

Initial Environmental Examination

Project Number: 40031
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India: Rajasthan Urban Sector Development
Investment Program—Bharatpur Solid Waste
Management Subproject

Prepared by Local Self Government Department

For the Government of Rajasthan
Rajasthan Urban Infrastructure Development Project

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

ABBREVIATIONS

| | | |
|---------|---|--|
| ADB | — | Asian Development Bank |
| AC | — | Asbestos cement |
| BNP | — | Bharatpur Municipal Board |
| CLC | — | City Level Committees |
| CLIP | — | City Level Investment Plan |
| DSC | — | Design and Supervision Consultants |
| EARF | — | Environmental Assessment Resettlement Framework |
| EC | - | Environmental Clearance |
| EIA | — | Environmental Impact Assessment |
| EMP | — | Environmental Management Plan |
| EMS | — | Environmental Monitoring Specialist |
| GRC | — | Grievance Redress Committee |
| H and S | — | Health and Safety |
| IEE | — | Initial Environmental Examination |
| IPIU | — | Investment Program Implementation Unit |
| IPMC | — | Investment Program Management Consultants |
| IPMU | — | Investment Program Project Management Unit |
| ITI | — | Industrial training institutes |
| JNNURM | — | Jawaharlal Nehru National Urban Renewal Mission |
| LSGD | — | Local Self Government Department |
| MFF | — | Multitranchise financing facility |
| MLD | — | Million liters per day |
| MoEF | — | National Ministry of Environment and Forests |
| NAAQS | — | National Ambient Air Quality Standards |
| NGO | — | Nongovernmental organization |
| NRW | — | Non-revenue water |
| O and M | — | Operation and maintenance |
| PHED | — | Public Health Engineering Department |
| PIU | — | Project Implementation Unit |
| PMU | — | Project Management Unit |
| ROW | — | Right of way |
| RPCB | — | Rajasthan State Pollution Control Board |
| RUIDP | — | Rajasthan Urban Infrastructure Development Project |
| RUSDIP | — | Rajasthan Urban Sector Development Investment Program |
| SBR | | Sequence Batch Reactor |
| SEIAA | — | State Environment Impact Assessment Authority |
| SPS | — | Safeguard Policy Statement |
| STP | — | Sewage treatment plant |
| TOR | — | Terms of reference |
| UIDSSMT | — | Urban Infrastructure Development Scheme for Small and Medium Towns |
| ULB | — | Urban local body |
| USEPA | — | United States Environmental Protection Agency |

WEIGHTS AND MEASURES

| | | |
|--------------------------|---|----------------------------|
| lakh | – | 100 thousand = 100,000 |
| crore | – | 100 lakhs = 10,000,000 |
| $\mu\text{g}/\text{m}^3$ | – | micrograms per cubic meter |
| km | – | kilometer |
| lpd | – | liters per day |
| m | – | meter |
| mg/l | – | milligrams per liter |
| mm | – | millimeter |
| MTD | – | Metric ton per day |
| ppm | – | parts per million |

NOTE{S}

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

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EXECUTIVE SUMMARY

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. RUSDIP Phase II is being implemented over a seven year period beginning in 2008, and being funded by a Multitranche Financing Facility (MFF) loan from the Asian Development Bank (ADB). The Executing Agency is the Local Self-Government Department (LSGD) of the Government of Rajasthan; and the Implementing Agency is the Project Management Unit (PMU) of the Rajasthan Urban Infrastructure Development Project (RUIDP). ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in ADB's SPS. This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, loans involving financial intermediaries, and private sector loans.

2. This Initial Environmental Examination (IEE) has been prepared for the Bharatpur Solid Waste Management Subproject as part of RUSDIP Phase II – Tranche 3. The subproject site is located in Bharatpur town, the administrative center of Bharatpur District. The subproject covers (i) construction of a landfill, internal road, boundary walls, leachate collection tank, and office building; (ii) procurement of waste storage and litter bins, landfill vehicles, and waste collection vehicles; and (iii) implementation of a public education and information program.

3. The subproject is needed to improve the solid waste management system particularly collection, transportation and disposal facilities of Bharatpur Town.

4. Detailed design began in the end of year 2008 and completed in June 2009. Construction of the infrastructure (expected to start in 2011) and procurement of equipment will be completed in and around one and half years. The solid waste management system should therefore begin to operate in the year 2013.

