Government of Rajasthan
Asian Development Bank

Technical Assistance

Project Number: 40031

India: Rajasthan Urban Sector Development Investment Program (RUSDIP)

INITIAL ENVIRONMENTAL EXAMINATION (DRAFT)

JAISALMER: URBAN DRAINAGE SUBPROJECT

FEBRUARY 2006

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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 will be implemented over a five year period beginning in late 2007, and will be funded by a loan via the Multitranche 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. Alwar, Jaisalmer and Jhalawar/Jhalrapatan are the towns chosen to benefit from the first tranche of RUSDIP investment.

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, 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 for the first tranche of funding were assessed by 13 Initial Environmental Examination (IEE) Reports and 3 Environmental Reviews, prepared according to ADB Environment Policy (2002) and Environmental Assessment Guidelines (2003). This document is the IEE report for the Jaisalmer Urban Drainage Subproject.

B. Extent of 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 that 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 classed this program as Category B and following normal procedure for MFF loans has determined that one IEE 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. Category A projects require EC 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 drainage sub-project that is the subject of this IEE.

3. Review and Approval Procedure

12. For Category B projects the Draft IEE 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 for the Jaisalmer Urban Drainage subproject. It discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this subproject. It is one of 18 documents describing the environmental impacts and mitigation of all subprojects proposed in Tranche 1. These were prepared in January and February 2007 by one International and one Domestic Environmental Specialist via inputs of two and three months respectively.

II. DESCRIPTION OF THE PROJECT

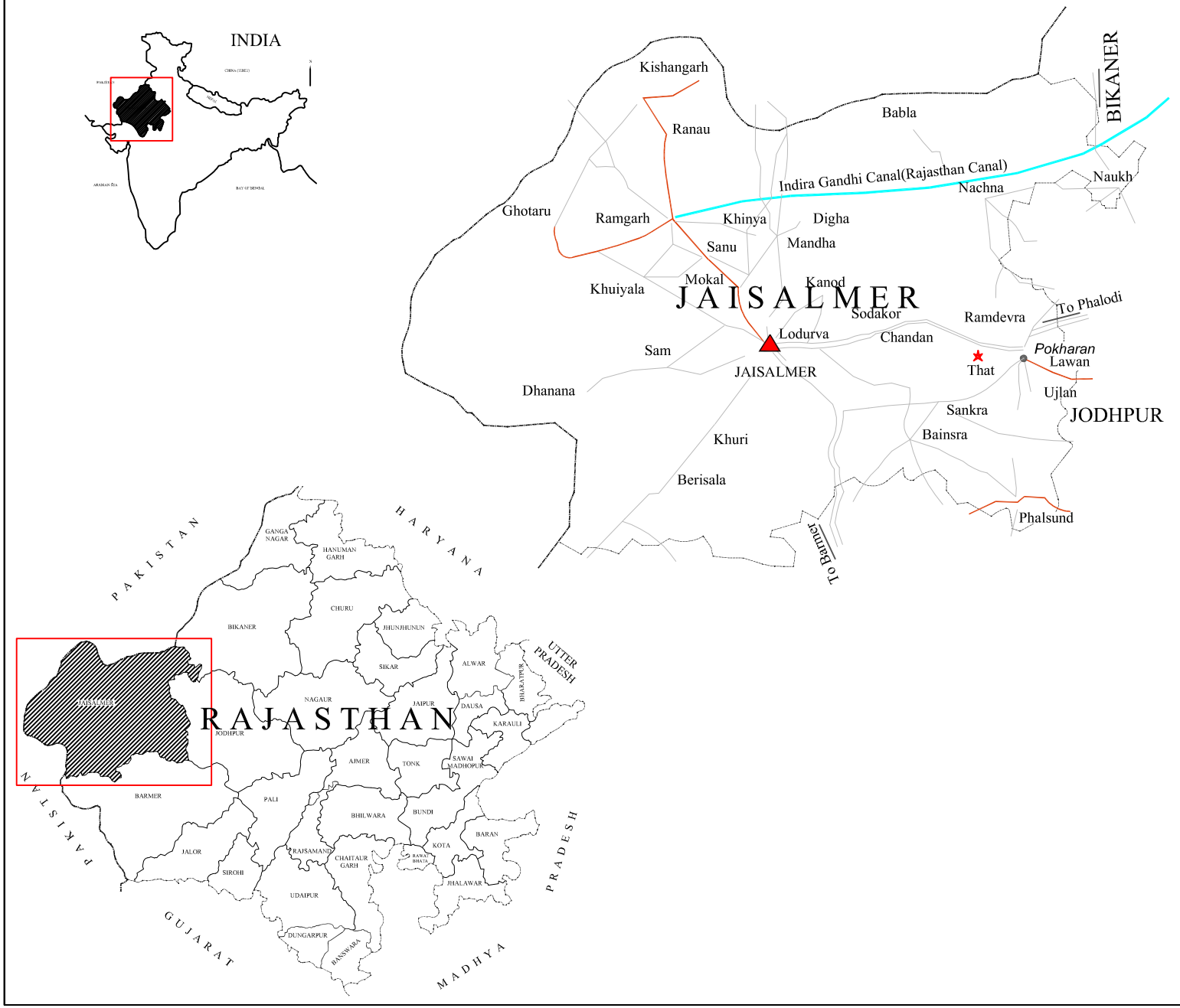
A. Type, Category and Need

14. This is a drainage sub-project, and as explained above it has been classified by ADB as Category B, because it is not expected to have major negative environmental impacts. Under ADB procedures such projects require an IEE to identify and mitigate the impacts, and to determine whether further study or a more detailed EIA may be required. The sub-project is needed because the present drainage system is inadequate for the needs of the growing population. There are open drains alongside certain roads and streets, but many are blocked and overflowing, and most contain household sewage discharged through illegal connections. Leakage from drains and the municipal water supply system is a major problem in the historical fort and walled city where many structures are suffering serious water damage. This is one of a series of subprojects designed by the RUSDIP that are intended to raise the standards of the municipal infrastructure and services of Jaisalmer and the other urban centres to those expected of modern Asian towns.

B. Location, Size and Implementation Schedule

15. The sub-project is located in Jaisalmer, the headquarters town of Jaisalmer District, in the west of Rajasthan in north-western India (Figure 1). The infrastructure will be located in the

[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 (February 2007)



Rajasthan Urban Sector
Development Investment Program
ADB TA 4814-IND

Jalsalmer
Regional Map

LEGEND:-

- International Boundary
- State Boundary
- District Boundary
- Railway
- District Headquarter \ Program Town
- Canal

