project is Improvement and Widening of road from Bikaner road (NH-89) to Jodhpur road (NH-65) by pass at Nagaur (**Figure 2.1**) and construction of drain from Andhiya Pipal Khan to Saleo Kankad. The project implementation will start in early 2014 and will be completed within 12 months. Photographs of the project area are attached as **Annexure I**

C. Description of the Sub-project

a) Road work

1. Existing Road Condition

16. It is an important by pass road of Nagaur town, it connects Jodhpur road to Bikaner road and peripheral villages. Presently it is a intermediate lane (average carriageway of 5.5m) and proposed to be upgraded to four lane in a stretch of 4000m from Jodhpur road(NH-65) to Bikaner road(NH-89) and road side drain with provision of interlocking tiles in a stretch of 550m (Bikaner road to Krishi mandi).

2. Subproject Components

17. The main component of the sub-project is improvement and widening to four lane of road from Bikaner road (NH-89) to Jodhpur road (NH-65) by pass (a stretch of 4000m) at Nagaur. The available average right of way at Bikaner road (NH-89) to Jodhpur road (NH-65) is 25 mtr.

18. There is no existing shoulder of the road so the earthen shoulder is proposed of average 1.5m on either side of road. Road side drains are proposed in a stretch of 550m as there is no existing road side drain and 2.50m wide median is also proposed for the complete road stretch. As such there is no sharp horizontal curve. As such there are no any major utilities. There is one intersection. Street lights are not available and it has been proposed for complete stretch of 4000m. The inventory of road are as follows:

Table 2.1 Road Inventory of the Proposed Road

SL	Proposed Road	Length (mtr)	Carriage way (Existing)	Carriage way (Proposed)	Drain	Median
1	From Bikaner road(NH-89) to Jodhpur road(NH-65) by pass	4000	5.5	14.0	Not available, Proposed road side drain in stretch of 550m	Not available and proposed 2.5m
	Total	4000				

- **Existing Crust**

19. The existing road is WBM (Water Bond Macadam) road in a length of 800 meter with available right of way equal to 23.0 meter. The bituminous road is available for a length of 3025 meter having crust thickness of 25mm PMC (Pre Mix Carpet) and 100mm sub base. The existing bituminous road is inadequate for the present day traffic and the growth of traffic in the next 15 years.

- **Improvement of Pavement**

20. The design life for urban roads as laid down in IRC: 86-1983 in 15 years. However, considering the cost of project and resources availability, it is proposed that the pavement is designed to cater the design life of 5 years.

21. The total right of way available of existing bituminous road is 23.0 meter width and carriageway on bituminous road is proposed to be of 14.0 meter width and 1.2 meter median. The cumulative figure of 3.69 million standard axles has been considered for the design. The CBR of the sub-grade soil is 10.00. The crust thickness for 3.69 msa and CBR of 10.00 works out to 475 mm, as per table 2 of IRC: 37-2001. However the total crust thickness may be kept as 525 with GSB as 200 mm in place of 150 mm considering the msa 16.62 for the design life period of 15 years. So the following recommendations are made for crust thickness:

New/Widening Portion

GSB	:	200 mm
WMM	:	250 mm
DBM	:	50 mm
SDBC	:	25 mm

3. **Present Traffic data based on Survey & Projection**

22. Classified traffic volume count was carried on the project road on 10th -11th August 2013. 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 2.2

Table-2.2 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	1727	1727	133	133
Motor Cycles	1921	1441	172	129
Auto rickshaw	405	486	37	44
Light Commercial Vehicles	143	200	11	15
Mini Buses	31	68	4	9
Standard Buses	256	563	29	64
Trucks	1147	4244	38	141
Multi Axle Truck	66	145	3	7
Agricultural Tractor	171	684	22	88
Cycles	374	150	37	15
Animal Driven carts	51	204	7	28
Cycle rickshaws	15	23	2	3
Total	**6307**	**9935**	**495**	**676**

Table-2.3 Projection for Traffic volume of Proposed Road

Peak Hour flow in August 2013	**:**	**676**
Peak Hour flow at the end of construction period	**:**	**630X(1+0.075)+46=724 PCU**
Peak Hour flow for 15 years design period	**:**	**630X(1+0.075)^15+46=1910 PCU**
Peak Hour flow for 5 years design period	**:**	**630X(1+0.075)^5+46=950 PCU**

b) **Drain work**

1. **Existing Drain Condition**

23. The surrounding of the Nagaur town is devoid of any vegetation and the gradient is steep/ resulting in heavy runoff. Most of the storm drains are in an appalling condition. Barring a few, all the drains have inadequate capacity but are heavily choked by silts, plastic bags, garbage, thus making it further inadequate. Silt and boulders coming down along with runoff have further aggravated the condition. In addition, drains are also found to be invariably carrying sewage and sullage flow in the absence of any sewerage system in city.

24. The city is divided into 6 zones. Zone-1 & 2 geographically shares the major part of the city. The storm flow is from the east side of the city towards the west side of the city. There are natural ponds in which storm water can be stored but due to higher altitudes around the ponds the water is not draining in it. Secondly the grown up building structures around it further reduces its catchments flow area. The topography of city is such that water moves out the city and falls in the outskirts of the western part of the city.

25. Zone-1 is fern shaped and geographically attached from fort area, Kabristan, Naya Basti, Gandhi chowk, Bhargava colony, Kasai mohalla, Neharu colony, Kareem nagar, Sharda puram colony, Marudhar colony, Karni colony, pratap sagar pond, Bakhat sagar, Ghosi nada, Hanuman chowk, Silawat mohalla, Harizan basiti, Naya Teliwara, Ghosi nada, Indra colony, Vyas colony, Mohamipura, Ginani, circuit house and Regar mohalla. There are two pumping station one at Dulai pond and other at near Govt. Sr. Secondary school. The water is then pumped to pratap sagar pond from where it falls at agriculture land near the Bikaner highway. Its catchments area is 749.66 hectare & length is 5.120 Km. The size of the drain is not adequate, as a result storm water flowing in the drains gets spreads in surrounding areas . Therefore the full discharge does not reach the main drain. Presently it carries the wastewater of peripheral colonies as well as the storm water. Most part of the drain is chocked with debris, silt & sullage.

26. In this project report Zone – I is covered and maor drain from Andhiya Pipal Khan to Saleo kankad is proposed.

2. Detail of Works for Proposed Portion of Drain

- Construction of drain from Andhiya Pipal Khan to Saleo Kankad to railway culvert. Length of proposed Pucca Drain is 2010 m.
- Section of proposed drain is 3.6 m width at bottom and 4.76m width at top and water depth is 1.45m
- 150 mm thick GSB road is proposed along the road up to final disposal point near railway culvert so that drain can be cleaned and maintained in future.

Figure 2.1: Widening & Strengthening of road from Bikaner to Jodhpur road by pass

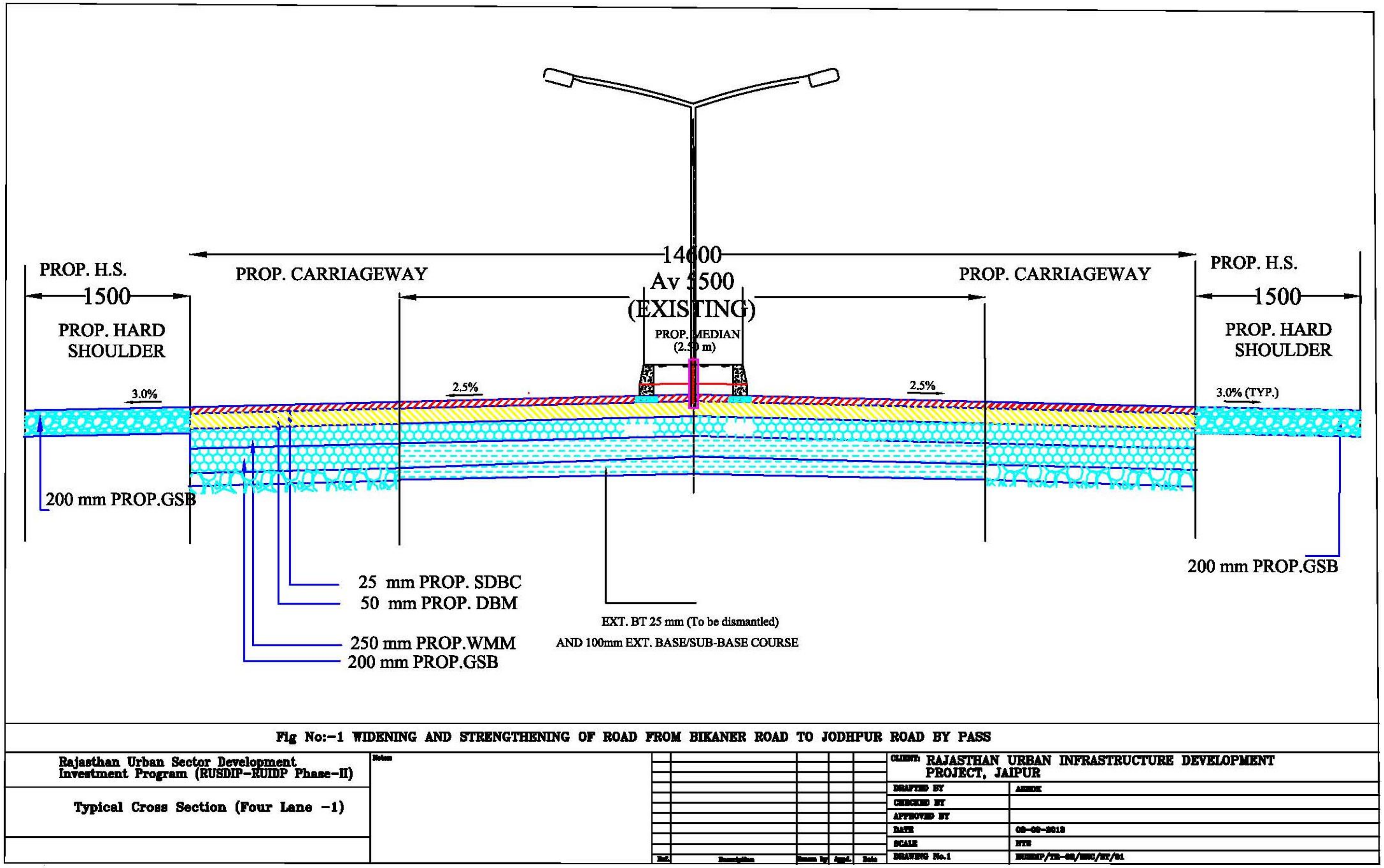


Figure 2.2: Widening & Strengthening of road from Bikaner to Jodhpur road by pass (Bikaner road to Krishi Mandi)

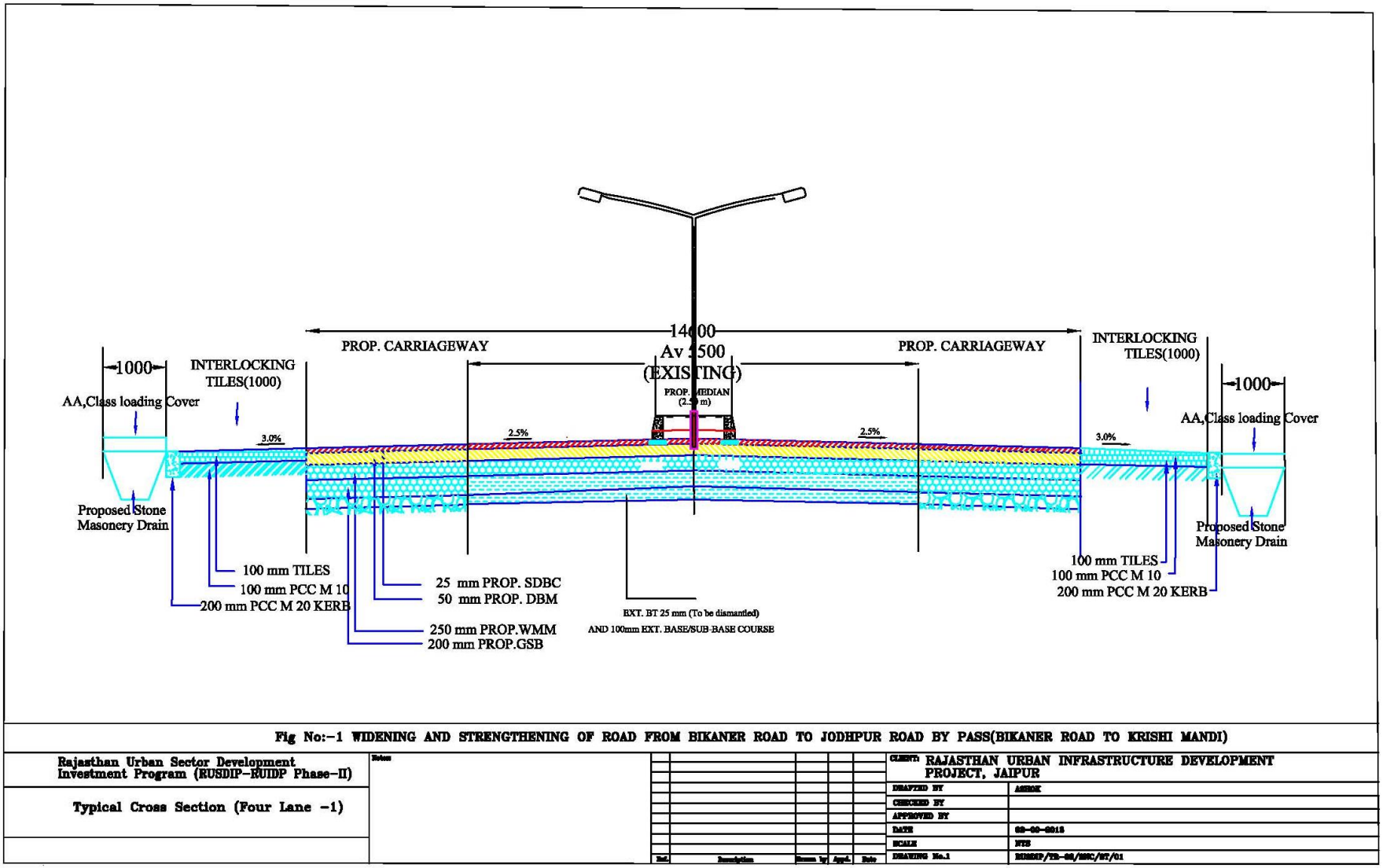


Figure 2.3: Alignment of Drain from Andhiya Pipal Khan to Saleo Kankad to Railway Culvert