5. The subproject site is located in a government-owned vacant land relatively far from the built-up areas of Bharatpur town. A portion of the land is currently being used as the town's dumpsite for collected solid wastes. It is not prone to water-logging, salinization, and flash flood. There are also no protected areas, wetlands, mangroves, or estuarine. Trees, vegetation (mostly shrubs and grasses), and animals in the subproject site are those commonly found in built-up areas. One protected heritage site Keoladeo Ghana National Park (also known as Bharatpur Bird Sanctuary) is located at a distance of 4.5 km from the proposed landfill site.

6. Potential negative impacts were identified in relation to construction and operation of the improved infrastructure. No impacts were identified as being due to the subproject design or location. An Environmental Management Plan (EMP) is proposed as part of this IEE which includes (i) mitigation measures for significant environmental impacts during implementation, (ii) environmental monitoring program, and the responsible entities for mitigation, monitoring, and reporting; and (iii) public consultation and information disclosure; and grievance redress mechanism. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. A number of impacts and their significance have already been reduced by amending the designs.

7. During the construction phase, impacts mainly arise from the need to excavate large areas which can result to increase in dust and noise levels, disturbance to residents and

businesses along the delivery routes, and traffic. These are common impacts of construction in built-up areas, and there are well developed methods for their mitigation.

8. One field in which impacts are low of interest in the subproject is archaeology because the landfill site is located 596 meters from a monument¹ protected by the Archaeological Survey of India. A series of specific measures have been developed to avoid damaging important remains during construction.

9. Special measures were also developed to protect workers and the public from exposure to (i) carcinogenic asbestos fibres in the event that asbestos cement pipes used in the existing water supply system are uncovered accidentally during excavation work; and (ii) dumped wastes on the subproject site during land preparation.

10. It is proposed that the subproject retain a buffer zone (greenbelt) of 33% of the total land area to be planted with tall trees and endemic species; will employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain; and ensure that people employed in the longer term to maintain and operate the new facilities are residents of nearby communities. Once the system is operating the hygienic environment of the town will be improved.

11. Mitigation will be assured by a program of environmental monitoring to be conducted during construction and operation stages. The environmental monitoring program will ensure that all measures are implemented, and will determine whether the environment is protected as intended. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries. Any requirements for remedial action will be reported to the IPMU.

12. The main impacts of operating the solid waste landfill and other subproject components will be beneficial to the citizens of Bharatpur town because they will be provided with a safe repository for non-biodegradable waste (and rejected material from the composting plant²) to serve the town population for 25 years.

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

14. The subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures. Based on the findings of the IEE, the classification of the Project as Category "B" is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS (2009).

¹ Ancient Statue of Yaksha listed in ASI's website (http://asi.nic.in/asi_monu_alphalist_rajasthan.asp)

² Bharatpur Municipal Board will build a composting plant from through its own budget.

15. Since the project site is located within 10 km of the Bharatpur Bird Sanctuary, the sub-project is classified as category "A" per GOI notification (2006). An Environmental Impact Assessment (EIA) study and an Environmental Clearance (EC) from the Ministry of Environment and Forest (MoEF) is required before commencement of the subproject.

I. INTRODUCTION

A. Purpose of the Report

1. The 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 (the Government) through the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT).

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

3. This Initial Environmental Examination (IEE) has been prepared for the Bharatpur Solid Waste Management subproject as part of RUIDP Phase II. The subproject covers (i) construction of a landfill, internal road, boundary walls, leachate collection tank, and office building; (ii) procurement of waste storage and litter bins, landfill vehicles, and waste collection vehicles; and (iii) implementation of a public education and information program.

4. This IEE covers the general environmental profile of Bharatpur and includes an overview of the potential environmental impacts and their magnitude on physical, ecological, economic, and social and cultural resources within the subproject's influence area during design, construction, and operation stages. An Environmental Management Plan (EMP) is also proposed as part of this IEE which includes mitigation measures for significant environmental impacts during implementation of the Project, environmental monitoring program, and the responsible entities for mitigation and monitoring.

B. Extent of the Initial Environmental Examination

5. This IEE was prepared on the basis of detailed screening and analysis of all environmental parameters, field investigations and stakeholder consultations to meet the requirements for environmental assessment process and documentation per ADB's Safeguard Policy Statement (2009, SPS) and Government of India (the Government) Environmental Impact Assessment (EIA) Notification of 2006.

1. ADB Policy

6. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in ADB's SPS. This states that ADB requires environmental assessment of all project loans, program loans,

sector loans, sector development program loans, loans involving financial intermediaries, and private sector loans.

