Environmental Assessment Document

Initial Environmental Examination: Jhalawar and Jhalrapatan Solid Waste Management Subproject
Project Number: 40031

April 2007

India: Rajasthan Urban Sector Development Investment Program

Prepared by Local Self Government Department.

Initial Environmental Examination: Jhalawar and Jhalrapatan Solid Waste Management Subproject
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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 11 Initial Environmental Examination (IEE) Reports, prepared according to ADB Environment Policy (2002) and Environmental Assessment Guidelines (2003). This document is the IEE report for the Jhalawar and Jhalrapatan Solid Waste Management 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 proposed 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]. This subproject proposes separate landfills for each of the two towns, so EC should therefore not be required.

3. Review and Approval Procedure

12. For Category B projects the IEE report is 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 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 Jhalawar and Jhalrapatan Solid Waste Management 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 11 IEEs describing the environmental impacts and mitigation of all subprojects proposed in Tranche 1. These documents 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 solid waste management 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 solid waste infrastructure in Jhalawar and Jhalrapatan is inadequate for the needs of the growing population. The Municipal Boards have designated waste collection points, but refuse is mainly discarded in the streets and drains, and dumped on vacant plots of land, from where it is collected irregularly by the municipality and dumped on open ground outside each town. 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 Jhalawar, Jhalrapatan 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 the two neighbouring towns of Jhalawar and Jhalrapatan, in Jhalawar District, in the south-east of Rajasthan in north-western India (Figure 1). The main

[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)

infrastructure will be two new engineered landfills, to be built on 3.5 and 3.0 ha of government land outside Jhalawar and Jhalrapatan respectively, and new metal collection bins at various locations in each town. Other components include the provision of vehicles and equipment, plus training and support to the municipal boards in the operation of a solid waste management system.

16. Detailed design will begin in the middle of 2007 and should be completed by the end of the year, after which construction of the infrastructure and procurement of equipment will be completed in around six months. The two solid waste management systems should therefore begin to operate in the middle of 2008.

C. Description of the Sub-project

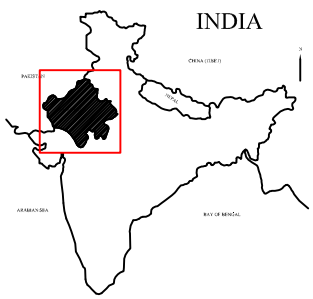
17. Table 1 shows the nature and size of the various components of the subproject. There are two elements, which each cover the establishment of the necessary infrastructure in one town. In each case this will comprise: construction of a landfill and composting plant (plus an access road at the Jhalrapatan site); construction of storage bins in the town; and provision of vehicles and equipment. The descriptions shown in Table 1 are based on the present proposals, which are expected to be substantially correct, although certain details may change as development of the subproject progresses, 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 precise location of each landfill within the larger plots of government land) have not yet been finalised.

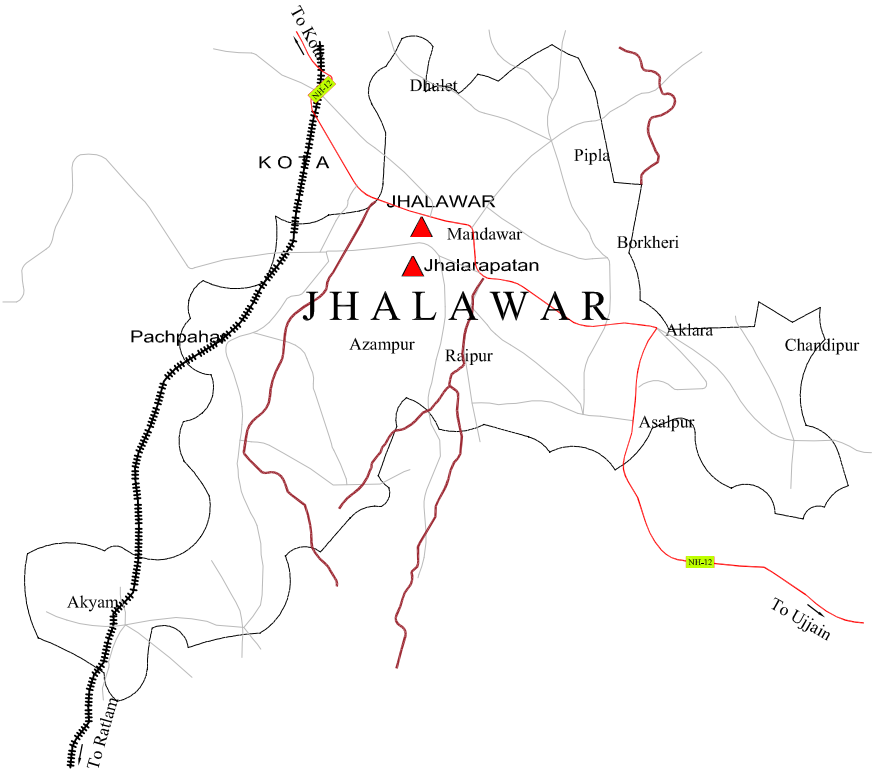
18. For Jhalawar the landfill and composting plant will be built on 3.5 ha of government land along the Gagroan Road 4 km south-east of the town, where the landfill will occupy 3 ha and the composting facility 0.5 ha (Figure 2 and 4; Photo 1). The landfill will be 2 m deep and extend 8 m above ground level when full, and the floor will be sealed with amended clay and provided with drains to collect leachate, which will be transferred into small evaporation ponds. The working area will be divided into 25 cells, one for each year of operation. The composting area will be paved with concrete slabs, and the whole site will be enclosed by a 2 m high brick wall. The landfill and composting plant for Jhalrapatan will be identical in design and will be located on 3 ha of government land near Giridharpura, 5 km south-east of the town (Figure 3 and 5; Photo 2). At this site a 600 m access road will also be built to the landfill from the Giridharpura Road, and this will be 5.5 m wide, constructed from concrete, with a 1 m earth shoulder on either side.

19. The waste collection/storage bins to be provided in each town will be of metal, 3 m^3 in capacity (Photo 3), located on small concrete plinths at various points, mainly on waste ground adjacent to roads. Two bins will be provided at each location to allow the segregation of biodegradable waste; and in total there will be 65 bins in Jhalawar and 48 in Jhalrapatan.

20. Equipment to be provided in the two towns includes:

- Over 30,000 household waste bins and 380 roadside litter bins (Photo 4);
- 138 push carts to collect waste from houses and deposit it in the storage bins;
- 19 twin-compartment tractor trucks to transport full storage bins to the landfills (Photo 5);
- A backhoe digger/bulldozer, compactor and dump truck at each landfill to handle waste (Photo 6).





Rajasthan Urban Sector
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Jhalawar & Jhalrapatan Reglonal Map

LEGEND:-

- International Boundary
- State Boundary
- District Boundary
- NH — National Highway
- Other road
- Railway
- Program Towns

OVERLAY LEGEND:-

GOVT. OF RAJASTHAN

ASIAN DEVELOPMENT BANK

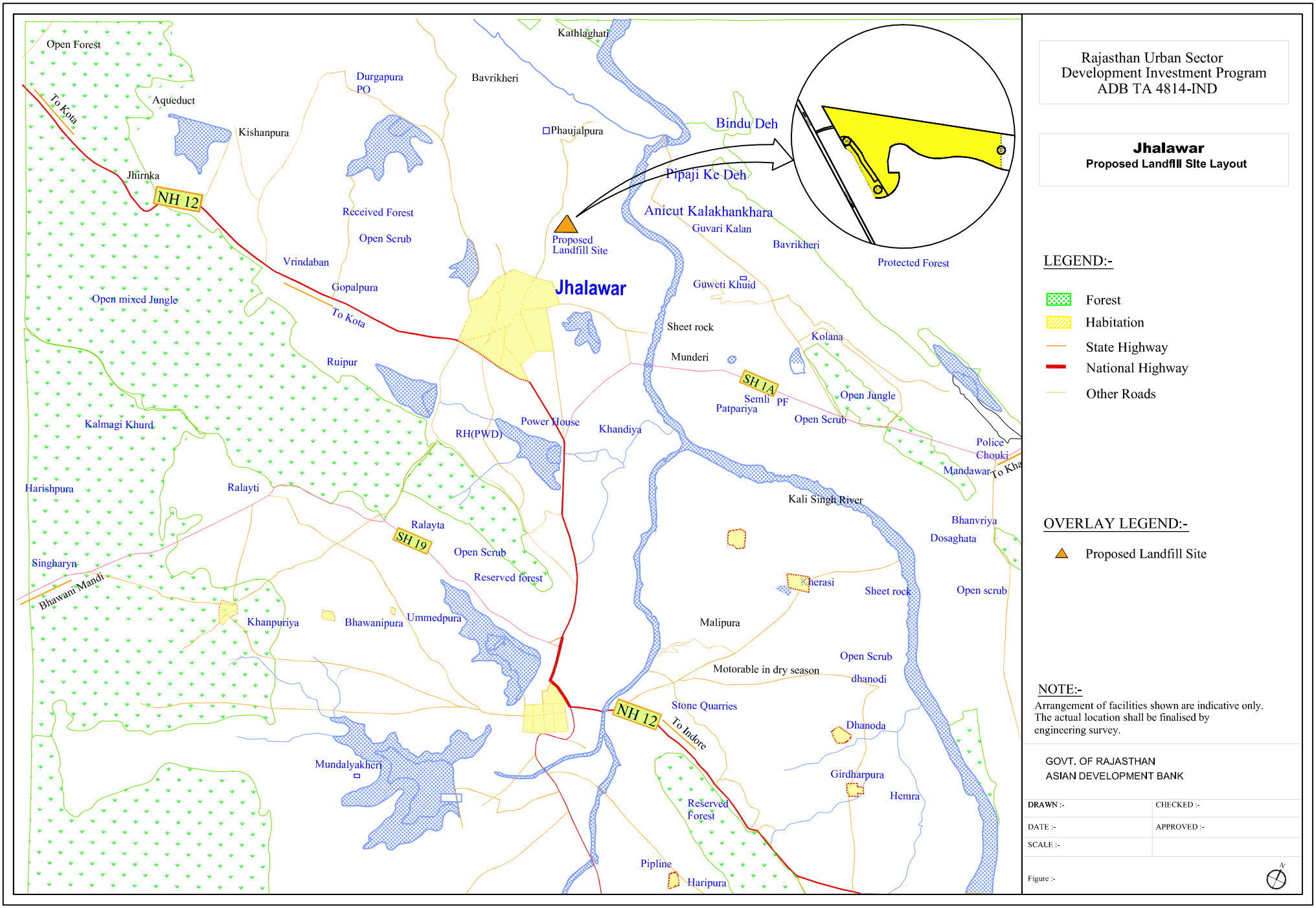
DRAWN :-	CHECKED :-
DATE :-	APPROVED :-
SCALE :-	

