

Environmental Assessment Document

Initial Environmental Examination: Nagaur Sewerage and Sanitation Subproject
Project Number: 40031
September 2008

India: Rajasthan Urban Sector Development Investment Program

Prepared by Local Self Government Department

For the Government of Rajasthan
Rajasthan Urban Infrastructure Development Project

The initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

ABBREVIATION

ADB	Asian Development Bank
CWR	Clear Water Reservoir
DSC	Design and Supervision Consultancy
EA	Executing Agency
EAC	Expert Appraisal Committee
FI	Financial Intermediary
GLSR	Ground Level Service Reservoir
GoI	Government of India
GoR	Government of Rajasthan
GSI	Geological Survey of India
IA	Implementing Agency
IEE	Initial Environmental Examination
IPMC	Investment Programme Management Consultancy
IPMU	Investment Programme Management Unit
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
LPCD	Litre Per Capita per Day
LPS	Litre Per Second
LSGD	Local Self-Government Department
MFF	Multitranches Financing Facility
MLD	Million litre Per day
MoEF	Ministry of Environment and Forests
NAAQS	National Ambient Air Quality Standards
OD	Outer Diameter

OHSR	Over Head Service Reservoir
OM	Operations Manual
PHED	Public Health Engineering Department
PMU	Project Management Unit
RCC	Reinforced Cement Concrete
ROW	Right of Way
RPCB	Rajasthan State Pollution Control Board
RSPM	Respirable Suspended Particulate Matter
RUIDP	Rajasthan Urban Infrastructure Development Project
RUSDIP	Rajasthan Urban Sector Development Investment Program
SPM	Suspended Particulate Matter
STP	Sewerage Treatment Plant
ToR	Terms of Reference
UA	Urban Agglomeration
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
uPVC	Unplasticized Poly Vinyl Chloride
USEPA	United States Environmental Protection Agency
WC	Water Closets

WEIGHTS AND MEASURES

lakh	–	100 thousand = 100,000
crore	–	100 lakhs = 10,000,000
$\mu\text{g}/\text{m}^3$	–	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

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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 Multitranchise 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 Environment Policy 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: Environmental Considerations in ADB Operations. This states that ADB requires environmental assessment of all project loans, programme loans, sector loans, sector development programme loans, financial intermediation loans and private sector investment operations.

6. The nature of the assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts and are assigned to one of the following categories:

- Category A: Projects that could have significant environmental impacts. An Environmental Impact Assessment (EIA) is required.
- Category B: Projects that could have some adverse environmental impacts, but of less significance than those for category A. An Initial Environmental Examination (IEE) is required to determine whether significant impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
- Category C: Projects those are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
- Category FI: Projects that involve a credit line through a financial intermediary (FI) or an equity investment in a FI. The FI must apply an environmental management system, unless all subprojects will result in insignificant impacts.

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

2. National Law

8. The GoI EIA Notification of 2006 (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 categorises the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the EC based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

11. The only type of infrastructure provided by the RUSDIP that is specified in the EIA Notification is solid waste management, where EC is required for all Common Municipal Solid Waste Management Facilities (facilities that are shared by more than one town)¹. EC is thus not required for the sewerage sub-project that is the subject of this Environmental Examination.

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 and the national environmental protection agency (MoEF in this case). 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 report for the Nagaur sewerage and sanitation sector. It discusses the generic environmental impacts and mitigation measures relating to the location, design, construction and operation of physical works proposed under this sewerage and sanitation subproject.

II. DESCRIPTION OF THE PROJECT

A. Type, Category and Need

14. This is a sewerage and sanitation sub-project, and as explained earlier 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 because there is no underground sewage system in Nagaur City at present. Only few households have covered with individual septic tanks. The disposal of waste and effluent of septic tank is through the open drains. Presently the open drains, which have been constructed by Municipal Board, convey the sludge and sewage which is leading to unhygienic and unsanitary conditions.

15. From the demand gap analysis it is to be concluding that there is comprehensive need of ULB scheme for proper collection and treatment and disposal of sewage in the town. It is also to be seen from demand gap assessment that significant area of land will be required for installation of sewage treatment facilities. Photographs of the project area are attached as **Appendix 1**

B. Location, Size and Implementation Schedule

16. The sub-project is located in Nagaur, the headquarters town of Nagaur District, in the central part of Rajasthan (**Figure 2.1**). The infrastructure will extend throughout many parts of the town, where pipes for new secondary and tertiary sewer networks will be buried within or

¹ According to the Rajasthan State Pollution Control Board, the MoEF intends to issue a clarification to the EIA Notification in due course, which will add all landfill facilities and Sewage Treatment Plants to the list of projects specified as requiring EC under the Notification. This has not yet been issued, so the text above indicates the correct legal position at the time of writing

alongside roadways. There will be a new Sewage Treatment Plant (STP) of 8 MLD to be built on 50 Bigha land available at Mouza Nagaur. Proposed sewer network is shown in **Figure 2.2**. Location of STP is shown in **Figure 2.3**. Environmental features in and around the proposed STP is depicted in SOI toposheet (**Figure 2.4**).

17. Detailed design will begin in the second quarter of 2008 and should be completed by the end of the year. Construction of all elements will begin in early 2009, and the treatment works will be built in around 6 months. Construction of the trunk sewer and networks will take up to 1½ - 2 years, so all work should be completed by the middle of 2010.

C. Existing Sewerage and sanitation situation

18. In Nagaur about 40% have developed using pour-flush toilets connected to septic tank, another 20% population is having conservancy latrines/ dry latrines. Balance is using public latrines or defecates in open areas. The general drainage of town is through open drains. Effluent from septic tanks as well as raw sewage is discharged into the drains, which ultimately out falls in local water bodies. The waste water accumulated in Dulai pond is pumped to Sewage pond near Nakash Gate from where waste water is again pumped to Pratap Sagar pond. This pumping is on a temporary basis worked intermittently with the purpose of restricting overflow from the first two ponds. To protect public health and the further environmental degradation it is of prime importance to design and construct a sanitary sewerage system with facilities of adequate treatment.

19. The portion of the town considered to be benefited from the Subproject is fairly densely populated. Out of 40 municipal wards, population density is more than 100 persons per hectare in at least 24 wards. Under the Subproject it is proposed to cover a 2001 population of 59,129 in an area of 470.38 hectares encompassing 25 municipal wards, the average population density being more than 125 persons per hectare. However, all these wards are not proposed to be covered by total collection system including branches and laterals and will be provided with trunk and interceptor sewers. Branch and lateral sewers will be provided in 8 of the above 25 wards, where necessary facilities for house service connections will also be provided under the Subproject. These 25 wards are ward nos. 5 to 7, 9 to 11, 15 to 28, 34 to 37 and 39. Among these 8 wards with 2001 population of 17,732 covered in an area of about 262.28 hectare. These are, however, fast developing as substantial vacant lands are available in these wards, especially in wards 34 and 39. In the other 17 wards it is proposed to intercept dry weather flow tapped from the road side drains and conveying the same to an intermediate sewage pumping station. These areas are expected to be connected through laterals by ULB either from their own fund or through other funding.

D. Description of the Sub-project including detailed scope of work

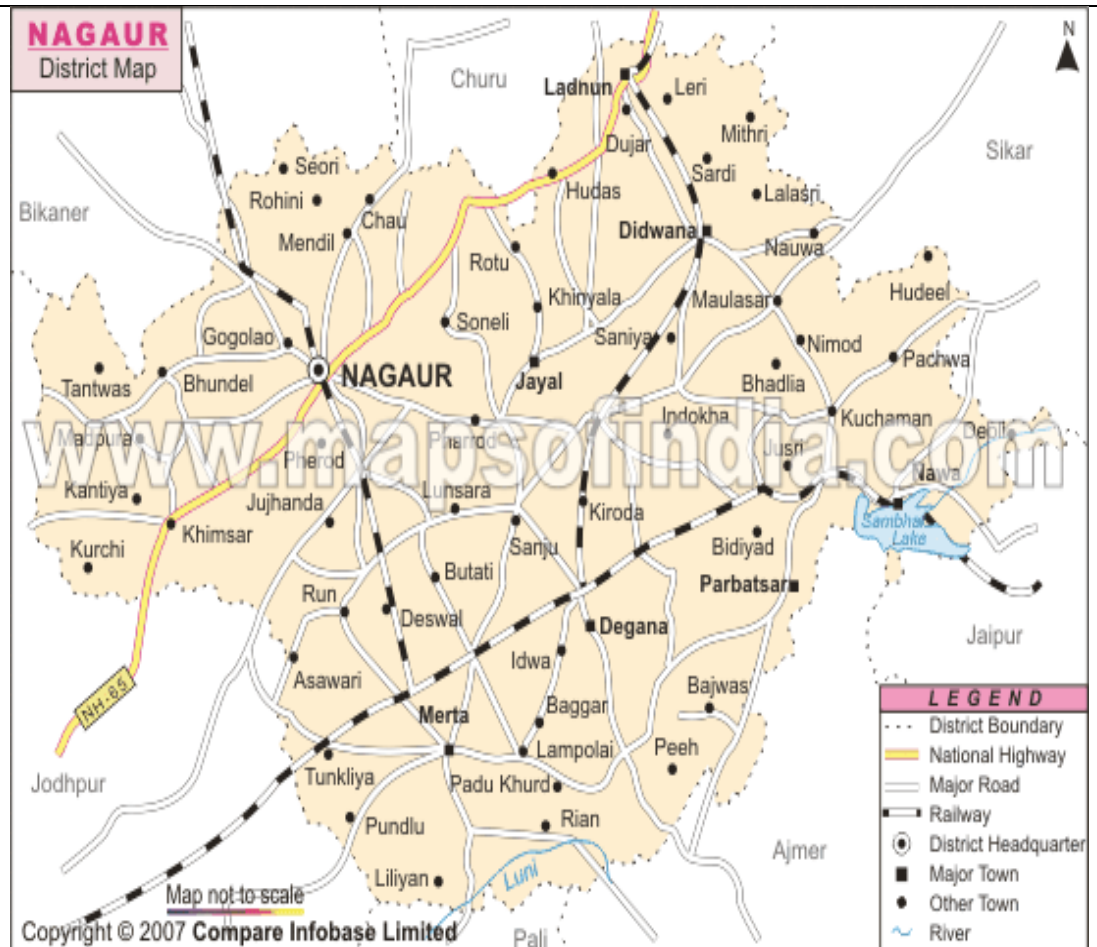
20. The proposed Subproject will comprise of construction of 8MLD sewage treatment plant (with WSP process), laying of Trunk sewers for a length of about 5.17 km diameter varying from 900mm to 1200mm, secondary and lateral sewers, diameter varying from 200mm to 600mm, of about 20 km. For house service connection it has been proposed to lay 110&160mm OD uPVC pipes (4 to 6 connections per manholes). The house service connection is normally to the manholes. However, provisions for required numbers of road side chambers are also made, which, if required, shall be used in wide roads for ease in construction and maintenance where 2 or 3 House service connections (HSC) shall be to Road side Chamber (RSC) and RSCs will be in turn connected with manholes. Also provision has been made in the cost estimate for

dismantling cum refilling the septic tank / soak pit utilities for those who do not find space for effecting a separate connection.

21. The collection system is designed for waste water volume to be generated for the projected population of 2041. Per capita waste water generation is considered as 80% of the net water supply of 135 lpcd. Peak factor has been considered to design the sewer lines. Minimum velocity of 0.6 m/ sec to achieve self cleansing and maximum velocity of 2.5 m/ sec to avoid possible scouring have been considered for design purposes. For all the component designs standard design criteria and practices have been adopted. Minimum cover is 0.9m. Provision of manholes at suitable intervals is also considered.

22. **Table 2.1** shows the nature and size of the various components of the subproject. As indicated above there are three main elements: provision of a network to collect sewage from different city part; a trunk sewer to transport waste to the STP; and a new STP to treat sewage to Indian Urban standards. The descriptions shown in **Table 2.1** are based on the present proposals, which are expected to be substantially correct, although certain details may change as development of the subproject progresses.

Figure 2.1: Map showing the location of the project



Rajasthan Urban Sector Development
Investment Program
ADB TA 4814-IND

Nagaur Regional Map

Govt of Rajasthan
Asian Development Bank

Fig 2.2: Proposed sewer network of Nagaur

SEWERAGE SYSTEM FOR NAGOUR TOWN

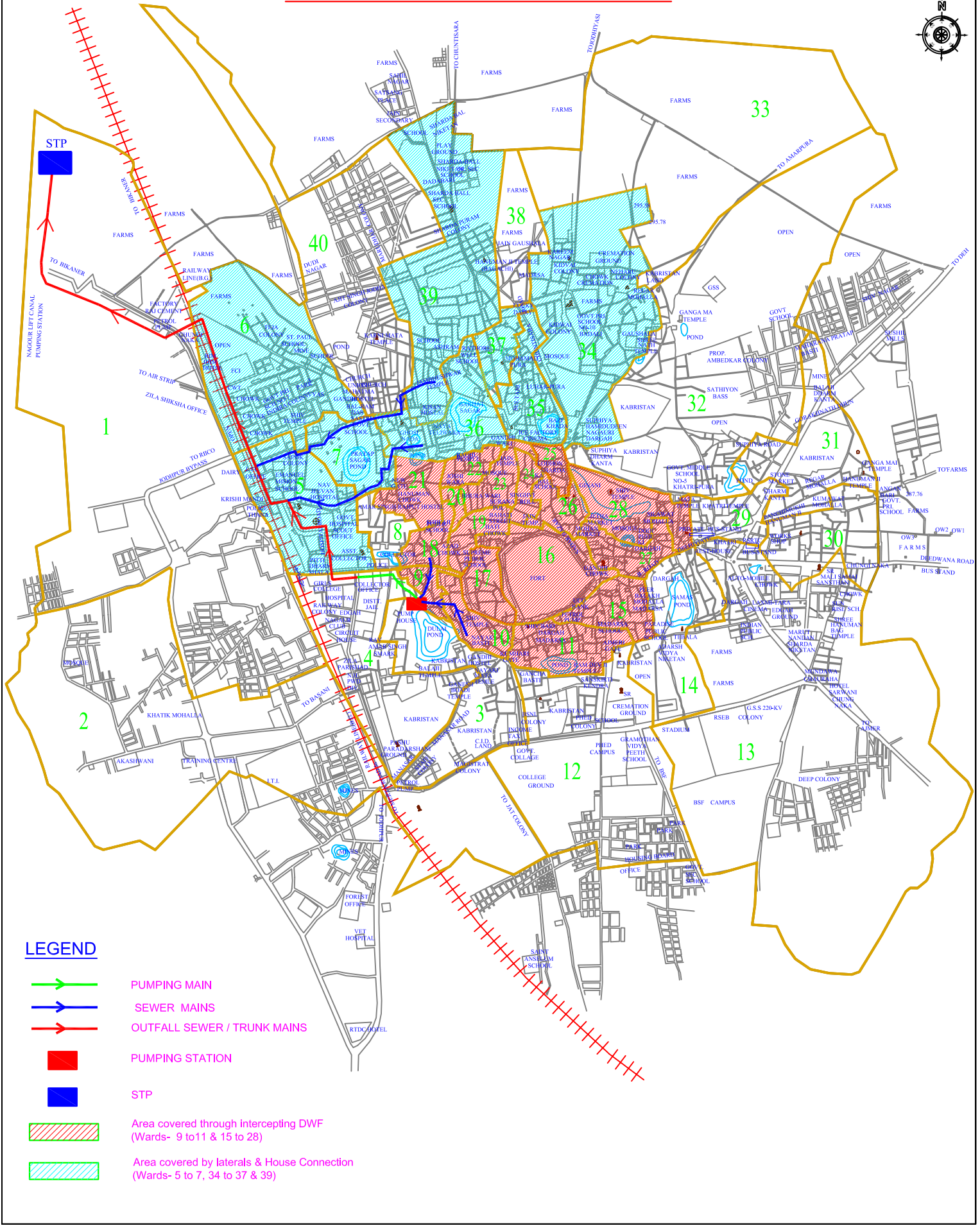
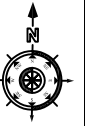