7. **Screening and Categorization.** The nature of the environmental 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 are assigned to one of the following four categories:

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

8. **Environmental Management Plan.** An EMP which addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project's impact and risks.

9. **Public Disclosure.** ADB will post the following safeguard documents on its website so affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

- (i) For environmental category A projects, draft EIA report at least 120 days before Board consideration;
- (ii) Final or updated EIA and/or IEE upon receipt; and
- (iii) Environmental Monitoring Reports submitted by the Investment Program Implementation Unit (IPIU) during project implementation upon receipt.

2. National Law

10. The Government's 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 categorized as A or B depending on the scale of the project and the nature of its impacts.

11. Categories 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 environmental clearance if appropriate.

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

13. The only type of infrastructure provided by the RUSDIP that is specified in the EIA Notification is solid waste management which an EC is required. Present location of landfill site at Bharatpur is within 4.5 km of a protected heritage area, the Bharatpur Bird Sanctuary, hence a detailed EIA study is required for the issuance of an EC. All necessary "No Objection Certificates" from line agencies are already obtained and attached to this report as **Appendix 1**.

3. Municipal Solid Waste (Management and Handling) Rule

14. The Government's Municipal Solid Waste Management Rule (2000) requires authorization for setting up the landfill and handling of wastes from Rajasthan Pollution Control Board (RPCB). The application for authorization has been filed on 14 May 2010.

II. DESCRIPTION OF THE PROJECT

A. Type, Category and Need

15. **Type.** This is a solid waste management subproject intended to improve the current situation in Bharatpur in terms of providing a disposal area, improving the collection system, and raising the awareness of the community of their responsibility to place their waste at collection points, and to segregate waste that is suitable for recycling.

16. **Category.** Environmental examination indicates the proposed subproject falls within ADB's environmental Category B projects. The Project components will only have small-scale, localized impacts on the environment, and can be mitigated. 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.

17. **Need.** The subproject is needed because the present solid waste infrastructure in Bharatpur is inadequate for the needs of the growing population. There are too few collection points and people deposit their solid waste on open grounds where it creates unhealthy environment and produces health hazard. Although the municipality collects the waste from these areas periodically, the service is irregular.

B. Location and Implementation Schedule

18. **Location.** The subproject is located in Bharatpur town, the headquarters town of Bharatpur district. The main infrastructure, a new engineered landfill, will be built on a 11.34-

hectare (ha) government land far from the built-up areas of the town. The new metal collection bins will be placed at various locations in the town.

19. **Implementation Schedule.** Detailed design started from end of 2008 and completed in June 2009. After necessary clearance construction will start from 2011 end with construction of the infrastructure and procurement of equipment to be completed in 1.5 years.

C. Description of the Subproject

1. Existing Solid Waste Management

20. **Management.** The SWM in Bharatpur town is managed by the Bharatpur Nagar Parishad (BNP) headed by the Chief Sanitary Inspector supported by *safai karamcharis* (sweepers) for the collection of waste from bins and street-sweeping. Lack of separate department for solid waste management is a great challenge faced by BNP for efficient SWM.

21. **Generation.** Bharatpur generates approximately 116.74 metric tons per day (MTD) of municipal solid wastes comprising of biodegradable and non biodegradable components. Generation is likely to increase to 157 MTD by 2026. Sources of solid waste are households, streets, alleys, vacant lots, construction and demolition sites, repairing sites, treatment plants, parks, gardens, roadside trees, institutions and commercial establishments such as hotels, stores, restaurants, and markets.

22. **Collection.** No waste segregation is being practiced. The frequency of collection is once a day or less. House to house collection is not done since households are required to deposit their wastes at designated locations. In most of the areas, the wastes are dumped haphazardly on the road side due to inadequate distance between the bins. Wastes are being collected and transported as mixed refuse in single compartment vehicles. Solid wastes in the slum areas are not collected resulting to indiscriminate disposal and unhygienic conditions.

23. Street cleaning operation (street sweeping and waste collection from bins) is carried out daily by sweepers. It is noted that the process of street sweeping in Bharatpur is still primitive with the sweepers using brooms to make small heaps of solid waste. These heaps of waste are then taken by hand carts to the nearest waste collection area.