Figure :-

N

Table 1: Improvements in Solid Waste Management Proposed in Jhalawar and Jhalrapatan

Infrastructure	Function	Description	Location
1. Jhalawar			
Sanitary Landfill	Provide a safe repository for non-biodegradable waste (and rejected material from the composting plant) to serve the town population for 25 years.	A 3.5 ha clay-lined engineered landfill, a maximum of 8 m high when cells are full, with drains and ponds to collect and treat leachate.	On 3.5 ha within a larger plot of government land along Gagroan Road, 4 km south-east of Jhalawar
Composting Facility	Convert biodegradable domestic waste to marketable agricultural manure compost	A 0.5 ha paved area on which piles of biodegradable waste are allowed to decompose naturally in the open air.	At the landfill site, adjacent to the landfill area.
Waste Storage Bins	Provide a location where householders can deposit and segregate their waste, from where the municipality can collect the material regularly and transport to landfill.	65 closed metal containers of 3 m^3 capacity, located on small concrete platforms, with two bins per site to allow segregation of biodegradable waste	At appropriate locations in the town, on waste ground adjacent to roads.
Landfill vehicles	Relocate waste after deposition at the landfill and cover with soil at the end of each day, and on closure of each cell	1 backhoe digger/bulldozer; 1 compactor; 1 tipper truck	Landfill site
Secondary collection vehicles	Carry full waste storage bins from the town to the landfill where waste is unloaded	11 twin-container tractors	Jhalawar Town
Primary collection veh's	Collect waste from households	80 push carts	Jhalawar Town
Litter bins	Deposition of waste by people in town	200 street litter bins	Jhalawar Town
Household waste baskets	Waste storage and segregation in houses	19,243 household waste baskets	Individual households in Jhalawar
2. Jhalrapatan			
Sanitary Landfill	As above	A 3.0 ha clay-lined engineered landfill, a maximum of 8 m high when cells are full, with drains and ponds for leachate.	On 3.0 ha within a larger plot of government land near Giridharpura, 5 km south-east of Jhalrapatan
Composting Facility	As above	A 0.5 ha paved area alongside the landfill	At the landfill site
Access road	Provide access to the landfill from the main road	600 m concrete road, 5.5 m in width, with an additional 1 m shoulder on either side	The road will run directly to the landfill from the Giridharpura Road
Waste Storage Bins	As above	48 closed metal containers of 3 m^3 capacity	At appropriate locations in the town
Landfill vehicles	As above	1 backhoe; 1 compactor; 1 tipper truck	Landfill site
Secondary collection vehs	As above	8 twin-container tractors	Jhalrapatan Town
Primary collection veh's	As above	58 push carts	Jhalrapatan Town
Litter bins	As above	180 street litter bins	Jhalrapatan Town
Household waste baskets	As above	12,428 household waste baskets	Individual households in Jhalrapatan



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Jhalawar
Proposed Landfill SIte Layout

LEGEND:-

- Forest
- Habitation
- State Highway
- National Highway
- Other Roads

OVERLAY LEGEND:-

- Proposed Landfill Site

NOTE:-
Arrangement of facilities shown are indicative only. The actual location shall be finalised by engineering survey.

GOVT. OF RAJASTHAN
ASIAN DEVELOPMENT BANK

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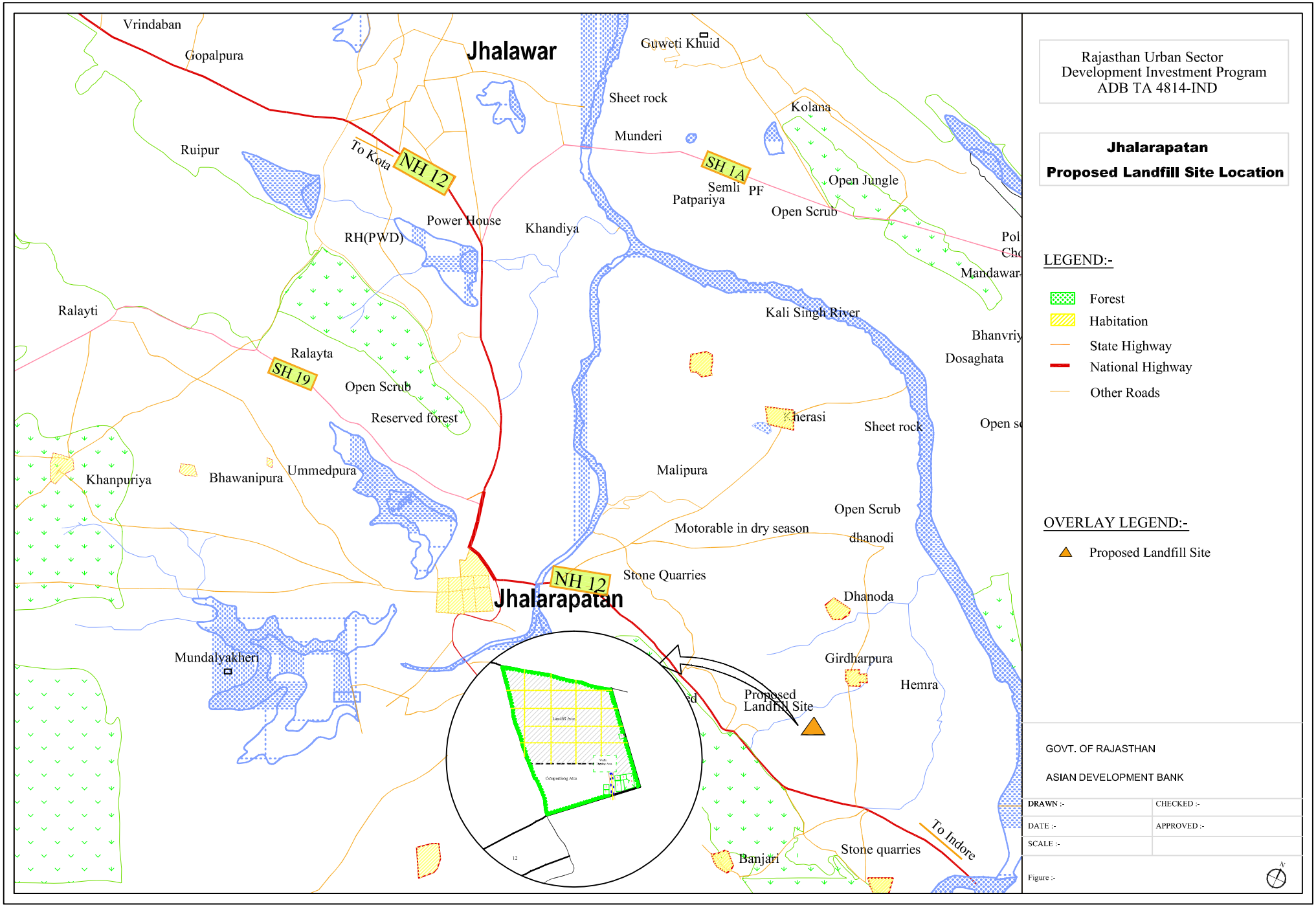

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Jhalarapatan
Proposed Landfill Site Location