OVERLAY LEGEND:-

GOVT. OF RAJASTHAN

ASIAN DEVELOPMENT BANK

DRAWN :-	CHECKED :-
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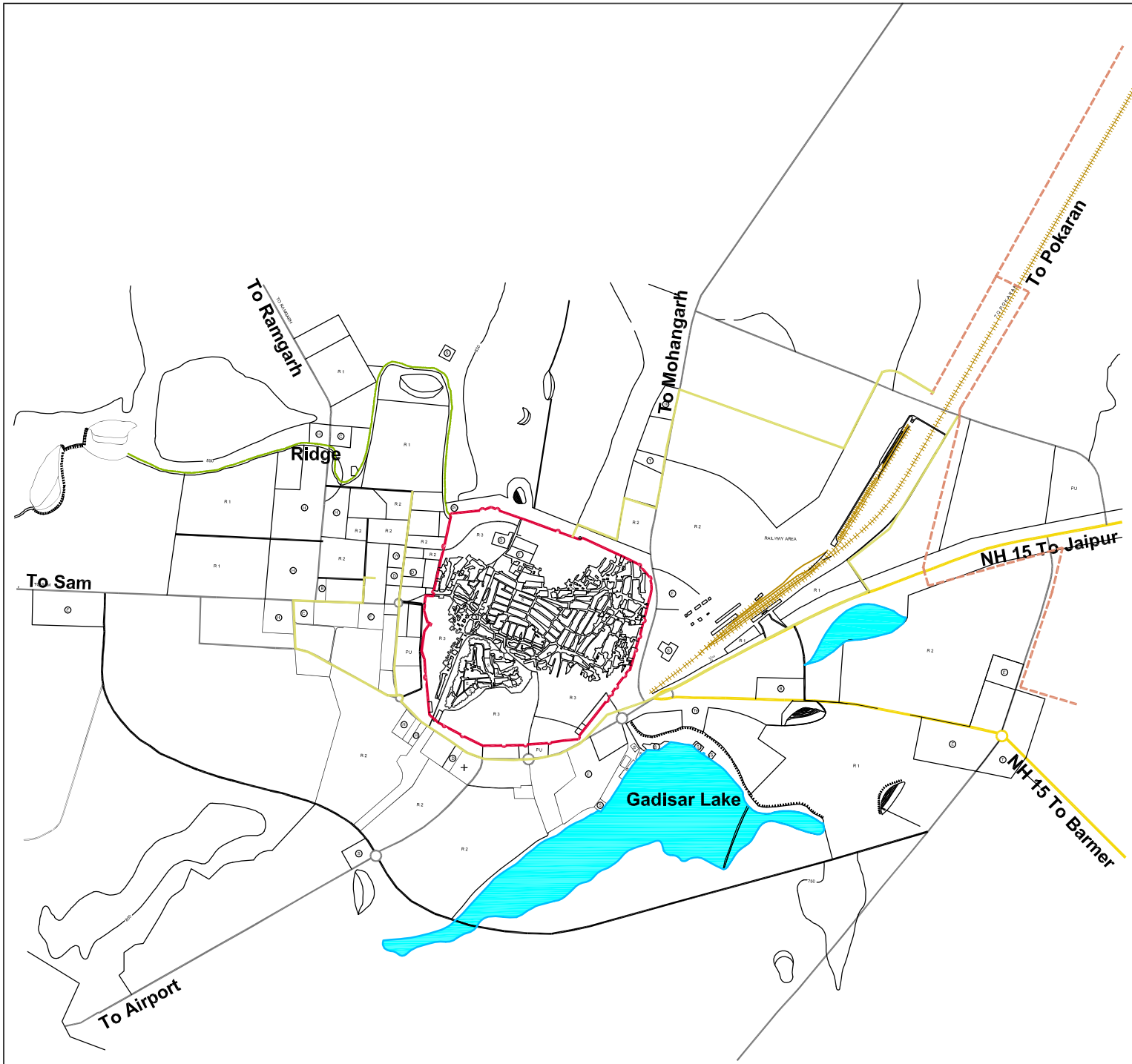

RAJASTHAN URBAN SECTOR DEVELOPMENT INVESTMENT PROGRAM

(ADB TA 4814 - IND)

JAISALMER

Dralnage Network

LEGEND:

- Walled City, Jaisalmer
- Water Bodies
- National Highway
- Major Roads
- Rallway Track
- Ridge

OVERLAY LEGEND:

- Exlstlng Nalla (SWD)
  Bottom Width: 0.6 - 0.75 m
  Top Width: 1.5 - 1.8 m
- Proposed Nalla (approx. 12.8 km)

GOVT. OF RAJASTHAN

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western and north-western outskirts of the town, where two new concrete *nallahs* (drainage channels) will be built to extend the existing drainage network and carry surface water out towards the north-west alongside the railway line (Figure 2).

16. Detailed design will begin in the middle of 2007 and should be completed by the end of the year. Construction will begin in early 2008, and should take around nine months, so all work should be completed by the end of 2008.

C. Description of the Sub-project

17. The subproject will build two new concrete drains, which will complement and extend the existing concrete *nallah* system. This runs in two main branches to the south and north-east of the town outside the walled area, and carries water from smaller drains in neighbourhood streets and lanes.

18. The new *nallahs* will be U-shaped in cross section, with concrete floors and brick sides faced with mortar, and will be approximately 5 m wide and 2.5 m deep and a total of 12.8 km in length. There will be two branches: one will follow a zigzag route alongside roads in the west of the town to join and extend the existing southern nallah along the east of the railway line (Figure 2, Photo 1); and the second will extend the northern nallah on the western side of the railway line. All construction will be on government-owned land, within an easement intended for drain construction.

19. The above description is based on the present proposals, and is expected to be substantially correct, although certain details may change as development of the subproject progresses, particularly in the detailed design stage. It should also be noted that at this stage the infrastructure has been designed in outline only, to determine overall feasibility and budget costs, so certain aspects (such as the exact dimensions of the drains) have not yet been finalised.

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Location

20. Jaisalmer District is located in the extreme west of both Rajasthan and India, and shares western and northern borders with Pakistan. It lies between the longitudes of 69° 29’ to 72° 20’ East, and latitudes of 26° 01’ 20” to 28° 02’ North (Figure 1), is at an average altitude of 242 m above MSL, and forms the major part of the Great Indian Desert (Thar Desert). Jaisalmer Town is the district headquarters and lies roughly in the centre, 550 km west of the State capital Jaipur and 300 km northwest of Jodhpur. The municipal area covers 126.27 km^2 in total, in which there is a population of only 57,537 according to the 2001 census. Most of the area consists of rocky hillsides and uninhabited areas of sand.

2. Topography, soil and geology

21. Although Jaisalmer Town is situated in the heart of the Thar Desert with its characteristic large and mobile sand dunes (Photo 2), the town and its environs present a different physiography. The town is located in an area of elevated rocky ridges extending from the

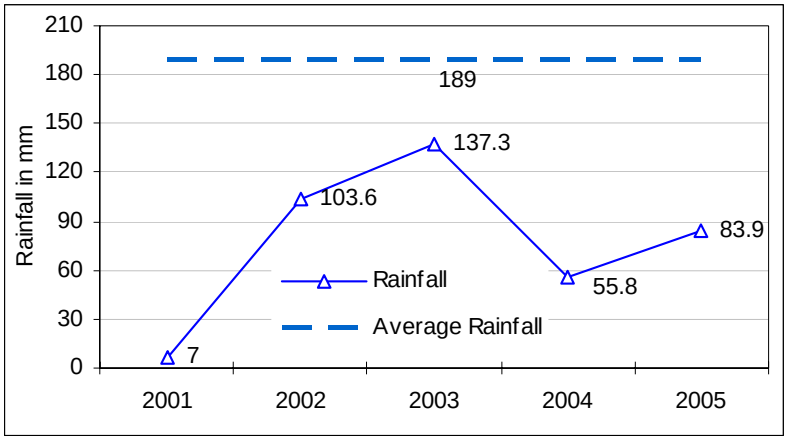
Barmer District Hills in the south-west, and separated by undulating alluvial and sandy valleys. This area is around 15-20 km wide and stretches for over 60 km to the north of the town, and generally slopes from the north-west to the south-east. Soils are stony, sandy, and relatively infertile.

22. One of the most notable physical features of the town is Jaisalmer Fort (Photo 3), constructed in the 12th century, 75 m above ground level on a *trikuta* or triple-peaked hill. Two valleys run around the fort and meet in the south-east, and the surrounding land (on which the town subsequently developed) slopes towards the valleys, forming an overall bowl-like topography. There is little natural drainage and no permanent surface water, because of the very limited rainfall (see below).

23. According to the Vulnerability Atlas of India, most of Jaisalmer District, including Jaisalmer Town, is in an area of medium earthquake risk (Zone III). Although Rajasthan has not experienced a major earthquake in the recent past, there have been 37 events with a magnitude of 5-7 since 1720, with the most recent occurring in 2001. This measured 6.9 on the Richter Scale, but because the epicentre was in neighbouring Gujarat, there was only limited damage Jaisalmer, although "Salim Singh ki Haveli" and "Hawa Pol" in the fort were affected.