Figure 2.3: Location of Sewage Treatment Plant Site

Figure 2.4: Location of Sewage Treatment Plant in Survey of India toposheet

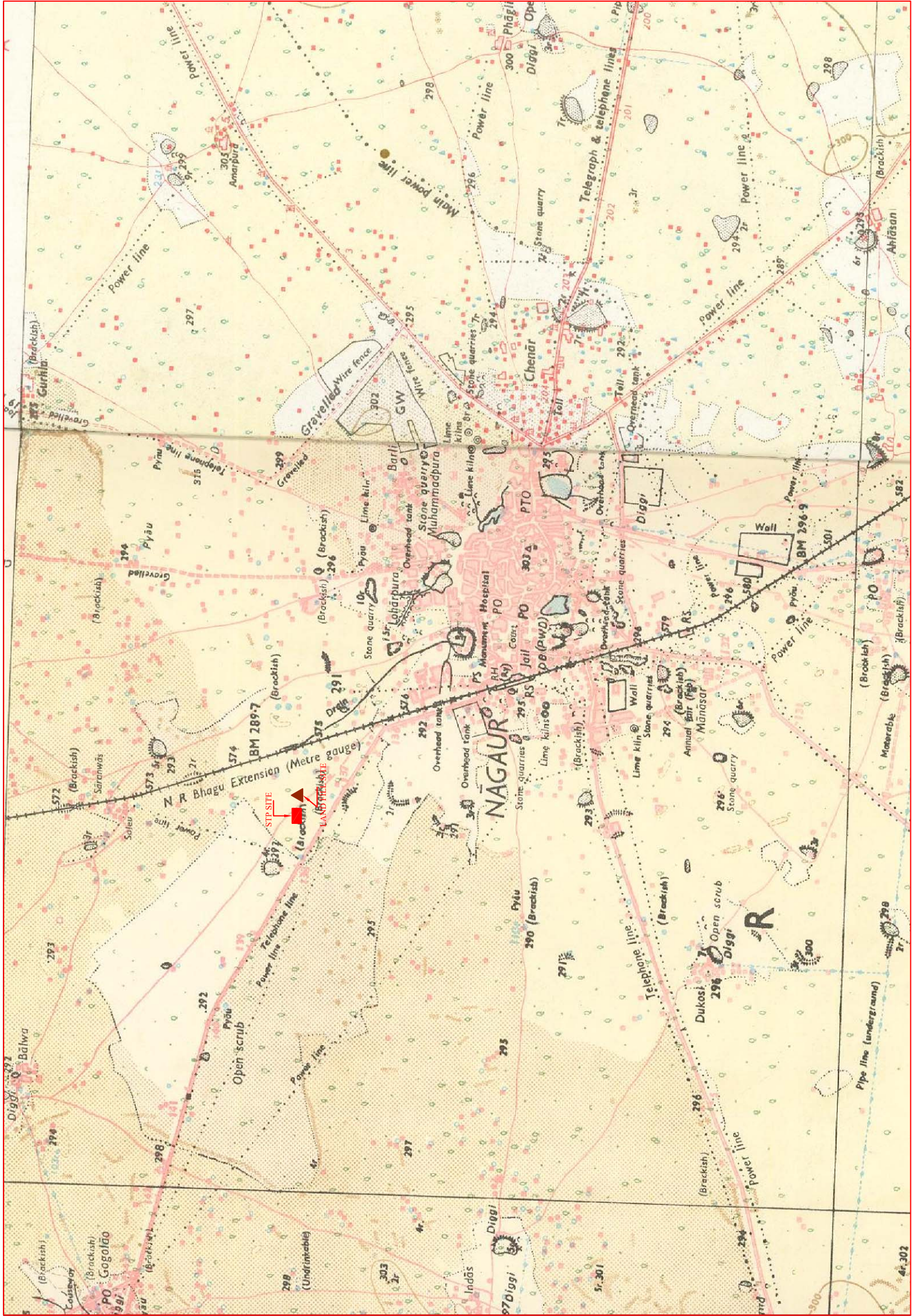


Table 2.1: Improvements in sewerage infrastructure proposed in Nagaur

Infrastructure	Function	Description	Location
Sewage Treatment Plant (STP)	For treatment of Raw Sewage, so as to make disposable.	8 MLD STP (WSP) which includes 2 numbers (nos.) of anaerobic ponds, 2 nos. facultative stabilization ponds, 1 pump sump , 1 no. inlet chamber, 1 no. screen chamber, 1 grit chamber, 1 no. sump, 1 no. measurement channel, 3 nos. distribution box, 4 nos. outlet chamber	50 Bigha land available at Mouza Nagaur under Khasra no. 73
Trunk main and Lateral (Secondary) Sewers and tertiary network and house connection	To connect collection network up to STP I Different dia. of sewer network and to connect with outfall sewer.	Collection network dia varying from 200mm to 600mm, 20 km. including laying of Trunk main sewer dia varying from 900mm to 1200mm, 5.17 km. along with construction of Manholes, providing property connections and restoration of roads.	All around the town
Sewage pumping station – pumping main	Pumping of sewer	Sewage Pumping Station pumping main for 0.36 km of 400 mm DI dia including Civil, mechanical, electrical and instrumentation works	At pumping station

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

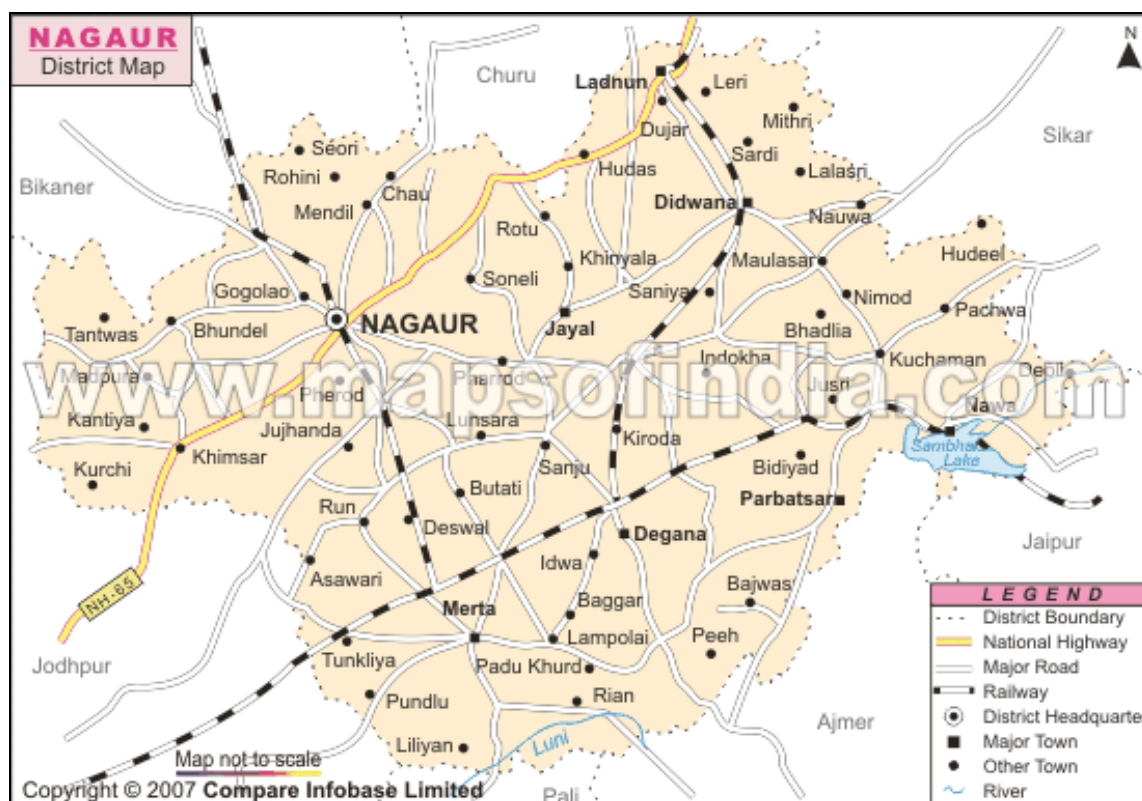
1 Location

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

24. For the purpose of administration, the district is divided into four administrative sub-division, viz., Nagaur, Merta, Deedwana and Parbatsar. Each sub-division is divided into two tehsils viz., Nagaur, Jayal, Merta, Degana, Deedwana, Ladnu, Parbatsar and Nava.

25. 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 135km from Jodhpur and 112 km from Bikaner and 300 km from Jaipur. The nearest Airport is at Jodhpur (137 km). District map of Nagaur shows in **Figure 3.1**.

Figure 3.1: District map of Nagaur



2 Topography, Natural hazard and Drought

26. **Topography** Nagaur is the districts headquarter. It is located at latitude ($26^{\circ}25'$ to $27^{\circ}40'$ and $23^{\circ}31'$ to $30^{\circ}12'$) north and longitude ($73^{\circ}18'$ to $75^{\circ}15'$ and $69^{\circ}30'$ to $78^{\circ}17'$) east, at a height of about 327m above the mean sea level.

27. **Natural Hazards-** Earthquake: 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.

28. **Drought:** Low rainfall coupled with erratic behaviour of the monsoon in the State makes Rajasthan the most vulnerable to drought. Based upon the discussion with PHED officials the water table in the City continuously decreases by 2-3 meter on an annual basis combined with significant drawdown conditions.

Figure 3.2: Earthquake zones of Rajasthan

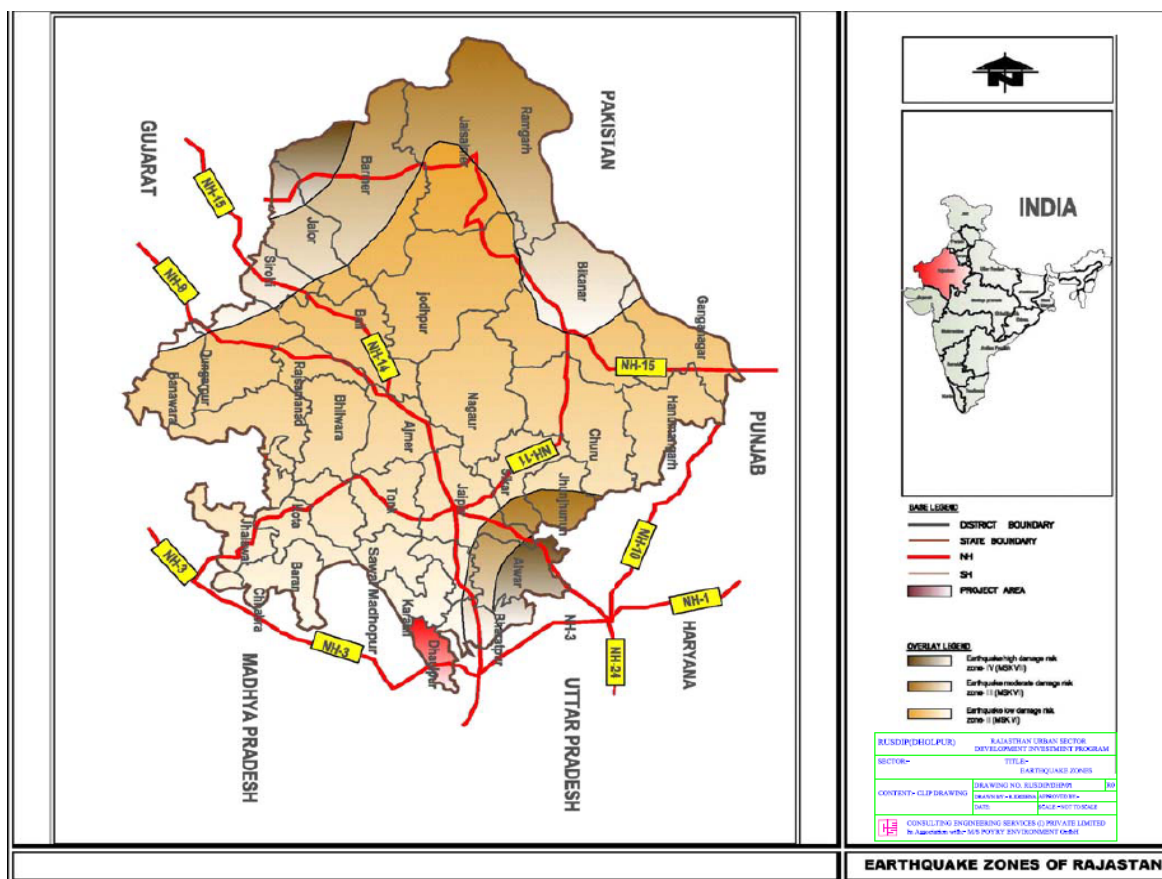
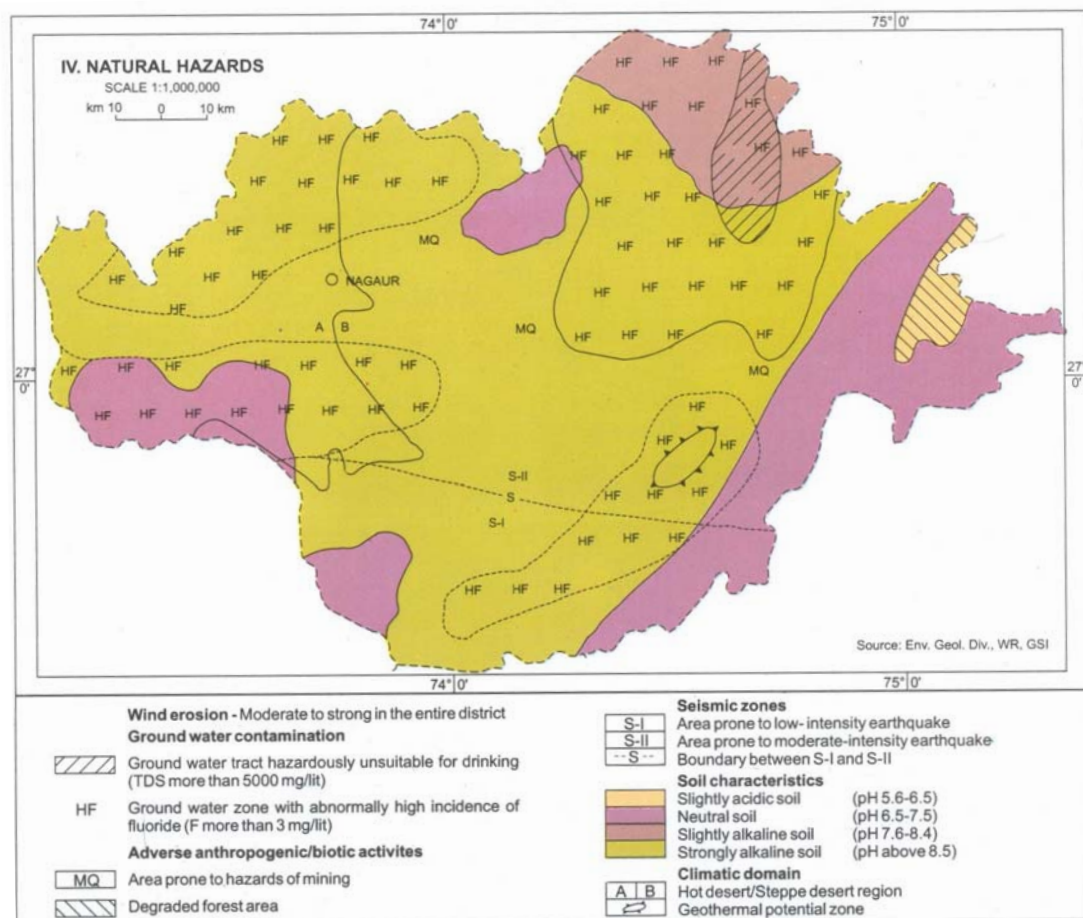


Figure 3.3: Natural Hazard map of Nagaur (GSI Resource map)



3 Geology, geomorphology, mineral resources and soil

29. The climate of the district is arid to semi-arid and the average annual rainfall is 383 mm. The district forms a part of the Great Thar desert and is covered mainly by Aeolian sands masking the hard rocks.

30. 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.