24. **Storage of Solid Wastes.** Wastes are temporarily placed in different containers prior to collection. These containers are composed of (i) 75 containers of 4.5 cubic meters (m³) and 61 containers of 1.0 m³ capacity with or without covers and (ii) 14 metallic bins which are provided with dumper placer.

25. **Transportation of Solid waste.** Wastes are manually placed in the collection vehicles and transported by tractor trailers. Bharatpur only has two dumpers, one loader, and 2 tractors. The existing transportation fleet of the BNP has a rated capacity of 1.5 – 2.0 MT/vehicle/trip. Further, the operational efficiency of the fleet on road is only about 60 to 70% per day. Sweepings and all other solid wastes that are collected in bins and in open hips are transported by and disposed without any treatment on available open/barren areas within the town. It is reported by BNP that each vehicle makes 4 trips per day between the assigned wards and the disposal areas. However, it is observed that the vehicles are not filled to maximum capacity to complete scheduled number of trips.

26. **Disposal of solid waste.** BNP has adopted dumping as a method of waste disposal. BNP is currently using portion of the subproject site as dumping site for the collected wastes. Infestations by insects and flies, scavenging by domestic animals and rag picking through the wastes are a common sight in the dumpsite. Biomedical wastes are collected and transported to Alwar for incineration.

2. Subproject Components

27. **Table 1** shows the nature and size of the various components of the subproject. There are three main elements: (i) construction of a landfill, internal road, boundary walls, leachate collection tank, and office building; (ii) placement of storage bins in the town; and (iii) 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.

28. Layout plan of the landfill site is shown in Appendix 2 The landfill is designed to have an active life of 15 years and the closure and post-closure period will be 5 years after the 'active period' is completed. The design capacity is 80 MTD and the total landfill area is 11.34 ha and out of this, 2 ha will be used to accommodate all infrastructure and support facilities as well as to allow the formation of a green belt around the landfill. By Indian standards, the Bharatpur landfill is classified as a medium landfill.

29. The landfill will be 4 meter (m) deep from natural ground level and waste heap height will be extended to maximum of 2.5 m above ground level when full. The landfill floor will be sealed with amended clay liner and high density polyethylene (HDPE) geo-synthetic liner. A landfill drainage system has been incorporated in the design to collect leachate, which will be transferred into a leachate collection tank. A 1,350-m internal road for movement of the vehicles, boundary walls for security, plantation for buffer zone, and auxiliary infrastructures such as a small office building with toilet for workers, weighing bridge for recording of incoming wastes, area lighting, watchman room, and fire-fighting equipment are also included in the design.

30. The waste collection/storage bins will be of metal, 1.1 m³ in capacity, to be located on small concrete plinths at various points in the town. These will be placed at ground level and mostly adjacent to roads.

31. Equipment and vehicles to be provided includes:

- (i) Garbage collection container of 1.1 m³ capacity;
- (ii) Street litter bins 150-liter capacity;
- (iii) Bin carrier (capacity 1.1 m³) auto rickshaw for secondary collection;
- (iv) Rickshaw trolley(8 bins); and hand cart (6 bins) for primary collection; and
- (v) A backhoe digger, compactor, and truck for landfill site and secondary transportation.

Table 1 : Improvements in Solid Waste Management Proposed in Bharatpur

| Infrastructure | Function | Description | Location |
|-----------------------------------|--|---|---|
| 1. Physical Infrastructure | | | |
| Sanitary Landfill | Provide a safe repository for non-biodegradable waste (and rejected material from the composting plant) to serve the | - High density polyethylene (HDPE) geo-membrane and clay-lined engineered landfill. - Design active life: 16 yrs | 11.34 hectare (ha) uninhabited barren government-owned land area. |