3. Climate

24. The climate is typical of a desert region, being hot and arid, with large day-night temperature extremes and sporadic and erratic rainfall. Winter extends from November to March, and the coolest period occurs in January when daytime temperatures average below 20 °C and often fall to freezing at night. Temperatures begin to rise in March and peak in May-June, when daytime values sometimes reach 48 °C. Wind speeds may also increase at this time, and dust storms are common. The south-west monsoon arrives in July, causing a sudden drop in temperature, although the air remains dry as rain only falls on an average of six days per year. The long-term average rainfall is just 189 mm, and annual figures have been well below average on each of the past few years (Figure 3). The monsoon ends in mid-September and air temperatures rise, only to fall again a few weeks later with the onset of winter. Winds are generally light in winter and moderate to strong in the monsoon, and blow mainly from the north-west and south-west, and from the south and south west in the monsoon.



Source: Agriculture Dept 2007

Figure 3: Average Annual Rainfall in Jaisalmer 2001-2005

4. Air Quality

25. There are no data on ambient air quality in Jaisalmer Town, which is not subject to monitoring by the Rajasthan State Pollution Control Board (RPCB) as there are no major industries. Located in the Thar Desert, particulate matter is likely to be high, particularly during summer dust storms driven by relatively strong north-west to south-west winds. Traffic is the only significant pollutant, so levels of oxides of sulphur and nitrogen are likely to be well within the National Ambient Air Quality Standards (NAAQS). This is illustrated by data from Jodhpur (Table 1), which is larger and has more industry than Jaisalmer, but is less exposed to particulate matter.

Table 1: Ambient Air Quality in Jodhpur (Annual Average, 2004; units in μg/m^3)

Monitoring Station	Land use	SOx	NOx	RSPM	SPM
Sojati Gate	Residential	7	19	121	336
Maha Mandir Police Thana	Residential	6	19	96	310
NAAQ Standard	*Residential*	*60*	*60*	*60*	*140*
RIICO Office	Industrial	6	20	115	341
NAAQ Standard	*Industrial*	*80*	*80*	*120*	*360*

RSPM: Respirable Suspended Particulate Matter; SPM: Suspended Particulate Matter
Source: Central Pollution Control Board (CPCB) 2004

5. Surface Water

26. There are no perennial rivers in Jaisalmer District, and no natural lakes or ponds, which is not surprising given the low rainfall. A few ephemeral streams appear on land outside the town during rainfall, and water accumulates in certain low lying areas, but the water is shallow and drains into the sand very quickly. A few manmade reservoirs have been created by constructing simple bunds, such as Gadi Sagar Lake (Photo 4), which was built in the 14th century and was for some time the main source of water for the town.

6. Groundwater

27. Because of the sandy soils and lack of rainfall, the water table is very deep around Jaisalmer Town, ranging from 38-46 m below ground level. The main aquifer lies below this depth, comprising Lathi formations from the Lower Jurassic Age, composed of mainly sandstones and some lime stones in the upper levels. The aquifer is tapped by a number of wells, but the yield is reported to be low. Jaisalmer Municipal Board (JMB) has developed a well field at Dabla Village 12.5 km from the town, where the aquifer is around 85 m below the surface. There are 12 tubewells of 200 m depth providing an average yield of 18,000 l/h, producing a total of around 3 million litres per day.

28. The Public Health Engineering Department (PHED) regularly monitors the quality of water from the Dabla field, and the most recent data (Table 2) shows that fluoride concentration is slightly above the acceptable level according to national quality standards, and Total Dissolved Solids are above the desirable level but below the acceptable level.

Table 2: Quality of groundwater from the Dabla field (2005)

Parameter	Units	Monitored	Drinking Water BIS Standard	
		Value	Desirable Level	Acceptable Level
pH	-	7.6	6.5-9.0	NR
Chloride (Cl)	mg/l	190	250	1000
Total Dissolved Solids (TDS)	mg/l	980	500	2000
Nitrate (NO_3)	mg/l	4	45	100
Fluoride (F)	mg/l	1.6	1.0	1.5

Source: CDP Jaisalmer; BIS = Bureau of Indian Standards

B. Ecological Resources

29. Jaisalmer Town is an urban area located on a hard rocky substratum, surrounded by a harsh desert environment of wind-blown sand and dunes. The municipal area includes large swathes of uninhabited rocky hills and sand dunes, with alluvial soil and sand in the intervening valleys, which are cultivated where there is enough rain. Natural vegetation is very limited, and consists of mainly sparse, scattered shrubs and grasses (Photo 5). The fauna of the town comprises mainly domesticated animals (camels, cows, goats, pigs and chickens), plus other species able to live close to man (urban birds, rodents and some insects). In the desert away from the inhabited area there is a more natural fauna, which includes hyaenas (*Hyaena hyaena*), desert fox (*Vulpes pusilla*), jackal (*Conis aures*) and chinkara gazelle (*Gazella gazella pallas*).

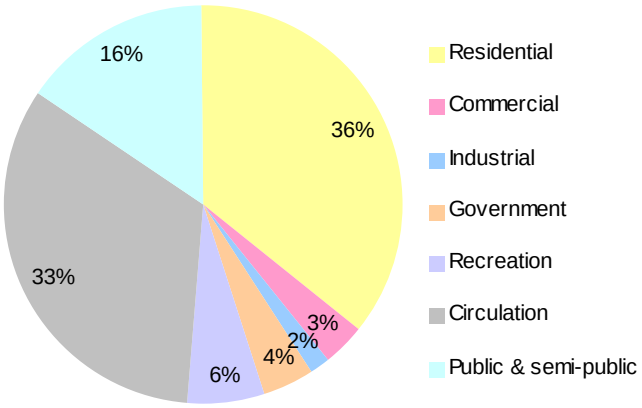
30. There are no forests in Jaisalmer District, mainly because of the climatic conditions. The nearest protected area is the Desert National Park 40 km away, which is designated as an excellent example of the Thar Desert ecosystem. This area includes a wide range of desert environments, including sand dunes, craggy rocks, salt lake bottoms, intermediate areas and fixed dunes, and the fauna is more diverse than found around Jaisalmer. It includes blackbuck, wolf, Indian fox, hare and desert cat, in addition to those species noted above. Small numbers of the great Indian Bustard are also found, which is an endangered bird species that is close to extinction.

C. Economic Development

1. Land use

31. Located in the Thar Desert in the extreme north-west of India, Jaisalmer is an important urban centre for its vast desert hinterland, and is also of strategic importance because of its proximity to Pakistan. Traditionally a services and administrative town, it was not until the late 1970's that trade and commerce began to increase, mainly through growth in the tourism sector.

32. Jaisalmer however offers little potential for further development, mainly because of the harsh and inhospitable landscape and the remoteness of the town. Only around 10 % (1,247 ha) of the total municipal area is developed, mainly because the remainder of the land is rocky and hilly and unsuitable for inhabitation, industry or infrastructure. Figure 4 shows the current land use in the developed area, from recently conducted surveys, which indicates that the major uses are for residential areas, roads/transportation and public and semi-public land. There is also a significant military presence, with a number of defence installations both inside and outside the town.



Source: Jaisalmer Urban Improvement Trust

Figure 4: Current land use in Jaisalmer (developed area)

2. Industry and Agriculture

33. There is very little industrial development in Jaisalmer and the town is in fact classified as a “No Industries District” in State planning terms. Economic activities are growing steadily however, stimulated by development in the tourism sector, as increasing mobility and affluence means that people are able to visit more remote regions, to benefit from the dual attractions of beautiful scenery and a rich historical and cultural heritage.

34. Rajasthan Industrial Infrastructure Corporation (RIICO) has developed a small scale industrial area on 25 ha of land in the town, which currently houses 136 units, specialising mainly in light industry, such as manufacturing farm equipment, repairing automobiles and machinery, and furniture-making. There are also a number of stone polishing workshops, located here because of the vast amount of building material and decorative stone available from quarries in the surrounding hillsides. There are a number of small cottage industries in the town, manufacturing *khadi*, cotton and woollen garments and handicrafts (Photo 6), and this is one sector that has particularly benefited from the increase in tourism. There are also a number of hotels and restaurants, to serve the growing numbers of visitors.