31. *Mineral Resources:* Thick gypseous beds of the district provide reserves of about 953 Million tones (Mt) from Dhankoria (27° 20': 73° 44') Bhadwasi (27° 19': 73° 40') and Nagaur (27° 12': 73° 44') deposits. Extensive deposits of China clay are found in Khajwana area. Lignite occurrences have been reported from around Metra Road R.S.

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

Figure 3.4: Geology and mineral map of Nagaur district (Source: GSI Resource map)

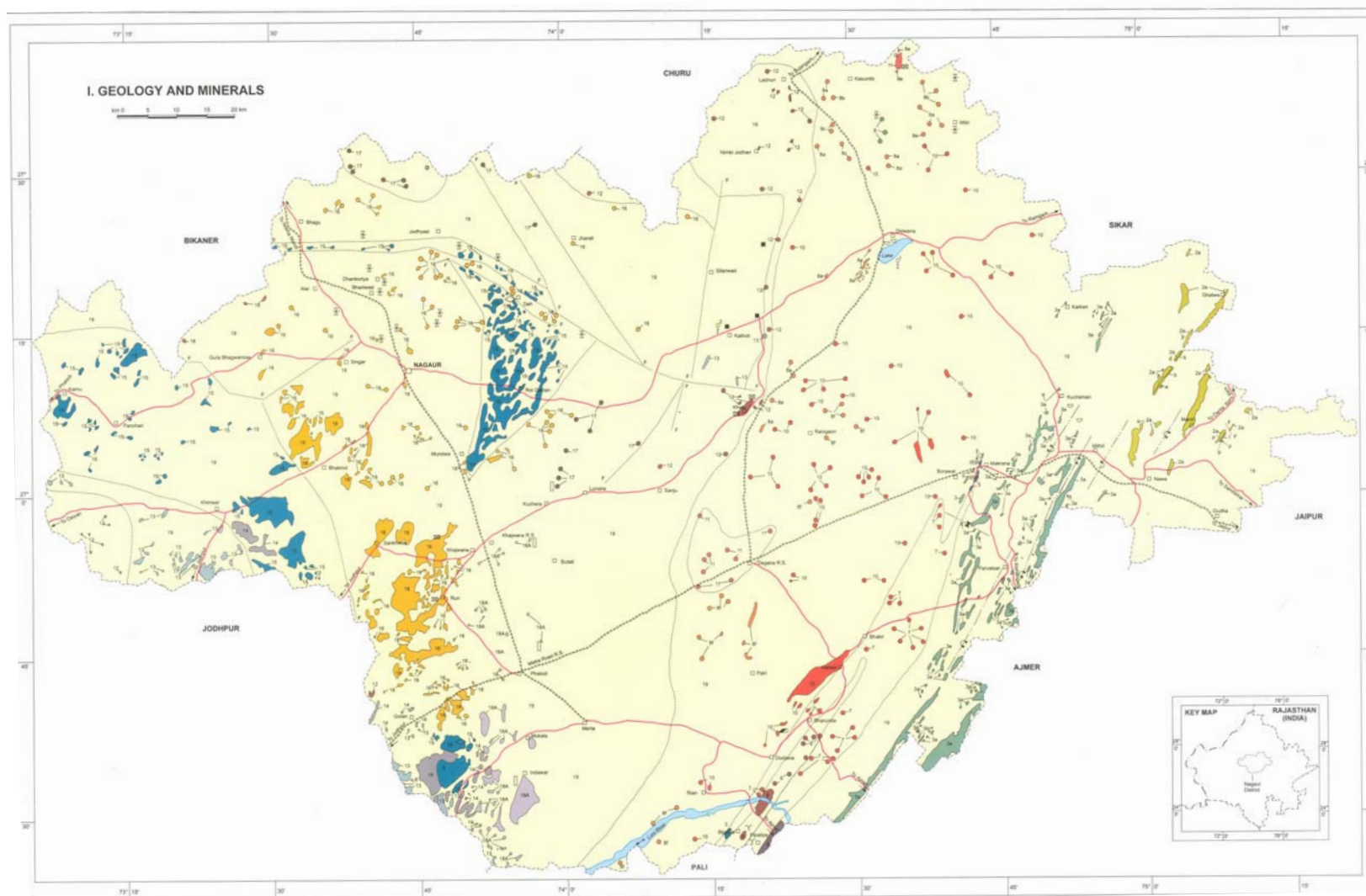
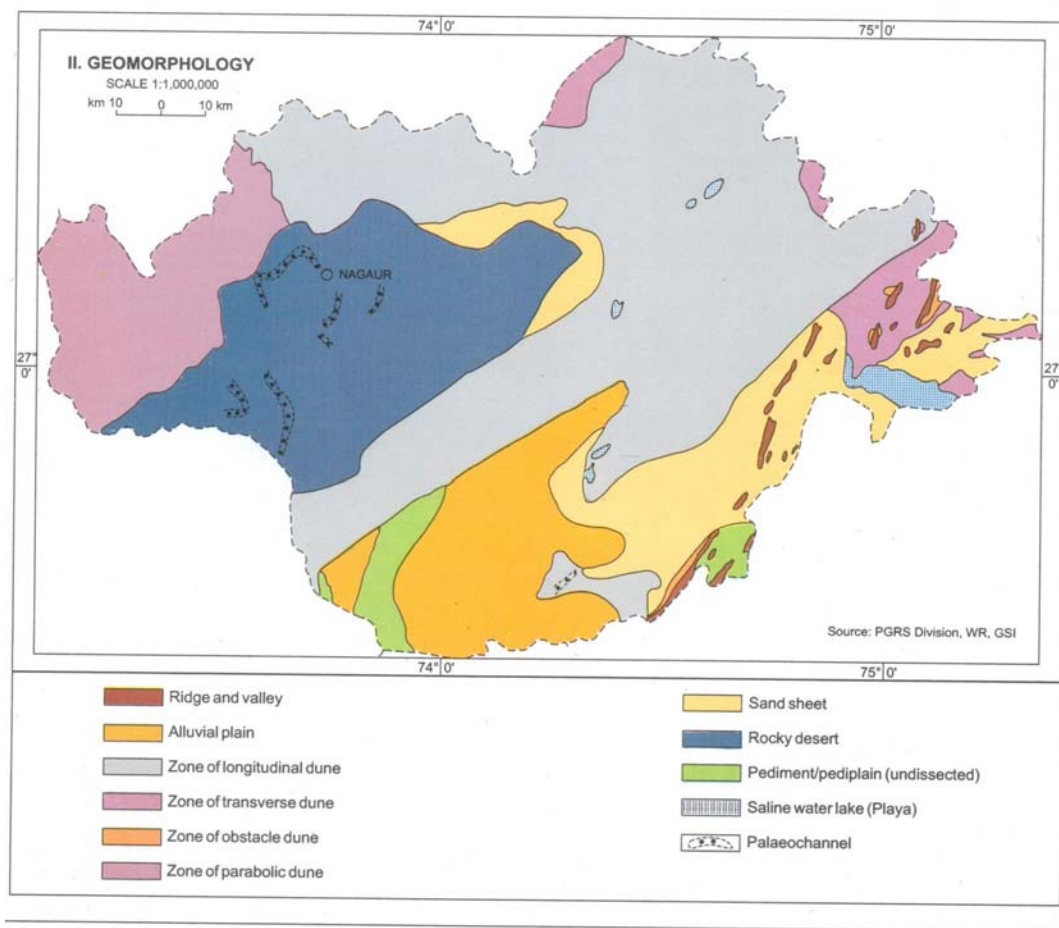


Figure 3.5: Geomorphology and Geohydrology of Nagaur district
(source: GSI Resource map)



33. *Soil characteristics:* Soil of the region falls within low rainfall zone of 300- 500 mm. The soils are sandy loam, shallow depth red soils in depressions. **Table 3.1** shows nutrient level in the Nagaur soil including area coverage of saline and sodic soil. The nutrient status of the Nagaur soil is graded as medium to high level.

Table 3.1: Fertility status – major nutrients and problematic soils of Nagaur district

	Nutrient			Saline Soil(Ha)	Sodic or Alkali(Ha)
	N	P	K		
Status	L	M	H	3315	10658

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

4 Climate

34. 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 47⁰ C with 0⁰ C as the

lowest recorded temperature. The average temperature of the district is 23.5⁰ 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 & Ladnun in the district. The average rainfall in the district is 36.16 cm. The average humidity is 52%.

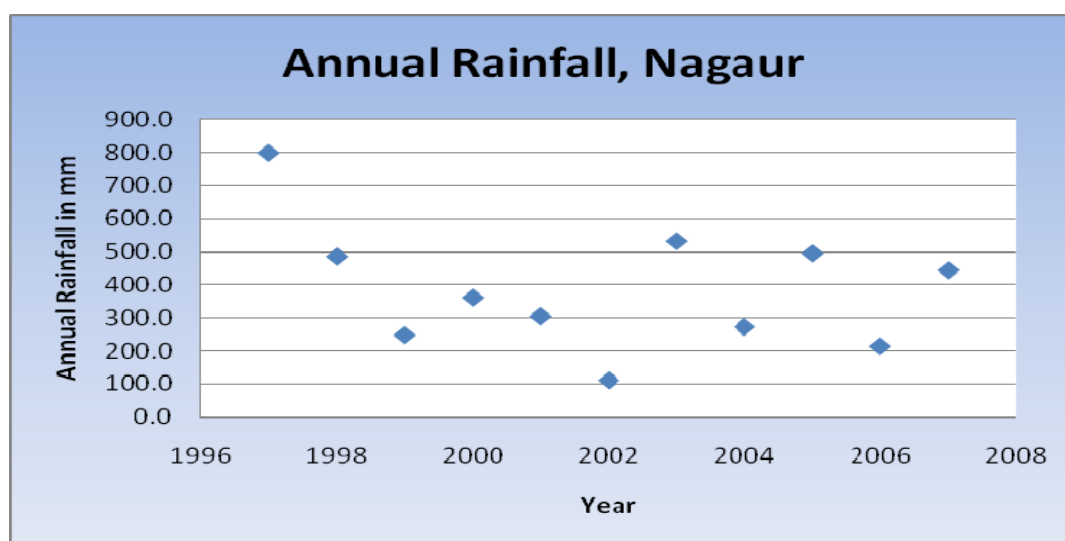
35. The rainfall over Nagaur is scanty and is concentrated over four month i.e. from June to September. The rains are erratic and so is the distribution of the rainfall. However agriculture and the animal wealth are dependent on rains to large extent. Seasonal Rainfall data for the recent year (2005-2006) is shown in **Table 3.2**. **Figure 3.6** shows yearly variation (1997-2007) of rainfall at Nagaur.

Table 3.2: Rainfall at Nagaur in recent years (2005-06)

S.No.	Months	Rainfall (mm)
1	June	69
2	July	290
3	August	0
4	September	115
5	October	0
6	November	0
7	December	0
8	January	0
9	February	0
10	March	0
11	April	0
12	May	0
13	Monsoon Rainfall	474
14	Non monsoon rainfall	0
15	Annual Rainfall	474

(Source: Irrigation Department, Govt. of Rajasthan)

Figure 3.6: Rainfall at Nagaur during 1997 to 2007



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

5 Air Quality

36. There are no data on ambient air quality of Nagaur Town, which is not subject to monitoring by the Rajasthan State Pollution Control Board (RPCB) as there are no major industries. The nearest station is located at Jaipur (287 km from Nagaur). 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). The ambient air quality data is depicted in **Table 3.3**.

Table 3.3: Ambient Air Quality in Jaipur (Annual Average, 2004; units in µg/m³)

Monitoring Station	Land use	SO _x	NO _x	RSPM	SPM
Alwar Residential, Rural and others area	Residential	5.57	29.9	106	302
NAAQ Standard	Residential	60	60	60	140
Alwar Industrial area	Industrial	22.69	9.32	131	300
NAAQ Standard	Industrial	80	80	120	360

RSPM: Respirable Suspended Particulate Matter; SPM: Suspended Particulate Matter

Source: Annual Report 2005-2006 Rajasthan State Pollution Control Board

6 Surface Water

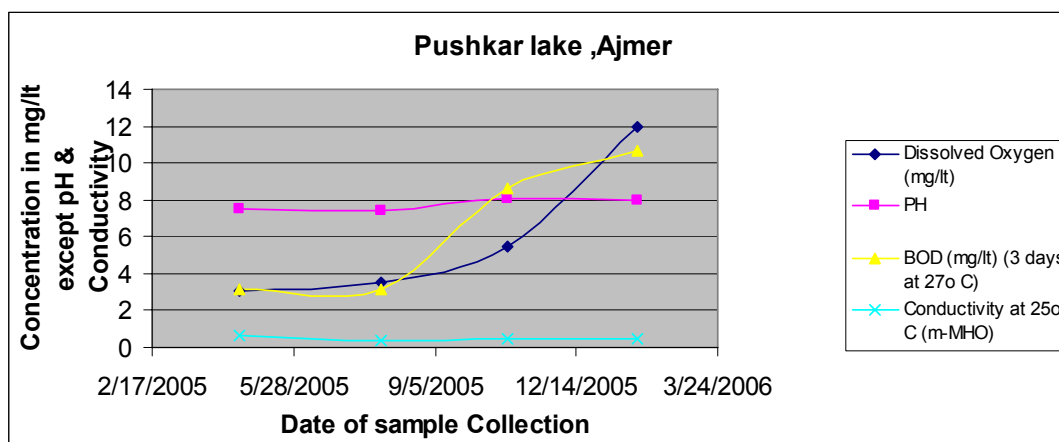
37. *River status:* River Luni is a non-perennial river, it rises near Pushkar in Ajmer district and after passing over the western slopes of the Aravali, it crosses Nagaur district in the south and flows through it towards the west for nearly 37 km. before entering into Pali

38. There is no water quality monitoring station at Nagaur. The Pushkar Lake located at Ajmer (160 km from Nagaur) is the nearest water quality monitoring station. The monitoring has been carried out by Rajasthan Pollution Control Board at that Lake. The data on DO, pH, BOD and Electrical conductivity is given in **Table 3.4**. **Figure 3.7** shows variation of water quality at that lake.

Table 3.4: Water quality data of Pushkar Lake, Ajmer

Location	Parameters				
	Date of Sample Collection	Dissolved Oxygen (mg/l)	P ^H	BOD (mg/l) (3 days at 27° C)	Conductivity at 25° C (m-MHO)
Pushkar, 160 km from Nagaur	4/20/2005	3.04	7.48	3.19	0.61
	7/29/2005	3.53	7.4	3.11	0.38
	10/26/2005	5.46	8.02	8.58	0.42
	1/26/2006	12	8	10.7	0.45

Source: Annual Report 2005-2006 Rajasthan State Pollution Control Board

Figure 3.7: Variation of water quality parameters in lake water

7 Geohydrology and Groundwater

39. 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 3.5**. In most of the cases ground water table ranged between 20 - 60 m bgl.

Table 3.5: Number and Percentage of National Hydrograph Network Station (Nagaur) with water fluctuation range

Period	No of wells analysed	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: Ground water year book 2005-06 Rajasthan, Central Ground Water Board, Jaipur (2007)

40. The Central Ground Water Board carried out chemical testing of tube well water seasonally. The average concentrations of major constituents are shown in **Table 3.6**. Geohydrological map of the district is shown in **Figure 3.8**.