LEGEND:-

- Forest
- Habitation
- State Highway
- National Highway
- Other Roads

OVERLAY LEGEND:-

- Proposed Landfill Site

GOVT. OF RAJASTHAN

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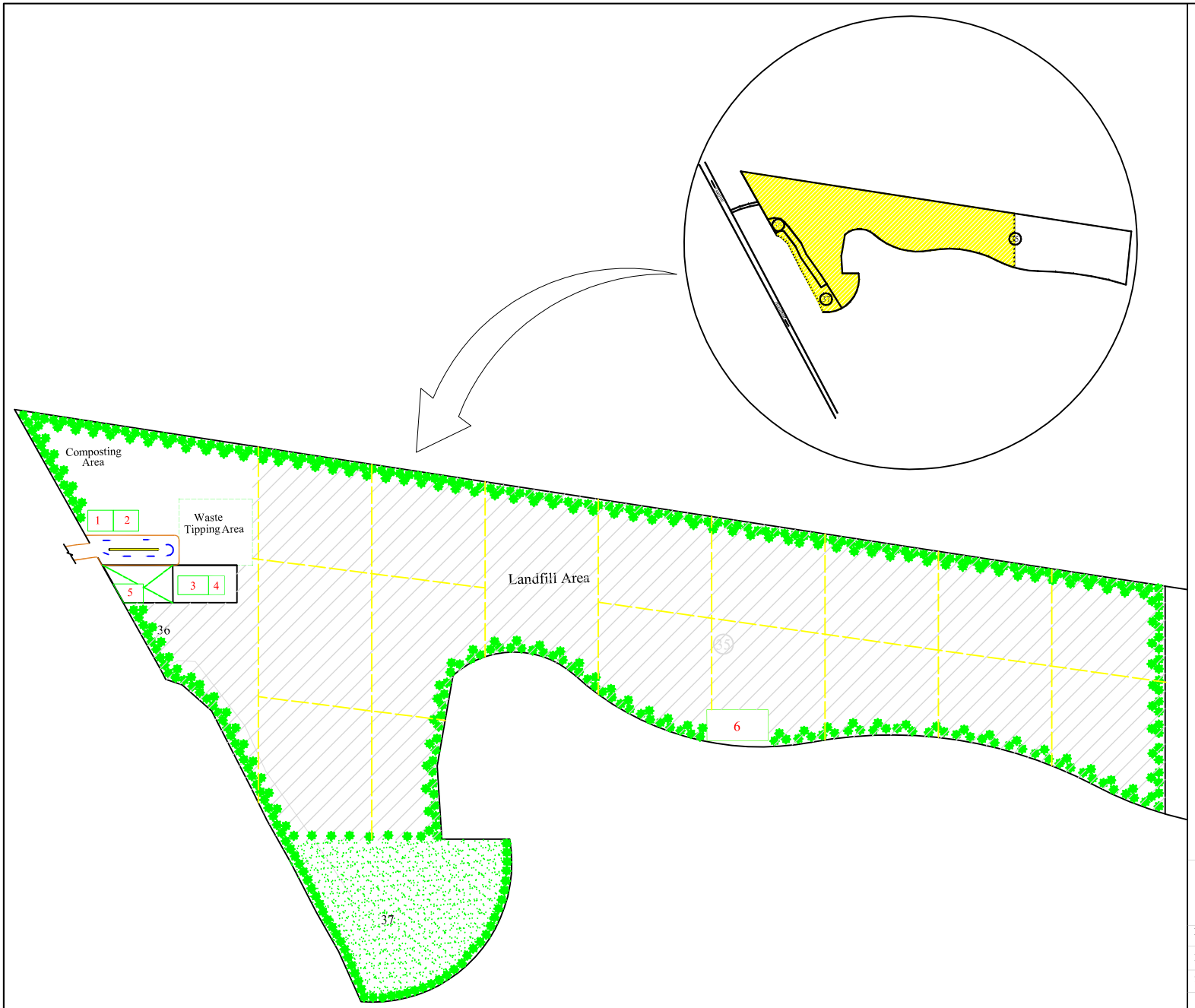

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Jhalawar
Conceptual Layout of Compost & Landfill

LEGEND:-

1. Security Room
2. Weight Bridge
3. Office & Staff Amenities
4. Compost Storage & Selling Area
5. Workshop
6. Leachate Collection Sump

(71) Khasra No.

OVERLAY LEGEND:-

NOTE:-

Arrangement of facilities shown are indicative only. The actual location shall be finalised by engineering survey.

GOVT. OF RAJASTHAN
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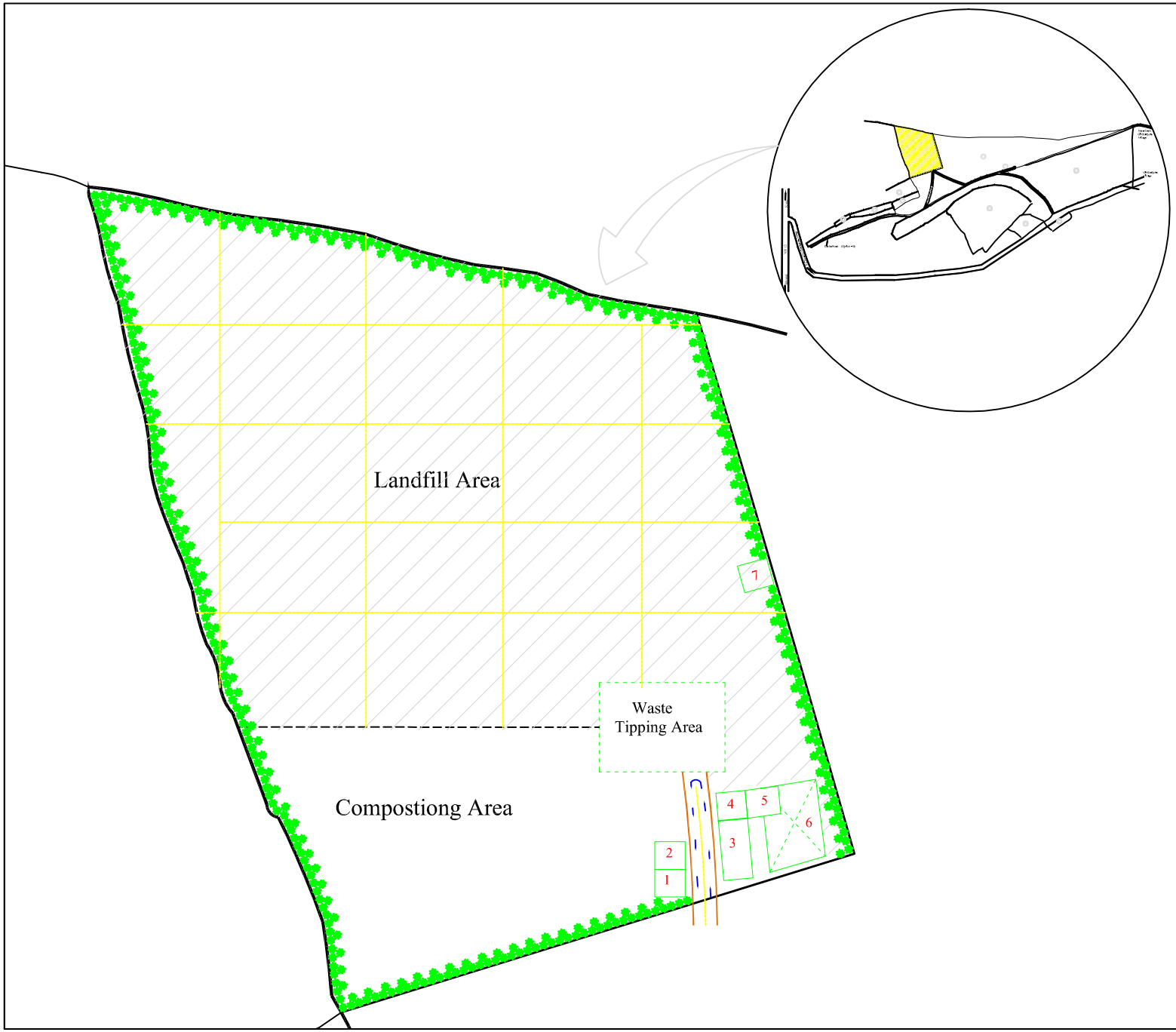

Rajasthan Urban Sector
Development Investment Program
ADB TA 4814-IND

Jhalrapatan
Conceptual Layout of Compost & Landfill

LEGEND:-

1. Security Room
2. Weight Bridge
3. Office & Staff Amenities
4. Compost Storage & Selling Area
5. Workshop
6. Parking
7. Leachate Collection Sump

(71) Khasra No.

OVERLAY LEGEND:-

NOTE:-
Arrangement of facilities shown are indicative only. The actual location shall be finalised by engineering survey.

GOVT. OF RAJASTHAN
ASIAN DEVELOPMENT BANK

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III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Location

21. Jhalawar District is located in the south-east of Rajasthan, between the longitudes of 75° 27’ 35” to 76° 56’ 48” East and latitudes of 23° 45’ 20” to 24° 52’ 17” North, adjoining the neighbouring state of Madhya Pradesh (Figure 1). Jhalawar Town is the district headquarters and lies towards the centre, with the smaller Jhalrapatan 20 km to the south-east. The two towns share a single municipal boundary, which is why they are considered jointly by RUSDIP. The municipality is an average of 316 m above Mean Sea Level, and the State capital Jaipur lies 330 km to the north and the town of Kota is 85 km to the north-west.

2. Topography, Soil and Geology

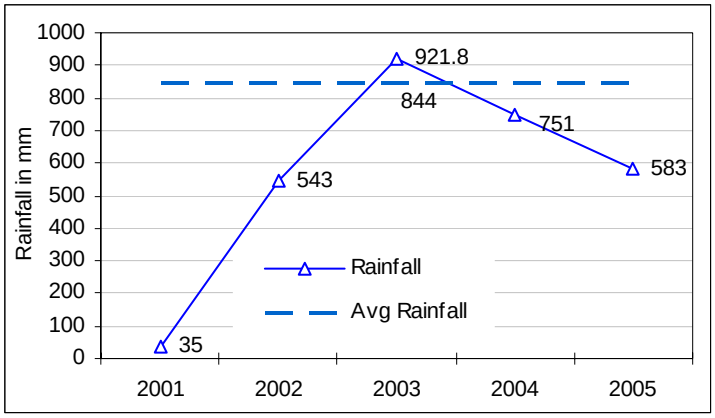
22. Both towns are located in the Jhalawar Plain, which is bounded in the north, south and east by the Mukunda hills. This is a fertile plain of mainly alluvial soil and is crossed by the Kalisindhi and Ahu rivers and a number of smaller streams. North-east of Jhalawar, between two ridges of hills, lies a long valley containing the artificial lakes of Kadila and Manasarowar.

23. Jhalawar District is at the edge of the Malawa plateau on Vindhyan strata at the northern edge of the great spread of basaltic rocks known as the Deccan trap formation. There are vast deposits of sandstone lying in horizontal strata around Jhalawar and Jhalrapatan (Photo 7), below which is a hard black rock stratum. Soil is mainly dark in colour produced by weathering of the underlying rock, and is generally high in organic matter but low in nitrogen. The influence of the sandstone is also seen in places, where soil is looser and granular, with a more sandy texture.

24. According to the Vulnerability Atlas of India, Jhalawar District is in an area of low earthquake risk (Zone II), characterised by old and geologically stable rock formations. Rajasthan has not experienced a major earthquake in the recent past, but there have been 37 events with a magnitude of 5-7 since 1720. The most recent occurred in 2001 and measured 6.9 on the Richter Scale, but because the epicentre was in neighbouring Gujarat, there was only limited damage in Rajasthan, and none reported in Jhalawar or Jhalrapatan.