35. Agriculture is restricted by both climate and physiography, as the limited rainfall and desert soils mean that there are very few areas that are suitable for agriculture, and yields are limited to a maximum of one crop per year. The main product is the fodder crop *jowar*, which is grown to feed the herds of camels, cattle, sheep and goats that are a feature of areas outside the town. Although the Indira Gandhi Nahar Project (IGNP) brings water for irrigation and domestic use into Rajasthan (including Jaisalmer District) from the Ravi and Bias rivers, this does not reach Jaisalmer Town where agriculture remains limited.

3. Infrastructure

36. PHED provides a piped municipal water supply in Jasailmer, which is sourced from the Dalba groundwater field (3 MLD) and from the Dewa Minor canal of the IGNP, 34 km away (5 MLD). The system supplies 80% of the population, but water is available for only 1-2 hours per day, mainly because of leakage losses (estimated at 40%) and low and unequal network pressure. The provision is also unequal, with un-served areas being mainly the slums and fringe

or newly-developed areas. Profuse leaking from the network in the fort area is causing severe degradation of buildings and the fort walls and foundations.

37. There is a piped sewerage system only inside the fort, which serves 2% of the population. Developed in 1994, the system does not function well because of the undulating topography and blockages caused by solid waste, so leakages and overflows are very frequent. This contributes to the deterioration of the fort structures as well as detracting from the appearance of the fort (which is a major tourist attraction) and creating a public health hazard. There is no sewage treatment, and wastewater collected by the system accumulates in a low lying area near Gadisar Gate, which has become a major mosquito breeding ground. Most other households utilise pit latrines or septic tanks, and there are illegal connections through which sewage is deposited into open storm water drains. Because of the availability of large areas of vacant land, open disposal and open defecation are also prevalent.

38. There is also no proper system for storm water drainage in the town, and although this is not a major problem because of the limited rainfall, sudden storms (including one in 2006) can cause quite widespread flooding, damaging property and possessions. There are roadside drains in certain areas, but these are poorly designed with inadequate gradients, and are frequently clogged with solid waste and polluted by sewage.

39. The solid waste management system is also ineffective, and refuse is mainly discarded in the streets and drains, and dumped on vacant plots of land. Jaisalmer generates an estimated 21 tons of solid waste per day and the Municipal Board (JMB) collects around 12 tons from its manual street sweeping operation (conducted inside the fort), and removes other waste from vacant plots irregularly. Collected waste is transported on open vehicles to the outskirts of the town and dumped on open ground. The Municipality has recently acquired a 76 ha plot of land with the intention of constructing a sanitary landfill, but at present waste is simply dumped on a part of this area.

40. Thermal power is the main source of energy in Rajasthan, contributing 89% of the electricity, compared to hydropower, which produces the remainder. State-level companies (Rajya Vidyut Utpadan Nigam Ltd, RVUN; and Rajya Vidyut Prasaran Nigam Ltd, RVPN) are responsible for power generation and transmission respectively, and distribution is provided by a regional company, the Jaipur Vidyut Vitran Nigyam Ltd (JVVNL). Power is supplied from the central grid by overhead cables carried on metal and concrete poles, mainly located in public areas alongside roads. The power supply is erratic and there are frequent outages in warmer months, and large fluctuations in voltage.

4. Transportation

41. The fort area and the walled old city are characterised by very narrow roads that are frequently congested with traffic and pedestrians (Photo 7). In contrast the remainder of the town has a relatively good road system, particularly in the outer areas, where streets are wide and not heavily used by traffic (Photo 8). The total road length in the town is 157 km, of which 70% are surfaced with bitumen/tar, 15% are stone paved and 15% are WBM (Water-borne Macadam). Most of the roads are maintained by JMB and around 15% by the Public Works Department (PWD), and the condition is generally poor, with many roads in need of repairs and resurfacing. This plus the absence of parking spaces and pedestrian walkways leads to slow traffic and congestion.

42. Transport in the city is mainly by personal vehicles (motorcycles and bicycles) and auto- and bicycle-rickshaws. The Rajasthan State Road Transport Corporation (RSRTC) runs public buses to neighbouring villages and towns and to larger towns farther afield, such as Jodhpur, Bikaner, Barmer and Jaipur, with which there are good road connections. Jaisalmer is also connected to Jodhpur, Jaipur and Delhi by the national railway. The nearest airport is 300 km away at Jodhpur, although there is a military air strip in Jaisalmer, which is also used for civilian purposes.

D. Social and Cultural Resources

1. Demography

43. According to the national census the population of Jaisalmer was 38,735 in 1991 and 57,537 in 2001, which shows an annual increase of 4.9 % over the decade. Gross population density is very low (457 persons/km), but because so much of the municipal area is undeveloped there are locations of very high density, particularly in the fort and walled city.

44. Overall literacy is 74.9%, reported at 85.5% for males and 60.7% for females, which is considerably better than literacy in the state as a whole, which is 60.4% overall, and 75.7% for males and 44.0% for females. The sex ratio is however significantly below the natural 1:1 ratio, being 764 females per 1000 males, lower than both the state and national averages (879 and 929 respectively).

45. According to the census, in 2001 only 32% of the population was in paid employment, significantly lower than both the state and national averages (42.1 and 39.1% respectively). This indicates that most of the townspeople are engaged in the informal sector, earning a living where they can, from small trading, casual labour, etc. Of those that are employed, almost all (96%) are involved in the service and industrial sectors, with the remainder being engaged in agricultural activities and household and cottage industries (around 2% each).

46. Around 75% of the people are Hindus, 20% are Muslim, and the remainder are mainly Sikhs and Janis. The majority of the inhabitants are Yadav Bhatti Rajputs, who take their name from a common ancestor named Bhatti. The main language is Marwari/Rajasthani, the principal dialect of the state. Most people speak the national language of Hindi and a few also speak English. Other languages spoken include Khariboli, Godvari and Urdu (because Rajasthan borders Pakistan). About 4% of the population are from Scheduled Tribes (ST), but these are part of the mainstream population, and around 10% of the population belong to scheduled castes (SC).

2. Health and educational facilities

47. There are good educational facilities in Jaisalmer, which serve both townspeople and inhabitants of surrounding villages and towns in the hinterland. There are 41 primary schools, 27 secondary schools and 7 higher secondary schools, plus two general degree colleges and an industrial training institute (ITI).

48. As the district headquarters town, Jaisalmer is the main centre for health facilities in the area and there is a district general hospital with 150 bed capacity, 4 dispensaries, a mother and child welfare centre and a government-run homeopathic hospital. There is also a private hospital of 25 bed capacity, and a number of private clinics.

3. History, culture and tourism

49. Founded with the construction of the fort in 1156, the Golden City of Jaisalmer originally became wealthy from trade because of its position on the camel-train routes between India and Central Asia, and the merchants and townspeople built magnificent houses and mansions, intricately carved from wood and sandstone. Variously occupied by Rajputs, Mughals and maharajas, the city rose again to prominence in the 17th century because of its links to Delhi, and this heralded another period of building, featuring many grand palaces and *havelis* (decorated residences). The city declined with the rise of shipping and the port of Bombay, but since partition and the conflicts with Pakistan, its strategic importance has once again become important, as well as more recently, its attraction to tourists.