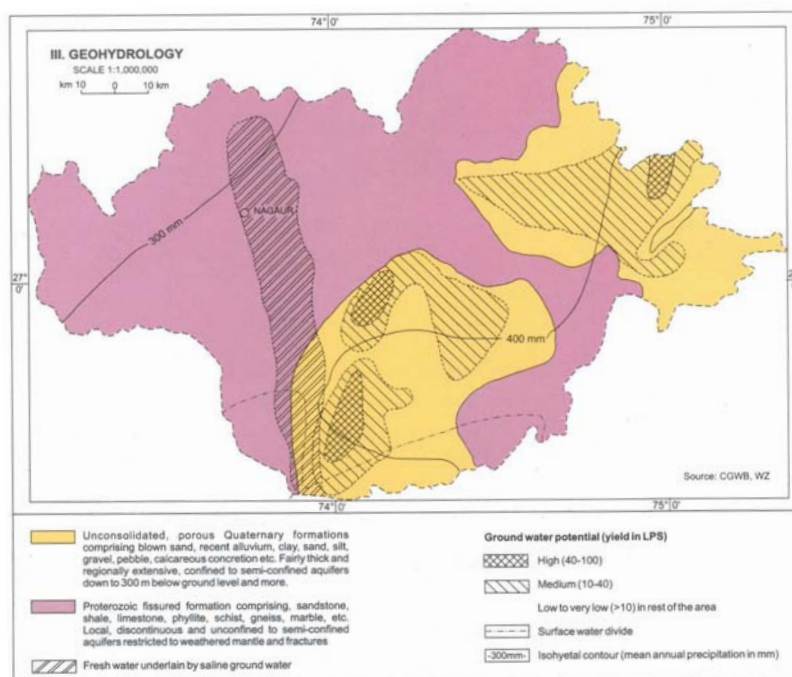
41. As per PHED the entire Nagaur city is considered dark zone from groundwater exploitation point of view. As far as groundwater condition is concerned, the TDS level is in the range of 460-695 ppm, Chloride level is between 50-140 ppm, Nitrate between 23-37 ppm and Fluoride between 1.02 to 1.55 ppm.

Table 3.6: Ground Water Quality in and around Nagaur

Parameters	Maximum Level	Minimum Level	Standard of Drinking water (IS: 10500: 1991)	
			Desirable limit (mg/l)	Maximum Permissible limit (mg/l)
pH	8.56	7.85		
EC (micro-mhos/cm at 25 °C)	11410	390		
Cl (mg/l)	3195	33	250	1000
SO ₄ (mg/l)	2650	4	200	400 (if Mg does not exceeds 30 ppm)
NO ₃ (mg/l)	601	12	-	100
PO ₄ (mg/l)	0.65	0.11		
Total Hardness(mg/l)	2100	40	300	600
Ca(mg/l)	456	8	75	200
Mg(mg/l)	788	5	30	100
Na(mg/l)	2530	8	-	-
K(mg/l)	294	1	-	-
F(mg/l)	11	0.38	1.0	1.5
Fe(mg/l)	1.5	0	0.3	1.0
SiO ₂ (mg/l)	56	0		
TDS (mg/l)	7417	254	500	2000

Note: Total – 40 nos. samples

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

Figure 3.8: Geohydrological map of Nagaur district (Source: GSI resource map)

B Ecological Resources

42. **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 Ladhun and Didwana are much greener than the north –west region of district. The leaves of the khejri are used as fodder. It exudes gum. The tree is considered holy by some people and is, therefore, worshipped .The timber of rohira and shisham is considered good for furniture. Costs are generally made from the wood of dhau .

43. **FAUNA** : Wild Animals :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 and wild cat and birds. The common birds fluttering in the district include peencha , bulbul , sugan chiri and mor (Peacocks).

44. 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 & other geographical constraints account for this. The western part of the district is divided of natural vegetation cover except for low herbs & grass which grows on low sand dunes. However, the south-eastern part of the district & part of the northern tehsil of Ladhun & Didwana have much greater greenery as compared to north-west part of the district. Khejri trees are commonly found in the district. It's 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, dhangoor, akara, rohira & shisham trees provide timber & is used for making furniture. Dhangoor is generally used for making cots. A common shrub-phog provides building material from its roots & twigs. Common grass found in the district include bargers, bhambar etc.

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

C Economic Development

46. Nagaur city was an important city of the Wildlife reserve and a place of historical importance. The town founded in 1765 A.D was named after its founder Maharaja Nagaur Singh-I of Jaipur.

47. In olden times there were minor manufacturers having a market in the neighbouring areas while for the rest of the trades there were hereditary artisans like carpenters, blacksmiths, potters, goldsmiths & 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.

48. 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 Calcutta and other business centres 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.

49. 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 city infrastructure and as a result a number of problems such as housing, slums, traffic congestion, and deficiency in municipal services have emerged.

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

Table 3.7: Consumption of Electricity in Million Kwh (2003-04)

District	Domestic	Non-Domestic (Commercial)	Industrial	Public Lighting	Public Water Works	District	Domestic
			Small	Medium	Large		
Nagaur	86.322	18.463	23.83	39.966	31.50	1.947	47.836

1 Land use

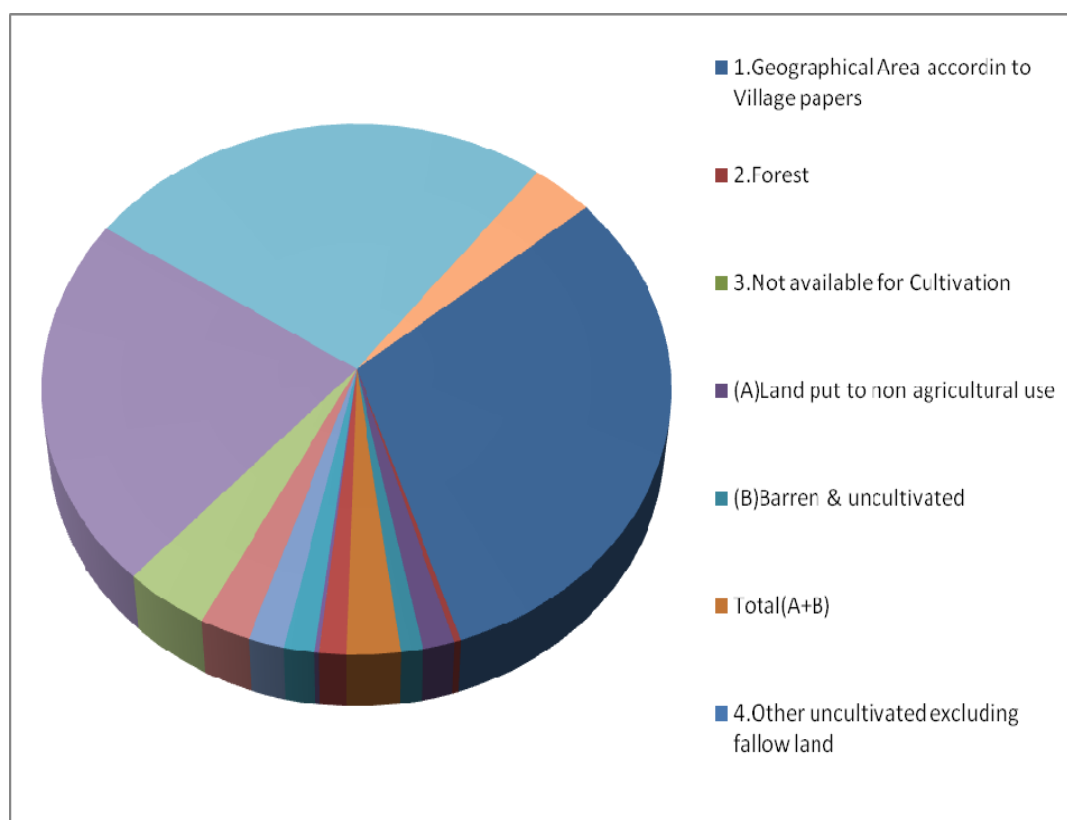
51. Land use of the Nagaur district is shown in **Table 3.8** and in **Figure 3.9**.

Table 3.8: Land use of Nagaur district

Nagaur	Area
1.Geographical Area according to Village papers	1764380
2.Forest	17989
3.Not available for Cultivation	
(A)Land put to non agricultural use	86454
(B)Barren & uncultivated	59009
Total(A+B)	145463
4.Other uncultivated excluding fallow land	
(C)Permanent pasture & other grazing land	71601
(D)Land under misc. tree crops & groves not included in net area sown	28
(E)Culturable waste	11984
Total(C+D+E)	83613
5.Fallow land	
(F)Old fallow land	97408
(G)Current fallow land	136527
Total(F+G)	233935
6.Net area sown	1283380
7.Total cropped area	1477904
8.Area sown more than once	194524

Area in ha.

(Source: Statistical abstract Rrajasthan 2004)

Figure 3.9: Land use of Nagaur district

2 Commerce, Industry and Agriculture

52. There are number of industrial units are exist in and around the Nagaur city. The details are discussed below.

3 Large & medium scale industries

53. Industrial units with a fixed capital investment of Rs. 5 crores and above are categorised as large scale industries. There are seven large and medium scale industries which exist in Nagaur district.

Table 3.9: List of existing large & medium scale industries

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

4 Small Scale Industry

54. 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 12849. 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.

Table 3.10: Details of Registered SSI Unit in District Nagaur

S. No.	Type of Industries	SSI Unit			Artisan Unit		
		No.	Invest (in lacs)	Empoyment	No.	Invest (in lacs)	Empoyment
1	Agro Based	2301	5944.79	13450	162	16.74	539
2	Forest Based	317	191.15	1189	1868	15.50	2692
3	Mineral Based	2138	6221.06	13538	422	115.07	882
4	Cloth Based	677	245.78	1482	2787	62.50	4180
5	Engineering Based	1545	2234.63	7817	302	5.18	471
6	Chemical Based	221	811.36	1123	6	1.04	13
7	Animal Based	9	4.30	26	3036	103.53	4463
8	Other	1295	1022.36	3757	5	0.50	11
	Total	8503	16675.43	42382	8588	320.06	13251

a. Khadi & village industries

55. The khadi & Village Industries of the district include leather, tanning & manufacture of leather goods, weaving of cloths, woollen carpets, soap, furniture, rope making etc.. Besides, the traditional blacksmiths, carpenters & potters etc. are also available in the most of the parts of the district. The development of village industries has an important place in the development plan of the state. These have been getting impetus through incentives, mainly in the form of loans being provided by Rajasthan Khadi Gramudyog Board, Rajasthan Financial Corporation, etc.

b. Hand- tools industry

56. If Rajasthan State is in the helm of handicrafts over the world, Nagaur claims its superiority in hand-tools. Hand-tools Industry has flourished in & around Nagaur over the years. The industry peers into the past dating back 600 years. It is worth-seeing how iron is moulded & made use of for different sections of the society. In fact, hand-tools are so well-designed as if they are additional hands for human beings. About 300 types of hand-tools are manufactured catering to the requirements from gold-smiths to aeroplane engineers. Though the iron industry has undergone drastic changes, the hand-tools industry remained unchallenged & unmatched. The demand of these hand made tools always witnessed growing trend. Hand Tools Design, Development & Training Centre (HTDDTC) is engaged in motivating more units to come up.

c. Salt industry

57. Nagaur district is also an important salt producing area, Nawa & Deedwana tehsils being the major salt producing zones. Moreover, the Sambhar area (although forming part of the Jaipur district) is quite close to the salt belt of the Nagaur district. The industries based on common salt area local resources could sustain inter-alia the following kind of plants:-

- o Caustic Soda Plant
- o Soda ash plant
- o Chlorine gas plant
- o sodium sulphate plant
- o Iodised salt & refinery

d. Gypsum based industries

58. Nagaur district is very rich in gypsum deposits with Nagaur, Bhadwasi, Bhadana and Manglod as particularly the best Gypsum bearing areas in the district. The reserves were estimated to be 952 million tones with 81% content and above by the Geographical Survey of India. A substantial part of the gypsum produced here has been supplied to the Sindri fertilizer factory in Bihar. It has also found its way to Haryana, after primary grinding. An industrial complex in Nagaur, based on gypsum, along with ancillaries could be a major employment provider for the local population. Gypsum based industries are as follows:

- o Cement plant (Portland)
- o Fertilizer plant
- o Plaster of Paris plant
- o Potteries and moulds plant
- o Sulphuric acid plant

e. Lime stone based industries

59. Best grade lime stone is found at Gotan, Mundwa, Kathoti and Ambali in the Nagaur district. Lime stone is also available in the Nagaur district in abundant quantity & the quality is reasonably good. Large reserves amounting to about 33 Million tones of high grade lime stone are found near Gotan. The deposit near Mundwa contains a reserve of about 1.19 million tones of high grade lime stone. The industries based on limestone as a resource are as follows :

- o Quick Lime
- o Hydrated Lime
- o Precipitated chalk plants
- o Mineral Grinding plants
- o Cement plant

f. Wolframite Tungesten

60. Wolfram (Wolframite) deposits are found in the Renwat hill at Degana. In this mineral, the tungstate of iron and manganese, occurs, in the veins or lodes of granite and phyllites especially. Tungsten is specially suitable for use in the production of alloy steels and high speed cutting steels which retain hardness even when they are red hot. However for small quantities generally low grade materials have been mined. A reserve of the order of 3,400 tones has been established. Other minerals available in Nagaur district including sandstone. It is available almost every where in the district, but the best grades are available at Khatu in Deedwana tehsil where as many as 150 quarries already exists. Fairly good deposits of white clay are found of near the village of Suradhana, Khajawana, Mundwa, Dhadhariya Khurd and at a number of other places in Merta Tehsil.

61. **Industrial area:** In Nagaur district, Rajasthan state Industrial Development & Investment Corporation Ltd. (RIICO) has developed industrial areas & are located at Nagaur, Merta, Makarana. The district also has three industrial area of District Industrial Centre (DIC).

62. In and around the Nagaur city area there are about 70-80% of lands used for agricultural purpose. Crop production statistics as depicted in **Table 3.11** indicates much more crop production in Kharif season in compared to Rabi season.

Table 3.11: Crop production in around Nagaur district

Type of Crops	Under Rabi Crops 2003-04 (Prod in Tonnes)	Under Kharif Crops 2003-04 (Prod in Tonnes)
Cereals	226465	700976
Pulses	37958	225412
Food Grains	264423	926388
Oilseeds	115718	16375
Others	44262	100232
Total	424403	1042995

(Source: Vital Agricultural statistics 2004-05, Directorate of Agriculture and Statistics, Govt. of Rajasthan)

5 Infrastructure

63. **Water supply:** Nagaur town being District head quarter and with having a population of 93915 as per census 2001 has been fully covered under Urban Water Supply Scheme. Presently, this scheme is run and maintained with assistance of 45 nos. tube wells as water source. It is also important to note here that even a single tube well with safe & adequate quantity of water is not available within 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. It is also important to note here that out of 45 tube wells water quality of tube wells in 35 nos. which are located at Khajwana and Janana & Indokali are almost safe whereas tube wells at Khen, Soliyana & Fagli which are 10 in nos are having excessive fluoride content between 5 & 7 ppm, hence in absence of 100 % safe & with sufficient water quantities at Khajwana, Indokali & Janana, Nagaur town is served with water after diluting of both the quality of water by mixing to each other at a interval of 48 hrs. Presently town maintained service level at 60 LPCD (approx) as compared to that of basic requirement of 135 LPCD.

Presently, Nagaur town has been distributing drinking water through 9 nos. of Service Reservoirs where as there would require 4 nos. of SR's for new emerged and developed slums and colonies surroundings of town. Since existing distribution system is old & insufficient and in the state of ruins it would be needed for replacement where as extension of existing system for new slums and colonies would require in additional pipelines. Total production from all these sources presently is 7.0 MLD and present service level is 60 lpcd. The city is divided into 48 zones out of which 28 zones are supplied water by direct boosting and remaining 20 are through service reservoirs. The approximate total length of the distribution network length is 165 km. Approximately 4.1 ML of water is stored in 9 Service reservoir. Water is supplied through 9914 water connections.

64. *Sewerage System:* Nagaur town does not have underground sewerage system as of now. The municipal drains are mostly open & overflowing into *Nalla* causing problem in rainy season. The water flow in the drain is also dirty as it receives flow from toilets and an sullage causing unsanitary condition.

65. *Sanitation:* Only 70 % of the households reportedly has septic tanks and soaks well as the system of sewerage disposal. The remaining accounted for cases of open defecation which is an unacceptable and unhygienic practice. The raw settled sewage from septic tank is periodically flushed out by sanitary workers of the Municipal Board and discharge to open spaces, agricultural lands in an indiscriminate manner. Slum areas were also not equipped with requisite sanitation (LCS etc.) resulting in open defecation.

66. *Drainage:* In Nagaur town itself no natural drainage system exists to drain away the rainwater or wastewater from the town. Presently there exists a minimal network of storm water drains in the city. The existing network of (roadside) storm water drains in Nagaur has been identified under broad categories as follows.