3. Climate

25. Like most of Rajasthan the climate of Jhalawar and Jhalrapatan is mainly dry, with significant rainfall only during the monsoon season. Winter extends from November to March, and the coolest period occurs in January when daytime temperatures average around 25 °C and often fall below 10 °C at night. Temperatures begin to rise in March and peak in May-June, when daytime values sometimes reach 48 °C. The south-west monsoon arrives in June, causing a sudden drop in temperature and increase in humidity. The long-term average rainfall is 844 mm, of which over 90% falls in the monsoon period. However, like the rest of Rajasthan rainfall has been relatively low in the past few years, and was above average only in 2003 (Figure 6). The monsoon ends in mid-September and air temperatures rise briefly, only to fall again a few weeks later with the onset of winter. Winds are generally light and northerly or north-easterly in winter and moderate to strong from the west and south-west in the monsoon.



Source: Agriculture Dept 2007

Figure 6: Average Annual Rainfall in Jhalawar 2001-2005

4. Air Quality

26. There are no data on ambient air quality in Jhalawar or Jhalrapatan, but there is a station monitored by the Rajasthan State Pollution Control Board (RPCB) at Kota, which should be representative of the general area. Data from 2004 (Table 2) shows that suspended matter is high because of the dry atmosphere and dusty roads, and Respirable Suspended Particulate Matter (RSPM: <10μm) and Suspended Particulate Matter (SPM) frequently exceed National Ambient Air Quality Standards (NAAQS). In contrast, levels of chemical pollutants (oxides of sulphur and nitrogen) are relatively low because of the limited heavy industry, which is also the case in both Jhalawar and Jhalrapatan.

Table 2: Ambient Air Quality in Kota (Annual Average, 2004; units in μg/m^3)

M. Station	Land use	SOx	NOx	RSPM	SPM
Municipal Office	Residential	6	24	90	256
Samcore Glass	Residential	6	24	99	237
NAAQ Standard	*Residential*	*60*	*60*	*60*	*140*
RSPCB Office	Industrial	7	25	98	279
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

27. Jhalawar District receives the most rainfall in Rajasthan and is relatively well provided with surface water as a result. All of the rivers and streams are part of the Chambal system, which is the only perennial river in the state. Kalisindhi and Ahu are the main rivers (Photos 8 and 9), and both originate in Madhya Pradesh and flow north through Jhalawar into Kota District. All of the rivers and streams are full and swiftly flowing in the monsoon, but most are dry throughout the rest of the year, except for the Kalisindhi and Ahu, which retain water in depressions known locally as *deh*. These areas were the main source of water supply for Jhalawar and Jhalrapatan until recently, when two weirs were constructed in the Kalisindhi to provide a more secure supply, at Manpur 4 km northeast of Jhalawar (2001), and at Bhawrasa 6 km southeast of Jhalrapatan (2004).

28. The Public Health Engineering Department (PHED) monitors the quality of water from the Kalisindhi River at the intakes for the Jhalawar and Jhalrapatan water supply systems, and recent data (Table 3) shows that the quality is relatively good.

Table 3: Water Quality in the Kalisindhi River, December 2006

Parameter	Units	Monitoring Location		BIS Drinking Water Standard	
		Manpura	Bhawrasa	Desirable Level	Acceptable Level
pH	-	8.3	8.1	6.5-9.0	NR
Turbidity	NTU	70	130	Unobjectionable	
Total Alkalinity	$\mu g/m^3$	80	120	NS	NS
Chloride	$\mu g/m^3$	10	15	250	1000
Sulphate	$\mu g/m^3$	ND	ND	200	400
Total Dissolved Solids	$\mu g/m^3$	104	258	500	2000
Nitrate	$\mu g/m^3$	7.5	12.5	45	100
Total Hardness	$\mu g/m^3$	70	140	300	600
Fluoride	$\mu g/m^3$	0.40	0.34	1.0	1.5

Source: PHED; BIS = Bureau of Indian Standards

29. There are no natural lakes in Jhalawar district, but there are a number of artificial lakes and tanks in and around both towns, the water from which is mainly used for irrigation. These include Chandra Sarovar, Khandia Tank, Durgapura Tank and Naya Talab in Jhalawar, and Gomti Sagar and Mundliakheri (formed by damming the Chandrabhaga River) in Jhalrapatan.

6. Groundwater

30. Jhalawar and Jhalrapatan are in the south-eastern plateau region of Rajasthan, where groundwater is mainly found in layers of basalt, sandstone and shale, intercalated with sandstone. The groundwater resource of the Jhalrapatan block covers over 1300 km^2, but is heavily exploited, mainly by abstraction for agricultural use (Table 4). The water table varies from 7 m to 15 m below ground level, and rises to 2-7 m after the monsoon.

Table 4: Groundwater Resources in Jhalawar and Jhalrapatan (2003-04)

Description	Basalt Strata	Sandstone and Shale Strata
Net annual groundwater availability	58.6219 MCM	34.4722 MCM
Annual irrigation extractions	57.8988 MCM	27.6108 MCM
Domestic extractions	2.8489 MCM	1.6859 MCM
Groundwater development stage	107 %	85 %
Category	Over exploited	Critical

Source: GoR Groundwater Department

B. Ecological Resources

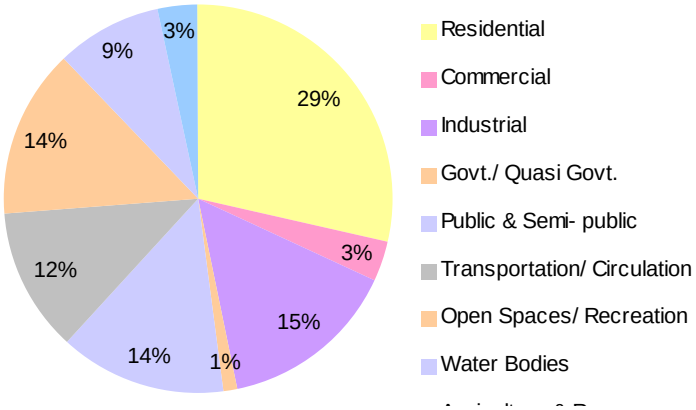
31. Jhalawar and Jhalrapatan are both urban areas surrounded by land that was converted for agricultural use many years ago (Photo 10). There is no remaining natural habitat in either town, where the flora is limited to artificially planted trees and shrubs, and the fauna comprises domesticated animals (cows, goats, pigs and chickens), plus other species able to live close to humans (urban birds, rodents and some insects).

32. There are reserve forest areas in the north and north-east of Jhalawar and the north-west and south-east of Jhalrapatan, and although protected from building and most other types of activity, these contain little of ecological interest. Vegetation is sparse and comprises mainly domesticated species (Photo 11), and the fauna is also very limited. There are fish in most of the rivers and tanks outside the towns, but no aquatic areas are protected; rahu (*Labeo rihita*) and sanwal are the most common fish species.

C. Economic Development

1. Land Use

33. Jhalawar Local Planning Area covers 33.09 km^2 and includes both Jhalawar (12.94 km^2) and Jhalrapatan (20.95 km$^{2)}$. According to the Master Plan for 1991-2011 the main land use is residential (29%) and there are also relatively large areas of industry (15%), public land (14%), transportation (12%) and open space (14%).



Source: Jaisalmer Urban Improvement Trust

Figure 7: Land Use in Jhalawar and Jhalrapatan

2. Industry and Agriculture

34. Both Jhalawar and Jhalrapatan are emerging as growing centres of commerce and industry. There are three industrial estates in Jhalawar and two in Jhalrapatan, which cover a total of 59 ha; and Rajasthan Industrial Infrastructure Corporation (RIICO) has also developed an industrial growth centre, which is currently partially occupied. Stone cutting and polishing is one of the main industries because of the large amounts of sandstone and other decorative materials quarried in surrounding hillsides, and also because of the proximity to Kota, which is famous for its stonework. There is also a large textile mill and various units related to fabrication, including PVC, agricultural accessories and handicrafts.

35. Agriculture is also important, because of the fertile plains and reasonably good rainfall, and Jhalawar District is the largest producer of coriander in the country and the second largest producer of oranges. Jhalawar and Jhalrapatan produce significant quantities of both of these crops, together with soya bean, wheat and opium. Many areas practice double cropping, and the main seasons are *kharif* (April-September: cotton, *jowar*, maize and groundnut) and *rabi* (October-March: wheat, gram, coriander, linseed, opium and sugarcane).

3. Infrastructure

36. PHED provides a piped municipal water supply to both towns (Photo 12),, which is extracted from the Kalisindhi River via two separate intakes at a rate of 6 MLD (Jhalawar) and 3.5 MLD (Jhalrapatan). In the dry season water is trapped in natural depressions in the riverbed, and also by means of the two man-made weirs at Manpur and Bhawrasa mentioned above. Water is treated by chlorination at a Water Treatment Plant in each town, and the piped distribution system reaches 90% of the population. However because of system losses (estimated at 40%), water is available for only 1-2 hours per day, and only on alternate days in the summer.

37. There is no sewerage system in Jhalawar or Jhalrapatan, and although around one third of houses have individual sanitation facilities (septic tanks or pit latrines), the rest of the population uses community toilets provided by the Municipal Boards, illegal connections from latrines to storm water drains, or practice open defecation.

38. There are roadside drains in many areas, alongside 30% of the roads in Jhalawar and 75% of the roads in Jhalrapatan (Photo 13). This includes both earth and concrete drains, but these are often poorly designed with inadequate gradients, and are frequently clogged with solid waste and polluted by sewage. There is also no drainage outfall, and water discharges onto areas of low-lying land in the town.