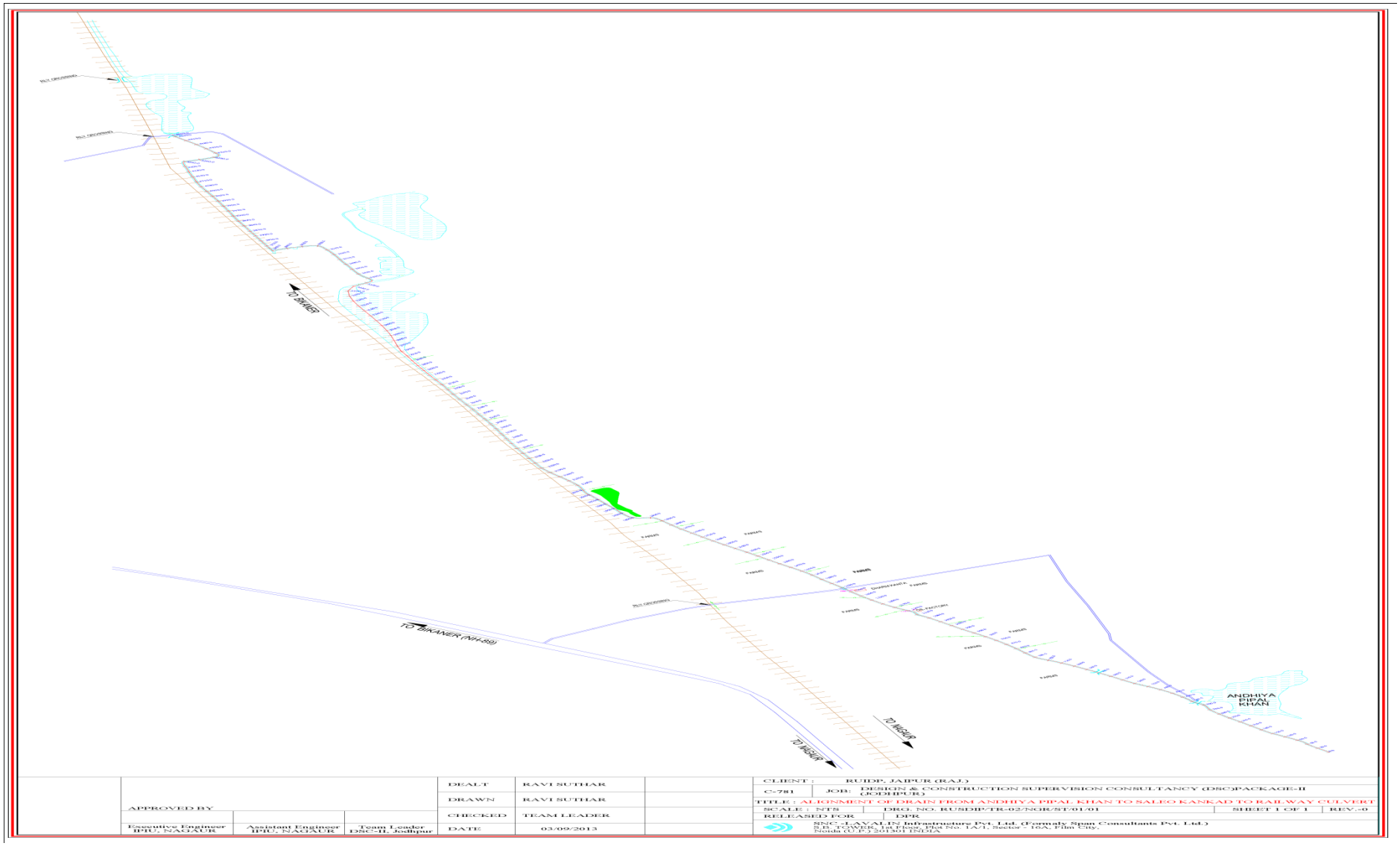
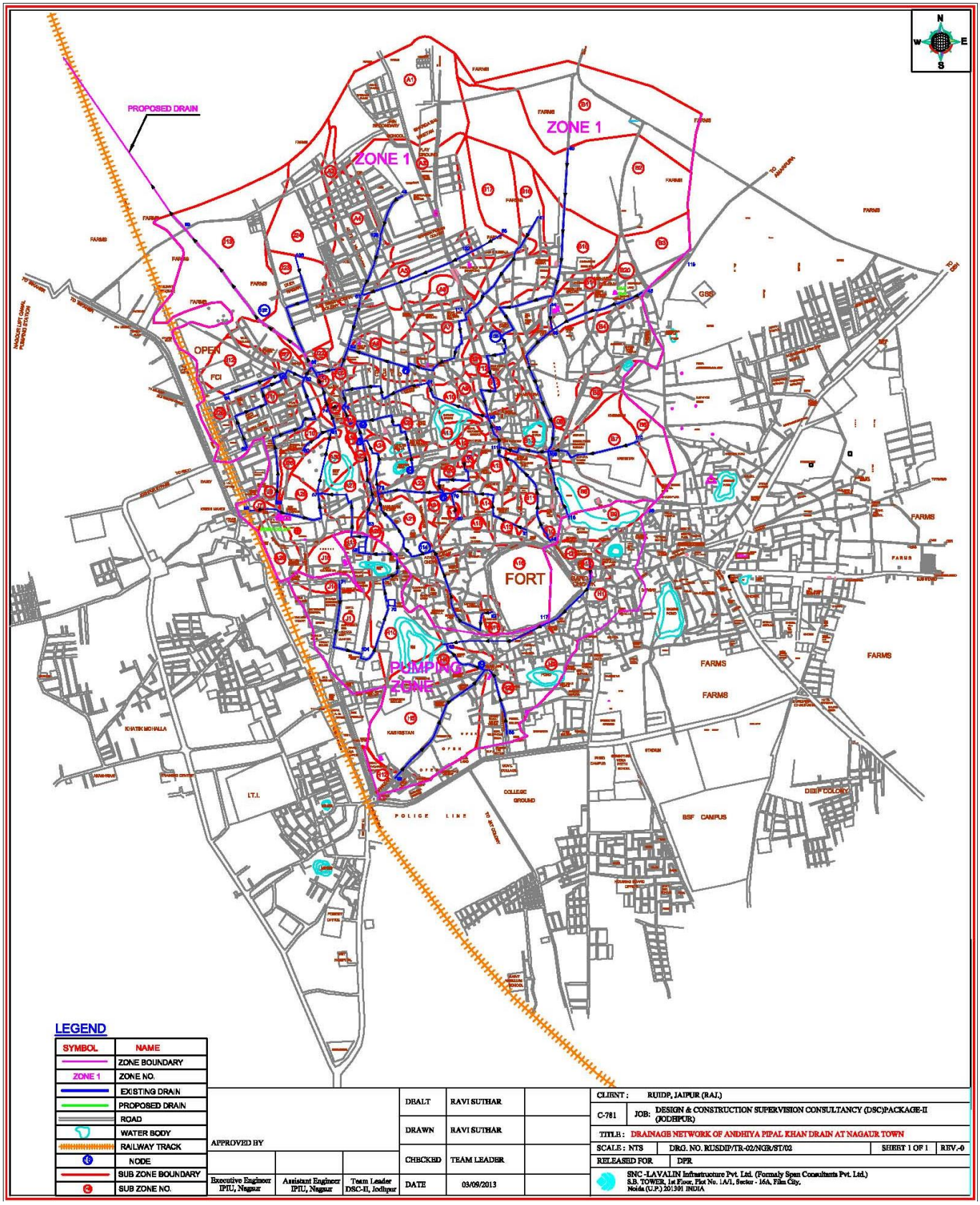


Figure 2.4 Drainage Network of Andhiya Pipal Khan Drain at Nagaur



III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1 Location

27. The Urban Agglomeration (UA) of Nagaur district is located about 300 km from Jaipur. It is surrounded by Jaipur, Ajmer, Jodhpur, Bikaner, Churu, and Sikar districts. The total area of the town is 37.81 sq km. Nagaur town is the administrative headquarter of the district. Its geographical spread is a good combine of plain, hills, sand mounds and as such it is a part of the great Indian Thar Desert.

28. For the purpose of administration, the district is divided into nine administrative sub- division, viz., Nagaur, Merta,Jayal, Degana, Deedwana, Ladnun, Makarana, Nawa and Parbatsar. There are ten tehsils under the sub-division[2] viz., Nagaur, Merta,Jayal, Degana, Deedwana, Ladnun, Makarana, Nawa, Parbatsar.and Khivansar.

29. The present district of Nagaur finds a place in the heart of the Rajasthan state. If we draw a cross over the map of Rajasthan the centre of this cross is bound to fall in the district of Nagaur. Before the merger of the states, Nagaur was a part of the erstwhile Jodhpur State. It is about 135 km from Jodhpur, 112 km from Bikaner and 300 km from Jaipur. The nearest Airport is at Jodhpur (137 km). District map of Nagaur is shown in **Figure 3.1.**

Figure 3.1: District Map of Nagaur

2 Topography, Natural hazard and Drought

30. Topography: Nagaur is the district headquarters. It is located at latitude (26º25' to 27º 40' and 23º3' to 30º12') north and longitude (73º18' to 75 º15' and 69º30' to 78º17') east, at a height of about 327m above the mean sea level.

31. Natural Hazards: Nagaur town lies in low damage risk zone II. The area is less prone to earthquakes as it is located on comparatively stable geological plains based on evaluation of the available earthquake zone information. **Figure 3.2** depicts the earthquake zones of Rajasthan. **Figure 3.3** shows natural hazard zones of the Nagaur district.

32. Drought: Low rainfall coupled with erratic behavior of the monsoon in the State makes Rajasthan the most vulnerable to drought. Based on discussions with PHED officials the water table in the town continuously decreases by 2 to 3 meter on an annual basis combined with significant drawdown conditions.