| Infrastructure | Function | Description | Location |
|---|---|---|---|
| | town population for 25 years. | - Capacity: 80 MTD - Dimension of Landfill Trench – 90 m x 60 m 4 m deep and 2.5 m high when cells are full | North-East Side of town near Noh Village. Site is approximately 5.97 km away from Mansingh Circle |
| Internal Road | Internal road within the landfill for movement of vehicles | - length: 1350 meter (m) - width: 3.75 m with 1-m wide hard shoulders on both sides | landfill site |
| Boundary walls, drainage, office building with toilet, weigh bridge, area lighting, fire-fighting equipment | - Protection of landfill site; - Day-to-day operation and management; - Collection and storage of leachate | - boundary wall: 800-m stone masonry with barbed wire fencing on top approx 800 meter length - Office building: 75 m ² - weigh bridge: 27 m ² capacity - others: fire-fighting equipment, area lighting, watchman room | landfill site |
| Leachate Collection Tank | Collection of leachate generated at landfill site - leachate collection tank is to collect the leachate from header pipe and active landfill area | - Capacity: 5m x 3m x 3m= 45 m ² - Holding time for leachate: 3 days - Leachate will be collected from sump | Landfill site- corner |
| Waste Storage Bins | - Provide a location where householders can deposit and segregate their waste; and - Provide a location from where BNP can collect the wastes regularly and transport to the landfill. | - number: 145 - capacity: 1.1 cubic meters (m ³) | Town area, government right-of-way (ROW) |
| 2. Vehicles and Equipments | | | |
| Landfill vehicles | Will be used in the landfill to (i) relocate wastes after delivery; (ii) cover wastes with soil at the end of each day, and (iii) cover compacted wastes with soil on closure of each cell. | - one (1) backhoe machine; - two (2) truck-mounted 14 m ³ refuse compactors | Landfill site |
| Secondary collection vehicles | Will be used to (i) collect wastes from the town area; and (ii) carry the wastes to transfer stations. | - three (3) bin carrier auto rickshaws with capacity of 1.1 m ³ ; - one (1) truck with hydraulic lift of 10 m ³ capacity; - one (1) truck with hydraulic lift of 5 m ³ capacity | Town area |
| Primary collection vehicles | Will be used to collect waste from households | - thirty nine (39) rickshaw trolley with capacity of 8 bins); - seventy nine (79) hand carts with capacity of 6 bins | Town area |
| Litter bins | Will be used by people to deposit their wastes | - 314 street litter bins with 150 liters capacity | Town area |

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Administrative Boundaries

32. Bharatpur is situated at the foothills of the Aravalli Mountain series and forms boundaries with Gurgaon district of Haryana in the north and north-east. Mathura and Agra lies in the east. Dhaulpur district lies in its south and Sawai Madhopur, Dausa and Alwar district in the west. The administrative headquarters is Bharatpur town.

2. Topography, Drainage, and Natural Hazards

33. **Topography.** Topography Bharatpur lies between the East longitude 76° 53' to 78° 17' and North latitude 26° 22' to 27° 83'. It is situated at 100 meters above MSL. Topographically Bharatpur, is levelled and saucer in shape. The 11.34-ha landfill site is a flat area.

34. **Drainage.** The peculiar topography of the town provides natural drainage pattern. The area has been divided into two river drainage basins, namely Barah river basin towards north and Banganga river basin towards south.

35. **Natural Hazards.** Bharatpur town lies in medium to high risk zone (III and IV). The area is prone to earthquakes as it is located on comparatively unstable geological plains based on evaluation of the available earthquake zone information. The Natural Hazard Zone Map of Bharatpur district is shown in Figure 1. Evaluation of the map shows that larger part of the district is flood prone but the landfill site is not located in this area. There are gullied and ravenous areas at the southern part of the district. Groundwater is also not suitable for consumption.