39. There is no proper solid waste management system in the towns, and although the Municipal Boards have designated 25 open collection points in Jhalawar and 15 in Jhalrapatan, refuse is mainly discarded in the streets and drains, and dumped on vacant plots of land. Jhalawar generates around 16 tons of solid waste per day and Jhalrapatan 9 tons, of which around 60% is collected, by manual street sweepers and irregular municipal collections by truck. Collected waste is transported on open vehicles to the outskirts of each town, where it is dumped on open ground (Photo 14 and 15).

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. In both towns roads are very narrow and congested in the older central areas, and as these house most of the commercial activity, there is considerable pedestrian and vehicular traffic (Photo 16). There are 53 km of roads in Jhalawar and 19 km in Jhalrapatan, of which around 30-40% are surfaced with bitumen/tar, 20-40% are concrete, < 3% are WBM (Water-borne Macadam) and the remainder (20-30%) are unpaved earth roads. All roads in Jhalrapatan and 90% of the roads in Jhalawar are maintained by the Municipal Board, and the rest are maintained by the Public Works Department (PWD). The condition of the roads is generally poor, and many are in need of repairs and resurfacing.

42. Transport in the towns is mainly by personal vehicles (mostly motorcycles and bicycles) and auto- and bicycle-rickshaws. The towns are connected to each other and to neighbouring areas by a good road network. National Highway 12 (NH 12) passes through both towns and runs north through Kota to the state capital Jaipur, and also runs south to Bhopal, the capital of Madhya Pradesh. The nearest railway station is at Ramganj Mandi, 25 km north of Jhalawar, and the nearest airport is at Jaipur, 300 km away.

D. Social and Cultural Resources

1. Demography

43. According to the national census the population of Jhalawar was 38,671 in 1991 and 48,054 in 2001, an annual growth of 2.3% over the decade; whereas in Jhalrapatan there were 23,067 people in 1991 and 30,103 in 2001, a growth of 2.9%. With a combined total of 78,157 people in a municipal area of 33.12 km^2, the population density in 2001 was 2,360 persons per km^2.

44. Overall literacy is reported at 82.1% in Jhalawar (90.5% for males and 72.8% for females) and 80.4% in Jhalrapatan (90% for males and 70.2% for females). These are both 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, with 901 and 909 females per 1000 males in the two towns, which is higher than the state average (879) but lower than the national figure (929).

45. According to the census, in 2001 only 29% of the total population of the two towns 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 (92%) are involved in the service and industrial sectors, with the remainder being mostly engaged in agricultural activities.

46. Over 90% of the people are Hindus, and the remainder are mainly Muslims and Jains. The main local language is Rajasthani, the principal dialect of the state, and almost all people also speak the national language of Hindi. Other languages spoken include Gujarati, Punjabi and Kanjari. About 3.5% of the population are from Scheduled Tribes (ST), but these are part of the mainstream population; around 12.5% of the population belong to scheduled castes (SC).

2. Health and Educational Facilities

47. There are good basic educational facilities in Jhalawar and Jhalrapatan, which serve both townspeople and inhabitants of surrounding villages and towns in the hinterland. There are 31 primary schools, 52 secondary schools and 18 higher secondary schools in the twin towns, plus two general degree colleges and a professional training institute. The towns also benefit from the proximity of Kota city, which is one of the most important educational centres in Rajasthan.

48. As the district headquarters town, Jhalawar is the main centre for health facilities in the area. There are four hospitals (including the district hospital that is presently being upgraded to 300 bed capacity), plus a special TB hospital, two dispensaries, a mother and child welfare centre, two family welfare centres and three homeopathic hospitals.

3. History, Culture and Tourism

49. Jhalawar was named after its founder, Jhala Zalim Singh (I), who was the Dewan of Kota State and established the town in 1796 as a cantonment (administrative and military area) near the existing Jhalrapatan Fort. Jhalawar state separated from Kota state in 1838 under the rule of Jhala Madan Singh (grandson of Jhala Zalim Singh), who built the famous Garh Palace in 1840-1845.

50. Interlinked over the centuries, the two towns have a rich cultural heritage which includes a number of sites that are of interest both historically and more recently to tourists. These include:

- The Garh Palace (otherwise known as Jhalawar Fort), which currently houses the district collectorate and other government administrative offices (Photo 17);
- The 14th century Gagroan Fort, 12 km north of Jhalawar is in a spectacular location on a remote hillside overlooking the Kalisindhi River, and is visible from the municipal water supply intakes (Photo 18);
- The ruins of the old city of Chandravati, which was largely demolished during the Muslim period, is on the left bank of the Chandrabagha River just south of Jhalrapatan;
- The 10th century Surya temple in the centre of Jhalrapatan, which contains one of the country's best preserved Surya (sun god) idols (Photo 19); the 11th century Shantinath Jain Temple; and the 14th century Chandrabhaga Temple (Photo 20), also in Jhalrapatan;
- There are also many events and festivals that attract visitors, of which the Kartik Fair held in Jhalrapatan in October and November is one of the most prominent, featuring earthen statues depicting the Hindu Ramayana epic (Photo 21).

IV. ENVIRONMENTAL IMPACTS AND MITIGATION: INFRASTRUCTURE CONSTRUCTION

A. Screening Out Areas of No Significant Impact

51. From the descriptions given in Section II.C it is clear that implementation of the project should not have major environmental impacts because most of the construction is relatively straightforward, and work in the towns will affect a series of very small sites only.

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 5, with an explanation of the reasoning in each case.

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

Table 5: 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 either town or on the government owned land outside the towns where the landfills will be built
Coastal resources	Jhalawar and Jhalrapatan are not located in a coastal area
Population and communities	Construction will not affect population numbers, location or composition

B. Landfill Sites and Composting Plants

1. Construction Method

54. Construction of each landfill will begin with excavation to reduce the floor of the site to 2 m below the present ground level. This will be done by backhoe diggers and bulldozers, and waste soil and rock will be loaded onto trucks and taken off site for disposal (Photo 22). Once the floor is level and the sloping sides have been formed, a clay layer will be created, by watering and compacting the existing soil if it is of the required composition, or by importing a clay and Bentonite mixture, which will be applied from trucks and smoothed and finished by hand. This will be covered with a geo-textile membrane to improve the retention capacity, and perforated plastic pipes will be laid on the surface to collect leachate, which will drain into small shallow evaporation ponds dug in an adjacent part of the site. Finally a 200 mm depth of gravel will be added above the geo-textile to allow leachate to drain into the pipes.

55. A 0.5 ha portion of each site will be left at the original ground level for the composting plant, and after minimal earth removal to render it flat, the surface will be sealed with concrete pavement, brought in on trucks and put into position by hand.

56. A small trench (ca 0.5 x 0.5 m) will be dug around the perimeter of each site by backhoe and hard-core and concrete will be inserted to form foundations. A double-skin brick wall (ca 2m high) will then be built by hand by masons. Other facilities, including a small building for workers and a shed for vehicles, will be constructed in a similar manner. Foundations will be dug by backhoe and hardcore and concrete will be tipped in to form foundations and the floor, after which bricks will be applied by hand to form the structures.

57. At the Jhalrapatan site an access road will be built from the main Giridharpura Road to the landfill 600 m away (Figure 3). The route will first be levelled by a small bulldozer, with waste material being taken offsite on trucks for disposal. The 5.5 m width of the road will then be delimited by small shuttering boards pegged into the ground, and cross-boards will be inserted every 5-10 m to subdivide the road into a series of short lengths. A concrete and aggregate mix will then be poured into the first 5-10 m length, to form a thickness of around 200 mm. The surface will be flattened by hand using smoothing boards, and after drying the edge-boards will be removed. The operation will then be repeated in each successive section, and after each length has dried masons will apply concrete by hand to seal the joints and remove any imperfections in the final surface.

2. Physical Resources

58. Although the impacts of constructing the landfills will be confined to two isolated sites, physical impacts could be significant because of the relatively large size of the area affected and the invasive nature of the excavation work.

59. Construction of the two landfills will require the excavation of 5.5 ha of land to a depth of 2 m, so around 100,000 m^3 of waste soil and rock will be produced, all of which will need to be removed and disposed of. There will therefore be quite large physical changes at the two sites, 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 also a lot of potential for the creation of dust, and this will need to be controlled regardless of the remote location, to avoid effects on site workers and adjacent roads and farmland.

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

- Contact the town authorities to arrange for the beneficial use of this material where possible, in construction projects, to raise the level of land prior to construction of roads or buildings, or to fill previously excavated areas, such as brickworks;
- Reduce dust by removing waste as soon as it is produced (by loading directly onto trucks);
- Use tarpaulins to cover soil and other loose material when transported by truck;
- Stockpile suitable topsoil and subsoil for use in the daily covering of refuse once the landfill is operating, in which case stockpiles will need to be sprayed with water when necessary to avoid the production of dust during dry windy conditions.

61. Another physical impact 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 relatively deep water table in this area (10-15 m), and the fact that the Contractor will almost certainly plan excavation work to avoid the monsoon season.

62. The other construction work at the landfill sites (levelling and paving the composting areas and construction of the perimeter walls and small buildings for workers and vehicles) will all have physical impacts, but they will be very small in scale compared to those of the landfill excavation, and will thus be of little significance in themselves.

63. Constructing the access road should also not be greatly significant in physical terms as it will be built on the existing ground surface. The work will require minor ground clearing and levelling and is unlikely to involve significant excavation or infill, so physical changes will be minor. The work involves concreting, so it will be conducted in the dry season, when there should be no problems from the runoff of water containing silt, sand or cement. If dust is generated from exposed soil during windy weather this should be controlled by lightly spraying with water when necessary.

3. Ecological Resources

64. Both proposed landfill sites are located within larger areas of government-owned land that are not currently used for any specific purpose. The Jhalawar site is alongside the Gagroan road about 4 km south-east of the town, and is covered with a sparse vegetation of common bushes, shrubs and grasses, that are being degraded in places by the dumping of refuse (Photos 1 and 15). The Jhalrapatan site is at Giridharpura approximately 5 km south-east of the town, and is almost devoid of vegetation (Photo 2); there are also no signs of animals, apart from domestic goats and cattle that are taken across the site to drink at a pond that forms during rainfall on lower ground some distance away. Neither site contains any fauna, flora, or habitats that are of any special ecological interest, so there should be no adverse ecological impacts from construction of the landfills.