Figure 3.2: Earthquake zones of Rajasthan

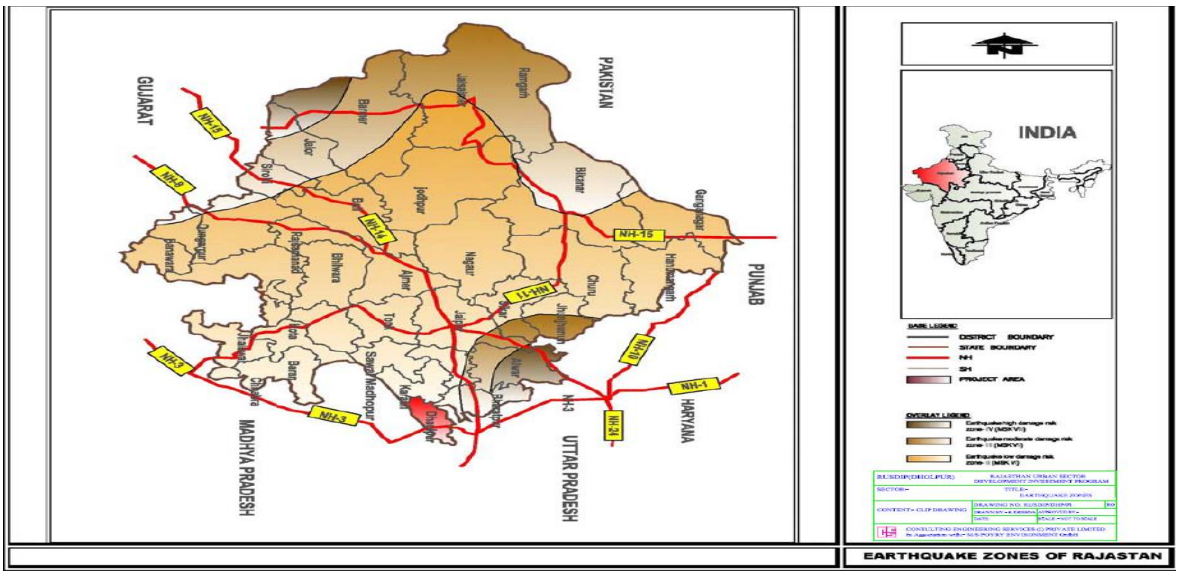
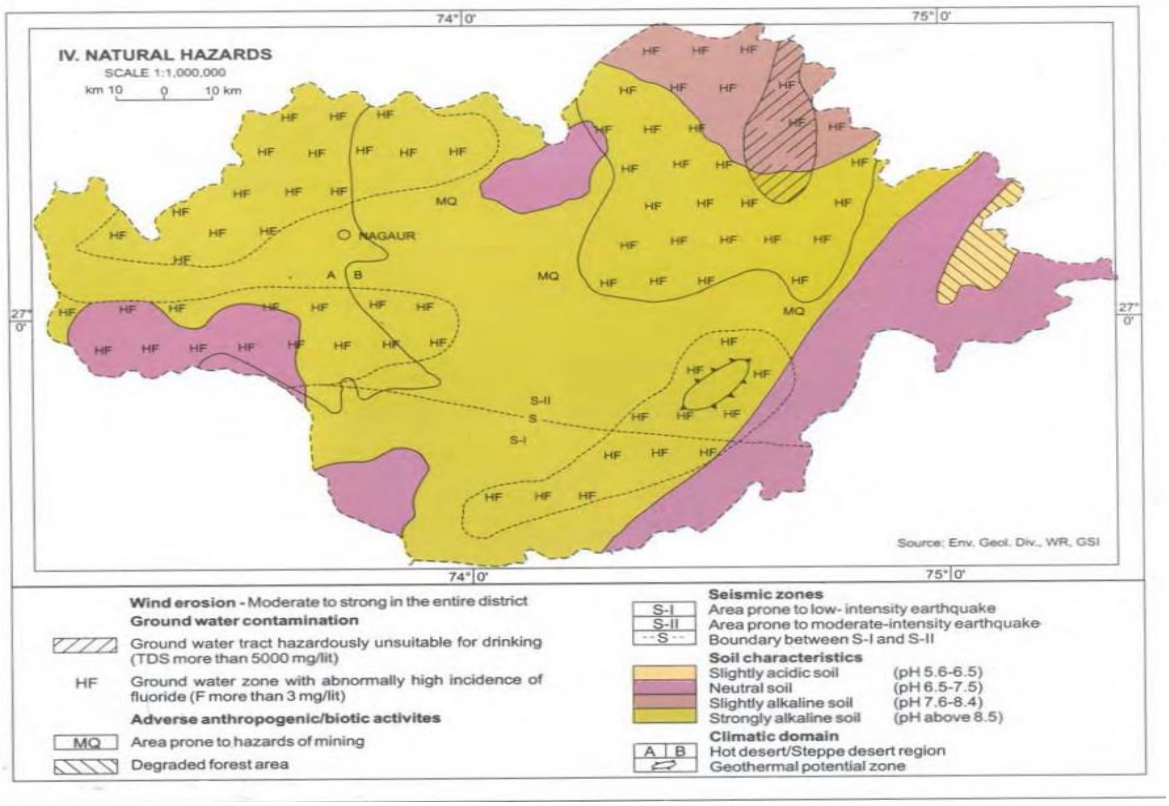


Figure 3.3: Natural Hazard map of Nagaur (GSI Resource map)



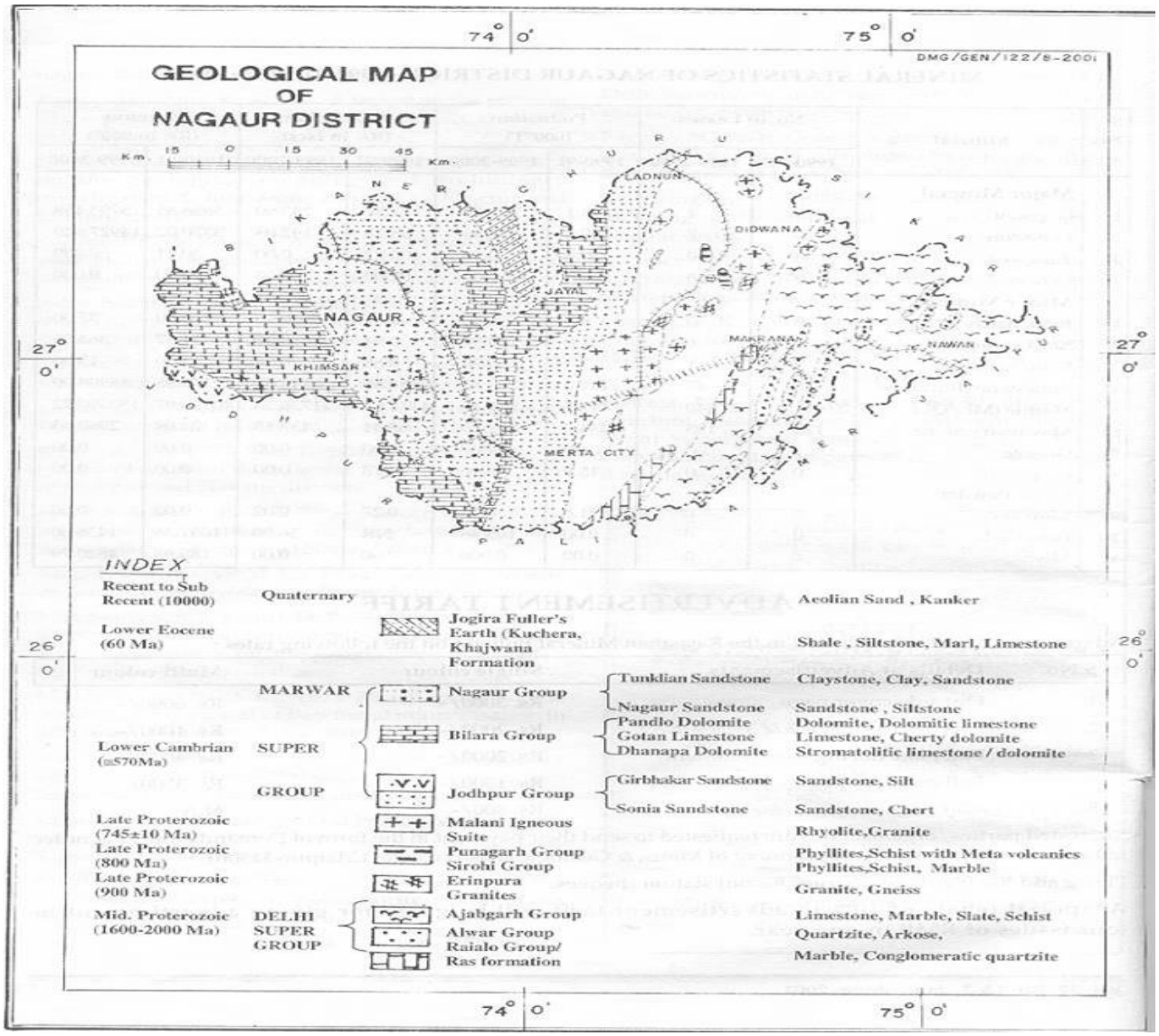
3 Geology, geomorphology, mineral resources and soil

33. The district forms a part of the Great Thar desert and is covered mainly by Aeolian sands masking the hard rocks. The various rock types of the district belong to the Delhi Super Group, the Erinpura Granite, the Malani igneous Suite and the Marwar Super Group and the palana formation. The rocks of the Alwar group are well exposed in the Eastern part of the district and comprise arkose, grit, and schist. The rocks of the Delhi Super Group have been intruded by the Sendra.

34. **Mineral Resources**: Thick gypseous beds of the district provide reserves of about 953 million tons from Dhankoria, Bhadwasi, and Nagaur deposits. Extensive deposits of China clay are found in Khajwana area. Lignite occurrences have been reported from around Merta Road Railway station.

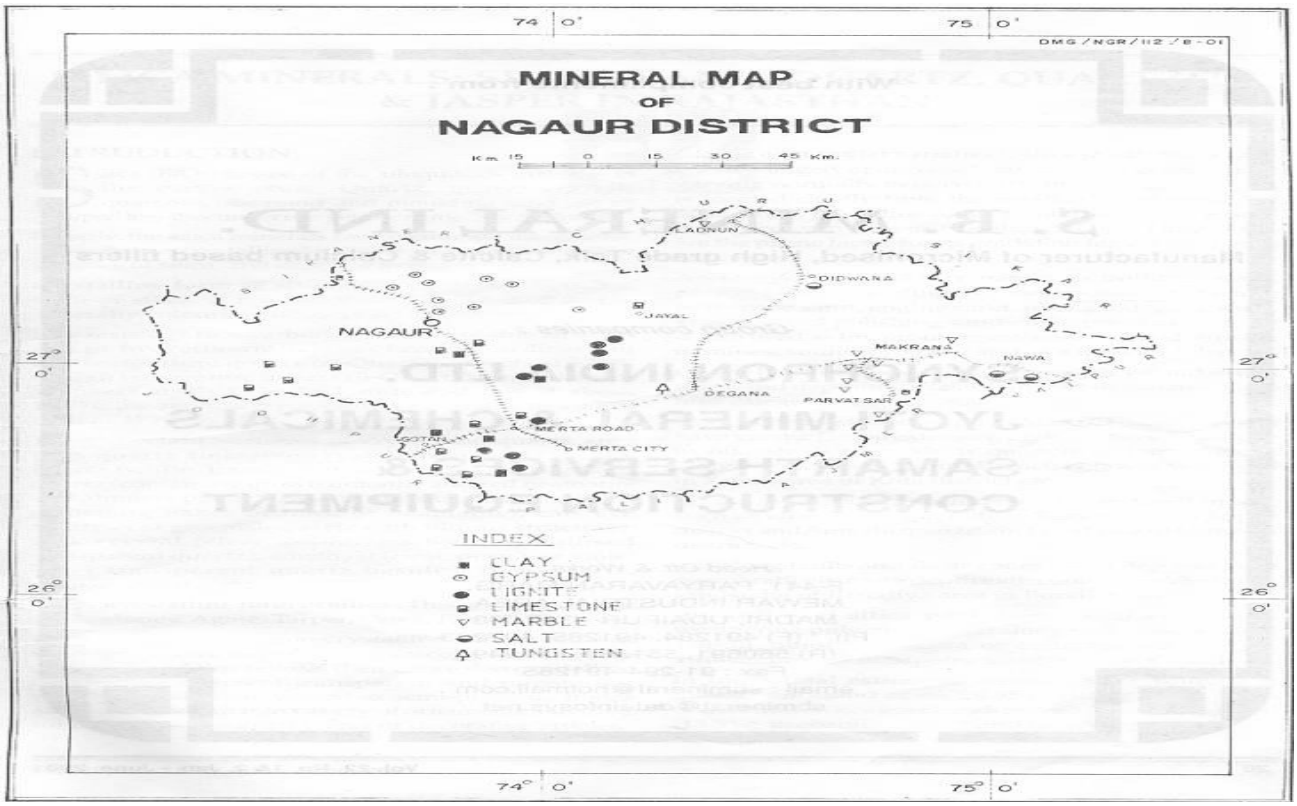
35. Geology map, mineral map and Geomorphological map of Nagaur district is shown in **Figure 3.4**, **Figure 3.5** and **Figure 3.6**.

Figure 3.4: Geology Map of Nagaur District



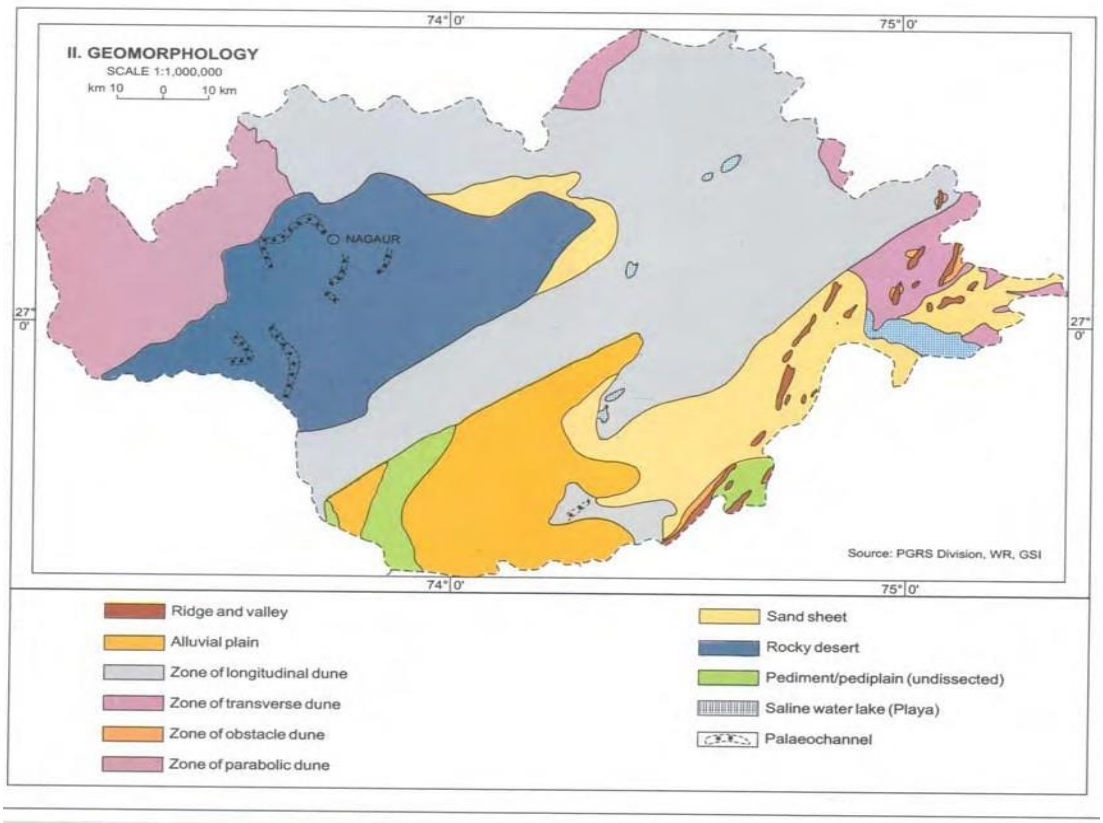
(Source: GSI Resource Map)