3. Geology, Geomorphology, Mineral Resources, and Soils

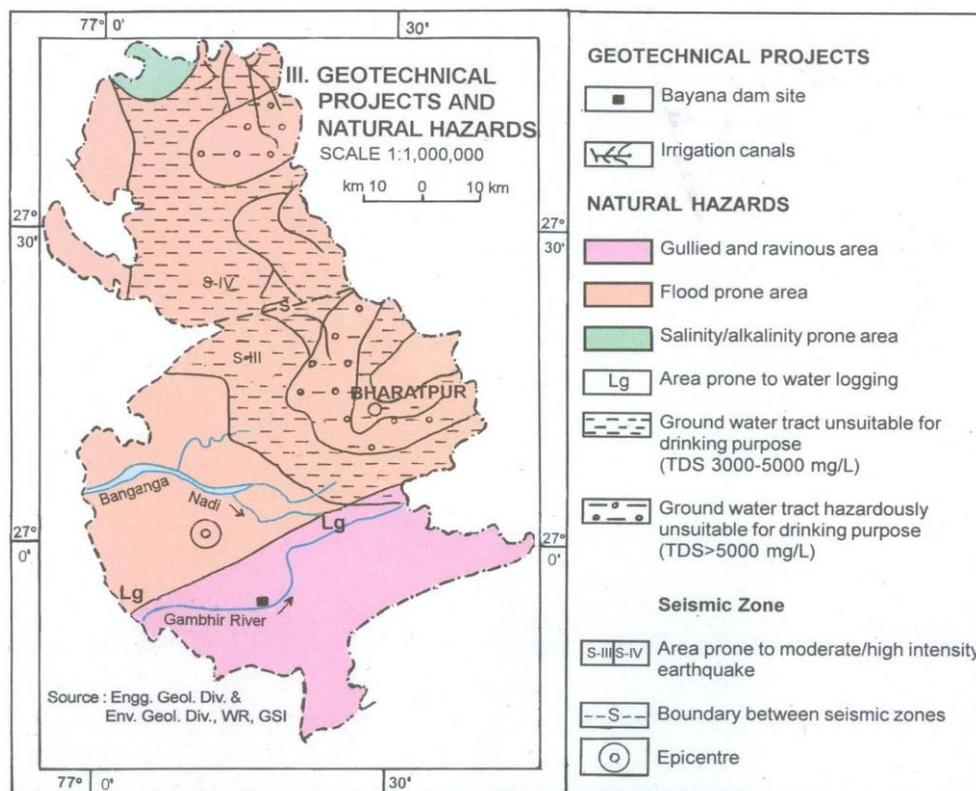
36. **Geology.** The rock types of district exposed are grouped under Alwar and Ajabgarh Groups belonging to the Delhi super group (Lower to Middle Proterozoic). The rocks of Alwar group comprising quartzite, basic volcanic tuffaceous sandstone, shale etc. are well exposed in the south-western part of the district around Khankhera. The major parts of the district are occupied Quaternary alluvium and blown sand which conceal the hard rock geology. Hydro-geological domains of unconsolidated and consolidated rocks formation with varying ground water potential.

37. **Geomorphology.** Geo-morphologically the district classified into seven geomorphic units namely hill and valley, younger flood plains, ravine, obstacle dunes and pediment / pediplain. On an average 90 % of the district area covered with unconsolidated porous formations.

38. **Mineral Resources.** Barytes, buildings stones, and quartz are the important minerals of the district. The landfill site has no mineral resources.

39. **Soils.** The soil is generally alluvial, prone to water logging. The nature of recently alluvial calcareous has been observed. Nutrient level in the Bharatpur soil including area coverage of saline and sodic soil. The nutrient status of the Bharatpur soil is graded as low to medium level.

Figure 1: Natural Hazard Zone Map of Bharatpur



Source: GSI Resource map

4. Climate

40. The climate of Bharatpur is generally dry. The maximum average temperature during summer is 44 degree Celsius to 47 degree Celsius and during winters it is -5 degree Celsius to 1 degree Celsius. The climate is generally dry. The wind blows at low except during summer and monsoon, when hard and turbulent winds are experienced. The average rainfall is 646 mm with 80 to 90 percent of the annual rains is experienced during June to September.

5. Air Quality

41. There is no data on ambient air quality of Bharatpur town, which is not subject to monitoring by the RPCB as there are no major industries. Traffic is the only significant pollutant in Bharatpur, so levels of oxides of sulphur and nitrogen are likely to be well within the National Ambient Air Quality Standards (NAAQS).

6. Surface Water

42. There are quite a number of rivers that flow through the Bharatpur district. The main rivers are Chambal, Ban-Ganga, Barah, Parwati and Gambhiri. However, there are no water quality monitoring stations at any of these rivers. Visual observations and interviews with PHED show that main purposes of these rivers are agricultural, fishing, and domestic uses. Accordingly, water quality is not deteriorated.

7. Groundwater

43. There are number of National Hydrographic monitoring stations of Central Ground Water Board in and around Bharatpur. Fluctuation of ground water level in most of the cases ranged between 5 - 10 m below ground level.

44. Records of groundwater quality monitoring from Public Health Engineering Department (PHED) show groundwater quality in Bharatpur town conforms with the set norms of the municipality. It has been noted that groundwater contains high levels of total dissolved solids in its surrounding vicinity.

B. Biological Resources

45. The boundaries of the Bharatpur Bird Sanctuary, also known as Keoladeo National Park, a UNESCO World Heritage site, are located approximately 4.5 km from the proposed landfill site. According to the Bharatpur Bird Sanctuary Management Plan, the identified buffer zone is 500 m from the periphery of the bird sanctuary and all activities beyond this range are acceptable. The protected area contains grasslands, woodlands, swamps, and wetlands. These diverse habitats are home to 374 avian species including 140 species of waterfowl, 372 species of plants, 34 species of mammals, 57 species of fish, 14 species of snakes, 5 species of lizards, 3 species of geckos, 7 species of turtles, 8 species of amphibians, 71 species of butterflies, and a variety of other lower biota.