4. Economic Development

65. Both landfills and the access road at Jhalrapatan will be located on government land, so there will be no need to acquire land from private owners, and there should therefore be no direct impacts on the income or assets of landowners or the livelihoods of tenants. There is also no industry, housing or infrastructure on either site, and the only activity is the unauthorised dumping of refuse at the Jhalawar site, which will cease once the new landfill begins to operate.

66. Land around both locations is used for small-scale agriculture, but because the landfills require only a relatively small proportion of the total government land at each site, they can be located far enough from the perimeter to ensure that the agricultural activities are unaffected. There are no other land-uses in the vicinity, apart from *ad hoc* grazing and watering of livestock as indicated above.

67. One aspect of the work that may have economic implications is the transportation of waste soil and stone from each site to locations where it can be put to beneficial use as recommended above. This will require a large number of lorry movements, which could disrupt traffic on the Gagroan and Giridharpura roads, and particularly in Jhalawar and Jhalrapatan if such vehicles were to enter the towns. The transportation of waste will be implemented by the Construction Contractor in liaison with the town authorities, and the following additional precautions should be adopted to avoid effects on traffic:

- Planning transportation routes so that heavy vehicles do not enter the towns and do not use narrow local roads, except in the immediate vicinity of delivery sites;
- Scheduling transportation activities to avoid peak traffic periods.

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 historical remains. Given that the proposed landfill sites are uninhabited and show no sign of having been used to any extent in the past, then it could be that there is a low risk of such impacts. Nevertheless this should be ascertained by consulting the appropriate authorities, and steps should be taken according to the nature of the risk. This should involve:

- Consulting historical and archaeological authorities at both national and state level to obtain an expert assessment of the archaeological potential of each site;
- Selecting an alternative location if either site is considered to be of medium or high risk;
- Including state and local archaeological, cultural and historical authorities and interest groups in consultation forums as project stakeholders so that their expertise can be made available to the project;
- Developing a protocol for use by the Contractor in conducting any excavation work, to ensure that any chance finds are 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. There are no modern-day social and cultural resources (such as schools and hospitals) near either site, and no areas that are used for religious or other purposes, so there is no risk of other impacts on such community assets.

70. There are safety risks associated with any construction work, even in a remote location, and the Contractor will be required to produce and implement a site Health and Safety Plan to protect the safety of both workers and the general public. This should include such measures as:

- Excluding the public from the sites;
- 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. 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 this part of the scheme, the Contractor should be required to employ at least 50% of the landfill labour force from communities within a radius of say 2 km from each site, if sufficient people are available. This will have the added benefit of avoiding social problems that sometimes occur when workers are imported into host communities, and avoiding environmental and social problems from workers housed in poorly serviced camp accommodation.

C. Storage Bins

1. Construction Method

72. Waste storage bins will be provided at approximately 30 locations in Jhalawar and 20 in Jhalrapatan, from where waste will be collected daily by the Municipal Board. The sites will be on open ground adjacent to roads, and at each a small concrete plinth (approximately 3 x 2 m and 0.25 m above ground level) will be built. This will require the excavation of soil down to

around 0.25 m by backhoe (Photo 22), after which the sides above- and below- ground will be encased in wooden shuttering. Concrete will be inserted and allowed to dry, after which the shuttering will be removed. The closable metal storage bins will be manufactured locally and brought to each site on trucks and placed on the plinths by means of a small crane.

2. Physical Resources

73. These facilities will involve simple construction at relatively small sites, and as a result there should not be major environmental impacts.

74. Excavation of foundations for the storage bin plinths will produce around 1.5 m^3 of waste at each site (<100 m^3 in total), which the Contractor will probably spread across any adjoining waste ground. The work will affect the surface of each area only and will be conducted in the dry, so there is no risk of surface or groundwater collecting in dug areas. There should also be no need for precautions against dust as each excavation will be very small in scale.

3. Ecological Resources

75. There are no significant ecological resources in or around either town, so this work should also have no impacts on ecology. The sites should however be selected to avoid the need to remove any trees.

4. Economic Development

76. The waste bins will all be located on government land, so there will be no need to acquire land, and there should thus be no impacts on the assets or income of landowners or tenants. Because the sites are so small, construction should also not impede the access of customers to shops and businesses in the vicinity, so there should be no loss of business or other economic impacts.

77. Excavation could however damage existing infrastructure located alongside roads, in particular water supply pipes and sewer lines, either existing systems or new infrastructure installed by RUSDIP or other programmes. It will be particularly important to avoid damaging existing water pipes as these are mainly manufactured from Asbestos Cement (AC), which can be carcinogenic if inhaled, so there are serious health risks for both workers and the public (see below). It will be important therefore to avoid these impacts by:

- Obtaining details from the Municipal Boards of the nature and location of all infrastructure, and selecting waste bin sites to avoid any conflict or damage;
- Integrating the construction of the various infrastructure subprojects conducted in Jhalawar and Jhalrapatan so that:
  - Different infrastructure is located on opposite sides of the road wherever feasible;
  - Roads and inhabitants are not subject to repeated disturbance by excavation in the same area for different purposes.

78. Precautions will also be needed to avoid impeding traffic, particularly where storage bins are to be located in the centre of the towns where roads are narrow and easily congested (Photo 16). This will require the Contractor to:

- Place all excavated soil off the road wherever possible; and

- Where this cannot be achieved, conduct the work during periods of low traffic volume (for example on a Sunday).

5. Social and Cultural Resources

79. As was the case for the landfills, there is a risk that the excavation work related to these facilities could damage undiscovered historical remains. The risks may be more significant in this case because such artefacts are more likely in areas that have been inhabited for a long period as Jhalawar and Jhalrapatan towns have. This could be counterbalanced however by the fact that in this case the excavation will be superficial, and will affect small areas only. Regardless of this the preventative measures described in Section IV.B.5 will need to be employed. These are:

- Consulting national and state historical and archaeological authorities to assess the archaeological potential of all construction sites;
- Selecting alternative 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 in conducting all excavation, to recognise, protect and conserve any chance finds (see Section IV.B.5 for details).

80. Construction of these facilities should not be large enough to significantly disturb any nearby modern-day social and cultural resources, such as schools, hospitals, temples and sites of tourism importance. However it would not be desirable to have operating waste handling facilities in the vicinity of these resources, so such locations should be avoided when sites are selected during the detailed design stage.

81. The storage bins will be located in both residential and commercial areas, and although people should not be significantly disturbed by the construction, they should nevertheless be informed about the work and the operation of the facilities in advance so that they will utilise them when available. This should involve:

- Consultation with the local community to inform them of the nature, duration and minimal impacts of the construction work;
- A public education campaign to inform residents of the new waste management system and their role in its successful implementation.

82. Safety risks are probably greater at these sites than at the much larger landfills, because they are located in the towns, where there will be large numbers of people, vehicles and activities. The Contractor will thus be required to produce and implement the Health and Safety Plan, outlined in Section IV.B.5;

83. 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.

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

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

85. Finally, there could again be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to communities that are affected by the work, as suggested in Section IV.B.5, the Contractor should be required to employ at least 50% of his labour force from communities in the vicinity of construction sites.

V. ENVIRONMENTAL IMPACTS AND MITIGATION: OPERATION AND MAINTENANCE

A. Screening Out Areas of No Significant Impact

86. Because the waste storage sites in the towns are relatively small and self-contained, and the landfills are located outside the towns in uninhabited and unused areas, providing the waste management systems are managed effectively, they should operate without major environmental impacts (see below). As a result there are several environmental sectors that should be unaffected once the systems begin to function. These are identified in Table 6 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.

[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

Table 6: Fields in Which Operation and Maintenance of the Completed Solid Waste Management Systems are Not Expected to Have Significant Impacts

Field	Rationale
Climate	Odour from decaying waste is the only impact on air quality
Fisheries & aquatic biology	There are no rivers or lakes close to any of the waste management sites
Wildlife, forests, rare species, protected areas	There are none of these features in or outside these towns
Coastal resources	Jhalawar and Jhalrapatan are not located in a coastal area
Infrastructure, health and education facilities, physical or cultural heritage, historical or archaeological resources	Locations of waste management facilities (waste storage bins and landfills) will be selected in the detailed design stage to avoid municipal infrastructure and sites and facilities of social or cultural importance

B. Operation and Maintenance of the Improved Waste Management System

87. The Municipal Boards will be responsible for management and implementation of the waste management system in each town, and will distribute over 30,000 bins to households (two per household) for temporary waste storage. This will be supported by a public education campaign, through which citizens will be requested to segregate their biodegradable and general domestic waste into separate bins, and will be informed about their waste collection and management system.

88. Each Municipal Board will introduce door-to-door primary waste collection throughout the town by its own staff or through private sector participation (PSP) by a local contractor or NGO. Hand-operated pushcarts will collect waste from each household on a regular cycle every day or two days, and the segregated waste will be deposited into separate storage bins in the locality. Waste will also be removed from litter bins in the streets, and debris from street sweeping and drain de-silting will also be deposited into the municipal bins. These will be removed daily by purpose-made vehicles, and two empty bins will be replaced at each site.

89. Full containers will be transported to the landfill, where one bin will be emptied in the general refuse area, and the bin containing biodegradable waste will be emptied at the composting plant. Waste for landfilling will be moved into the currently-used cell by backhoe/bulldozer, and reduced in volume by a compactor vehicle. All waste will be covered by soil at the end of each day, and by a thicker layer of topsoil at the end of each year, when one cell will be closed and another will begin.