Table: 3.12: Type of drains and existing length in Nagaur city

Type of drain	Existing Length (Mts)
Box Drain	1000
Conduit Drain	-
Closed Pucca Drain	2000
Open Pucca Drain	500
Kutchra Drain	5000
Others	2000

67. *Industrial Effluents.* Industries exist in Nagaur, which is outside the city 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.

68. *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.

69. The MSW generated in the Nagaur city (including slum area) mainly consist of domestic refuses, waste from Commercial Area, Vegetable-Fruit market, bio-medical waste, waste from Hotels and Restaurants, Industries etc. The waste collection system being followed is quite primitive, individual households/units throw the garbage on road side/open drains close to their houses and the sweepers collect the garbage in the form of small heaps on road sides. Similarly the open drains are also cleaned periodically and the sludge is heaped adjacent to the drain where it is left for 2-3 days to get dried and lifted. Tractor trolleys then lift these dumps the heaped garbage once or twice a day. The MSW generated is transported to garbage dumping site. The MBC 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 city 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.

6 Transportation

70. **Table 3.13** provides a breakdown of road surface composition in Physical growth of the city has resulted in a corresponding increase in vehicular traffic greater than that of the city's population growth due to improving economic status of the city.

Table 3.13: Road Surface Composition

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

Source: PWD Nagaur

71. Overall road network of the district is given in **Table 3.14**.

Table 3.14: Road Network of Nagaur

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

1 Demography

72. The district comprises of 1570 Revenue Estates (Villages), out of which Merta, Deedwana, Makarana, Parbatsar and Kuchaman are the major towns of the district. The total area of the district is 17,718 sq. km., out of which 17,448.5 sq. km is rural and 269.5 sq. km is urban. As per the 2001 census, the population of the district is 27,75,058 (4,77,337 urban and 22,97,721 rural population) which is 4.91% of the total population of the State. The density of population in the district is 157, as against 165 of Rajasthan as a whole. 12,87,921 persons of the district are literate, out of which 10,21,314 are rural and 2,66,607 are urban, which makes it 58.26% of the total population. Out of this literate population 75.33% are males and 40.45% are females. Working population of the district is 39%. Projected population of the Nagaur city is shown in **Table 3.15**.

Table 3.15: Projected Population

Year	Population (no.)
2001	93915
2011	123580
2021	162954
2031	215004
2041	283877

73. Nagaur Municipal area comprises 40 wards. Ward Wise Population is shown in **Table 3.16**.

Table 3.16: Ward wise Population-2006

Ward No.	Population 2006
1	3330
2	3756
3	2860
4	2363
5	2303
6	2208
7	2099
8	2141
9	2344
10	4548
11	2128
12	2421
13	1951
14	1929
15	2092
16	2165
17	1718
18	2008
19	2266

Ward No.	Population 2006
20	1886
21	1875
22	1656
23	2220
24	3427
25	3847
26	4990
27	2738
28	4167
29	1991
30	2968
31	3850
32	2117
33	2485
34	2999
35	3110
36	2080
37	2480
38	2807
39	2460
40	2063

2 Health and educational facilities

74. 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

	(Nos)
Colleges	5
Professional colleges	4
Higher Secondary and Secondary Schools	252
Primary and middle schools	2733

(Source: Official website of district)

75. There is 1 district hospital, 1 TB hospital and 1 leprosy hospital in the Nagaur city. **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

S.No.	Facilities	Number
1	Hospital	1
2	TB Hospital	1
3	Mother and Child Care Center	1
4	Leprosy Hospital.	1
5	Total	4

(Source: District Statistical Hand Book 2005)

Table 3.19: Medical facility at Nagaur district

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

(Source: Official website of district)

3 History, culture and tourism

76. 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.

IV. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: LOCATION AND DESIGN

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

78. 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.

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

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

V. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: INFRASTRUCTURE CONSTRUCTION

A. Screening out areas of no significant impact

80. From the descriptions given in Section III.C it is clear that implementation of the project will affect a significant proportion of the town as branches of the new sewerage network will be built alongside many roads and streets. Areas outside the town will also be affected, by construction of the trunk sewer and STP.

81. It is not expected that the construction work will cause major negative impacts, mainly because:

- o Most of the network and the trunk sewer will be built on unused ground alongside existing roads and can be constructed without causing major disruption to road users and any adjacent houses, shops and other businesses;
- o The STP will be located on government-owned land that is not occupied or used for any other purpose;
- o Most network construction will be conducted by small teams working on short lengths at a time so most impacts will be localised and short in duration;
- o The overall construction programme will be relatively short for a project of this nature, and is expected to be completed in 1.5 -2 years.

82. As a result 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.

83. These environmental factors have thus been screened out presently but will be assessed again before starting of the work.

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 facilities will be built
Coastal resources	Nagaur is not located in a coastal area
Population and communities	Construction will not affect population numbers, location or composition

84. All the locations for sub-project components are not finalised. Tentative Rapid Environmental Impact Assessment checklist is shown in **Appendix 2**.

B. Sewage Treatment Plant

1 Construction method

85. Work components of STP involve

- o A series of oxygenation and waste stabilisation ponds, each approximately 50 x 100 m and 2-3 m in depth;
- o Pump stations and pipes with valves to transfer material between ponds;

86. Although the site is fairly large, the construction will be straightforward, involving mainly simple excavation. The ponds will be dug by backhoe diggers and bulldozers, and soil will be transferred into trucks for offsite disposal. Clay will then be applied to the floor and sloping sides of each pond and after watering will be covered with low density poly-ethylene (LDPE) sheeting. A thin layer of cement mortar is then added, and concrete tiles are embedded into the surface by hand, with more cement grouting applied to seal joints between tiles.

87. Trenches for the pipe-work will also be dug by backhoe, and pipes will be brought to site on trucks, offloaded and placed into each trench by small cranes or pipe-rigs, after which soil will be replaced by hand to cover the trench.

88. Foundations for the small pump houses will be dug by backhoe, and concrete and aggregate will be tipped in to create the foundations and floor. The brick sides will then be built by hand by masons and pumps will be brought in on trucks and placed inside the pump house by crane. The roof material will then be attached by hand.

2 Physical Resources

89. Although the impacts of constructing the STP will be confined to a single site, because of its size and the invasive nature of the excavation work, physical impacts could be significant, so mitigation measures will be needed.

90. Ponds will be dug on around 80% of the site, and if these are excavated to a depth of 2.5 m, and substantial waste soil will be generated. This is a very large amount of waste, which could not be dumped without causing further physical impacts on air quality (dust), topography, soil quality, etc. It will be important therefore to reduce the amount of dumping by finding beneficial uses for as much waste soil as possible. This will require:

- o Contacting the town authorities to arrange for the use of this material where possible in construction projects, to raise the level of land prior to construction of roads or buildings, or to fill previously excavated areas, such as brickworks;
- o Preventing the generation of dust (which could affect surrounding agricultural land and crops) by removing waste material as soon as it is excavated, by loading directly onto trucks, and covering with tarpaulins to prevent dust during transportation.

91. Another physical impact associated with large-scale excavation is the effect on drainage and the local water table if groundwater and/or surface water collect in the voids. Given the difficulties of working in wet conditions the Contractor will almost certainly conduct all excavation in the dry season, so this should avoid any impacts on surface water drainage. If water collects in any quantity it will need to be pumped out, and it should then be donated to neighbouring farmers to provide a beneficial use to the communities most affected by this aspect of the work, and improve public perceptions of the project.

3 Ecological Resources

92. At proposed site no ecological interest is noted, so construction will cause no significant ecological impacts. There are some trees that will need to be removed, and given global concerns regarding the loss of trees, the project should make a small positive ecological contribution by planting three native trees at a nearby site for every one that is removed.

4 Economic Development

93. The site of the proposed STP is owned by the government so there should be no need to acquire land from private owners, which might affect the income and assets of owners and tenants. The land is not farmed and there are no industries or housing in the vicinity so there should be no impact on income-generating activities.

94. The only aspect of the work that has any economic implications is the transportation of waste material from the site to locations where it can be put to beneficial use as recommended above. This will require a large number of lorry movements, which could disrupt traffic near the site and particularly in Nagaur if such vehicles were to enter the town. The transportation of waste will be implemented by the Construction Contractor in liaison with the town authorities, and the following additional precautions should be adopted to avoid effects on traffic:

- o Planning transportation routes so that heavy vehicles do not enter Nagaur town and do not use narrow local roads, except in the immediate vicinity of delivery sites;

- o Scheduling transportation activities to avoid peak traffic periods.

5 Social and Cultural Resources

95. Although the STP will be built on an uninhabited and un-used site, with no residential areas nearby, there is a risk that the work could damage social and cultural resources, so careful mitigation and strict adherence by the EA and Contractor will be necessary.

96. Rajasthan is an area with a rich and varied cultural heritage that includes many forts and palaces from the Rajput and Mughal periods, and large numbers of temples and other religious sites, so there is a risk that any work involving ground disturbance could uncover and damage archaeological and historical remains. Given that this particular location is uninhabited and shows no sign of having been used to any extent in the past, then it could be that there is a low risk of such impacts. Nevertheless this should be ascertained by consulting the appropriate authorities, and appropriate steps should be taken according to the nature of the risk. This should involve:

- o Consulting historical and archaeological authorities at both national and state level to obtain an expert assessment of the archaeological potential of the site;
- o Selecting an alternative location if the site is considered to be of medium or high risk;
- o Including state and local archaeological, cultural and historical authorities and interest groups in consultation forums as project stakeholders so that their expertise can be made available to the project;
- o Developing a protocol for use by the Contractor in conducting any excavation work, to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved. This should involve:
 - Having excavation observed by a person with archaeological field training;
 - Stopping work immediately to allow further investigation if any finds are suspected;
 - Calling in the state archaeological authority if a find is suspected, and taking any action they require ensuring its removal or protection in situ.

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

98. 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 ensure that such gains are directed towards communities most directly affected by this part of the scheme, the Contractor should be required to employ at least 50% of the STP labour force from communities within a radius of say 2 km from the site, if sufficient people are available.

C. Sewerage Network and Trunk Sewer

1 Construction method

99. Provision of a sewerage system in part of the town during the second phase of investment (Tranche 2) will involve construction of:

- o The secondary and tertiary network will collect sewage from individual houses have a sufficient water supply, These pipes will be of small diameter (200 to 600 mm) and will be located in shallow trenches (ca 1.5 m in depth).
- o The trunk sewer will also be of RCC pipes and will convey sewage from the secondary network to the STP These pipes will be 900 and 1200 mm in diameter

100. These two elements of the project involve the same kinds of construction and will produce similar effects on the environment, so their impacts are considered together.

101. Most pipes will be buried in trenches immediately adjacent to roads, in the un-used area within the ROW, alongside the edge of the tarmac. The trunk main and secondary network will be located alongside main roads, where there is generally more than enough free space to accommodate the pipeline. However in parts of the tertiary network where roads are narrow, this area is occupied by drains or the edges of shops and houses etc., so the trenches may have to be dug into the edge of the road.

102. Trenches will be dug by backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed nearby, and the pipes (brought to site on trucks and stored on unused land nearby) will be placed in the trench by crane or using a small rig. After the pipes are joined, loose soil will be shovelled back into the trench, and the surface layer will be compacted by hand-operated compressor.

103. Pipes are normally covered by 1.2 m of soil, and a clearance of 100 mm is left between the pipe and each side of the trench to allow backfilling. Trenches will therefore be quite large, a maximum of 2.3 m deep and 1.2 m wide for the trunk main, and a minimum of 1.5 m deep and 0.4 m wide for the tertiary network.

104. At intervals, small chambers (ca 1-2 m³) will be created to allow inspection and clearance of blockages and sediment during operation. These will be excavated by backhoe, and hardcore and concrete (mixed on site) will be tipped in to form the base. Brick sides will then be added by masons by hand, and the top will be sealed at ground level by a metal manhole cover.

105. As noted above, some of the narrower roads are constructed of concrete and have no available space at the edge because of the presence of drains, or shop- and house-fronts encroaching into the ROW. In these places it may be necessary to break open the surface of the road using hand-held pneumatic drills, after which the trench and pipeline will be constructed as described above. On completion a concrete layer will be re-applied to the surface to repair the road.

2 Physical Resources

106. Construction of trenches will have similar physical impacts to the excavation work at the STP, although their extent and significance will be different because trenches are linear structures and the network is located in the town. Since length of the trunk main is not much the

generation of waste will be less. Although this is <10% of the quantity produced at the STP it is still a significant amount of waste, and in this case there are additional considerations because piles of soil could impede traffic and other activities in the town (see below) and dust could affect inhabitants during dry weather. These impacts should be mitigated by applying the same measures as at the STP site to minimise waste and dust, and there will need to be some additional precautions to control dust. The Contractor should:

- o Contact the town authorities to find beneficial uses for the waste material, in construction projects, to raise the level of land prior to construction of roads or buildings, or to fill previously excavated areas, such as brickworks;
- o Remove waste material as soon as it is excavated (by loading directly into trucks), to reduce the amount stockpiled on site;
- o Use tarpaulins to cover loose material when transported from the site by truck;
- o Cover or water stockpiled soil to reduce dust during windy weather.

107. The other important physical impact associated with large-scale excavation (effects on surface and groundwater drainage) should not be an issue in this case because of the very low rainfall in this area and the very low water table. In addition the Contractor will almost certainly conduct all excavation in the dry season, to avoid the difficult working conditions during the monsoon.

108. The physical impacts of trenching will also be reduced by the method of working, whereby the network and trunk sewer will probably be constructed by small teams working on short lengths at a time, so that impacts will be mainly localised and short in duration. Physical impacts are also mainly temporary as trenches will be refilled and compacted after pipes are installed, and any disturbed road surfaces will be repaired. Because of these factors and the mitigation measures proposed above, impacts on the physical environment are not expected to be of major significance.

3 Ecological Resources

109. There are no significant ecological resources in or outside the town (protected areas or rare or important species or habitats), so construction of the network and trunk sewer should have no ecological impacts. However roadside trees should not be removed unnecessarily to build the trenches, and to mitigate any such losses the Contractor should be required to plant and maintain three new trees (of the same species) for each one that is removed

4 Economic Development

110. As the network and trunk sewer pipelines will all be conducted within the ROW of existing roads (either adjacent to the road, or beneath the road surface in narrower streets) there will be no need to acquire land, so there should be no direct effect on the income or assets of landowners, or the livelihoods of tenants.

111. There could be some economic impacts however, if the presence of trenches, excavated material, workers and machinery discourage customers from visiting shops and businesses adjacent to network construction sites, and the businesses lose income as a result. These losses will be short in duration as work at any one site should be completed in a week or less.

However the loss of income could be significant for small traders and other businesses that exist on low profit margins. These impacts should therefore be mitigated by:

- o Leaving spaces for access between mounds of excavated soil, and providing footbridges so that pedestrians can cross open trenches;
- o Increasing the workforce in these areas to ensure that work is completed quickly;
- o Consulting affected businesspeople to inform them in advance when work will occur.

112. ADB policy on Involuntary Resettlement requires that no-one should be worse off as a result of an ADB-funded project, and a separate Resettlement Plan and Resettlement Framework have been prepared to examine these issues and provide appropriate mitigation. This establishes that, in addition to the above practical measures to reduce the economic impact of the construction work, owners and tenants of affected businesses will also be compensated in cash for any income they lose.

113. Excavation could also damage existing infrastructure, in particular storm drains and water supply pipes, both of which are located alongside roads in the town. 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 the public (see below). It will be important therefore to avoid these impacts by:

- o Obtaining details from the Municipal Council of the nature and location of all infrastructure, and planning the sewer networks so that all such sites are avoided;
- o Integrating the construction of the various Nagaur subprojects (in particular water supply and sewerage) so that:
 - Different pipelines are located on opposite sides of the road wherever feasible;
 - Roads and inhabitants are not subject to repeated disturbance by trenching in the same area for different purposes.