46. **Flora.** The forests are generally irregular and situated on hills, usually on rocky or stony slopes or gently undulating grounds. Dhok (*Anogeissus Pendula*) is the principal species growing in these forests are: *Acacia catechu* (Khair), *Acacia leucophloe* (Arunj), *Butea monosperma* (Dhak). There were no observed endangered species in the landfill site in and around Bharatpur town.

47. **Fauna.** The district is known for its duck shoots. Geese, ducks, teals pintails, Siberian cranes during winter. Local birds are mainly egrets, painted storks, ibises, cormorants, saras-cranes, spoonbills, and open-billed storks, darter, besides common parakeets, crows, babblers, partridges and weaver bird. There were no observed endangered species in the Landfill site in and around Bharatpur town.

C. Economic Development

48. Economic base of a town reflects its prosperity. Bharatpur town, being the districts headquarter, has been functioning as administrative centre. Bharatpur is known not only for agriculture production but also for oil industries. It has also sustained growth in tertiary economic activities. The major economic activities are trade and commerce, thus it offers a number of wholesale and retail markets which act as a distribution centre for nearby towns and villages. Tourism income contributes very much towards economic generation of the town on the contrary household industries play a big role in providing employment and income generation.

1. Land use

49. Bharatpur District spreads over an area of 5,066 km² covering urbanization area circulation, public and semi-public, agriculture land, commercial area, road, water bodies, agriculture research and mining. The Landfill site is located in an agricultural area.

2. Commerce, Industry and Agriculture

50. **Commerce.** The main retail and wholesale business activities of the town are carried out with the newly developed main market street where retail and transport-oriented businesses are located.

51. **Industrial Development.** The industrial areas are Brij industrial area, Byana industrial area and Deeg industrial area. The Landfill site is not located in this industrial area.

52. **Agriculture.** Bharatpur district is known not only for agriculture production but for oil industries also mustard seeds and other agriculture products come to the market through mandies (wholesale market) established by Krishi Upaj Mandi Samiti (wholesale market committee) These Krishi Upaj Mandies are in Bharatpur. Nadbai, Weir, Deeg, Kaman, Bayana, Ropwas, and Bhusawar. About 70-80% of lands used for agricultural purpose.

3. Infrastructure

53. **Water supply.** The total combined available water from the ground water and surface water is 24.03 MLD out of which 22.0 MLD is used for residential purpose and 2.03 MLD is used for other purposes. Current supply per capita is 60 liters per capita per day (lpcd) as against the standards of 135 lpcd. The existing water supply system comprises mainly of asbestos cement (AC) pipes.

54. **Sewerage and Sanitation.** Bharatpur town does not have underground sewerage system. Out of the occupied residential houses only about 41.88% population have some kind of individual facilities and about 28.78% population with Low Cost Sanitation (LCS). Most of the houses have adopted the practice of providing onsite disposal by constructing water seal/bore hole latrines or by providing septic tank with effluent discharge into soak pits or open surface drains.

55. **Drainage.** Presently there exists a minimal network of storm water drains. These drains are also receiving the sludge and waste through domestic sewer. The existing drainage system is a piece-meal construction without proper designs of open nallahs (drains) that are irregular and insufficient. The waste water along with sewage is discharged into the fields towards west of the town through open drains.

56. **Industrial Effluents.** Industries are outside the town area. The industries are required to treat their own effluents before disposal and are not allowed by the Bharatpur Nagar Parishad to connect to the local sewer network.

57. **Solid Waste.** The total waste generation in the town is about 116.74 MTD. It is important to note that no initiatives has been taken till now in terms of door to door collection of solid waste. Presently most of the town wastes are simply dumped without any treatment in depressions, ditches or by the sides of the road flank. A portion of the subproject site is currently being used as a dumping site for the collected wastes. Infestations by insects and flies, scavenging by domestic animals and rag picking through the wastes are a common sight in the dumpsite. Biomedical wastes are collected and transported to Alwar for incineration.

58. **Transportation.** Bharatpur is well connected with all the important towns of the Rajasthan State and Uttar Pradesh State. It is situated on the National Highway No.11

connecting Agra, Jaipur, and Bikaner. Its total length within the district is about 71 km. The total road network length of the district is 1,985 km.