90. Waste at the composting plant will be sorted manually and via conveyors, and any unsuitable material will be transferred to the landfill. Biodegradable waste will be left to rot in piles in the open air, with material being turned and mixed manually as required. Once the compost has been formed it will be loaded into bags and taken away on a truck for sale to retailers.

C. Environmental Impacts and Benefits of the Operating System

1. Physical Resources

91. Clearly it is imperative that the Municipal Boards maintain the individual facilities and their waste management system as a whole in proper working order, because if the systems fall into disrepair then waste will accumulate in streets and on open ground as it does at present and there will be consequent impacts on many elements of the environment. Capacity building, public education campaigns and other support provided by this sub-project and future tranches of investment will be aimed at ensuring the continuation of the operating system.

92. If waste is collected regularly from houses, litter bins and elsewhere and the storage bins are emptied daily as intended, there should be no direct impacts on the physical environment in the towns. Even air quality should not deteriorate from increased odour, providing the bins are emptied and replaced each day.

93. The greatest physical impacts from the operating system will occur at the two landfills, where decomposing waste will rise to an eventual height of up to 8 m above ground level, which will greatly alter the appearance and topography of the sites. Although these impacts would be significant at certain locations this should not be the case at these sites, where there are no inhabited areas nearby from which people would be able to see the landfills.

94. The landfill design includes measures to collect leachate and prevent pollution of surface and groundwater, and because there is very low rainfall in these areas, the collected liquid will be allowed to evaporate in simple lined ponds. The design also includes measures to maintain an orderly appearance at each site and to prevent the liberation of excessive odours, as deposited waste will be covered with soil after compaction at the end of each day; and when a cell is closed at the end of each year, a thicker layer of topsoil will be applied to effectively seal the completed area. Simple tubed vents will be inserted into the material to allow the escape of methane and other gases produced by the decomposition process, and equipment will be provided for automatic monitoring of such gases, so that additional measures such as controlled flaring can be adopted if necessary.

2. Ecological Resources

95. As there are no significant ecological resources in or around the towns, or at or near the landfill sites, operation of the solid waste management systems should have no ecological impacts.

96. Poorly-managed landfills can cause negative ecological impacts by allowing the development of colonies of scavenging birds, rodents and other vermin, which can then be a nuisance and a health hazard in surrounding areas. This should not be a problem given the remoteness of these sites, and these animals will be discouraged anyway by the daily covering of deposited waste. Nevertheless the Municipality should routinely monitor the incidence of pests at the site and take further controlling action if necessary.

97. There can be small ecological gains as well as improvements in the appearance of such sites if trees are planted on and around completed waste cells, so this should be done. Given the sandy soil and low rainfall of the area such planting may need to be supported by the application of fertiliser from the composting plant and the use of an artificial watering regime.

3. Economic Development

98. Business and small industry in both towns should operate more efficiently if their waste is removed speedily and efficiently, so there should be small economic gains once the systems are in place. The main economic benefit will be obtained by the companies that are involved in operating the waste management systems, either in partnership with the Municipality via PSP schemes or through direct employment.

99. There should also be a significant economic benefit in the long term from the commercial sale of agricultural compost produced at the composting plants. Farms that utilise the compost should show increased yields, providing further economic gains.

100. The only negative economic impact from the operating waste management systems will be on traffic and transportation as there will be more heavy vehicles on the roads in and around the towns, collecting and transporting the storage bins. This should be mitigated by conducting these collections early in the day (when traffic is light) as much as possible, after which any remaining impacts should be counterbalanced by the economic and other benefits of the schemes.

4. Social and Cultural Resources

101. The main beneficiaries of the improved system of waste management will be the citizens of each town, whose general environment, and in some cases living conditions, will be improved considerably. The unsightly mounds of garbage should no longer be evident in the towns, and the attendant appearance, smell and public health risks should be removed. This should also enhance the cultural resources of the towns and make the various sites more appealing to visitors, which could then bring economic benefits.

102. There will also be socio-economic gains for people who are able to obtain employment with companies involved in operating the systems, or with the Municipalities, who will need to increase their manpower. Farmers who benefit from fertilizer produced at the composting plants should also experience increases in their income.

103. One group who will suffer economically are the “rag-pickers” who currently scavenge the piles of refuse in the town for materials that they can sell for re-use (textiles, bottles, etc). These activities will be prohibited at the new landfills, so this poor and vulnerable group of people will lose their means of livelihood. This has been recognised by the Municipal Boards, who plan to mitigate this impact by employing rag pickers at the composting plants to sort through the material to remove any non-biodegradable constituents.

VI. ENVIRONMENTAL IMPACTS AND MITIGATION: LOCATION AND DESIGN

104. 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.

105. 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 leachate from an unsealed landfill drains into an exploited aquifer and pollutes water sources this would be an impact of both location and design as it would not have occurred with a sealed landfill located in an area with no groundwater resources.

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

- Most elements of the subproject are relatively small in scale and involve straightforward construction and 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 involves excavation. However the routine nature of the impacts means that most can be easily mitigated.

VII. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

A. Summary of Environmental Impacts and Mitigation Measures

107. Table 7 lists the potential adverse impacts of the Jhalawar and Jhalrapatan Solid Waste Management 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

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

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

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

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

Investment Program Implementation Units (IPIU) will be established in seven zones across the

Table 7: Environmental Impacts and Mitigation for the Jhalawar and Jhalrapatan Solid Waste Subproject (Black = continuous activity; Grey = intermittent)

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Respon sibility	Location	07	2008			[3]
Construction: Landfills and Composting Plants						**3**	**1**	**2**	**Op**	
Excavation of landfills will produce large amounts of waste soil and stone	S2	P	Find beneficial uses for waste material in construction, land raising and infilling of previously excavated areas	Contractor	Landfill sites					+
			Retain topsoil and subsoil to cover waste when landfill is in operation							0
Dust could be produced when soil is excavated, transported and stockpiled	S2	T	Remove waste soil as soon as it is excavated	Contractor	Landfill sites					0
			Use tarpaulins to cover dry soil when carried on trucks	Contractor	From landfill					0
			Spray soil stockpiles with water in dry weather	Contractor	Landfill sites					0
Road construction could produce dust in dry weather	S2	T	Damp down exposed soil to reduce dust when necessary	Contractor	Access road					0
Traffic may be disrupted by lorries carrying waste material	S2	T	Plan routes to avoid both towns and narrow local roads	Contractor	From landfills					0
			Schedule transportation to avoid peak traffic periods							0
Ground disturbance could damage archaeological and historical remains	S1	P	Request state and local archaeological authorities to assess archaeological potential of landfill sites	DSC	All sites					0
			Select alternative if either site has medium/high potential	DSC						0
			Include state and town historical authorities as project stakeholders to benefit from their expertise	LSGD						0
			Develop and apply protocol to protect chance finds (excavation observed by archaeologist; stop work if finds are suspected; state authority to plan appropriate action)	DSC and Contractor						+
Workers and the public are at risk from accidents on site	S2	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
Economic benefits if local people are employed in Contractor's workforce	S2	T	Contractor should employ at least 50% of workforce from communities in vicinity of landfill sites	Contractor	All sites					+
Construction: Storage Bins										
Excavation for foundations could damage infrastructure	S1	P	Determine location of infrastructure and avoid these sites	DSC	Storage Bins					0
			Locate different infrastructure on opposite sides of roads							0

Sig = Significance of Impact (S3 = Not Significant, negligible impacts; S2 = Moderate, reversible impacts which are site specific and simple to contain and mitigate; S1 = Significant, potentially irreversible impacts requiring complex mitigation). 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)

Roads/people may be disturbed by repeated excavation	S2	T	Integrate subprojects to conduct excavation at same time	DSC/LGD	Storage Bins					0
Work could impede traffic in narrow roads	S2	T	Place excavated soil off road wherever possible	Contractor	Storage Bins					0
			Conduct this work during light traffic periods (eg Sunday)							0
Ground disturbance could damage archaeological and historical remains	S1	P	As above: ask authorities to assess potential of all sites	DSC	All sites					0
			As above: choose alternative sites if risk is high/medium	DSC						0
			As above: include state/local authorities as stakeholders	LSGD						0
			As above: apply protocol to protect chance finds	DSC/CC						+
Facilities may disturb schools, hospitals, tourist sites	S2	P	Choose sites that are not near sensitive buildings/areas	DSC	Storage Bins					0
Community should be informed about work in advance			Consult community; conduct public information campaign	LSGD	Towns					0
Workers and the public are at risk from accidents on site	S2	T	As above: prepare and implement H&S Plan (exclude public, use safety equipment, training, accident record)	Contractor	All sites					0
Existing water supply system uses AC pipes, a material that can be carcinogenic if inhaled as dust particles	S1	T	Design all infrastructure to avoid locations of AC pipes	DSC	All sites					0
			Train all construction personnel in dangers of AC pipes and how to recognise them in situ	Contractor	All sites					0
			Develop and apply protocol if AC pipes are encountered. This should include:	DSC and Contractor	All sites					0
			- immediate reporting of any occurrence to management;	Contractor	Storage Bins					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 for people employed in workforce	S2	T	As above: 50% of workforce from affected communities	Contractor	All sites					+
Operation and Maintenance										
Town environment will deteriorate if system malfunctions	S1	P	Maintain facilities and system in full working order	GA	All sites					0
Landfills can attract birds, rodents and other pests	S2	P	Monitor pest incidence & reduce numbers if necessary	GA	Landfills					0
Small ecological gains if closed landfills planted with trees	S2	P	Plant trees on closed cells; apply compost if necessary	OMC	Landfills					+
Traffic may be impeded by heavy waste vehicles	S2	P	Collect waste early in the day as much as possible	OMC	Towns					0
Rag-pickers will lose their means of livelihood	S2	P	Employ rag-pickers to sort waste at compost plant	GA	Landfills					+

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.

109. 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.

110. 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.[4]

C. Environmental Monitoring Plan

111. Table 7 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 operate the new waste management systems in the future. 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.

112. 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

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

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[5].