Figure 3.5: Mineral Map of Nagaur District



(Source: GSI Resource Map)

Figure 3.6: Geomorphology Map of Nagaur District



(Source: GSI Resource map)

36. Soil characteristics: Soil of the region falls within low rainfall zone of 300- 500 mm. Four types of soils have been reported in the district viz, clay, clay loam, sandy loam and sandy soil. The general texture of the soil in the area is sandy loam to clayey loam which is further classified into “Barani” or unirrigated and “Chahi” or irrigated soil. A part of Nagaur tehsils and south-eastern part of Merta tehsils has deep sandy loam, while red loamy soil exists elsewhere in the Merta tehsils except on the banks of river Luni, Light loamy soil occurs in Parbatsar tehsils away from hill ranges. A longitudinal belt from Didwana to Nawa extending up to Sambhar Lake has the characteristics of alkaline soil. Distribution of different types of soils is shown in the following **table 3.1**

Table 3.1: Distribution of Soil Types

S.No.	Soil type	Area (hec.)	Block
1	Clay	22840	Nagaur, Jayal, Merta, Riyan, Parbatsar
2	Clay Loam	134450	Nagaur, Kuchaman, Jayal, Riyan, Merta, Degana, Makrana, Ladnun, Parbatsar, Mundwa, Didwana
3	Sandy Loam	472905	Makrana, Ladnu, Parbatsar, Mundwa, Didwana, Nagaur, Kuchaman, Jayal, Riyan, Merta, Degana
4	Sandy	565705	Nagaur, Khuchaman, Jayal, Riyan, Merta, Degana, Makrana, Ladnun, Parbatsar, Didwana.

Source: CGWB Nagaur 2009

4. Climate

37. Nagaur has a dry climate with a hot summer. Sand storms are common in summer. The climate of the district is conspicuous by extreme dryness, large variations of temperature & highly variable rainfall. The mercury keeps on rising intensely from March till June. These are the hottest months. The maximum temperature recorded in district is 47^0C with 0^0C as the lowest recorded temperature. The average temperature of the district is 23.5^0 C. The winter season extends from mid November to till the beginning of March. Rainy season is of a short during from July to mid September. There are ten rain gauge stations, namely - Nagaur, Khinvsar, Didwana, Merta, Parbatsar, Makarana, Nawa, Jayal, Degana, and Ladnun in the district.

38. The rainfall over Nagaur 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. The average rainfall in the district is 36.16 cm. The average humidity is 52%.

39. Seasonal Rainfall data for the recent year (2004-2010) is shown in **Table 3.2**

Table 3.2: Rainfall at Nagaur in Recent Years (2004-2010)

S. No.	Months	Rainfall (mm)						
		2004	2005	2006	2007	2008	2009	2010
1	January	9.3	0	0	0	0	4	0
2	February	0	0	0	33.5	0	0	4.8
3	March	0	0	0	31.8	0	0	0
4	April	0	0	0	0	3	0	0
5	May	5	0	24.3	1	11.3	0	0
6	June	7.3	53.5	20.5	7	90	26.5	47.7
7	July	69.7	186	139.2	90.7	72.7	74.3	135.3
8	August	187.8	15.3	59.7	69.5	162.5	35.3	234.8
9	September	10.5	99.3	10.7	27	44	9	89.8

S. No.	Months	Rainfall (mm)						
		2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
10	October	11.7	0	9.8	0	0	0	0
11	November	0	0	0	0	0	0	17.3
12	December	0	0	0	0.5	0	0	0
13	**Annual**	**301.3**	**354.1**	**265.2**	**261**	**383.2**	**149.1**	**529.7**

(Source- IMD District-wise Rainfall data 2004-2010 Rajasthan)

5. Air Quality

40. Ambient Air Monitoring was done in year 2013, the results of that are shown in **Table 3.3**. Traffic is the only significant pollutant in Nagaur, so levels of oxides of sulphur and nitrogen are likely to be well within the National Ambient Air Quality Standards (NAAQS).

Table 3.3: Ambient Air Quality Monitoring Result of Nagaur

SL	Date of Monitoring	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.	**Sugan Singh Circle, Nagaur**					
1	15/02/2013	113.8	39.5	11.5	21.8	<1.15
2	16/02/2013	110.8	29.5	11.2	23.2	<1.15
	Average	**112.3**	**34.5**	**11.4**	**22.5**	<1.15
B.	**Vijay Ballabh Circle, Nagaur**					
1	17/02/2013	196.5	23.0	22.0	12.1	<1.15
2	18/02/2103	186.4	19.4	20.5	15.1	<1.15
	Average	**191.4**	**21.2**	**21.3**	**13.6**	<1.15
Permissible limits as per CPCB Notification, New Delhi, 18th November, 2009		**100**	**60**	**80**	**80**	**2**

Note: Sampling and Analysis done according to IS 5182(Pt- 2, 4, 5, 6, 10, 23)
BDL= Below Detection Limit, Detection Limit of CO = 0. 625 mg/m^3

6 Surface Water

41. No surface water resource in district has been reported except a few salt lakes. There is salt lake (Sambhar Lake) at south west of Didwana having an area of 777 hectare The Nawa tehsil also shares a part of well known Sambhar Lake in Jaipur district. There are eight (8) numbers of ponds in the district. Out of these 5 are in Degana and 3 in Parbatsar blocks. River Luni is a non-perennial river, it rises near Pushkar in Ajmer district and after passing over the western slopes of the Aravali, it crosses Nagaur district in the south and flows through it towards the west for nearly 37 km. before entering into Pali. There is no water quality monitoring station at Nagaur.

7 Geo-hydrology and Groundwater

42. There are number of National Hydrographic monitoring stations of Central Ground Water Board in and around Nagaur. Fluctuation of ground water level is shown in **Table 3.4** in most of the cases ground water table ranged between 20 to 60 m below ground level.

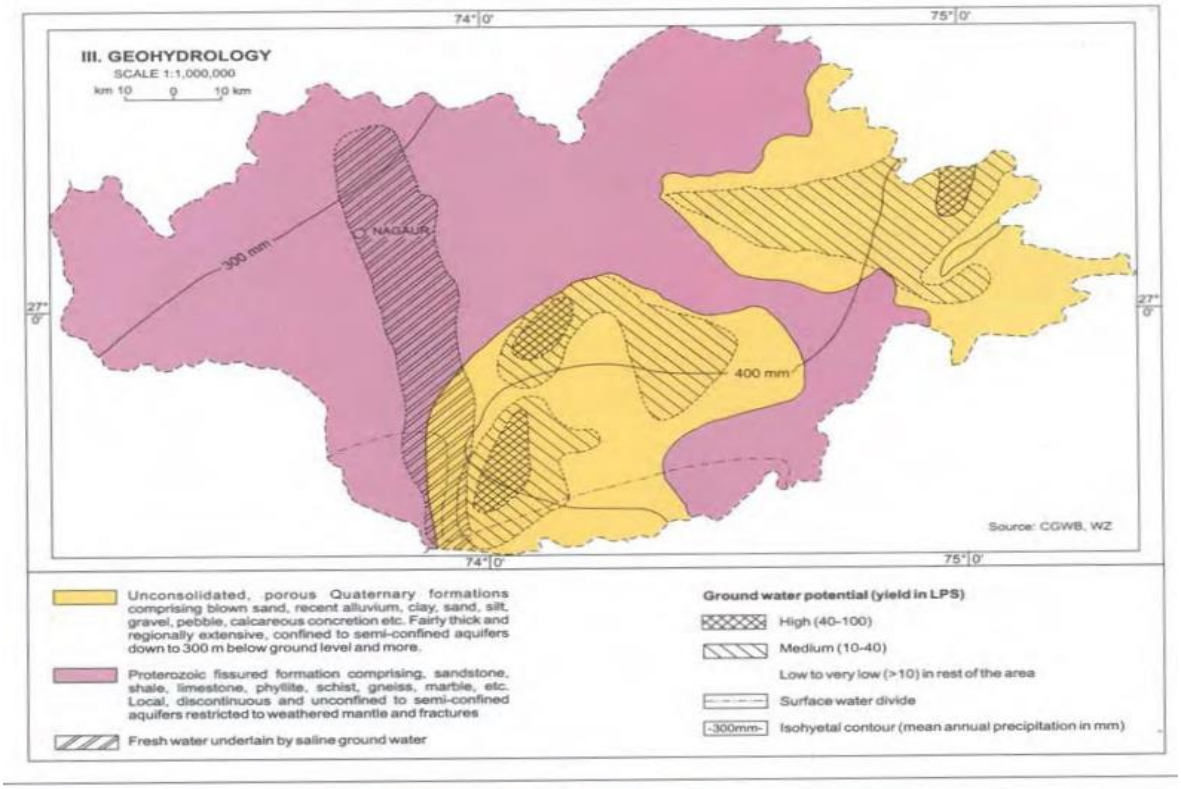
Table 3.4: Number and Percentage of National Hydrograph Network Station (Nagaur) with Water Fluctuation Range

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	27	5.37	63.5	0	0	0	0	2	7.41	4	14.81	19	70.37	2	7.41
Nov-05	28	5.27	62.25	0	0	0	0	3	10.34	3	10.34	21	72.41	2	6.9
Aug-05	29	5.44	62.25	0	0	0	0	3	10.34	3	10.34	21	72.41	2	6.9
May-05	35	6.02	61.96	0	0	0	0	2	5.714	4	11.43	27	77.14	2	5.71

Source: Central Ground Water Board, Nagaur (2009)

43. Geohydrological map of the district is shown in **Figure 3.7**

Figure 3.7: Geohydrological Map of Nagaur



(Source: GSI Resource Map)

44. Chemical quality of ground water in Nagaur district is generally brackish to saline with few pockets having fresh water with E.C. less than 2000 micro mhos/cm at 25°C. Then there are some areas suffering from high fluoride. The ground water quality is brackish to saline from east of Merta to Degana and from Didwana to Nagaur via Jayal block in the central, western, northwestern part of the district. In this big pocket E.C. of ground water is more than 3000 micro mhos/cm at 25°C. There are some pockets namely eastern part of Rian southern part of Degana,major part of Parbatsar, north and northeastern part of Kuchaman, western and northwestern part of the Merta block, major part of Mundawa, Kuchera-Khanwar-Gagawana area of Jayal block, south eastern part of Didwana , northern and south western part of Ladnun block, where the E.C. of ground water is within 3000 micro mhos/cm at 25°C. There are two salt lake area where ground water having E.C. more than 10000 micro mhos

45. Ground water in the alluvium is in general better in quality than that found in the sandstones of Nagaur and Palana series, and Meta sediments. The fluoride content of ground water in Nagaur district varies from less than 1 ppm to10 ppm. In a longitudinal belt extending from Manasar in Nagaur blocks to Indawar in Merta block the fluoride is more than 4 ppm. There is another big pocket in the south-eastern part of the district covering parts of Parbatsar, Makrana and Degana blocks where the fluoride is much over 4 ppm and the area is called Banka-patti (fluoride affected area).

- **Ground water quality in deeper aquifers**

46. The ground water quality is brackish to saline from east of Merta to Degana and from Didwana to Nagaur via Jayal block in the central part of the district. In this big pocket covering about 6000 km2 area the E.C. of ground water is more than 5000 µmhos/cm at 25°C. There are three pockets namely around Nimri in Ladnun block, around Gotan in Merta block and in a longitudinal belt in the eastern part of the district where the E.C. of ground water is within 2000 micro mhos/cm at 25°C.

47. Ground water in the alluvium is in general better in quality than that found in the sandstones of Nagaur and Palana series. Table 20 indicate that the ground water in quaternary alluvium has less than 1000 ppm T.D.S. (E.C. less than 2000 micro mhos/cm) only in the eastern part which in the widely spread area the range is between 1000-3000 ppm T.D.S. in the wells penetrating Tertiary sediments the salinity exceeds 3000 ppm. T.D.S.

48. The E.C. of ground water in the shallow aquifer of Nagaur and Palana sandstone varies from 900 to 6000 micro mhos/cm at 25°C. However the quality of water deteriorates with depth. At Merta city the borehole of 421.20 m deep, the ground water was with 28496 micro mhos/cm electrical conductance. The tube wells of the average depth of around 80 m tapping sandstones, the E.C. of ground water is around 2000 micro mhos/cm. The tube wells tapping phyllites, schists and gneisses, the quality of ground water is very poor.