114. Transport is another type of infrastructure that will be affected by some of the work, as in the narrower streets there is not enough space for excavated soil to be piled off the road. As noted above the road itself may also be excavated in places where there is no available land alongside. Traffic will therefore be disrupted, and in some very narrow streets the whole road may need to be closed for short periods. The Contractor should therefore plan this work in conjunction with the town authorities and the police force, so that work can be carried out during periods when traffic is known to be lighter, and alternative routes and diversions can be provided where necessary. The Contractor should also increase the workforce in areas such as this, so that the work is completed in the shortest possible time.

115. It is inevitable that there will be an increase in the number of heavy vehicles in the town (particularly trucks removing waste and delivering pipes and other materials to site), and this

could disrupt traffic and other activities, as well as damage fragile buildings if vibration is excessive. These impacts will therefore need to be mitigated by:

- o Careful planning of transportation routes with the municipal authorities to avoid sensitive areas as far as possible, including narrow streets, congested roads, important or fragile buildings and key sites of religious, cultural or tourism importance;
- o Scheduling the transportation of waste to avoid peak traffic periods, the main tourism season, and other important times.

5 Social and Cultural Resources

116. As was the case with the STP site, there is a risk that sewer construction, which involves extensive disturbance of the ground surface, could damage undiscovered archaeological and/or historical remains, or even unknown sites. The risks are in fact considerably higher in this case, because such artefacts are more likely to occur in areas that have been inhabited for a long period. The preventative measures described in Section V.B.5 will thus need to be employed and strictly enforced. These are:

- o Consulting national and state historical and archaeological authorities to assess the archaeological potential of all construction sites;
- o Selecting alternative routes to avoid any areas of medium or high risk;
- o Including state and local archaeological, cultural and historical authorities and interest groups as project stakeholders to benefit from their expertise;
- o Developing a protocol for use in conducting all trenching, to recognise, protect and conserve any chance finds (see Section V.B.5 for details).

117. Sewer construction will also disturb some modern-day social and cultural resources, such as schools, hospitals, temples, and sites that are of interest to tourists. Impacts will include noise, dust, and interrupted access for pedestrians and vehicles, and in cases where pneumatic drills are used to break the surface of concrete roads, there could be a risk of damage from vibration. Mitigation will therefore be needed to protect these resources and to enable usage by local people and visitors to continue throughout the construction work. This will be achieved through several of the measures recommended above, including:

- o Consulting the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;
- o Limiting dust by removing waste soil quickly, covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks;
- o Increasing the workforce in sensitive areas to complete the work quickly;
- o Providing wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required (including access to houses);

- o Using modern vehicles and machinery with standard adaptations to reduce noise and exhaust emissions, and ensuring they are maintained to manufacturers' specifications.

118. In addition the Executing Agency and Contractor should:

- o Consult municipal authorities, custodians of important buildings, cultural and tourism authorities, and affected communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.

119. 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:

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

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

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

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

- o Training of all personnel (including manual labourers) to enable them to understand the dangers of AC pipes and to be able to recognise them in situ;
- o Reporting procedures to inform management immediately if AC pipes are encountered;

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

- o Development and application of a detailed H&S procedure to protect both workers and citizens. This should comply with national and international standards for dealing with asbestos, and should include:
 - Removal of all persons to a safe distance;
 - Usage of appropriate breathing apparatus and protective equipment by persons delegated to deal with the AC material;
 - Procedures for the safe removal and long-term disposal of all asbestos-containing material encountered.

122. There could again be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to communities that are affected by the work, as suggested in Section B.5, the Contractor should be required to employ at least 50% of his labour force from communities in the vicinity of construction sites. Creating a workforce from mainly local people will bring additional benefits by avoiding problems that can occur if workers are imported; including social difficulties in the host community and issues of health and sanitation in poorly serviced temporary camps.

VI. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: OPERATION AND MAINTENANCE

A. Screening out areas of no significant impact

123. Although the sewerage system will need regular maintenance when it is operating, with a few simple precautions this can be conducted without major environmental impacts (see below). There are therefore several environmental factors which should be unaffected once the system begins to function. These are identified in **Table 6.1** below, with an explanation of the reasoning in each case. These factors are thus screened out of the impact assessment and will not be mentioned further.

Table 6.1: Fields in which operation and maintenance of the completed sewerage system is not expected to have significant impacts

Field	Rationale
Climate, topography, geology, seismology	There are no known instances where the operation of a relatively small sewerage system has affected these factors
Fisheries & aquatic biology	The only local fishery is in local pond, which will not be affected
Wildlife, forests, rare species, protected areas	There are none of these features in or outside the town
Coastal resources	Nagaur is not located in a coastal area

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

B. Operation and maintenance of the improved sewerage system

125. The new sewerage system will collect and treat all surface water, domestic wastewater and sewage produced by 50% of the town, and the remainder of the inhabited area and future expansion will be served by additional sewers provided via subsequent tranches of funds. Although treatment will not be to the standards of more developed countries, the technology is approved by the Central Public Health and Environmental Engineering Organization (CPHEEO) and Pollution Control Board attached as **Appendix 3** and the discharge after treatment will comply with Indian wastewater standards (**Table 6.2**).

Table 6.2: Waste Water Quality Discharge Standards

SL.no	Parameter	Standards			
		Inland surface water	Public sewers	Land irrigation	Marine/coastal areas
		(a)	(b)	(c)	(d)
1.	Colour and odour	remove as far as practicable			
2.	Suspended solids mg/l. max.	100	600	200	(a) For process waste water 100 (b) For cooling water effluent 10% above total suspended matter of influent.
3.	Particle size of suspended solids	shall pass 850 micron IS Sieve			(a) Floatable solids, max. 3mm. (b) Settable solids (max 850 micron)
4.	pH value	5.5. to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	shall not exceed 5°C above the receiving water temperature			shall not exceed 5°C above the receiving water temperature
6.	Oil and grease, mg./l. max.	10	20	10	20
7.	Total residual chlorine, mg/l. max.	1.0			1.0
8.	Ammoniacal nitrogen (as N.) mg/l max	50	50		50
9.	Total Kjeldahl Nitrogen (as NH ₃) mg/l. max	100			100
10.	Free ammonia (as NH ₃), mg/l.max	5.0			5.0
11.	Biochemical oxygen demand (3 days at 27°C), mg/l. max.	30	350	100	100
12.	Chemical oxygen demand, mg/l, max.	250			250
13.	Arsenic (as As) mg/l, max.	0.2	0.2	0.2	0.2
14.	Mercury (As Hg), mg/l, max.	0.01	0.01		0.01
15.	Lead (as Pb) mg/l, max	0.1	1.0		2.0
16.	Cadmium (as Cd)	2.0	1.0		2.0

SL.no	Parameter	Standards			
		Inland surface water	Public sewers	Land irrigation	Marine/coastal areas
	mg/l. max				
17.	Hexavalent chromium (as Cr. +6). mg/l, max	0.1	2.0		1.0
18.	Total Chromium (as Cr) mg/l, max	2.0	2.0		2.0
19.	Copper (as Cu) mg/l, max	3.0	3.0		3.0
20.	Zinc (as Zn) mg/l, max	5.0	15		15
21.	Selenium (as Se) mg/l, max	0.05	0.05		0.05
22.	Nickel (as Ni) mg/l, max	3.0	3.0		5.0
23.	Cyanide (as CN) mg/l, max	0.2	2.0	0.2	0.2
24.	Fluoride (as F) mg/l, max	2.0	15		15
25.	Dissolved phosphates (as P) mg/l, max	5.0			
26.	Sulfide (as S) mg/l, max	2.0			5.0
27.	Phenolic compounds (as C ₆ H ₅ OH) mg/l, max	1.0	5.0		5.0

126. The sewer pipes will not function without maintenance, as silt inevitably collects in areas of low flow over time. The project will therefore provide equipment for cleaning the sewers, including buckets and winches to remove silt via the inspection manholes, diesel-fuelled pumps to remove blockages, and tankers to transport the waste hygienically to the STP.

127. Piped sewers are not 100% watertight and leaks can occur at joints. Any repairs will be conducted by sealing off the affected sewer and pumping the contents into tankers, after which the faulty section will be exposed and repaired following the same basic procedure as when the sewer was built. Trenches will be dug around the faulty section and the leaking joint will be re-sealed, or the pipe will be removed and replaced.

128. At the STP sewage sludge will need to be removed from the active treatment ponds every four or five years. This is a simple process that does not require a Sludge Management Plan. Ponds are allowed to dry out naturally and the solid sludge is removed by manual digging. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer and farmers are normally allowed to remove the dry material for application to their land.

C. Environmental impacts and benefits of the operating system

1. Physical Resources

129. The provision of an effective sewerage system in 50% of the town should improve the physical appearance and condition of the city area that will no longer be discharged to the *nallahs*. This measure and the fact that there will be fewer septic tanks and less sewage discharged to drains, should also improve the appearance of the town and the quality of surface water drainage and groundwater. Clearly there will be further significant improvements once the whole town is connected to sewer via the future funding.

130. There could also be small-scale physical benefits from the operating STP if the sewage sludge that is removed periodically from the treatment ponds is provided to farmers and applied to fields, as it will improve soil structure and fertility. There could be a useful cost-recovery element if a system was established to sell this material to farmers, so this should be considered by the EA.

131. There are also certain environmental risks from the operating system, most notably from leaking sewer pipes as untreated faecal material can damage human health and contaminate both soil and groundwater. It will be imperative therefore that the Government Agency (GA) responsible for operating the sewerage system establishes a procedure to routinely check the operation and integrity of the sewers, and to implement rapid and effective repairs where necessary. If trenches are dug to locate and repair leaks or remove and replace lengths of pipe, the work will follow the same procedure as occurred when the infrastructure was provided. However the impacts should be much less significant as the work will be infrequent, and will affect individual small locations for short periods only. Work will not be conducted during rainfall so there will be no effect on drainage, and the excavated soil will be replaced in the trench so there will be no waste. Physical impacts should thus be negligible.

132. Treated effluent from an STP is often discharged to a nearby water body, which may then become contaminated by the high levels of nitrate, phosphate and organic matter in the effluent. As there is a *nallah* (natural or man-made drainage channel) in the vicinity of the proposed STP site, effluent may be discharged into this channel, which may then pollute surface and groundwater and present a risk to the health of humans and animals if it is consumed via well water. This can be avoided by developing a system to sell the treated wastewater to farmers (delivered by tanker) to irrigate their fields. This would provide water and plant nutrients and thus improve agricultural productivity and farm incomes, as well as allowing further cost-recovery by the EA. This should be operated in conjunction with a scheme to sell inert sewage sludge as a farm fertilizer as recommended above, and some of the capacity building and training provided by the project should focus on providing the GA with the skills to operate these measures. This should be preceded by rigorous bacteriological tests to confirm that the treatment methods render all dried sludge and effluent free from enteric bacteria and pathogens, so that it is safe to humans, animals and crops (see Section VII.C below). This water can also be discharged into ponding system developed specifically for aqua-culture if the potential exists

2. Ecological Resources

133. Although the new sewerage system will improve the environment of the town, there are unlikely to be significant ecological benefits as there are no natural habitats or rare or important species. If effluent from the STP was discharged into the nearby *nallah* there could be some small ecological benefits as marsh plants and animals will colonise the small wetland that is likely to be formed. However the risks of contaminating groundwater are more significant, so it would be more appropriate to forego this ecological gain in favour of the better disposal method suggested above, whereby the effluent is supplied to farmers to irrigate and fertilize their fields

or the treated water is discharged into water ponding system which can be developed by the project.

3. Economic Development

134. Although repairs to the sewer network could result in shops losing some business if access is difficult for customers whilst the work is carried out, any losses will be small and short-lived and will probably be at the level of normal business fluctuations. It should therefore not be necessary to compensate for such losses. Nevertheless simple steps should be taken to reduce the inconvenience of the works, including:

- o Informing all residents and businesses about the nature and duration of any repair work well in advance so that they can make preparations if necessary;
- o Requiring contractors employed to conduct these works to provide wooden walkways across trenches for pedestrians and metal sheets where vehicle access is required;
- o Consulting the local police regarding any such work so that it can be planned to avoid traffic disruption as far as possible, and road diversions can be organised if necessary.

135. As noted above, a by-product of the scheme could be to provide economic improvements in the agricultural sector if sewage sludge and treated wastewater provide farmers with a safe and affordable source of organic fertilizer, and crop yields increase as a result. The completed scheme should also contribute to improvements in environmental and community health in the town (discussed below), which could provide some knock-on benefits to business from healthier workers and consumers.

4. Social and Cultural Resources

136. Although there is a high risk of excavation in the town discovering material of historical or archaeological importance, there will be no need to take precautions to protect such material when areas are excavated to repair leaks in the sewer network, as all work will be conducted in trenches that have already been disturbed when the infrastructure was installed.

137. Repair work could cause some temporary disruption of activities at sites of social and cultural importance such as schools, hospitals, temples, etc, so at these locations the same precautions as employed during the construction period should be adopted. These include:

- o Consulting the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;
- o Completing work in these areas quickly;
- o Providing wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required;

- o Consulting municipal authorities, custodians of important buildings, cultural and tourism authorities, and local communities to inform them of the work in advance, and avoid sensitive times, such as religious and cultural festivals.

138. The responsible authorities will employ local contractors to conduct repairs of the sewer network, and contractors should be required to operate the same kinds of Health and Safety procedures as used in the construction phase (see Section V.C.5) to protect workers and the public. This should include application of the asbestos protocol if any AC pipes are encountered.

139. The use of local contractors will provide economic benefits to the companies and the workers they employ. There is however little prospect of directing these benefits to persons affected by any maintenance or repair works as contractors will utilise their existing workforce. To provide at least some economic benefits to affected communities, unskilled persons employed to maintain and operate the STP should be residents of the neighbouring area.

140. The citizens of the town will be the major beneficiaries of the new sewerage system, as human waste from those areas served by the new network will be removed rapidly and treated to an acceptable standard. This should improve the environment of these areas, and in conjunction with the development of other infrastructure (in particular water supply), should deliver major improvements in individual and community health and well-being. Diseases of poor sanitation, such as diarrhoea and dysentery, should be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

VII. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

A. Summary of environmental impacts and mitigation measures

141. **Table 7.1** lists the potential adverse impacts of the Nagaur sewerage 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. The final column assesses whether the proposed action will successfully mitigate the impact (shown as 0), and indicates that some of the measures will provide an additional benefit (shown as +).

B. Institutional arrangements for project implementation

142. The main agencies involved in managing and implementing the subproject are:

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

- o 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.
- o 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.
- o 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.
- o 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.
- o 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.