113. Table 7 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.

114. Table 8 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 7 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.

115. Given the scale of the investment in providing the infrastructure, LSGD will also wish to conduct monitoring during the operational period to confirm the long-term benefits of the scheme. Table 8 shows that a specialist consultant will be appointed to conduct a survey of the amount of litter and garbage in the town, during the construction period (baseline), and annually for the first five years of operation of the improved waste management system.

D. Environmental Management and Monitoring Costs

116. Most of the mitigation measures require the contractors to adopt good site practice, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. Regardless of this, any costs of mitigation by the contractors (those employed to construct the infrastructure or the local companies employed to operate the waste management system) 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.

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

- The environmental monitoring during construction, conducted by the EMS; and
- The long-term garbage survey that will be commissioned by LSGD.

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

These have not been budgeted elsewhere, and their costs are shown in Table 9, with details of the calculations shown in footnotes beneath the table. The figures show that the total cost of environmental management and monitoring for the subproject as a whole (covering the one year of design and construction, and the first five years of operation) is INR 0.9 million, ie US$ 20,000.

Table 8: 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)	Landfill sites	Contractor	Site observations; CC records	Monthly	EMS
Retain topsoil and subsoil to cover waste when landfill is operating	Landfill sites	Contractor	Site observations	Monthly	EMS
Remove waste soil as soon as it is excavated	Landfill sites	Contractor	Site observations	Weekly	EMS
Use tarpaulins to cover dry soil when carried on trucks	From landfills	Contractor	Observations on and off site	Weekly	EMS
Spray soil stockpiles with water in dry weather	Landfill sites	Contractor	Site observations	Weekly	EMS
Damp down exposed soil to reduce dust when necessary	Access road	Contractor	Site observation; resident survey	Weekly	EMS
Plan truck routes to avoid both towns and narrow local roads	From landfills	Contractor	Observations off site; CC record	Weekly	EMS
Schedule transportation of waste to avoid peak traffic periods	From landfills	Contractor	Observations on and off site	Weekly	EMS
Request archaeological authorities to assess potential of all sites	All sites	EDC	EDC records; design reports	As needed	EMS
Select alternatives if sites have medium or high potential	All sites	EDC	EDC records; design reports	As needed	EMS
Include state and town historical authorities as stakeholders	All sites	DEA	DEA records; observations at meetings	As needed	EMS
Develop and apply archaeological protocol to protect chance finds	All sites	EDC and CC	EDC and CC records; site observations	Weekly	EMS
Prepare and implement a site H&S Plan (safety of workers/public)	All sites	Contractor	Site observations; CC records	Monthly	EMS
Exclude the public from site	All sites	Contractor	Site observations; CC records	Monthly	EMS
Ensure that workers use Personal Protective Equipment	All sites	Contractor	Site observations; CC records	Monthly	EMS
Provide Health & 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
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
Determine location of infrastructure and avoid these sites	Storage bins	EDC	EDC records; design reports	As needed	EMS
Locate different infrastructure on opposite sides of roads	Storage Bins	DSC	Site observation; design reports	Monthly	EMS
Integrate subprojects to conduct trenching at same time	Storage Bins	DSC/LSGD	Site observation; design reports	Monthly	EMS
Place excavated soil off road wherever possible	Storage Bins	Contractor	Site observations	Weekly	EMS
Conduct work near narrow roads during light traffic (eg Sunday)	Storage Bins	Contractor	Site observations	Weekly	EMS
Choose sites that are not near sensitive buildings/areas	Storage bins	EDC	Design reports; site observation	As needed	EMS

Consult community; conduct public information campaign	Towns	DEA	DEA records; resident surveys	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
OPERATION AND MAINTENANCE					
Maintain facilities and system in full working order	All sites	AMC	Site observation; resident survey	Monthly	
Monitor pest incidence & reduce numbers if necessary	Landfill sites	AMC	Site observation; AMC records	Monthly	
Plant trees on closed cells; apply compost if necessary	Landfill sites	OM Contractor	Site observations	Monthly	
Collect waste early in the day as much as possible	Towns	OM Contractor	Site observation; resident survey	Monthly	
Employ current rag-pickers to sort waste at compost plant	Landfill sites	GA	GA records; worker survey	As needed	
LONG-TERM SURVEYS					
Township litter and garbage survey	Towns	Consultant	Systematic observation; resident survey	Annual for 6 years	Specialist consultant

Table 9: 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
2. Survey of litter and garbage (6 years)				
Domestic Consultant	6 x ½ month	100,000	300,000	
Expenses	Sum	200,000	200,000	500,000
TOTAL				900,000

VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project Stakeholders

118. 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:

- People who live and work near the sites of storage bins and in the general vicinity of the landfill sites;
- State and local authorities responsible for the protection and conservation of archaeological relics, historical sites and artefacts.

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, religious leaders, elders, women's groups);
- The beneficiary community in general; and
- The ADB.

B. Consultation and Disclosure to Date

119. 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:

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

- A public meeting was held in Jhalawar/Jhalrapatan in April 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 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

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

<u>Consultation during detailed design:</u>

- 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.

<u>Consultation during construction:</u>

- 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.

<u>Project disclosure:</u>

- 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

121. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Jhalawar and Jhalrapatan Solid Waste Management Subproject. Potential negative impacts were identified in relation to construction and operation of the improved infrastructure, but no impacts were identified as being due to either the subproject 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:

- Using natural or amended clay to seal the landfills and incorporating a drainage system to collect leachate, to prevent the pollution of groundwater;
- Including a composting plant to provide a beneficial use for biodegradable waste.

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

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

- Locating the storage bins and landfills on government-owned land to avoid the need for land acquisition and relocation of people;
- Locating both landfills at sites with no inhabitation nearby, to reduce the visual and other impacts of construction and operation of the facilities.

123. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because of the invasive nature of excavation work, because the secondary storage facilities (waste bins) are located in urban areas, some parts of which are densely populated, and because Rajasthan is an area with a rich history, in which there is a high risk that ground disturbance may uncover important remains. Because of these factors the most significant impacts are on the physical environment, the human environment, and the cultural heritage.

124. During the construction phase, impacts mainly arise from the need to dispose of large quantities of waste soil and stone produced by excavation at the landfill sites. These are common impacts of construction in and around urban areas, and there are well developed methods for their mitigation. These include:

- Finding beneficial uses for waste material;
- Covering soil to prevent dust during transportation on trucks;
- Damping down exposed soil and stockpiled material to reduce dust during dry weather.

125. 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 locations 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.

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

- 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).

127. 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;
- Plant trees on completed parts of the landfill sites once they are operating, to improve the appearance and provide a small ecological gain.

128. These and the other mitigation and enhancement measures are summarised in Table 7, which also shows the location of the impact, the body responsible for the mitigation, and the program for its implementation.

129. Once the systems are operating, it will be important that the Municipal Boards maintain their facilities and waste management system as a whole in proper working order, because the environment of the towns will deteriorate rapidly from waste accumulation if the systems begin to fail. The project will provide capacity building, public education and financial support to ensure continuation of the operating systems.

130. If waste is collected regularly from houses and municipal storage bins, transferred to the landfills and treated as intended, then there should be no significant negative impacts. Even the accumulation of waste to a design height of 8 m at the landfill sites should not be significant as waste will be compacted and covered with soil daily and when each cell is completed, thus limiting pests, odours and visual impacts. There are also no inhabited areas nearby from where people would be able to see the landfills.

131. The main impacts of the operating waste management systems will be beneficial as the general environment of the towns will improve considerably as mounds of garbage are no

longer evident and the appearance, smell and public health of the area improves as a result. This should enhance the cultural resources of the towns and make the historical and tourism sites more appealing to visitors. Some people will gain socio-economically from being employed in companies engaged to operate the systems, or in the expanded Municipality manpower. Farmers should also benefit from increased yields from the use of fertilizer produced in the composting plant.

132. Table 7 also assesses the effectiveness of each mitigation measure in reducing each impact to an acceptable level. This is shown as the level of significance of the residual impact (remaining after the mitigation is applied). This shows that all impacts will be rendered at least neutral (successfully mitigated), and that certain measures will produce a benefit (in addition to the major benefits provided by the operating schemes).

133. Mitigation will be assured by a programme of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the IPMU. There will also be a longer-term survey to monitor the expected improvements in the environment of the towns from the improved solid waste management.

134. Finally, stakeholders were involved in developing the IEE through both face-to-face discussions on site and a large public meeting held in each 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

135. 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 7) are implemented in full, as described in the text above;
- The Environmental Monitoring Plan proposed in Section VI.C of this report is also implemented in full.

X. CONCLUSIONS

136. The environmental impacts of the proposed improvements in solid waste management infrastructure in Jhalawar and Jhalrapatan have been assessed by the Initial Environmental Examination reported in this document, conducted according to ADB guidelines. The overall conclusion of the process 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 environment of both towns once the solid waste management schemes are in operation.

137. 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 1: Proposed landfill site, Jhalawar

Photo 4: Household waste storage bin

Photo 2: Proposed landfill site, Jhalrapatan

Photo 5: Dumper placer with container

Photo 3: Solid waste container

Photo 6a: Excavator cum loader

Photo 6b: Compactor

Photo 9: Ahu River

Photo 7: Rocky surface strata

Photo 10: Agriculture land in the outskirts

Photo 8: Kalisindh River

Photo 11: Domesticated bushes and shrubs

Photo 12: Piped water supply in Jhalrapatan

Photo 15: Open dumping of solid waste

Photo 13: Roadside drains in Jhalawar

Photo 16: Heavy vehicle & pedestrian traffic

Photo 14: Open dumping/buring of solid waste

Photo 17: Garh Palace

Photo 18: Gagroan fort

Photo 21: Earthen statues in Jalrapatan

Photo 19: Chndrabagha temple, Jhalrapatan

Photo 22: Backhoe digger for trenching

Photo 20: Surya temple, Jhalrapatan

APPENDIX