50. Tourism has risen in importance in Jaisalmer over the past 20 years, and in 2005 there were 280,000 tourists, almost double the number that visited in 2001 (150,000). The most important features of the town in terms of both culture and tourism are:

- Jaisalmer Fort, built in 1156 by the Rajput ruler Jaisala, rises over the city and provides magnificent views over the surrounding desert. Carved from sandstone and featuring 99 bastions, hundreds of narrow streets, a palace and many beautiful *havelis* and temples, this is the second oldest fort in Rajasthan. It is however suffering greatly from tourism pressure and damage from the leaking water system and ineffective drainage, and is on the World Monuments Watch list of100 endangered sites worldwide;

- Salem Singh, Patwon and Nathmal are the three most visited *havelis* (Photo 9) and are excellent examples of rich merchants' houses from the grand architecture period of the 19th century;

- Temples abound both inside and outside the fort, and the most notable are the seven interconnected yellow sandstone Jain temples dating from the 12th to 16th centuries and the Laxminath Hindu temple with its brightly decorated dome;

- Gadi Sagar south of the city walls was excavated in 1367 by Rawal Gadsi Singh. Once the water supply for the city it is now a picturesque lake, with clusters of small temples, a museum, and flocks of visiting waterbirds, particularly during the winter months.

IV. ENVIRONMENTAL IMPACTS AND MITIGATION: INFRASTRUCTURE CONSTRUCTION

A. Screening out areas of no significant impact

51. From the descriptions given in Section III.C it is clear that implementation of the project should not have major environmental impacts because the drains will be built in a relatively small area in the eastern and north-eastern outskirts of the town, and the construction work will be quite straightforward.

52. Because of this there are several aspects of the environment that are not expected to be affected by the construction process and these can be screened out of the assessment at this stage as required by ADB procedure. These are shown in Table 3, with an explanation of the reasoning in each case.

Table 3: 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
Coastal resources	Jaisalmer is not located in a coastal area
Population and communities	Construction will not affect population numbers, location or composition

53. These environmental factors have thus been screened out and will not be mentioned further in assessing the impacts of the construction process.

B. Main Drains

1. Construction method

54. As explained in Section II.C this subproject will involve construction of 12.8 km of new main drains, in two branches in the eastern and north-eastern outskirts of the town. Each drain will be approximately 5 m wide and 2 m deep, open at the top, with a concrete floor and brick sides faced with mortar. Each will be located alongside main roads, on government land on which a Right of Way (ROW) has been granted for this work.

55. The longer drain will take a zigzag course in the east of the town, and will join and extend the existing concrete *nallah* that flows to the south of the walled city and out towards the north-east on the eastern side of the railway line. The shorter drain will extend the existing northern *nallah* in the same direction, along the western side of the railway line (Figure 2).

56. Trenches for each drain will be dug by backhoe digger (Photo 10), supplemented by manual digging where necessary (Photo 11). Excavated soil will be placed nearby, and once the 5 x 2 m cavity has been created with the required gradient, concrete (mixed on site) will be poured in to form the base, at a thickness of around 150 mm. The walls will then be built from a single skin of bricks placed by hand by masons, and a top covering of mortar will be applied to finish the inside and upper surface of each wall. Loose soil will then be shovelled in to fill any space remaining between the brick and the edge of the trench.

2. Physical Resources

57. Although construction of drains involves quite simple techniques, the invasive nature of excavation, and in this case the relatively large size and length of the drains, means that there will be quite a lot of physical disturbance, in areas where there are a variety of human activities.

58. If the two drains are a total of 12.8 km in length and 5 x 2 m in cross section, this will require the excavation of 130,000 m^3 of soil, all of which will need to be removed and disposed of. There will therefore be quite large physical changes where the drains are built, and this quantity of waste could not be dumped without causing further physical impacts (on air quality, topography, soil quality, etc) at the disposal site. The work will almost certainly be conducted in

the dry season, so there is a lot of potential for the creation of dust, and this will be increased by the need to import quite large quantities of building material, in particular sand, as well as bricks and cement.

59. Action will therefore be needed to reduce physical impacts at both the construction and disposal sites, by controlling dust and reducing the amount of material to be dumped. The Contractor should therefore be required to:

- Contact the town authorities to find beneficial uses for as much waste material as 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;
- Reduce the generation of dust by removing waste soil as soon as it is excavated (by loading directly into trucks);
- Plan the work carefully so that sand is only brought to site when needed;
- Cover or damp down sand and soil stockpiled on site to reduce dust in windy weather;
- Use tarpaulins to cover loose material when transported to and from the site by truck.

60. The other important physical impact that is often associated with large-scale excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. However, this should not be a problem in this case, given the low rainfall and deep water table (>40 m) in this area, and the fact that excavation will be conducted in the dry season.

61. Physical impacts will also be reduced by the method of working, whereby the drains will probably be constructed by small teams working on short lengths at a time, so impacts will be mainly localised and short in duration. Because of this and the mitigation measures proposed above, impacts on the physical environment are not expected to be of major significance.

3. Ecological Resources

62. There are no significant ecological resources in or outside the town (protected areas or rare or important species or habitats), so construction of the drains should have no ecological impacts. However, 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 two new trees (of the same species) for each one that is removed.

4. Economic Development

63. All of this work will be conducted within an easement granted for creation of the drains, so there will be no need to acquire land, and thus there should be no direct effect on the income or assets of landowners, or the livelihoods of tenants. The proposed alignment is however encroached by structures in places (shop-fronts, boundary walls of houses), some of which may need to be removed. ADB policy on Involuntary Resettlement requires that no-one should be worse off as a result of an ADB-funded project, so where income-generating structures are removed (eg portions of shops or business premises), some form of compensation will need to be provided. A separate Resettlement Plan and Resettlement Framework have been prepared to examine these and related issues and provide appropriate mitigation. This establishes that:

- Drain alignments will be amended to avoid the removal of structures where this can be achieved within the existing easement and without compromising the functioning of the drain;

- Where this cannot be done and income-generating structures have to be removed, the owners will be compensated for the loss at the replacement cost of the structure.

64. Shops and other businesses located alongside the proposed drain routes will also experience economic impacts, as it is inevitable that the presence of trenches, excavated material, workers, vehicles and machinery will discourage customers from visiting certain premises whilst work is in the vicinity. Business income will therefore decrease for a short period, and although losses will be relatively small they could still be significant for small traders and other businesses that exist on low profit margins. These impacts should therefore be mitigated by:

- Compensating shopkeepers and other affected businesses for lost income;
- Leaving spaces for between mounds of excavated soil and providing footbridges for pedestrians and metal sheets for vehicles to maintain access across trenches where required;
- Increasing the workforce in these areas to complete the work quickly;
- Consulting affected businesspeople and informing them in advance when work will occur.

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

- Obtaining details from Jaisalmer Municipal Board (JMB) of the nature and location of all infrastructure, and planning the drain routes to avoid any conflict or damage;
- Integrating construction of the various Jaisalmer subprojects (in particular water supply, drainage and sewerage) so that:
    - Different infrastructure is located on opposite sides of the road wherever feasible;
    - Roads and inhabitants are not subject to repeated disturbance by construction in the same area at different times for different purposes.

66. Transport is another type of infrastructure that may be affected by some of the work, particularly if excavated soil is placed on adjacent roads, and if construction vehicles are not used and parked with due consideration to other road users. These impacts should however be relatively easy to avoid, and the Contractor should be required to:

- Keep excavated soil, and vehicles and machinery off adjacent roads wherever possible;
- Where there is not enough space alongside the road for this to be accomplished, conduct the work during periods when traffic is light;
- Contact the town police to ensure that warning signs and traffic diversions are provided when necessary;
- Increase the workforce in any such areas so that work is completed quickly.

67. Traffic and other activities will also be disrupted by the increase in the number of heavy vehicles in the town (in particular trucks removing waste and delivering materials), and this

might also damage fragile buildings if vibration is excessive. These impacts should therefore be mitigated by:

- 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;
- Scheduling the transportation of waste and other materials to avoid peak traffic periods, the main tourism season, and other important times.

5. Social and Cultural Resources

68. 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/or historical remains, or even unknown sites. In this case excavation will be conducted in Jaisalmer town, which has been inhabited for a long period, and where there could therefore be a significant risk of artefacts being discovered. This should be ascertained by consulting the appropriate authorities, and steps should be taken according to the nature of the risk. This should involve:

- Consulting national and state historical and archaeological authorities to assess the archaeological potential of all construction sites;
- Selecting alternative routes or sites to avoid any areas of medium or high risk;
- Including state and local archaeological, cultural and historical authorities and interest groups as project stakeholders to benefit from their expertise;
- Developing a protocol for use by the Contractor in conducting all 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 to ensure its removal or protection in situ.