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

Figure 7.1: Institutional Responsibility- RUSDIP

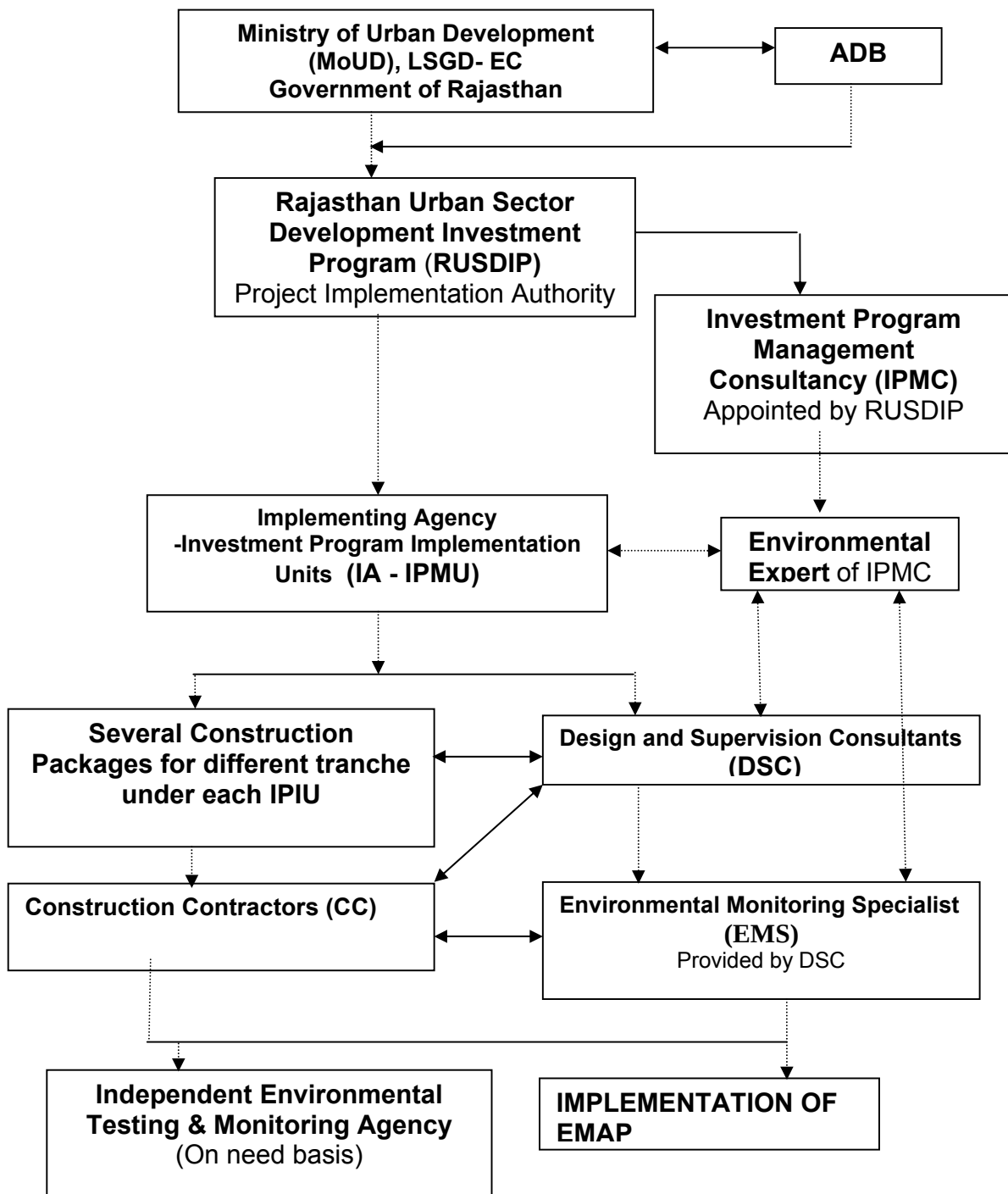


Table 7.1: Environmental impacts and mitigation for the Nagaur Sewerage Subproject
(Black = continuous activity; Grey = intermittent)

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	2008				2009				
Location and Design						D	D	3	4	1	2	3	Op	³
Discharge of treated effluent to <i>nallah</i> could pollute surface & groundwater with nitrate, phosphate, etc •Water ponding systems for aquaculture can be introduced for treated water	M	P	Conduct bacteriological tests to ensure safety of effluent	GA	STP									0
			Sell treated wastewater to farmers for irrigation Aquaculture can be introduced on a small scale.											+
Construction: Sewage Treatment Plant														
Excavation will produce large amounts of waste soil	M	P	Find beneficial uses for waste soil in construction, land raising and infilling of excavated areas	Contractor	All sites									+
Stockpiled soil could create dust in windy weather	M	T	Remove soil as soon as it is excavated	Contractor	All sites									0
Dust could also be produced when soil is transported	M	T	Use tarpaulins to cover dry soil when carried on trucks	Contractor										0
Rain and ground water could collect in excavated areas	M	T	Conduct all excavation in the dry season	Contractor	All sites									0
			Pump out groundwater & provide to farmers for irrigation	Contractor	STP site								+	
Some trees will need to be removed from the site	M	P	Only remove trees if it cannot be avoided	Contractor	All sites									0
			Plant and maintain two trees for every one removed										0	
Traffic may be disrupted by lorries carrying waste soil	M	T	Plan routes to avoid Nagaur Town and narrow local roads	Contractor	From STP site									0
			Schedule transportation to avoid peak traffic periods										0	
Ground disturbance could damage archaeological and historical remains	S	P	Request state and local archaeological authorities to assess archaeological potential of proposed STP site	DSC	All sites									0
			Select alternative if site has medium-high potential	DSC									0	
			Include state and town historical authorities as project stakeholders to benefit from their expertise	LSGD									0	
			Develop and apply protocol to protect chance	DSC and									+	

Sig = Significance of Impact (NS = Not Significant; M = Moderately Significant; S = Significant). Dur = Duration of Impact (T = Temporary; P = Permanent)

D = Detailed Design Period; Op = Period when infrastructure is operating

³ This column shows impacts remaining after mitigation: 0 = zero impact (impact successfully mitigated); + = positive impact (mitigation provides a benefit)

* Mitigation of these impacts will be provided through a separate Resettlement Plan, see Section VII.B

144. 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.

145. 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. Domestic Environmental Consultants (DEC) will be appointed by each IPIU to update the existing IEEs in the detailed design stage, and to prepare IEEs or EIAs for new subprojects, where required to comply with national law and/or ADB procedure.

C Environmental Monitoring Plan

146. **Table 7.1** shows that most mitigation activities are the responsibility of the Construction Contractors⁴ (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.

147. 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 operate⁵.

148. **Table 7.1** 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.

149. **Table 7.2** shows the proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies the various monitoring activities to be conducted during all

⁴ 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

⁵ In the operational period some infrastructure will be the responsibility of the Municipal Boards/Councils, whilst others will be the responsibility of the appropriate branch of the State government (such as PWD, PHED, etc)

phases. Some of the measures shown in **Table 7.1** 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.

150. Given the scale of the investment in providing the infrastructure, LSGD will also wish to conduct monitoring during the operational period to ensure the correct functioning of the STP and confirm the long-term benefits of the scheme. There will also be bacteriological surveys when the STP is operating, to ensure the safety of dried sludge and treated effluent before sale to farmers to fertilize and irrigate fields. **Table 7.2** shows that these long-term surveys will monitor:

- o the chemical and bacteriological quality of treated STP effluent;
- o the bacteriological content of dried sewage sludge;
- o the health of the population and the prevalence of diseases of poor sanitation.

151. An accredited consulting laboratory will be appointed to collect and analyse samples of treated effluent and dried sludge once per month for the first five years of operation of the STP. A domestic social studies consultant will be appointed to monitor public health and the incidence of disease, once per year over the same five year period, after collecting baseline data during the construction period.

D. Environmental management and monitoring costs

152. Most of the mitigation measures require the contractors 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 contractors (those employed to construct the infrastructure or the local companies employed to conduct O&M when the system is operating) are included in the budgets for the civil works and do not need to be estimated separately here. Mitigation that is the responsibility of LSGD will be provided as part of their management of the project, so this also does not need to be duplicated here. Costs of compensating shopkeepers for loss of business income during the construction period (**Table 7.1**) are calculated separately in the budgets for the Resettlement Framework and Resettlement Plans so are also excluded from this analysis.

153. The remaining actions in the Environmental Management Plan are:

- o The environmental monitoring during construction, conducted by the EMS;
- o The long-term post-construction surveys that will be commissioned by LSGD.

154. These have not been budgeted elsewhere, and their costs are shown in **Table 7.3**, with details of the calculations shown in footnotes beneath the table. The figures show that the total cost of environmental management and monitoring for the project as a whole (covering design, 1 ½ years of construction and the first five years of operation) is INR 2.25 million, ie US\$ 52,442.

Table 7.2: Environmental Monitoring Plan

Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Monitoring Frequency	Responsible for Monitoring
LOCATION AND DESIGN					
Sell treated wastewater to farmers for irrigation, development of water ponding system	STP	GA	Site observation; farmer survey	Monthly	
CONSTRUCTION					
Find beneficial uses for waste soil (construction, land raising, infill)	All sites	Contractor	Site observations; CC records	Monthly	EMS
Remove waste soil as soon as it is excavated	All sites	Contractor	Site observations	Weekly	EMS
Use tarpaulins to cover soil when transported on trucks	All sites	Contractor	Site observations	Weekly	EMS
Avoid Nagaur Town and narrow local roads when transporting soil	From STP	Contractor	Observations off site; CC record	Weekly	EMS
Avoid transporting soil during peak traffic periods	From STP	Contractor	Observations on and off site	Weekly	EMS
Cover or damp down stockpiled soil in dry weather	Inhabited areas	Contractor	Site observations	Weekly	EMS
Conduct all excavation work in the dry season	All sites	Contractor	Site observations	Monthly	EMS
Pump groundwater from excavated areas and provide to farmers	STP site	Contractor	Site observations; farmer survey	Monthly	EMS
Leave spaces for access between mounds of soil	Network sites	Contractor	Site observations	Weekly	EMS
Provide bridges to allow people & vehicles to cross open trenches	Network sites	Contractor	Site observations	Weekly	EMS
Only remove trees if it cannot be avoided	All sites	Contractor	Site observations	Weekly	EMS
Plant and maintain two trees for every one removed	All sites	Contractor	Observations on/off site; CC records	Monthly	EMS
*Compensate businesses for lost income	Where required	LSGD	Shopkeeper survey; LSGD record	As needed	IMA ⁶
Increase workforce in inhabited areas to finish work quickly	Network sites	Contractor	Site observations; CC records	Monthly	EMS
Inform shopkeepers and residents of work in advance	Network sites	LSGD	Resident surveys; CC records	Monthly	EMS
Confirm location of infrastructure and avoid these sites	Network sites	DSC	Site observation; design reports	Monthly	EMS
Locate water and sewer pipes on opposite sides of roads	Network sites	DSC	Site observation; design reports	Monthly	EMS
Integrate subprojects to conduct trenching at same time	Network sites	DSC/LSGD	Site observation; design reports	Monthly	EMS
If work will affect traffic, conduct when traffic is light	Network sites	Contractor	Site observations; CC records	Monthly	EMS
Ensure police provide traffic diversions when required	Network sites	Contractor	Site observations; CC records	Monthly	EMS
Request archaeological authorities to assess potential of all sites	All sites	DSC	DSC records; design reports	As needed	EMS
Select alternatives if sites have medium or high potential	All sites	DSC	DSC records; design reports	As needed	EMS
Include state and town historical authorities as stakeholders	All sites	LSGD	CC records; observations at meetings	As needed	EMS
Develop and apply archaeological protocol to protect chance finds	All sites	DSC and CC	DSC and CC records; site observations	Weekly	EMS
Plan transport routes to avoid narrow streets, important or fragile buildings, religious and tourism sites	Network sites	Contractor	Observations off site: CC record	Weekly	EMS
Plan work to avoid peak traffic and main tourism season	Network sites	Contractor	Site observations; CC records	Monthly	EMS

⁶ Resettlement issues (asterisked) will be monitored by an Independent Monitoring Agency (IMA) established under the Resettlement Framework

Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Monitoring Frequency	Responsible for Monitoring
Avoid using pneumatic drills near buildings at risk from vibration	Network sites	Contractor	Site observations; CC records	Weekly	EMS
Use modern vehicles and machinery and maintain as specified	All sites	Contractor	Site observations; CC records	Monthly	EMS
Consult authorities, custodians of buildings, communities; address key issues, avoid working at sensitive times	Network sites	Contractor	Site observations; CC records; resident surveys	Monthly	EMS
Prepare and implement a site H&S Plan including personal protection from transmission of HIV/AIDS (safety of workers/public)	All sites	Contractor	Site observations; CC records	Monthly	EMS
Exclude public from the site	All sites	Contractor	Site observations; CC records	Monthly	EMS
Ensure that workers wear Personal Protective Equipment	All sites	Contractor	Site observations; CC records	Monthly	EMS
Provide Health and Safety training including process of transmission of HIV/AIDS for all personnel	All sites	Contractor	CC records; worker interviews	Monthly	EMS
Follow documented procedures for all site activities	All sites	Contractor	Site observations; CC records	Monthly	EMS
Keep accident reports and records	All sites	Contractor	CC records	Monthly	EMS
Design infrastructure to avoid known locations of AC pipes	Network sites	DSC	DSC records; design reports	As needed	EMS
Train all personnel in dangers and recognition of AC pipes	All sites	Contractor	Site observations; CC records	Monthly	EMS
Develop and apply protocol if AC pipes are encountered	All sites	DSC/CC	DSC & CC records; site observations	Weekly	EMS
If AC pipes are encountered, report to management immediately	All sites	Contractor	Site observations; CC records	Weekly	EMS
Remove all persons to safe distance	All sites	Contractor	Site observations; CC records	Weekly	EMS
Workers handling AC: wear breathing apparatus; protective suits	All sites	Contractor	Site observations; CC records	Weekly	EMS
All AC material must be removed and disposed of safely	All sites	Contractor	Observations on and off site; CC records	As needed	EMS
Employ at least 50% of workforce from communities near sites	All sites	Contractor	CC records; worker interviews	Monthly	EMS
OPERATION AND MAINTENANCE					
Detect and repair sewer leaks rapidly and effectively	Network sites	GA	Site observation; resident survey	Monthly	
Sell dried inert sludge to farmers to fertilize land, ponding of water to introduce aquaculture	STP	GA	Site observation; farmer survey	Monthly	
Inform shopkeepers and residents of work in advance	Network sites	GA	Resident surveys	Monthly	
Provide walkways and bridges for vehicles	Network sites	OM Contractor	Site observation; resident survey	Monthly	
Request police to divert traffic if necessary	Network sites	OM Contractor	Site observations	Monthly	
Avoid using drills or heavy vehicles near fragile buildings	Network sites	OM Contractor	Site observations	Monthly	
Finish work quickly in sensitive areas	Network sites	OM Contractor	Site observations; OMC records	Monthly	
Consult communities, avoid working during sensitive periods	Network sites	GA	Site observation; resident survey	Monthly	
Prepare and operate H&S plan to protect workers and citizens	All sites	OM Contractor	Site observations; OMC records	Monthly	
Apply AC protocol to protect all persons if AC pipes encountered	All sites	OM Contractor	Site observations; OMC records	Monthly	
STP workers should be residents of neighbouring areas	STP	GA	Employer record; worker survey	Monthly	
LONG-TERM SURVEYS					
Survey of chemical and bacteriological quality of STP effluent	STP	GA	Water quality sampling/analysis	Monthly for 5 years	Consulting lab
Bacteriological surveys of dried STP sludge	STP	GA	Bacterial sampling/analysis		Consulting lab

Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Monitoring Frequency	Responsible for Monitoring
Survey of public health and incidence of water borne disease	Nagaur Town	GA	Hospital records; resident surveys	Annual for 6 years	Social studies consultant

Table 7.3: Environmental management and monitoring costs (INR)

Item	Quantity	Unit Cost	Total Cost	Sub-total
1. Implementation of EMP (2 years)				
Domestic Environmental Monitoring Specialist	1 x 3 month	130,000 ⁷	390,000	
Survey Expenses	Lumpsum	100,000	100,000	490,000
2. Survey of STP sludge and effluent (5 years)				
Domestic Consultant	5 x ½ month	130,000	325,000	
Sample Analysis	5 x 20	3,500 ⁸	350,000	
Other Expenses	Lumpsum	200,000	200,000	875,000
3. Survey of public health (6 years)				
Domestic Consultant	6 x ½ month	130,000	390,000	
Expenses	Lumpsum	200,000	200,000	590,000
4. Environmental mitigation including greenery development around STP and PS	Lumpsum	300,000	300,000	300,000
TOTAL				2,255,000

E Associated Facilities

155. There are no upstream associated facilities in this subproject; however, the downstream users of treated water can be considered associated to the facility.
156. If the Sewage Treatment Plant's (STP's) treated waste water is drained into a nallah or discharged into boreholes, care must be taken to properly treat it before it is discharged otherwise the infusion of contaminated waters in the ground aquifers can render the water permanently unfit for human consumption.
157. Inappropriate waste water disposal pollutes the receiving waters such as rivers, *nallahs*, water ponding systems for aquaculture and may render them unfit for abstraction and treatment if toxic in nature. These *nallahs*, rivers or farmers which "take away/use" this waste water are deemed to be end users of the wastewater from the STP. Therefore before disposal, all Indian wastewater discharge standards must be met in full and proper records must be maintained.

VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project stakeholders

158. 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:

- o 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

⁷ Unit costs of domestic consultants include fee, travel, accommodation and subsistence

⁸ Cost of a standard bacteriological analysis (total and faecal coliforms, E.coli, enterococci, etc) is \$90 (INR 3,500) per sample

- o Owners and users of any land that is acquired along the transmission main route;
- o Custodians and users of socially and culturally important buildings in affected areas;
- o State and local authorities responsible for the protection and conservation of archaeological relics, historical sites and artefacts;
- o State and local tourism authorities.