49. The fluoride content in ground water of tube wells constructed at Kanwai (Didwana block), Roru and As Ki Dhani (Ladnun block) is more than 3 ppm. The production well at Luniawas (Morta block) and Gorera (Nagaur block) also yielded water with more than 3 ppm fluoride.

B. Ecological Resources

50. **Flora:** The flora of the district is not rich owing to its geographical situation and scanty rainfall. The south-eastern areas including a part of the northern tehsils of Ladnun and Didwana are much greener than the northwest region of district. Khejri trees are commonly found in the district. The leaves are used as fodder. It also gives gum. Apart from commercial value, this tree is considered holy. The tree also plays an important role in checking soil erosion. The other common species found in the district are babul, neem, shisham, peepal, rohira, kalsi, dhangood, akara and rohira trees provide timber & is used for making furniture. Dhangood is generally used for making cots. A common shrub-phog provides building material from its roots & twings. Common grass found in the district include bargers, bhambar etc.

51. **Fauna**: Wild Animals such as chinkaras and black bucks which are rarely seen in this area are protected species under the Rajasthan Wild Animals and Birds Protection Act (1951). Among the small game, only titars are found. Other fauna of the district consists of deer, hare, jackal, pig, wild cat and birds. The common birds fluttering in the district include bulbul, sugan chiri, and mor (peacocks).

52. The district of Nagaur is poor in forest resources. The total area under including hills is reported to be 240.92 sq km, which is 1.3 percent of total geographical area of the district. Scanty rainfall and other geographical constraints account for this. The western part of the district is divided of natural vegetation cover except for herb and grass which grows on low sand dunes. However, the south-eastern part of the district and part of the northern Tehsil of Ladnun and Deedwana have much greater greenery as compared to north-west part of the district.

53. Near project site there is no forest area exists. No endangered species of flora and fauna are noted near subproject.

C. Economic Development

54. In olden times, there were minor manufacturers having a market in the neighboring areas while for the rest of the trades there were hereditary artisans like carpenters, blacksmiths, potters, goldsmiths and other artisans to meet the local demands. Even after independence, Nagaur district has been practically industrially backward on account of the lack of exploitation of natural resources and under developed infrastructural facilities. Now the industrial climate is changing and a number of incentives and concessions are being offered to prospective entrepreneurs and they are looking forward to establish their units in the district.

55. The prosperity of Nagaur reached its zenith in 17th century when the atmosphere of peace and security prevailed and the caravans passed through. Consequently, the business of wool, silk, opium and spices flourished. The merchants moved away to the British India and onwards to Kolkata and other business centers in central India. They earned a lot of money using their unique business acumen and decided to raise the palatial houses for their families in Nagaur.

56. With the coming of railways, the area near railway station was developed and many public buildings were constructed. The development of the town got an impetus during post independence period, where a number of government offices, buildings, residential colonies, Mandi yard and RIICO industrial area were developed. Most of the developments have taken place in the south-west, west and north-west direction. In some of the areas in the east and north-east unplanned colonies have been developed in haphazard manner, even outside the Municipal limit. These developments have exerted enormous pressure over the town infrastructure and as a result a number of problems such as housing, slums, traffic congestion, and deficiency in municipal services have emerged.

57. Power Status of the Area: There is no power generation unit at Nagaur. The consumption of electricity by different sectors is shown in **Table - 3.6**

Table 3.6: Consumption of Electricity in Lakh Kwh (2012- 2013)

Month	DS	NDS	PSL	Ag. (M)	SIP	MIP	HT	MIP w/w	M. load	Total
April 12	20.34	8.15	2.47	0.09	3.52	2.44	3.74	0.23	2.97	43.99
May 12	19.30	7.15	2.34	0.36	3.42	2.61	3.26	0.23	1.91	40.60
June 12	20.90	5.92	2.43	0.08	3.77	2.73	3.43	0.21	2.12	41.63
July 12	20.80	9.14	2.34	0.28	3.42	2.48	3.33	0.18	2.08	44.10
Aug. 12	19.16	6.39	2.35	0.11	3.92	2.55	2.05	0.18	2.11	38.88
Sep. 12	21.64	8.55	2.33	0.35	3.71	2.23	2.42	0.15	2.11	43.54
Oct. 12	20.33	9.55	2.30	0.04	3.69	2.24	2.70	0.14	1.90	42.95
Nov. 12	20.24	8.01	2.21	0.21	3.52	2.47	3.51	0.14	1.73	42.15

Month	DS	NDS	PSL	Ag. (M)	SIP	MIP	HT	MIP w/w	M. load	Total
Dec. 12	16.03	6.60	2.30	0.05	3.54	2.22	4.19	0.11	0.62	34.70
Jan. 13	15.26	9.10	2.33	0.29	2.89	2.76	5.16	0.11	0.71	42.65
Feb. 13	17.55	6.51	2.41	0.11	3.23	2.93	4.03	0.11	0.82	37.73
March 13	18.34	7.69	2.33	0.42	3.83	2.97	4.81	0.11	0.60	41.12

Source: Ajmer Vidyut Vitran Nigam Limited (AVVNL), Nagaur

58. **Work Force: -** As per 2011 Census, the total work force was estimated at 14.26 lakh (43.10 per cent of the total population) consisting of 8.57 lakh male and 5.68 lakh female workers. The marginal workers were 4.40 lakh (1.61 lakh males and 2.79 lakh females). About 70 per cent of the work force was engaged in agriculture and allied activities.

59. **Occupational Structure: -** It has been emerged the census data that the most of the population of the district is engaged in agriculture-allied activities in which women participation was seen at a large extent in comparison to male population but in other occupations like households industries and other workers category they are less in number as is evident from the **Table. 3.7**

Table 3.7: Occupational Structure, 2011

Sl. No.	Workers Participation	Percentage	
		Male	Female
1	Cultivator Laborers	54.4	62.5
2	Agriculture Laborers	14.4	24.6
3	Household Industries	2.4	1.6
4	Others Workers	39.0	11.3
5	Non-worker	58.9	73.1

Source: Census of India and estimates

1. Land use

60. The Land use in the year 2008-2009 in the district is given in the Table: 3.8 and in Figure 3.8

Figure 3.8: Land use of Nagaur District

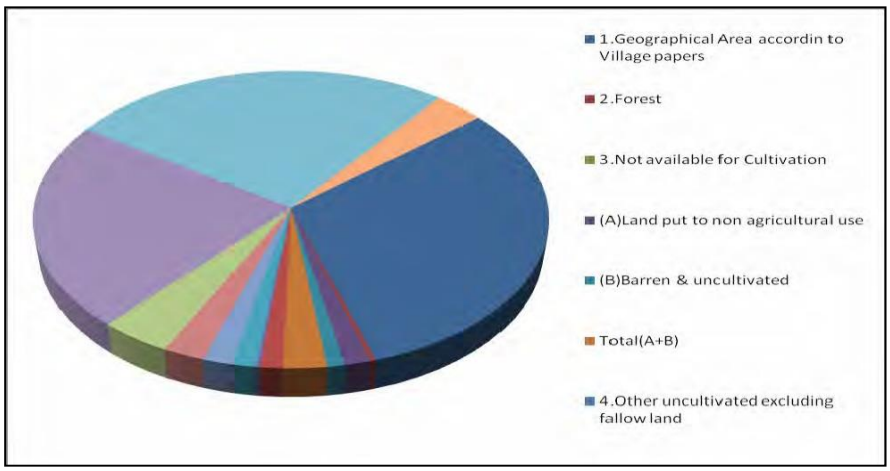


Table 3.8: Land use pattern in Nagaur District

No.	Description	Area (Hect.)	Percentage to Total Area
1	Forest	18271	1.04
2	Land put to non Agriculture use	86791	4.92
3	Barren and Uncultivated land	58582	3.32
4	Other uncultivated land excluding fallow land	72854	4.13
5	Cultivable waste	14353	0.81
6	Fallow land	259361	14.70
7	Net area sown	1254256	71.08
.	Total :-	1764468	
8	Double Crop Area	228999	12.98

Source: CGWB Nagaur 2009

61. 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. Industries in Nagaur District

62. **Industrial Prospects in Nagaur District: -** The Nagaur town is famous for its cottage and house hold industries. There are about 812 registered industrial units in the town which in all, employ about 2820 workers. Only a few medium and small scale units like Plaster of Paris, Hand tools, Metal works and leather industries have been established on the western side of railway line and along Basni road where recently RIICO have developed and organised Industrial area. There is no large scale industry in the town. Small units of dying and printing, Cement work, auto parts etc. have come up along major roads of the town. Most of the famous hand tools making house hold industries are located within the commercial areas north east of the fort. The Multani Luharo, who migrated to the town from Multan now in Pakisthan are mostly manufacturing the axe, evils, swords, knives, scissors and other iron hand tools.

63. **Large & medium scale industries: -** There are seven large and medium scale industries existing in the district. Out of seven four are in Makrana and all are in the field of marble processing. One cement industry exists in Gotan, one chemical industry of large scale category exists in Didwana and one unit in Degana among small scale industries. The major units are food based, agriculture based etc.

Table 3.9 Industries in Nagaur

S.No	Name of the Unit	Product Name
1	J.K. White Cement Works, Gotan	White Cement
2	Maheshwari Marble & Granites India Ltd. Bidiyad	Marble Slabs
3	Saboo Sodium Chlorides Ltd. Govindi-Marwar	Refined Iodised Salt
4	Sarvottam Industries Ltd. Merta Road	Edible Oil & Cakes
5	Nihon Nirman Ltd. Gotan	White Cement

Source: DIC Nagaur

64. **Small Scale Industry**: **-** Inspired by the incentives of the Government, the growth of small scale industries in the district is fast. The total industrial units, registered in the District Industries Centre upto March, 2000 were 12, 849. The major units covered by this sector are mainly food based industries, agriculture based industries etc. Some of these units are old &

traditional industries while there has been coming up in recent years either as demand or resources based industries.

65. **Mineral Resources: -** Town is located in the Central part of the Rajasthan and it falls in the desert track known as Thar. The district has large deposites of gypsum, which is mostly found near Nagaur Bahdwari, G of Mangla Dhakoria, Bahdana etc. Marble is other important deposit of Nagaur district. Makrana marbles are famous world over. Nagaur has also good quality of lime stone deposits near Gotan, Mundwa, Katholi and Amliah. It is being used for production of white cement. In addition to the above, district have rich salt and sand stone deposits.

66. Nagaur district is industrially backward because of poor infrastructure facilities and underutilization of natural resources. However, in the recent past, the district has come up with small-scale units like gypsum and limestone, masonry stone and marble stone industries. A detailed production breakup is summarized in the Table. 3.10

Table 3.10: Mineral Industries in Nagaur

SN	Mineral	Production (Tones) 1999-2000
1	Gypsum	227070
2	Lime Stone	36900
3	Masonry Stone	162562
4	Marble Stone	48580
5	Marble Block	458300

Source: Rajasthan Government

3. Agriculture

67. Bajara, Wheat, Jowar, Til, Guawar, Moong, Moth, Barley & Pulses are the major crops of the Nagaur District. The other crops of the district are taramira, rape mustard & gram. Kharif crops constitute the bulk of the food production in the district since the agricultural activities are mostly dependent on Monsoons. Kharif crops include bajara, jowar, moong, choula, rice, groundnut, til & guar. Rabi crops are usually sown in November whereas Kharif crops are sown with the beginning of the first rains in July

Table 3.11: Crop Production in and around Nagaur District

SN	Crops	Area & Production of major Crops	
		Area (Hect.)	Production (MT)
1	Bajara	461800	216400
2	Jowar	53800	18900
3	Pulses	426000	109600
4	Til	10800	1800
5	Ground-nut	18270	18770
6	Cotton	9200	9700
7	Guar	155800	42000
8	Wheat	76384	169047
9	Barley	11918	25687
10	Gram	17454	31233
11	Mustard etc.	98538	131133
12	Methi	4249	4986
13	Others	39883	28567
14	Zeera	12424	2959
15	Taramira	5708	3084

4. Infrastructure

68. Water supply: Nagaur Water Supply is presently depending on abstraction of ground water from well fields some of which are 30 to 40km away from Nagaur. The well fields are located at Runni, Indakali, Khazwana, Janana and Phagli.

69. The water supply scheme is run and maintained by 45 no. of tube well of size 8" – 10". , It is also important to note here that even a single tube well with safe & adequate quantity of water is not available within and around the town of Nagaur, hence, for drinking water for the entire population of the town is fully dependent on external sources, almost located at villages of Janana, Khajwana, Indokali & Khen of Tehsil Mundwa at a distance of 32 Km. from the Nagaur. Ground water reserve in this region is moderate to poor. Ground water stored in crevices, faults and fractures in underlying rocky formations can be abstracted adopting Down the Hole Drilling Technique deploying Combination Rigs. Yield from ground tube wells seldom exceeds 12000 lph. Static water level varies from 80 m to 130 m and yearly 5-6 level is further lowered down. Water bearing strata is at 200 – 230 m depth.

70. As per guidelines given in the manual of CPHEEO, Govt. of India and Circular-3 for guidelines for water supply sector for the works to be taken up under RUIDP, the rate of water supply may be adopted as 135 lpcd with addition of 20% losses (this includes losses for transmission system if very long @ 2% (max) and 3% for treatment plant may be taken where applicable and 15% distribution losses).