69. Drain construction will also disturb some more modern-day social and cultural resources, such as schools, hospitals, temples, and also sites that are of tourism importance. Impacts could include noise, dust, interrupted access for pedestrians and vehicles, and vibration from heavy vehicles and machinery. Given the historical importance of Jaisalmer, any such damage or disruption could be highly significant, so careful mitigation will 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:

- Consulting JMB to identify any buildings at risk from vibration damage and avoiding any use of heavy vehicles in the vicinity;
- Limiting dust by removing waste soil quickly, covering and watering stockpiles, importing sand only when needed, and covering soil and sand when carried on trucks;
- Increasing the workforce in sensitive areas to complete the work quickly;

- Providing wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required (including access to houses);
- Using modern vehicles and machinery with standard adaptations to reduce noise and exhaust emissions, and ensuring they are maintained to manufacturers' specifications.

In addition the Executing Agency and Contractor should:

- Consult JMB, 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;

70. 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:

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

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

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

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

- Training of all personnel (including manual labourers) to enable them to understand the dangers of AC pipes and to be able to recognise them in situ;
- Reporting procedures to inform management immediately if AC pipes are encountered;
- Development and application of a detailed H&S procedure to protect both workers and citizens. This should comply with national and international standards for dealing with asbestos, and should include:

[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

- 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.

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

V. ENVIRONMENTAL IMPACTS AND MITIGATION: OPERATION AND MAINTENANCE

A. Screening out areas of no significant impact

74. Although the drains will need regular maintenance when they are operating, with a few simple precautions this can be conducted without major environmental impacts (see below). There are therefore several environmental sectors which should be unaffected once the system begins to function. These are identified in Table 4 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 4: Fields in which operation and maintenance of the completed drains is not expected to have significant impacts

Field	Rationale
Climate, topography, geology, seismology	Because of the low population and low rainfall, the drainage system will not carry enough water to significantly affect these factors.
Fisheries & aquatic biology	No natural surface water bodies will be affected by operation of the drainage system
Wildlife, forests, rare species, protected areas	There are none of these features in or outside the town
Coastal resources	Jaisalmer is not located in a coastal area

B. Operation and maintenance of the improved drainage system

75. The new drains will improve the removal of surface and storm water runoff in the town, by extending existing concrete *nallahs* and providing a new main drain to serve the western outskirts. The main problems with the existing system are that the drains were poorly designed and built with ineffective gradients, and have been inadequately maintained over the years. As a result many are blocked with discarded garbage and are overflowing and leaking, and there are large areas of unsightly and unhygienic standing water around the town (see Figure 2). The new drains will be designed to Indian specifications so gradients should be sufficient to keep water flowing, and the provision of a municipal solid waste management system by another subproject should reduce the blockage of drains by discarded refuse.

76. It will be imperative however that the Government Agency (GA) responsible for operating the drainage network establishes a system to regularly inspect and maintain the drains, so that the infrastructure does not deteriorate and fall into disrepair, replicating the present problems. JMB and other GAs will thus be provided with a range of training, capacity building and support by present subprojects and future tranches of investment, to enable them to fulfil their management responsibilities. In the case of the urban drainage subproject the main requirements are to:

- Establish a programme of regular visual inspection of the drains and their contents and functioning to provide for the early identification of remedial action;
- Ensure that all remedial action is implemented promptly, including clearing any solid waste and other material that could cause blockages, and conducting any required physical repairs to the fabric of the drains to prevent leaks.

77. The subproject will also provide maintenance equipment, including shovels, buckets, winches, pumps and tankers, so that blockages can be dealt with. Any repairs to the *nallahs* should be small-scale, involving manual replacement of bricks and mortar, and will be carried out in the dry season to avoid the need to divert the water in the drains. If these are conducted when necessary there should be no need for major repairs during the 30-year design life of the drains.

C. Environmental impacts and benefits of the operating system

1. Physical Resources

78. As noted above, once the new drains are functioning they should contribute to an improvement in the physical appearance and condition of the town by helping to remove the large and unsightly pools of wastewater that are an almost permanent feature of southern and eastern areas at present (Figure 2). In combination with the repair of leaks in the water supply system under another subproject, the new *nallahs* should also help to ensure that similar pools do not re-form in the future. The quality of the town environment should then improve significantly.

79. If the *nallahs* are inspected and repaired regularly as outlined above, repairs should be small in scale and carried out manually by small teams of men, and should thus not produce noticeable physical impacts.

80. However the removal of blockages in the *nallahs* and other drains would have adverse impacts on the appearance and environment of the area if, as is current practice, drains are unblocked by removing garbage, silt and other material, and this is simply piled alongside. Not only is this unhygienic, but it is also inefficient, as much of this material inevitably returns to the drains, where it may cause further blockage. It will be very important for JMB to end this practice by ensuring that persons employed to clean drains are provided with suitable equipment (which can be as simple as shovels and wheelbarrows) and are instructed that all removed material must be deposited in the municipal waste storage bins, provided under the solid waste management subproject.

81. Water from the new drains will be discharged into a natural *nallah* in the north-east of the town, near the site of the new sewage treatment plant (Figure 2). Given the relatively poor reserves of groundwater in the area, there would be some additional benefit if water from the

drains was directed into the aquifer, through purpose-drilled recharging boreholes, or by simply being allowed to collect in an area of pervious ground. Consideration should therefore be given to including this additional design feature in this subproject.

2. Ecological Resources

82. Although the new drains 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 water from the drains was discharged into the *nallah* near the STP there could be some small ecological benefits if there was enough water to allow colonisation by marsh plants and animals. However the benefits of helping to recharge the aquifer would be more significant, so it would be more appropriate to forego the very minor ecological gain in favour of the enhancement suggested above.

3. Economic Development

83. Maintenance and repair of the *nallahs* will be small in scale and infrequent, and if carried out as described above, should have no effects on business, traffic or other economic activities. The overall improvements in the appearance and hygiene of the town provided by this and other subprojects should make the area more attractive to tourists, and in time this should bring financial benefits by helping the economy of the town to grow.

4. Social and Cultural Resources

84. Repairs to the *nallahs* should require no new excavation, in which case there should be no need for precautions to protect undiscovered archaeological or historical material. Repair work will be small in scale and conducted from inside the *nallah* so there should also be no disturbance of activities in or around any schools, hospitals, temples, tourist sites or other social or cultural resources in the vicinity. Contractors employed to conduct any repair work should be required to operate the same kinds of Health and Safety procedures as used in the construction phase (see Section IV.C.5) to protect workers and the public.

85. The citizens of the town will be the major beneficiaries of the improved drainage system, as the unsightly and unhygienic pools of standing wastewater will gradually disappear and should not recur in future. This should then improve the appearance and environment of the town, as well as protecting the ancient buildings and sites from the water damage they are exposed to at present. If, as expected, this ultimately brings more tourists into the town, then the citizens could benefit socio-economically from the related growth in the economy.

VI. ENVIRONMENTAL IMPACTS AND MITIGATION: LOCATION AND DESIGN

86. 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 IV and V above and no other impacts are expected.

87. In many environmental assessments there are certain effects that, although they will occur during either the construction or operation stage, should be considered as impacts primarily of the location or design of the project, as they would not occur if an alternative location or design was chosen. For example, if a drain with an inadequate gradient becomes blocked and ineffective, this is clearly an impact of the design as it would not occur if a drain with a greater slope had been provided.

88. 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 mainly because:

- The subproject is relatively small in scale and involves straightforward construction and low-maintenance operation, so it is unlikely that there will be major impacts;
- Most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other ground disturbance. However the routine nature of the impacts means that most can be easily mitigated;
- In the main field 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.