159. Secondary stakeholders are:

- o LSGD as the Executing Agency;
- o Other government institutions whose remit includes 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);
- o NGOs and CBOs working in the affected communities;
- o Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- o The beneficiary community in general; and
- o The ADB.

B. Consultation and disclosure to date

160. 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 nearby the project site

161. 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 minimise the impact on environment.

162. The public Consultation and group discussion meeting were conduct by RUIDP on Date 04 June 2008 after advertising in Local NEWS papers. 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 2 in Nagaur were discussed.

163. 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. Detail of this Public consultation/ Group Discussion are attached as **Appendix 4**

C Major Issues discussed during Public consultation are

- (i) Proposed waste water management project should ensure proper hygienic disposal of sewerage water in all wards of city.
- (ii) 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;
- (iii) Livelihood affected households should be given assistance in the mode of cash compensation;
- (iv) Local people should be employed by the contractor during construction work;
- (v) Adequate safety measures should be taken during construction work;
- (vi) Mobile kiosks/vendors/hawkers have shown willingness to shift in nearby places without taking any compensation and assistance from the Executing Agency;

- (vii) Local people have appreciated the waste water management proposal of the government and they have ensured that they will cooperate with the Executing Agency during project implementation.

D. Future consultation and disclosure

164. 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:

- Consultation during detailed design:
 - o 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;
 - o Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project.
- Consultation during construction:
 - o Public meetings with affected communities to discuss and plan work programmes and allow issues to be raised and addressed once construction has started;
 - o 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;
- Project disclosure:
 - o 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;
 - o 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;
 - o 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.

IX. FINDINGS AND RECOMMENDATIONS

A. Findings

165. 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. 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. Residents in towns will also benefit from savings in health care costs.

166. 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.

167. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Nagaur Sewerage and Sanitation Subproject. Potential negative impacts were identified in relation to construction and operation of the improved infrastructure, and the design and location of the subproject. 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:

- o Locating the trunk main and sewerage networks within the ROW of existing roads, to avoid the need to acquire land or relocate people;
- o Locating sewers on unused land adjacent to roads wherever possible, to avoid damaging roads and disrupting traffic and other activities.

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

169. Changes have also been made to the location of elements of the project to further reduce impacts. These include:

- o Locating the STP on government-owned land to avoid the need for land acquisition and relocation of people;
- o Locating the trunk main in the ROW alongside the Road, to avoid acquiring agricultural land and affecting the livelihoods of farmers and farm workers.

170. Regardless of these and various other actions taken during the IEE process and in developing the subproject, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because of the invasive nature of trenching work and the excavation of ponds at the STP site; because the sewer network is located in a town, some parts of which are densely populated; and because Rajasthan is an area with a rich

history, in which there is a high risk that ground disturbance may uncover important remains. Because of these factors the most significant impacts are on the physical environment, the human environment, and the cultural heritage.

171. During the construction phase, impacts mainly arise from the need to dispose of large quantities of waste soil; and from the disturbance of residents, businesses, traffic and important buildings by the construction work. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. These include:

- o Finding beneficial uses for waste material;
- o Covering soil and sand during transportation and when stored on site;
- o Planning work to minimise disruption of traffic and communities;
- o Providing temporary structures to maintain access across trenches where required.

172. Although there will be no need to acquire land or relocate people, roadside businesses will lose some income as access will be difficult for customers when work is in their vicinity. ADB policy requires that no-one should be worse off as a result of an ADB-funded project, so these losses will be compensated through a Resettlement Plan and Framework prepared to comply with Bank policy on Involuntary Resettlement.

173. 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:

- o Assessing the archaeological potential of all proposed construction sites, and selecting alternative locations to avoid any areas of medium or high risk;
- o Including archaeological, cultural and historical authorities and interest groups as project stakeholders to benefit from their expertise;
- o Developing a protocol for use in conducting all excavation to ensure that any chance finds are recognised, protected and conserved.

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

- o Avoid all known sites of AC pipes when the locations of new infrastructure are planned in the detailed design stage;
- o Train all construction personnel to raise awareness of the dangers of AC and enable early recognition of such pipes if encountered;
- o Develop and apply a protocol to protect workers and the public if AC pipes are encountered (including evacuation of the immediate area, use of protective equipment by workers, and safe removal and disposal of AC material).

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

- o Employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain;
- o Ensure that people employed in the longer term to maintain and operate the new STP are residents of nearby communities.

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

177. On completion the sewerage system should operate with routine maintenance, which should not significantly affect the environment, providing certain pre-conditions are met. These are that:

- o The operation and integrity of sewers are checked regularly and any leaks are repaired rapidly and effectively to avoid public health risks and contamination of land and water;
- o Treated effluent from the STP is sold to farmers to fertilize and irrigate fields instead of being discharged into a nearby *nallah*. Water ponding system could also be established for development of aquaculture in treated water

178. The repair of sewers will have fewer environmental impacts than the original sewer construction as the work will be infrequent and will affect small areas only. It will also be conducted in areas that have already been excavated, so there will be no need to protect archaeological material.

179. The regular removal of sludge from the treatment ponds should also have no environmental impacts, and if tests show that the drying procedure removes bacterial contamination the material should be sold to farmers to fertilize soil, as this will provide an environmental gain and some cost recovery.

180. The main impacts of the operating sewerage system will be beneficial as human waste from those areas served by the new network will be removed rapidly and treated to an acceptable standard. This will improve the environment and appearance of these areas, and the health and quality of life of the citizens. Diseases of poor sanitation should be reduced, which should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

181. **Table 7.1** 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 scheme).

182. Mitigation will be assured by a program 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. There will also be longer-term surveys to ensure the safety of sewage sludge and treated effluent for use in agriculture, and to monitor the expected improvements in the health of the population.

B. Recommendations

183. 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:

- o All mitigation, compensation and enhancement measures proposed in this environmental status report (**Table 7.1**) are implemented in full, as described in the text above;
- o The Environmental Monitoring Plan proposed in Section VII.C of this report is also implemented in full.

X. CONCLUSIONS

184. The environmental status of the proposed improvements in sewerage and sanitation 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.

185. 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.

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

PHOTOGRAPHS

APPENDIX 1



Land For STP Site



Road to STP Site



Proposed STP Site



Amar Singh Rathore Ki Chattri, Nagaur



Old Water Harvesting Structure, Nagaur



APPENDIX – 2:

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST (REA)

Rapid Environmental Assessment (REA) Checklist			SEWERAGE TREATMENT	
Instructions:				
♦	This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department			
♦	This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.			
♦	This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.			
♦	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:		RUSIDP		
Sector Division		SEWAGE TREATMENT - Nagaur		
SCREENING QUESTIONS			Yes	No
A. Project Siting				
Is the project area				No environmental sensitive area nearby
♦	Densely populated ?		√	
♦	Heavy with development activities?		□	√
♦	Adjacent to or within any environmentally sensitive area			
	•	Cultural heritage site		√
	•	Protected Area	□	√

Rapid Environmental Assessment (REA) Checklist					SEWERAGE TREATMENT
	•	Wetland	☐	✓	
	•	Mangrove	☐	✓	
	•	Estuarine	☐	✓	
	•	Buffer zone of protected area	☐	✓	
	•	Special area for protecting biodiversity	☐	✓	
	•	Bay	☐	✓	
B.	Potential Environmental Impacts				
Will the Project causes					
♦	impairment of historical/cultural monuments/areas and loss/damage to these sites?		☐	✓	The sewerage system is not impacting any such structures.
♦	interference with other utilities and blocking of access to buildings, nuisance to neighbouring areas due to noise, smell, and influx of insects, rodents, etc.?		✓	☐	Improvement of the sewerage system will minimize all these problems. STP site is away from settlement. So these problems will be minimum.
♦	dislocation of involuntary resettlement of people		☐	✓	STP has been proposed on government land and sewerage lines not disturbing any private property
♦	impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		☐	✓	Secondary treatment will be provided at the STP. So these types of problem will not arise
♦	overflows and flooding of neighbouring properties with raw sewage?		☐	✓	Sewerage system has been designed considering the population growth. It has been Designed for the scheme of 2041.

Rapid Environmental Assessment (REA) Checklist				SEWERAGE TREATMENT
♦	environmental pollution due to inadequate sludge disposal of industrial waste discharges illegally disposed in sewers?	☐	√	No chance of contamination with industrial waste because the design of sewerage is underground close conduct . No one will be allowed to connect with the system with out permission of the authority even for domestic connection permission is required.
♦	noise and vibration due to blasting and other civil works?	√	☐	Mitigation measures to be provided will be taken care in EMP
♦	discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?	☐	√	Confined underground domestic sewerage system. No chance for contamination
♦	inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisance, and protect facilities?	☐	√	STP site away from settlement. All the pumps will be with in enclosure and treatment plant will be surrounded by boundary. Adequate buffer zones as per MOEF norms will be provided.
♦	social conflicts between construction workers from other areas and community workers?	☐	√	Most of the worker will be from local area
♦	road blocking and temporary flooding due to land excavation during the rainy season?	√	☐	Mitigation measures to be provided will be taken care in EMP. Contractor will be suggested not to take such works in rainy season

Rapid Environmental Assessment (REA) Checklist				SEWERAGE TREATMENT
♦	noise and dust from construction activities?	√	□	Mitigation measures to be provided will be taken care in EMP
♦	traffic disturbances due to construction material transport and wastes?	√	□	Mitigation measures will be taken care in EMP with proper traffic management plan.
♦	temporary silt runoff due to construction?	□	√	Not considerable.
♦	hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?	□	√	All piping will be tested. Hydro-testing will be carried out for all material.
♦	deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?	□	√	No direct discharge. Only treated sewage will be discharged
♦	contamination of surface and ground waters due to sludge disposal on land?	□	√	It will be disposed off in designated site.
♦	health and safety hazards to workers from toxic gases and hazardous materials which may be contained in sewage flow and exposure to pathogens in sewage and sludge?	□	√	Ventilation Shaft will be provided at the trunk main. Regular health check-up of the workers

APPENDIX – 3**STP WSP Technology (Approved by CPHEEO)****Waste Stabilization Pond:**

Stabilization ponds are open, flow through earthen basins retaining the sewage comparatively long detention periods extending from a few to several days, during which period putrescible matter in the waste is stabilized in the pond through a symbiotic relation between bacteria and algae. They do not require skilled operational staff & their performance do not fluctuate from day to day.

The facultative pond functions aerobically at the surface while an aerobic condition prevails at the bottom. The aerobic layer act as a good check against odour evolving from the pond, The treatment effected by this type of pond is comparable to that of conventional secondary treatment process. The facultative pond is hence best suited and most commonly used for the treatment of sewage.

Process Description:

Waste stabilization pond is a process that will give desired results i.e. deliver a treated effluent' suitable for irrigation purpose (with nutrients and hygienically- safe). The process involves minimal mechanical and electrical equipment for screen, grit removal, flow measurement and minimal operation and maintenance. The routine maintenance will involve removal and disposal of screenings and grit; measurement of flow. Consumption of energy is minimal & O& M will only involve cutting of weeds, removing floating matter, repair of any damage to the embankments.

The waste stabilization pond system will include screen, grit chamber, flow Measuring arrangement, anaerobic pond and facultative pond will considerably reduce the area required. The effluent from the waste stabilization pond will contain algae which is a rich source of nutrients viz. Nitrogen (N), Phosphorous (P) and Potassium (K). The algae deposited on soil are used as organic manures enriching the soil with N, P, . K liberated from algal cells from bacterial action. A certain amount of nutrients in raw sewage, which have not been used for producing algal cells will also, be available in the treated sewage.

In properly designed, operated and maintained ponds, there will be no problem of odour, mosquito and fly nuisance. The percentage. removal of indicator bacteria and pathogens is higher in case of waste stabilization ponds than in case of conventional treatment processes.

No sludge treatment is required to be provided as the sludge collected in the pond is well stabilized. The sludge can be withdrawn after sufficiently long intervals.

THE TREATMENT PLANT SHALL CONSIST OF FOLLOWING UNITS

- Main inlet chamber with distribution chamber
- Bar screen chamber with coarse screen with clear openings of 50mm width and bar screen with 15 mm width
- Grit Chambers The grit chambers shall be able to remove grit particles of size 0.15 mm
- Anaerobic ponds
- Facultative ponds
- Office Building cum laboratory

APPENDIX – VIII-A PUBLIC CONSULTATION

Appendix 1: Proceedings of City Level Consultation Meeting At Nagaur on June 04 '2008

Introduction : Government of Rajasthan has embarked upon an ambitious project of developing infrastructures in the 15 towns of Rajasthan with an aim to raise general standard of hygiene and living of the people. The major factors contributing to this objective is to overcome deficit in various service sectors such as water supply, waste water, solid waste etc. The meeting is organized to make people of the town aware about this project, invite queries from them and thus to arouse interest in people for taking part in the program.

1. The public consultation meeting was therefore organized on **June 04 '2008** at Nagaur Municipal Board (NMB) meeting hall. The meeting was organized by the NMB on the request of the Board, prominent persons of the city, non-governmental organizations (NGOs), community based organizations (CBOs), political leaders, general public and also invited were the technical staff of the various government agencies (List of persons attended the meeting is enclosed herewith).

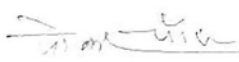
2. The objective of the meeting was to appraise the stakeholders about the environmental and social impacts of the proposed program and the safeguards provided in the program to mitigate the same.

In the specific context of Nagaur, the environmental and social impacts of the proposed subprojects under Tranche II & III in Nagaur were discussed in detail with people present.

3. Domestic environmental specialist and an EA representative, who is also the in-charge of Nagaur town, made the detailed presentation to the stakeholders (copy of presentation is enclosed herewith). Draft resettlement framework (RF) and summary initial environmental examination (SIEE) documents of RUSDIP, translated in the local language – Hindi, were displayed in the Notice Board of NMB and also distributed during presentation to the interested parties. The copies of documents are also made available to all the interested parties through the NMB. It may be noted that the EA has already distributed these documents to the affected persons (APs) and project implementation agencies, the PHED and NMB .

4. The comments, suggestions of the stakeholders are presented below:

- stakeholders attended this meeting, which was chaired by the elected Vice-chairperson of Nagaur Municipal Board.
- The meeting started with a briefing by the Chairman of Nagaur Municipal Board.
- Domestic environmental specialist then made a detailed presentation on (i) objective and benefits of RUSDIP, (ii) proposed subprojects in Nagaur in Tranche II & III, (iii) mandatory environmental and social assessment requirements of subprojects, i.e. Government Regulations and as well as ADB policies on Environment, involuntary Resettlement and Indigenous


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People – salient features of these three key safeguard policies were presented, (iii) key social safeguard features in the program to avoid social impacts, (iv) draft resettlement framework (v) IR impacts of Tranche II & III subprojects in Nagaur, (vi) environmental subproject selection criteria to minimize the negative environmental impacts of subproject implementation and, lastly, (vii) identified environmental impacts and mitigation measures through sample subproject IEEs.

- All the stakeholders supported the project and indicated their willingness to participate in the program to make it successful.
- Stakeholders were of the general view that these subprojects provide benefits to all the people by improving water supply, sewerage, roads and solid waste management infrastructure.
- Most of the stakeholders also indicated that solid waste at present is not managed properly. Waste is collected partially and disposed haphazardly all over, making Nagaur unhealthy. During rains the solid waste joins natural streams. Therefore, all were of the view that solid waste management subproject will improve the environmental and aesthetical values of the city.
- People were very much impressed by the ADB Policy that the "absence of formal legal title to land is not a bar to ADB policy entitlement".
- The EA further appraised that RUSDIP is designed to minimize the IR impacts. In unavoidable cases, the LA and R & R will be handled through the Resettlement Framework (RF) of RUSDIP. Stakeholders were satisfied that all possible IR issues are included in RF, however, indicated to the EA that this shall be implemented in letter and spirit.
- The ADB has also a policy according to which contract can not be finalized unless land required and RF/RP are cleared. With this policy cost over runs and delays will be avoided.

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