71. For augmentation of water supply of Nagaur town RUIDP is executing a package of water supply (RUSDIP / TR – 02 / NGR / WS – 01). After commissioning of this project Nagaur town will get the water supply from Indira Gandhi Canal. Under this package 8 ESRs at various locations of Nagaur and one CWR with pumping station is proposed at Kankariya School, Nagaur. Pumping main of different dia is also proposed to feed ESRs. New water supply distribution lines are proposed along with new metered house service connections.

72. **Sewerage System:** At present there is no Sewerage system in the town. Drainage system for storm water has also not yet been planned properly. In the town, some pucca drains are there. But these are also not sufficient for carriage of sullage & storm water. The waste from most of the part of the town is disposed into depressed area which has been taken the form of pond. However, in last few years' some works as development of infrastructure specially in drainage has been carried in the town, but still they overflows during heavy rainfall in rainy season.

73. Presently very few houses or Govt. institutions have their own onsite disposal system comprising of septic tanks or soak pits for disposal of their own sewage. Planned collection & carriage system for sewage and subsequent treatment and disposal does not exist

74. At present there are two packages are under execution by RUIDP for sewerage network at Nagaur town. One contract package RUSDIP//TR-02/NGR/WW-02/Lot – 02 is under execution. Under this package construction of 8 MLD Sewage Treatment Plant is proposed for safe disposal of sewage. Waste stabilization treatment process is proposed to treat sewage. One intermediate sewage pumping station of 3 MLD is also proposed to construct in this package. Second project is RUSDIP//TR-02/NGR/WW-03 under which sewerage trunk main and approximately 10 km laterals are proposed to be lay.

75. **Sanitation:** Only 70 % of the households reportedly has septic tanks and soaks well for 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 resulting in open defecation.

76. **Drainage:** Almost all the areas of the town totally lack in drainage and sewerage system. Waste water gets accumulated in streets creating unhygienic conditions, which is ultimately soaked in the sub soil. In some of the areas there are pucca drains but part of this waste water is carried to various tanks creating un-hygienic conditions.

77. **Industrial Effluents.** : Industries exist in Nagaur, which is outside the town area and effluent disposed scattered in local nallahs. As reported by the local MC, the responsibility of effluent disposal is under Industry'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.

78. **Solid Waste:** Municipal Board's jurisdiction is spread over an area of 37.81 sq km. 52 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

79. **Waste Collection-** The MSW generated in the Nagaur town (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. The MSW generated is transported to garbage dumping site. The MB has engaged one loader and three tractors and four private tractors for collecting and transporting the solid waste material. The waste material is lifted by loaders and put on trolley for transportation to disposal site. Roads in Nagaur town are very narrow, which is the main hindrance to carry solid waste material through tractors. It is very necessary to develop infrastructure i.e. adequate equipment like wheelbarrows, dumper placer, containers, dumper placers, machines, and storage devices for collection, transportation and disposal. There are 3 waste dumping sites, 3 nos. transfer station in operation. Transfer stations are located on an average 2 km from the disposal site.

80. **Irrigation Canals:** Canals have been constructed through almost all the dry valleys, making the lands around them very productive. The important canal systems are the Ganga canal system, the Bhakra canal system, the west Yamuna canal system, and the Indira Gandhi canal system. Nagaur will tap water supply from the Indira Gandhi Canal. Indira Gandhi Nahar Project (IGNP) is one of the most gigantic projects in the world aiming to desertify and transform desert waste land into agriculturally productive area. The project objectives include drought proofing, providing drinking water, improvement of environment, afforestation, employment, rehabilitation, development and projection of animal wealth and increasing agricultural produce. The project construction commenced in the year 1958. Though the project is only partially complete it has shown remarkable success.

81. Indira Gandhi Nahar Project was designed to utilize 9,367 Mm3/yr of the total 10,608 Mm3/yr allocated to Rajasthan from the surplus waters of the Ravi and Beas rivers – Which is applicable to Nagaur.

5. Transportation

82. **Table 3.12** provides a breakdown of road surface composition in Physical growth of the town has resulted in a corresponding increase in vehicular traffic greater than that of the town's population growth due to improving economic status of the town.

Table 3.12: Road Surface Composition

Surface Type	Total (km)
Concrete	30
Bituminous	108
WBM	18

Source: PWD Nagaur

83. Overall road network of the district is given in **Table 3.13**

Table 3.13: Road Network of Nagaur District

S. No.	Category of Road	Length in Kms.
1	National Highway (N.H. No. 65 & 89)	321.00
2	B.T. Road	6100.00
3	Metal Road	105.00
4	Gravel Road	452.00
5	Kuchcha Road	99.00
	Total	**7077.00**

D. Social and Cultural Resources

84. **Demography: -**As per provisional reports of Census India, population of Nagaur in 2011 is 100,618; of which male and female are 52,220 and 48,398 respectively. Although Nagaur city has population of 100,618; its urban / metropolitan population is 108,540 of which 56,310 are males and 52,230 are females.

Table 3.14 Population Growth Trends of Nagaur Town

S. No.	Year	Population	% Growth
1	1901	15657	
2	1911	16038	02.43
3	1921	16932	05.57
4	1931	21965	29.72
5	1941	28269	28.70
6	1951	40047	41.66
7	1961	41,727	04.20
8	1971	52,505	28.83
9	1981	61,811	17.72
10	1991	82,464	33.41
11	2001	1,01,874	23.54
12	2011	1,02,699	00.81

Table 1.15 Demographic features of Nagaur Town, 2011

Description	Qty.
Total Population	1,00,618

Description	Qty.
Urban Population	108,540
Sex Ratio (Females per 1000 Male)	927
Literacy Rate (%)	73.05
Female Literacy Rate (%)	82.06

85. **Growth Rate: -** The decennial growth of the city since 1901 has exhibited a continuous increase trend up to the year 1951 i.e. from 2.43% to 41.66%. The rate of growth was highest during 1941-1951 i.e. 41.66%. In the next decade i.e. 1951-1961 there was a sudden reversal in the trend when it fell only to 4.20%. The lower growth rate during recent years could be attributed to lack of employment opportunities, together without migration of businessmen to the metropolitan cities of the country.

Table 3.16 Ward wise Population of Nagaur Town, 2011

Ward No.	Population	Ward No.	Population
1	2,961	23	1,114
2	4,387	24	1,937
3	2,301	25	1,992
4	1,632	26	2,050
5	2,224	27	2,575
6	3,904	28	3,970
7	2,086	29	2,607
8	1,613	30	2,191
9	1,566	31	2,035
10	1,964	32	3,875
11	2,602	33	1,919
12	3,298	34	2,372
13	3,536	35	3,465
14	2,490	36	2,293
15	2,604	37	1,482
16	2,063	38	2,865
17	2,641	39	2,889
18	2,559	40	2,891
19	2,014	41	1,151
20	1,943	42	1,194
21	3,235	**Total**	**1,02,699**
22	2,140		

Source: Census of India, 2011

86. **Health and Educational facilities**: There are good educational facilities in Nagaur district, which serve both townspeople and inhabitants of surrounding villages and towns in the hinterland. There are 2733 primary schools, 252 secondary and higher secondary schools, plus 6 general degree colleges, 4 professional colleges including industrial training institutes (ITI). Table 3.17 shows education facility in the district.

Table 3.17: Educational facility of Nagaur District

Institutions	Numbers
Colleges	5
Professional colleges	4
Higher Secondary and Secondary Schools	252
Primary and middle schools	2733

(Source: Official website of Nagaur District)

87. There is 1 district hospital, 1 TB hospital and 1 leprosy hospital in the Nagaur town. **Table 3.18** and **Table 3.19** shows detail of medical facility of Nagaur town and entire district respectively.

Table 3.18: Medical facility at Nagaur urban area

SN	Facilities	Number
1	Hospital	1
2	TB Hospital	1
3	Mother and Child Care Centre	1
4	Leprosy Hospital.	1
5	**Total**	**4**

Source: Official website of district

Table 3.19: Medical facility at Nagaur district

Description	Nos.
Hospitals / Dispensaries	11
Primary Health Centers	96
Sub Health Centers	605
Beds	1458
Community Health Centers	17
Block Primary Health Centers	11
Medical Relief Society	105
Ayurvedic Hospitals / Dispensaries	154
Homeopathic Hospitals	3
Yunani Hospitals	4
Allopethic Hospitals	2

Source: Official website of district

88. **History, Culture and Tourism**: Nagaur has moderate tourist inflows with main attractions being Nagaur Fort, Tarkeen Dargah, Jain Temple in Glass, Saiji Ka Tanka, Khinvasar fort, Dadhimati temple, Meera Bai Temple. – include more information from http://www.nagaur.nic.in/ because we need to establish that although there are many historical, cultural and tourist palaces in Nagaur, these places will not be impacted.

IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES: LOCATION AND DESIGN

89. 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.

90. 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. For example, if a groundwater aquifer was depleted by excessive abstraction this would be an impact of both the location and design, because groundwater may not be depleted if the design had used surface water to augment the supply, and the specific aquifer would not have been depleted if the well field was located elsewhere.

91. However in the case, it is being considered that there are no impacts that can say to result from either the design or location of this subproject. 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 localized 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;

V. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: INFRASTRUCTURE CONSTRUCTION

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

92. From the descriptions given in Section II.C, 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.

93. 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 5.1,** with an explanation of the reasoning in each case.

Table 5.1: 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	There is no wildlife or rare or endangered species in the town or on the government owned areas outside the town on which
Coastal resources	Nagaur is not located in a coastal area
Population and communities	Construction will not affect population numbers, location or composition But after finalization of alignment the actual impact

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

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

B. Infrastructure Construction

1. Construction method

96. 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.

97. The new drains will be random rubble masonry channels with hard stone in foundation and plinth including levelling up with cement concrete to increase the velocity of water in the drain which will consequently increase the water carrying capacity.

98. Trenches for each drain will be dug by a backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed nearby. To attain better flow conditions inside the drains, plastering of the random rubble masonry walls will be done.

Loose soil will then be shovelled in to fill any space remaining between the wall and the edge of the trench.

99. 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. These two elements of the project will produce similar effects on the environment, so their impacts are considered together.

2. Physical Resources

100. 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 15-30 days for each road. However these physical environmental impacts are generic construction-related impacts associated with (i) road construction and (ii) removal and relocation of utility lines. These impacts are not expected to be significant and permanent, and can be managed through adoption of good engineering practices and undertaking specific mitigation measures.

101. Sources of Materials: Significant amount of gravel, sand, and cement will be required for this subproject. The construction contractor will be required to:

(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 PMU; and
(iv) Submit to DSC on a monthly basis documentation of sources of materials

102. Air Quality: Emissions from construction vehicles, equipment, and machinery used for excavation and road construction will induce impacts on the air quality in the construction sites as well on the road users (pedestrians and vehicles). Anticipated impacts include dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulphur oxides, particulate matter, nitrous oxides, and hydrocarbons) but temporary and during construction activities only. To mitigate the impacts, construction contractors will be required to:

(i) Consult with IPIU/DSC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
(i) Excavate the required ground at the same time as the other roads are built so that dug material is used immediately, avoiding the need to stockpile on site;
(ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
(iii) Use tarpaulins to cover sand and other loose material when transported by trucks; and
(iv) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly and ensure that only those vehicles having PUC should be permitted to work on site.

103. Surface Water Quality: There is no surface water body (pond or lakes) in Nagaur town. The rainfall in Nagaur town is scanty and for a short period over four month i.e. from June to September. Consequently there is very limited probability of surface water contamination. Construction activities may result mobilization of settled silt materials, run-off

from stockpiled materials, and chemical contamination from fuels and lubricants during construction works, which may contaminate downstream surface water quality of nearby drains/nallahs and ponds of the outskirt of the town. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, construction contractor will be required to:

(ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;

(iii) Prioritize re-use of excess soils and materials in the construction works. If soils will be disposed, consult with IPIU/DSC on designated disposal areas;

(iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;

(v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;

(vi) Dispose any wastes generated by construction activities in designated sites;

104. Noise Levels: There are no paleontological or architectural sites near the construction sites. The sensitive receptors are the adjacent settlements, health facilities, road users and general public. Increase in noise level may be caused by earth-moving and excavation equipment, and the transportation of equipment, materials, and people. Impact is negative, short-term, and reversible by mitigation measures. The construction contractor will be required to:

(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.

105. Existing Infrastructure and Facilities: Telephone lines, electric poles and wires, water and sewer lines within the existing road ROW will be removed/shifted thus there is anticipated disruption of service during construction. Excavation could however damage existing infrastructure located alongside roads, in particular water supply pipes. It is therefore important that construction contractors will be required to:

(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

106. Flora and Fauna: There are no protected areas in or within the subproject sites. Few trees and shrubs are the vegetation noted in the area, which may be affected due to construction activities. 20 Neem trees (girth size 30 to 100 cm) may be affected in this widening project. Land-clearing activities and presence of workers in the sites can damage or cause loss of existing flora. Potential impacts are negative but reversible by mitigation measures. The construction contractors will be required to:

(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 Board or District Collector;

(iii) Earth-ball trees and transplant to pre-identified areas;

(iv) Require to plant three native trees for every one that is removed; and

(v) Prohibit employees from cutting of trees for firewood.