VII. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

A. Summary of environmental impacts and mitigation measures

89. Table 5 lists the potential adverse impacts of the Jaisalmer drainage 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

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

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

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

The IPMU will be assisted by Investment Program Management Consultants (IPMC) who will manage the program and assure technical quality of design and construction; and Design and

Table 5: Environmental impacts and mitigation for the Jaisalmer Drainage Subproject (Black = continuous activity; Grey = intermittent)

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	07	2008				[3]
Construction						D	1	2	3	Op	
Excavation of trenches 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						+
Excavation and removal of waste soil and importation and storage of sand and other material could produce dust	M	T	Remove waste soil as soon as it is excavated	Contractor	All sites						0
			Cover soil & sand with tarpaulins when carried on trucks								0
			Only bring sand to site when needed								0
			Cover or spray stockpiles of loose material stored on site								0
Trees may be removed along drain routes	M	P	Only remove trees if it cannot be avoided	Contractor	All sites						0
			Plant and maintain two trees for every one removed								0
Some structures in RoW may need to be removed	M	P	Realign drain routes to avoid structures where possible	DSC	All sites						0
			*Compensate owners of lost structures: replacement cost	LSGD							0
Businesses may lose income if customers' access is impeded	M	T	*Compensate businesses for lost income	LSGD	All sites						0
			Leave spaces for access between mounds of soil	Contractor							0
			Provide bridges to allow people & vehicles to cross trench	Contractor							0
			Increase workforce in these areas to finish work quickly	Contractor							0
			Consult businesspeople and inform of work in advance	LSGD							0
Excavation could damage other infrastructure	S	P	Determine location of water pipes, electricity pylons, etc and design scheme to avoid damage	DSC	All sites						0
			Locate different infrastructure on opposite sides of road	DSC							0
Residents may be disturbed by repeated trenching	M	T	Integrate subprojects to conduct trenching at same time	EDC/LGD	All sites						0
Traffic may be disrupted by soil & vehicles on road	M	T	Keep soil, vehicles, machinery off road when possible	Contractor	All sites						0
			If work will affect road, conduct when traffic is light								0
			Ensure police provide warning signs/diversions if needed								0
			As above: increase workforce to finish this work quickly								0
Traffic in town could be disrupted by vehicles en route to and from site, delivering materials or removing waste	M	T	Plan routes to avoid narrow streets, congested roads, important/fragile buildings, key religious & tourism sites	Contractor	All sites						0
			Plan work to avoid peak traffic and main tourism season								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

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

			Include state and town historical authorities as project stakeholders to benefit from their expertise	LSGD							0
			Develop and apply protocol to protect chance finds (excavation observed by archaeologist; stop work if finds are suspected; state authority to plan appropriate action)	DSC and Contractor							+
Sites of social/cultural importance (schools, hospitals, temples, tourism sites) may be disturbed by noise, dust, vibration and impeded access	M	T	Identify buildings at risk from vibration damage and avoid using heavy vehicles nearby	Contractor	All sites						0
			As above: remove waste quickly, cover/spray stockpiles, import sand only when needed, cover soil/sand on trucks								0
			As above: increase workforce to finish work quickly								0
			As above: use bridges to allow access (people/vehicles)								0
			Use modern vehicles/machinery & maintain as specified								0
			Consult relevant authorities, custodians of buildings, local people to address issues & avoid work at sensitive times								0
Workers and the public are at risk from accidents on site	M	T	Prepare and implement a site Health and Safety Plan that includes measures to:	Contractor	All sites						0
			- Exclude the public from site;								0
			- Ensure that workers use Personal Protective Equipment								0
			- Provide Health & Safety Training for all personnel;								0
			- Follow documented procedures for all site activities;								0
			- Keep accident reports and records.								0
Existing water supply system uses AC pipes, a material that can be carcinogenic if inhaled as dust particles	S	T	Design infrastructure to avoid known locations of AC pipes	DSC	Network sites						0
			Train construction personnel in dangers of asbestos and how to recognise AC pipes in situ	Contractor	All sites						0
			Develop & apply protocol to protect workers and public if AC pipes are encountered. This should include:	DSC and Contractor	Network sites						0
			- immediate reporting of any occurrence to management	Contractor							0
			- removal of all persons to a safe distance								0
			- use of appropriate breathing apparatus and protective suits by workers delegated to deal with AC material								0
			- safe removal and long-term disposal of AC material								+
Economic benefits if local people are employed in Contractor's workforce	M	T	Contractor should employ at least 50% of workforce from communities in vicinity of construction sites	Contractor	All sites						+
Operation and Maintenance											
Appearance & environment will deteriorate if material from unblocked drains is piled on adjacent land	S	P	Drain cleaners must deposit material from blocked drains in municipal waste storage bins	GA	All drain sites						0
Water from drains could help to recharge groundwater	M	P	Discharge drain water into boreholes or porous ground	DSC	From *nallahs*						+
Health & Safety of workers and the public could be at risk during repair work	M	T	Prepare and operate H&S Plan with same measures as used in construction phase	OMC	All sites						0

Supervision Consultants (DSC), who will design the infrastructure, manage tendering of Contractors and supervise the construction process.

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

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

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

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

91. 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.

92. Environmental issues will be coordinated by an Environmental Specialist within the IPMU, 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

93. Table 5 shows that most mitigation activities are the responsibility of the Construction Contractors (CC) employed to build the infrastructure during the construction stage, or the O&M Contractors employed to conduct maintenance or repair work when the system is operating. Responsibility for the relevant measures will be assigned to the Contractors via the contracts through which they are appointed (prepared by the DSC during the detailed design stage), so they will be legally required to take the necessary action. There are also some actions that need to be taken by LSGD in their role as project proponent, and some actions related to the design that will be implemented by the DSC.

94. A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. This

will be conducted by a qualified Environmental Monitoring Specialist (EMS) from the DSC. The EMS will be responsible for all monitoring activities and reporting the results and conclusions to the IPMU, and will recommend remedial action if measures are not being provided or are not protecting the environment effectively. The EMS may be assisted by environmental specialists in particular technical fields, and junior or medium-level engineers who can make many of the routine observations on site. Post-construction monitoring will be conducted by the relevant Government Agency (GA) to whom responsibility for the infrastructure will pass once it begins to operate[4].

95. Table 5 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.

96. Table 6 shows the proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies the various monitoring activities to be conducted during all phases. Some of the measures shown in Table 5 have been consolidated to avoid repetition, and there has been some re-ordering to present together those measures that relate to the same activity or site. The EMP describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring). It does not show specific parameters to be measured because as indicated above, most measures will be checked by simple observation, by checking of records, or by interviews with residents or workers.

D. Environmental management and monitoring costs

97. 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 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 structures and/or business income (Table 5) are calculated separately in the budgets for the Resettlement Framework and Resettlement Plans so are also excluded from this analysis.

98. The remaining actions in the Environmental Management Plan are the various environmental monitoring activities to be conducted by the EMS. These have not been budgeted elsewhere, and their costs are shown in Table 7. The figures show that the total cost of environmental management and monitoring for this subproject as a whole (covering design and construction) is INR 0.4 million, ie US$ 9,000.