107. Landscape and Aesthetics: The construction activities will produce solid wastes as well as excess construction materials. Such waste could include removed concrete, wood, trees and plants, packaging material, empty containers, spoiled soil, sludge, oils, lubricants, paints, chemicals, worn-out spares, remnants of construction materials, and other similar items. These impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(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.

108. Transportation – Accessibility: Hauling of construction materials and operation of equipment on-site can cause traffic problems and conflicts in ROW. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

(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 Rajsamand Municipal Traffic Office for temporary road diversions and for provision of traffic aids if transportation 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.

109. Socio-Economic: Manpower will be required during the whole period of construction stage. This can result to generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to:

(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) Procure construction materials from local market.

110. Occupational Health and Safety: Workers need to be mindful of the occupational hazards which can arise from working in infrastructures like roads and roads. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

(i) Develop and implement site-specific Health and Safety (H&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&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&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 night or walking through heavy equipment operating areas;

(x) Ensure moving equipment is outfitted with audible back-up alarms;

(xi) Mark and 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.

111. Community Health and Safety: Hazards posed to the public; specifically in high-pedestrian areas (such as the busy road) may include traffic accidents and vehicle collision with pedestrians. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(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.

112. Work Camps: Operation of work camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and

lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(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) Train employees in the storage and handling of materials which can potentially cause soil contamination;
(v) Recover used oil and lubricants and reuse or remove from the site;
(vi) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
(vii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and
(viii) Request IPIU/DSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

113. Social and Cultural Resources: For this subproject, excavation will occur in and around existing road ROWs, so it could be that there is a low risk of such impacts. Nevertheless, the construction contractor will be required to:

(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 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.

114. Two of the subproject roads are having inhabitations, markets, religious places and public utilities, so action should be taken to minimise disturbance as far as possible. The contractor will require:

(i) 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;
(ii) Involving the community in planning the work programme so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times;
(iii) Avoiding conducting noise-generating activities at night;
(iv) Implementing the measures described in EMP to reduce dust;
(v) 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.

115. There is invariably a safety risk when substantial construction such as this 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:

(i) Excluding the public from the site;

(ii) Ensuring that all workers are provided with and use appropriate Personal Protective Equipment;
(iii) Health and Safety Training for all site personnel;
(iv) Documented procedures to be followed for all site activities;
(v) Accident reports and records; Etc.

3. Ecological Resources

116. 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

117. Although much of this work will be conducted within the ROW of the existing roads, there may be a need to acquire some land at the periphery of the site and for the construction of temporary access roads. This will be obtained through the legal mechanism of the Land Acquisition Act (1894) through which the government purchases the land compulsorily from the owners at a rate that is established on the basis of recent transactions. 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. This establishes that no more than 10% of the total land of any owner or occupant should be acquired, and that 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 (e.g. shop premises) that have to be removed.

118. 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.

119. 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.

120. 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 Nagaur (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

121. Rajasthan is an area with a rich and varied cultural heritage that includes many forts and palaces from the Rajputs 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 the following protocol:

(i) IPIU/DSC or any authorized person with archaeological field training to observe excavation;
(ii) Stop work immediately within an area of 25m if any suspicious archaeologically important material is found during construction activities
(iii) The discovered site or area shall be demarcated
(iv) Inform IPIU/DSC if a find is suspected, and take any action they require ensuring its removal or protection in situ.
(v) The contractor shall secure the site to prevent any damage or loss to the material until the responsible local authorities take over
(vi) Notify the supervising engineer who in turn will notify the responsible local authorities immediately (within 24 hrs or less)
(vii) Responsible local authorities are in charge of protecting and preserving the site before deciding on subsequent appropriate procedures.
(viii) Decisions on how to handle the finding shall be taken by the responsible local authorities. This could include changes in the layout.
(ix) Construction work could resume only after permission is granted from the responsible local authorities

122. There are no modern-day social and cultural resources (such as schools and hospitals) near the site except one temple (Sheetla mata temple). The boundary wall of the temple may be impacted. There is no risk of other impacts on such community assets.

123. 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 minimize disturbance as far as possible. This will require:

- 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;
- Involving the community in planning the work programme so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times;
- Avoiding conducting noise-generating activities at night;
- Utilizing 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.

124. 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:

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

125. During construction of road work 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.

126. 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.

VI. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: OPERATION AND MAINTENANCE

A. Operation and maintenance of new infrastructure

127. The widened road will have a design life of 10-15 years, during which time 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.

B. Environmental impacts and benefits of the operating road

1. Physical Resources

128. Once the new road 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 low 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. There are no significant ecological resources in or around the town, so any repairs or Maintenance work can be conducted without ecological impacts. As there is no significant flora and fauna in or around project site, there should also not be any ecological impacts from the increase in abstraction.

3. Economic Development

133. The widened roads 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

VII. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

A. Summary of environmental impacts and mitigation measures

138. **Table 7.1 to 7.3** lists the potential adverse impacts of the Nagaur road subproject as identified and discussed in Sections IV, V and VI, and the mitigation proposed to reduce these impacts to acceptable levels. The table also shows how the mitigation will be implemented, who will be responsible, and where and when the mitigation activities will take place. The mitigation programme is shown as the quarter of each year in which each activity will occur, which relates to the project programme described in Section II.B.

B. Institutional arrangements for project implementation

139. 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.

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

Figure 7.1: Institutional Responsibly- RUSDIP

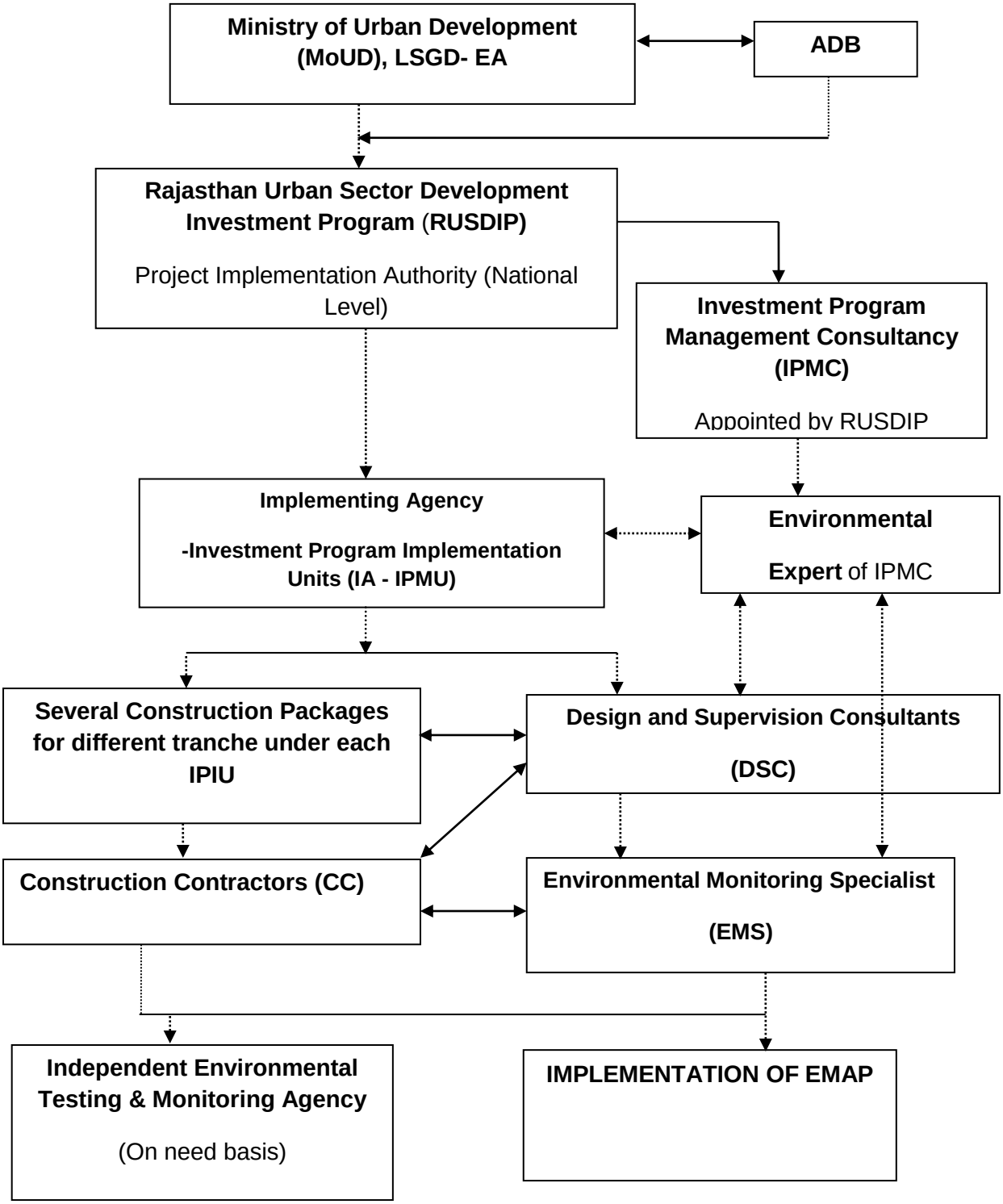


Table:-7.1 Anticipated Impacts and Mitigation Measures – Pre-construction Environmental Mitigation Plan

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.	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	IPIU and DSC	Chance Finds Protocol

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		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 recognised and measures are taken to ensure they are protected and conserved.		
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	(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	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.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	water logging, and water pollution.	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.		

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
Air Quality	Emissions from construction vehicles, equipment, and machinery used for excavation and construction resulting to dusts and increase in	(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	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 (PM 10 & PM 2.5) (iv) vehicular

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons)	weather; (iii) Carry out air quality monitoring; (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.		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; and (vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP).	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) records of surface water quality inspection; (iv) effectiveness of water management measures; (v) for inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.
Noise Levels	Increase in noise level due to earth-moving and excavation equipment,	(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	Construction Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	and the transportation of equipment, materials, and people	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.		sound barriers; (iii) equivalent day and night time levels
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	Construction Contractor	(i) tree-cutting permit for affected trees; (ii) number of replanted trees

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		areas; (iv) Require to plant three native trees for every one that is removed; and (v) Prohibit employees from cutting of trees for firewood.		
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	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
		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 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.		
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	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

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		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 Health and Safety 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 provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for		water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of Health and Safety 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
		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 dB (A) 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;	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

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(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.		
Social and Cultural Resources	risk of archaeological chance finds	(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 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	Construction Contractor	(i) records of chance finds

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		protection in situ.		

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	Road & Highway Department	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	Road & Highway Department	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.	Municipal Corporation of Nagaur	% 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	(i) Inventory of trees; (ii) Tree-cutting permit;	checking of records	(i) Inventory of trees prepared; (ii) Tree-cutting permit obtained from Municipal	once	IPMU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
		the town Investment Project Implementation Unit (IPIU)	(iii) Location and number of trees replaced for every one tree cut		Council or District Collector; (iii) Location identified and number of trees estimated		
Utilities		Design and Supervision Consultants (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	Design and Supervision Consultants (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	not applicable	IPIU and DSC to determine locations prior to award of	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage	checking of records	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal	once	IPMU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
areas, and disposal areas.		construction contracts.	areas, and disposal areas.		areas provided to construction contractors prior to commencement of works.		
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	Design and Supervision Consultants (DSC)	Establish baseline values of Particulate Matter (PM10 & PM2.5), as Sulphur Dioxide (SO2), Nitrous Oxides (NOx), Carbon Monoxide (CO)	Air sample collection and analyses by in-house laboratory or or 3rd party laboratory accredited by NABL and MoEF	National Ambient Air Quality Standards (NAAQS)	Once prior to start of construction	IPMU
Baseline Environmental	Subproject	Design and Supervision	Establish baseline values of suspended	Water sample	Water Quality Standards (IS-	Once prior to start of	IPMU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Condition - Water Quality	sites	Consultants (DSC)	solids (i) (TSS, TDS), (iii) pH (iv) biological oxygen demand (BOD), (v) fecal coliform	collection and analyses by in-house laboratory or 3rd party laboratory accredited by NABL and MoEF,	3025 and CPCB Guideline)	construction	

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	Design and Supervision Consultants (DSC)
Air Quality	construction sites and areas designated for stockpiling of materials	Construction Contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices	(i) checking of records; (ii) visual inspection of sites	(i) stockpiles on designated areas only; (ii) complaints from sensitive receptors satisfactorily	monthly for checking records	Design and Supervision Consultants (DSC)

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			(iii) ambient air for Particulate matter PM_{10} and $PM_{2.5}$. (iv) vehicular emissions such as sulphur dioxide (SO_2), nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons (HC)		addressed; (iii) air pollution control devices working properly; (iv) National Ambient Quality Standards for ambient air quality; (iv) IS:-5182 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) records of surface water quality inspection; (iv) effectiveness of water management measures; (v) for inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.	visual inspection	(i) designated areas only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and silt from construction activities (iv) Indian Standards for Water Discharges to Inland Waters and Land for Irrigation	monthly	Design and Supervision Consultants (DSC)
Noise Levels	(i) construction sites;	Construction Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-	(i) checking of records;	(i) complaints from sensitive receptors satisfactorily addressed; and (ii) silencers	Monthly	Design and Supervision Consultants

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	(ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps		producing equipment and sound barriers; (iii) equivalent day and night time levels	(ii) visual inspection	in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary		(DSC)
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	Design and Supervision Consultants (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	Design and Supervision Consultants (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	Design and Supervision Consultants (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	Design and Supervision Consultants (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	Design and Supervision Consultants (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	(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	Quarterly	Design and Supervision Consultants (DSC)

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			exposed to hazardous or noxious substances; (vii) record of Health and Safety 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.		alarms		
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 satisfactorily addressed	Quarterly	Design and Supervision Consultants (DSC)
Work Camps	work camps	Construction Contractor	(i) complaints from sensitive receptors; (ii) water and sanitation	visual inspection	(i) designated areas only; (ii) complaints from sensitive	Quarterly	Design and Supervision Consultants

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			facilities for employees; and (iii) IPIU/DSC report in writing that the camp has been vacated and restored to pre-project conditions		receptors satisfactorily addressed		(DSC)
Social and Cultural Resources	construction sites	Construction Contractor	records of chance finds	checking of records	Implementation of Chance Finds Protocol	as needed	Design and Supervision Consultants (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	MC	complaints from sensitive receptors	checking of records	complaints from sensitive receptors satisfactorily addressed	as needed	MC
Accessibility	subproject sites	MC	complaints from sensitive receptors	checking of records	complaints from sensitive receptors satisfactorily addressed	as needed	MC
Ecological Resources	subproject sites	MC	% survival of planted trees	checking of records	at least 80% survival rate	quarterly	MC

141. 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.

142. 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 (see below) to ensure that mitigation measures are provided and protect the environment as intended. Environmental Consultants 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.

C. Environmental Monitoring Plan

143. Tables above shows that most mitigation activities are the responsibility of the Construction Contractors[1] (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.

144. 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[2].

145. Tables above 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.

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[1] During implementation the contractor will submit monthly progress reports, which includes a section on EMP implementation to the IPIU. The IPIU will submit reports to the IPMU for review. The IPMU will review progress reports to ensure that the all mitigation measures are properly implemented. The IPMU will consolidate monthly reports and submit quarterly reports to ADB for review

[2] 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 etc)

146. Tables above shows the proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies the various monitoring activities to be conducted during all phases. Some of the measures shown in Tables above have been consolidated to avoid repetition, and there has been some re-ordering to present together those measures that relate to the same activity or site. The EMP describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv)frequency of monitoring and (v) responsibility (for both mitigation and monitoring). It does not show specific parameters to be measured because as indicated above, most measures will be checked by simple observation, by checking of records, or by interviews with residents or workers.

D. Environmental Management and Monitoring Costs

147. 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 acquiring land and compensating businesses for loss of income during the construction period (Tables above) are calculated separately in the budgets for the Resettlement Framework and Resettlement Plans so are also excluded from this analysis.

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 7.7**. The figures show that the total cost of environmental management and monitoring for this subproject as a whole (covering design and construction) is INR 1.35 million.

Table 7.7 Estimated Environmental management and monitoring costs (INR)

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	150,000[3]	450,000		DSC
Survey and monitoring expenses - air and noise quality	Lump Sum	300,000	300,000	7,50,000	Contractor
2. Improvement of aesthetics along the road including plantation	Lump Sum	600,000	600,000	600,000	Contractor
TOTAL				**13,50,000**	

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

VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project stakeholders

148. 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 network improvements will be provided and near sites where facilities will be built.
- Owners and users of any land that is acquired along the transmission main route;
- 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.

149. **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

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

- 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 etc.

151. Local populations are very much interested on the project and they will help project authorities in all aspects. But mitigation measures will be required at project sites to minimize the impact on environment.

152. 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.

153. 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.

154. The public Consultation and group discussion meeting were conduct by RUIDP on Date 08 October 2013. 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 Nagaur, the environmental and social impacts of the proposed subprojects under Tranche 3 in Nagaur were discussed.

155. 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 Nagaur; and discussed the Government and ADB's Environment policies acts and potential environment impacts of the sub-projects in Nagaur. 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. Details of this Public consultation / Group Discussion are enclosed in **Annexure-III**.

156. **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.

C. Future consultation and disclosure

157. 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:

158. 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.

159. Consultation during construction:

- Public meetings with affected communities to discuss and plan work programs 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;

160. 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;

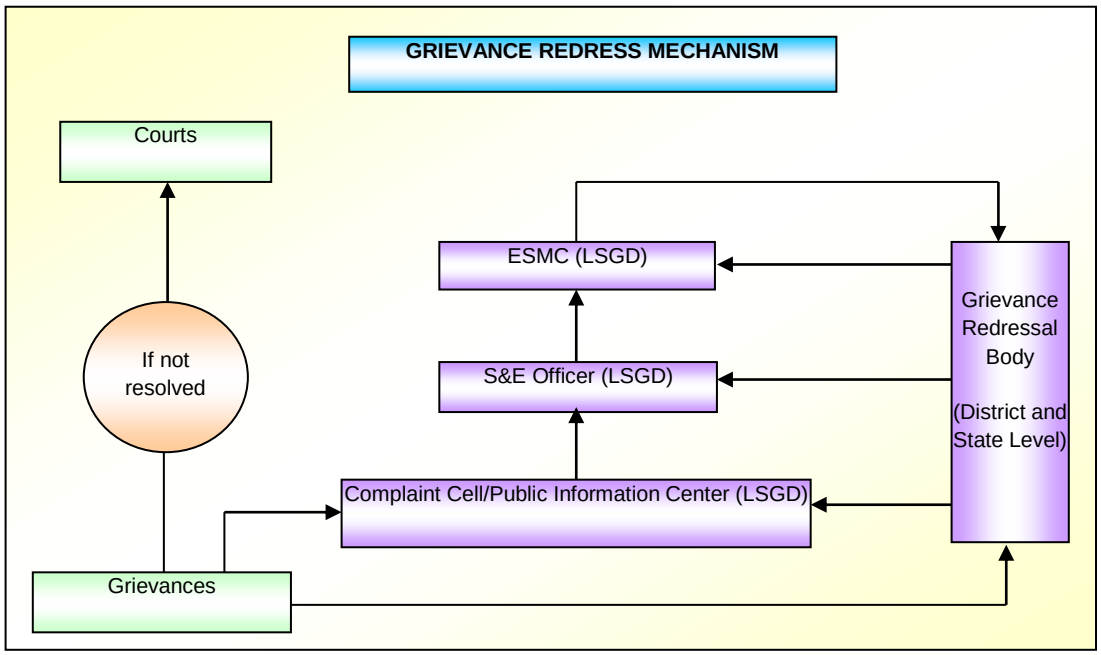
- Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and providing a mechanism through which comments can be made.

D. Grievance Redress Mechanism

161. 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.

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

Figure 8.1: Grievance redress mechanism – RUSDIP,



Environment and Social Management Committee (ESMC)

IX. 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 Sikar Urban Transport and Roads 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. There could also be a need to acquire a small amount of land at the periphery of the site, which includes a thin strip inside the boundary of some establishments. Such impacts are also

frequently encountered and are dealt with by a combination of the legal process and additional measures required by ADB policy on Involuntary Resettlement. Actions are discussed in a separate Resettlement Plan and Resettlement Framework, and include:

- Acquisition of land through the GoI Land Acquisition Act, through which the market value is paid, based on an analysis of recent transactions;
- Ensuring that no more than 10% of the land of a single owner or occupant is acquired;
- Providing additional compensation for loss of business and income-generating assets.

170. 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.

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 summarized 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 work 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 reduced.

175. **Table 7.1 to 7.3** also assesses the effectiveness of each mitigation measure in reducing each impact to an acceptable level. This is shown as the level of significance of the residual impact (remaining after the mitigation is applied). This shows that all impacts will be rendered at

least neutral (successfully mitigated), and that certain measures will produce a benefit (in addition to the major benefits provided by the operating schemes).

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,

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

X. CONCLUSIONS

178. The environmental status of the proposed improvements in road project in Nagaur 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

SITE PHOTOGRAPHS

Start Point of Proposed Road

End Point of proposed Road

Near Rotari Choraha

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: Nagaur Road Subproject

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**		√	Heritage sites are located in and around the town, but away from the subproject site
▪ **PROTECTED AREA**		√	No protected area nearby the subproject
▪ **WETLAND**		√	No designated water body nearby the subproject site
▪ **MANGROVE**		√	No sea coast nearby the subproject site
▪ **ESTUARINE**		√	No sea coast nearby the subproject site
▪ **BUFFER ZONE OF PROTECTED AREA**		√	No protected area nearby the subproject

Screening Questions	Yes	No	Remarks
▪ **SPECIAL AREA FOR PROTECTING BIODIVERSITY**		√	No special area of protected land of significant biodiversity located nearby
B. POTENTIAL ENVIRONMENTAL IMPACTS **WILL THE PROJECT CAUSE…**			
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	√		The boundary wall of Sheetla Mata temple may be impacted; all preventive measures will be taken care off
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?		√	There is no encroachment on precious ecology.
▪ 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 no surface water resources exist in the vicinity of our project area
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		√	There is no surface water resources exist in the vicinity of our 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?		√	EMP will be follow up strictly
▪ noise and vibration due to blasting and other civil works?			No blasting work will be involved
▪ dislocation or involuntary resettlement of people?	√		Some venders are there along the proposed project area, they are to be shifted to another location for some time and will be compensated for the period as per SRP
▪ dislocation and compulsory resettlement of people living in right-of-way?		√	No need of compulsory resettlement
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		√	No such impact

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?		√	No such impact anticipated, in reality the surrounding environment will be improve after completion of the work
▪ 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
▪ 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?		√	The nature of work does not require extraordinary skilled labour to be called from outside. Local labor 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?		√	During construction period contractor will take all precaution to avoid any accidental spill as per Environmental Management Plan
▪ increased noise and air pollution resulting from traffic volume?	√		Air and noise pollution may be there due to operation of construction machinery for very short period but 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
▪ social conflicts if workers from other regions or countries are hired?		√	Local labor will be employed
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		√	Local labor will be employed
▪ 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?		√	No such impact

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.		√	No such impact. EMP will be follow up strictly

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)		√	Nagaur town lies in low damage risk zone II
▪ 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)?		√	

Note: Hazards are potentially damaging physical events.

Annexure- III

Public Consultation- Environment

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: - **08.10.2013, 04:50 PM**

Location: - **Hotel Baba Ramdev and Pawan Bhojnalaya, near Jodhpur road, NAGAUR**

Public Consultation in Hotel Baba

Public Consultation in Pawan Bhojnalaya

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 sheetla mata Temple and temple boundary nearby the proposed project. Because project alignment is along the existing road no impact expected	
5	Un favorable climatic condition	Nagaur is dry area with very high temperature during summer creating unfavorable 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	
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 sewerage line project is under progress.
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 water supply 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, Nagaur is establishing a SWM plant, Proposed Project 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	Perception of villagers on tree felling and a forestation	People are against the tree felling	20 trees affected in this widening road project now 3 trees will plant at cost of one tree.
12	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.

13	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.
14	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.
15	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	
16	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

S. No.	Name	Designation
1	Rahul Kumar	Driver
2	Bhagwati Prashad	Farmer
3	Mohd. Waseem	Driver
4	Mohd. Haneef	Student
5	Rajkumar	Student
6	Harsh Kumar Singh	Student
7	Ram Saroop	Labour
8	Shaitan Chandra	Vendor
9	Bhanwar Lal	Labour
10	Akhil kumar	Serviceman
11	Mukesh Kumar	Student

Summary of out come

Some locals are aware of the project. The Nagaur town is heavily developed with industries & infrastructure facilities so population of this town is increasing; 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.

Annexure- IV

Sample Outline Traffic Management Plan

A. Principles for TMP

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

(i) the safety of pedestrians, bicyclists, and motorists travelling through the
(ii) construction zone;
(iii) protection of work crews from hazards associated with moving traffic;
(iv) mitigation of the adverse impact on road capacity and delays to the road users;
(v) maintenance of access to adjoining properties; and
(vi) addressing issues that may delay the project.

B. Operating Policies for TMP

2. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

(i) Make traffic safety and temporary traffic control an integral and high-priority element of project from planning through design, construction, and maintenance.
(ii) Inhibit traffic movement as little as possible.
(iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
(iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
(v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
(vi) Train all persons that select, place, and maintain temporary traffic control devices.
(vii) Keep the public well informed.
(viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

C. Analyze the impact due to street closure

3. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) approval from the ULB/Public Works Department (PWD) to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, PWD, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;

(iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
(iv) determining if additional traffic control or temporary improvements are needed along the detour route; considering how access will be provided to the worksite;
(v) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
(vi) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

4. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the Detour Street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

D. Public awareness and notifications

5. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices ward level meetings and city level meeting with the elected representatives.

7. The PIU will also conduct an awareness campaign to educate the public about the following issues:
(i) traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
(ii) defensive driving behaviour along the work zones; and
(iii) reduced speeds enforced at the work zones and traffic diversions.

8. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centres. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

(i) explain why the brochure was prepared, along with a brief description of the project;
(ii) advise the public to expect the unexpected;

(iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
(iv) educate the public about the safe road user behaviour to emulate at the work zones;
(v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and indicate the office hours of relevant offices.

E. Install traffic control devices at the work zones and traffic diversion routes

10. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- Warning Lights

11. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. All the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

12. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

13. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flagggers/personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

14. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.