[4] 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)

Table 6: Environmental Monitoring Plan

Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Monitoring Frequency	Responsible for Monitoring
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 and sand when transported on trucks	All sites	Contractor	Observations on and off site	Weekly	EMS
Only bring sand to site when needed	All sites	Contractor	Site observations; CC records	Weekly	EMS
Cover or damp down soil and sand stockpiled on site	All sites	Contractor	Site observations	Weekly	EMS
Leave spaces for access between mounds of soil	All sites	Contractor	Site observations	Weekly	EMS
Provide bridges to allow people & vehicles to cross open trenches	All sites	Contractor	Site observation; resident survey	Weekly	EMS
Keep soil, vehicles, machinery off road when possible	All 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
Realign drain routes to avoid encroaching structures if possible	Where required	DSC	Site observation; design reports	Monthly	EMS
*Compensate owners (at replacement cost) for lost structures	Where required	LSGD	Owner survey; LSGD record	As needed	IMA[5]
*Compensate businesses for lost income	Where required	LSGD	Shopkeeper survey; LSGD record	As needed	IMA
Increase workforce in inhabited areas to finish work quickly	All sites	Contractor	Site observations; CC records	Monthly	EMS
Inform shopkeepers and residents of work in advance	All sites	LSGD	Resident survey; LSGD records	Monthly	EMS
Confirm location of existing infrastructure and avoid these sites	All sites	DSC	Site observation; design reports	Monthly	EMS
Locate different infrastructure on opposite sides of roads	All sites	DSC	Site observation; design reports	Monthly	EMS
Integrate subprojects to conduct trenching at same time	All sites	DSC/LSGD	Site observation; design reports	Monthly	EMS
If work will affect road, conduct when traffic is light	All sites	Contractor	Site observations; CC records	Monthly	EMS
Ensure police provide traffic diversions when required	All sites	Contractor	Site observations; CC records	Monthly	EMS
Plan transport routes to avoid narrow streets, important or fragile buildings, religious and tourism sites	All sites	Contractor	Observations off site; CC record	Weekly	EMS
Plan transport of waste to avoid peak traffic and tourist season	All sites	Contractor	Observations on and off site	Monthly	EMS
Request archaeological authorities to assess potential of all sites	All sites	DSC	DSC records; design reports	As needed	EMS

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

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
Avoid using heavy vehicles near fragile buildings	All 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	All sites	Contractor	Site observations; CC records; resident surveys	Monthly	EMS
Prepare and implement a site H&S Plan (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 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
Design infrastructure to avoid known locations of AC pipes	All 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
Keep accident reports and records	All sites	Contractor	CC records	Monthly	EMS
Employ at least 50% of workforce from communities near sites	All sites	Contractor	CC records; worker interviews	Monthly	EMS
OPERATION AND MAINTENANCE					
Deposit material from blocked drains in town waste storage bins	All drain sites	GA	Site observations	Monthly	
Discharge drain water into recharge boreholes or porous ground	From *nallahs*	DSC	Site observation; design reports	As needed	EMS
Prepare and operate H&S plan to protect workers and citizens	All sites	OM Contractor	Site observations; OMC records	Monthly	

Table 7: 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	100,000[6]	300,000	
Survey Expenses	Sum	100,000	100,000	400,000
TOTAL				400,000

VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project stakeholders

99. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders are:

- Residents, shopkeepers and businesspeople who live and work near the route of the proposed drains;
- Custodians and users of socially and culturally important buildings in affected areas;
- State and local authorities responsible for the protection and conservation of archaeological relics, historical sites and artefacts;
- State and local tourism authorities.

Secondary stakeholders are:

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

B. Consultation and disclosure to date

100. Two forms of public consultation have been used during preparation of the IEE, to discuss the project and involve the community in planning the mitigation measures and develop the Environmental Monitoring Plan. These are:

- A public meeting was held in Jaisalmer Town in March 2007, to which representatives of primary and secondary stakeholders were invited. Attendees were informed about the aim of the various subprojects and the benefits they would bring, together with their

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

likely impacts and the ways in which they would be mitigated. Participants were invited to discuss their views and concerns, which were then incorporated into the IEE. Appendix 1 contains a summary of the meeting;
- *Ad hoc* discussions were also held on site with people and communities who could be affected by the subprojects, so that views could be expressed in a less formal setting. These were also considered in preparing the IEE.

This IEE will be disclosed to the public by making it available on the ADB website, together with the IEEs prepared for the other subprojects and the summary IEE (SIEE) describing the impacts and mitigation of all subprojects.

C. Future consultation and disclosure

101. LSGD will extend and expand the consultation and disclosure process significantly during implementation of RUISDP. 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:

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

Consultation during construction:

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

Project disclosure:

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

IX. FINDINGS AND RECOMMENDATIONS

A. Findings

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

- Selecting routes for the proposed drains that are located entirely on government land, to avoid the need to acquire land or relocate people;
- Selecting drain dimensions to ensure that all construction can be conducted within the width of an existing easement, to avoid the need to acquire additional land.

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

103. 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; because the drains are located in an area where there are shops and other businesses; and because Rajasthan is an area with a rich history, so 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.

104. During the construction phase, impacts mainly arise from the need to dispose of large quantities of waste soil and import sand and other building materials; and from the potential disturbance of 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:

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

105. Although there will be no need to acquire land or relocate people, some structures (such as shop fronts) that are encroaching into the easement may have to be removed, and roadside businesses may 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 a Resettlement Plan and Framework have been prepared to deal with these and related issues. This establishes that:

- Drain alignments will be amended to avoid the removal of structures where possible;
- Where this cannot be achieved, owners will be compensated at replacement cost for any structures that have to be removed;

- Cash compensation will also be provided for any loss of business income.

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

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

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

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

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

- Employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain;
- Consider directing water from the drains onto porous ground or into purpose-made boreholes to make a small contribution to improving groundwater reserves in the area.

109. These and the other mitigation and enhancement measures are summarised in Table 5, which also shows the location of the impact, the body responsible for the mitigation, and the programme for its implementation.

110. Once the drains are completed it is important that they are properly maintained to prevent the infrastructure falling into disrepair and replicating the problems of the present system. The responsible agency should therefore:

- Establish a programme for the regular visual inspection of the condition and functioning of the drains;
- Ensure that blockages are cleared and repairs are conducted promptly and effectively.

111. If this is done any repairs should be small-scale and infrequent, involving the manual replacement of small areas of brick and concrete, which can be done from within the drain area and should therefore not have significant environmental impacts.

112. The main impact of the new *nallahs* will be beneficial as the unhygienic pools of wastewater that are an unsightly feature of the town at present should gradually drain away; and the improved drainage and repair of leaks in the water supply system provided by another subproject should ensure that similar pools do not re-form in the future. This will improve the appearance and environment of the town, as well as protecting the ancient buildings and sites from the water damage that is of such concern at the moment. If, as expected, this attracts more tourists to the area, then there could be economic benefits for the town and its citizens.

113. Table 5 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 benefits provided by the operating scheme).

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

115. Finally, stakeholders were involved in developing the IEE through both face-to-face discussions on site and a large public meeting held in the town, after which views expressed were incorporated into the IEE and the planning and development of the project. The IEE will be made available at public locations in the town and will be disclosed to a wider audience via the ADB website. The consultation process will be continued and expanded during project implementation, when a nationally-recognised NGO will be appointed to handle this key element to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

B. Recommendations

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

- All mitigation, compensation and enhancement measures proposed in this IEE report (Table 5) and in the Resettlement Framework for the RUSDIP are implemented in full, as described in these two documents;
- The Environmental Monitoring Plan proposed in Section VI.C of this report and the internal and external monitoring proposed in the Resettlement Framework are also implemented in full.

X. CONCLUSIONS

117. The environmental impacts of the proposed improvements in drainage infrastructure in Jaisalmer Town have been assessed by the Initial Environmental Examination reported in this document, conducted according to ADB guidelines. 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. These measures were integrated into the IEE and are summarised in this report.

118. 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 the appearance and environment of the town once the scheme is in operation.

119. There are no uncertainties in the analysis, and no additional work is required to comply with ADB procedure or national law. There is thus no need for further study or Environmental Assessment.

Photo 1a: Drain alignment

Photo 3: Jaisalmer Fort

Photo 1b: Drain alignment

Photo 4: Gadi Sagar Lake in Jaisalmer

Photo 2: Sand dunes around Jaisalmer

Photo 5: Natural vegetation in Jaisalmer

Photo 6: Jaisalmer handicrafts

Photo 9: Haveli

Photo 7: Narrow streets in the Fort area

Photo 10: Backhoe digger

Photo 8: Roads in the outskirts of Jaisalmer

Photo 11: Digging a trench by hand