D. Social and Cultural Resources

59. **Demography.** The population of Bharatpur 205,235 (2001 Census) with a density of 3,644.22 persons per km². High growth is accounted on induced industrial development, natural growth, concentration of developmental activities like establishments of more government offices, trade and commerce, services and other activities, colleges and residential colonies.

60. **Health and Educational Facilities.** There are good educational facilities in Bharatpur district, which serve both townspeople and inhabitants of surrounding villages and towns in the hinterland. There are 1,482 primary schools, 538 secondary and higher secondary schools, 33 general degree colleges, and 4 industrial training institutes and polytechnic college.

61. There are 430 numbers hospitals and dispensaries located in Bharatpur. Of these 7 are general hospitals, 59 primary health centers, 2 maternity and pediatric centers, 1 tuberculosis hospital, 2 leprosy hospitals, 36 dispensaries, and 323 subcenters.

62. **History, Culture, and Tourism.** Bharatpur the Eastern Gateway to Rajasthan was founded by Maharaja Suraj Mal in 1733 AD, it was once an impregnable well fortified city, carved out of the region formerly known as Mewat. The trio of Bharatpur, Deeg and Dholpur has played an important part in the history of Rajasthan.

63. Bharatpur is the main tourist place of Rajasthan. The historical places include Lohagarh fort or the 'Iron Fort' and other places like Keoladeo National Park, Kamra Khas Palace, Deeg fort, and Purana Mahal which attracts domestic and foreign tourists.

64. The subproject sites are not located in or near any historically, culturally, archaeologically or architecturally significant areas. The nearest significant site is the monument of Yaksha, an Archaeological Survey of India (ASI) listed monument³ located 596 m from the boundaries of the landfill site. However, this monument will not be directly impacted by the construction and operation of the landfill.

IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES

65. This section of the IEE reviews possible subproject-related impacts, in order to identify issues requiring further attention and screen out issues of no relevance. ADB SPS (2009) require that impacts and risks will be analyzed during pre-construction, construction, and operational stages in the context of the subproject's area of influence. As defined previously, the primary impact areas are (i) the sites for intake well, WTPs, pumping houses, service reservoirs, raising mains, and pipe network alignments; (ii) main routes/intersections which will be traversed by construction vehicles; and (iii) quarries and borrow pits as sources of construction materials. The secondary impact areas are: (i) entire Bharatpur area outside of the delineated primary impact area; and (ii) entire Bharatpur district in terms of over-all environmental improvement.

³ Ancient Statue of Yaksha listed in ASI's website (http://asi.nic.in/asi_monu_alphalist_rajasthan.asp)

66. The ADB Rapid Environmental Assessment Checklist for Solid Waste Management in www.adb.org/documents/guidelines/environmental_assessment/eaguidelines002.asp was used to screen the subproject for environmental impacts and to determine the scope of the IEE investigation. The completed Checklist is found in **Appendix 3**. All the proposed subproject components will interact physically with the environment.

67. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) being located in the built-up area of Bharatpur, will not cause direct impact on biodiversity values. The Landfill site will be in properties held by the local government and access to the subproject area is thru public rights-of-way and existing roads hence, land acquisition and encroachment on private property will not occur.

A. Pre-construction

1. Landfill

68. **Design Considerations.** The design of the landfill is on accordance with GOI Municipal Solid Waste (MSW) (Management and Handling) Rules, 2000 and the Central Public Health and Environmental Engineering Organisation (CPHEEO) Manual on Municipal Solid Waste Management⁴. As recommended in the CPHEEO Manual, the design considered this components: (i) a liner system at the base and sides of the landfill which prevents migration of leachate or gas to the surrounding soil; (ii) a leachate collection and control facility which collects and extracts leachate from within and from the base of the landfill; (iii) a gas collection and control facility (optional for small landfills) which collects and extracts gas from within and from the top of the landfill and then treats it or uses it for energy recovery; (iv) a final cover system at the top of the landfill which enhances surface drainage, prevents infiltrating water and supports surface vegetation; (v) a surface water drainage system which collects and removes all surface runoff from the landfill site; (vi) an environmental monitoring system which periodically collects and analyses air, surface water, soil-gas and ground water samples around the landfill site; and (vii) closure and post-closure plan which lists the steps that must be taken to close.

69. The conversion of the dumpsite to an engineered landfill will be done in a phased manner. The dumpsite and the surrounding areas will be cleaned up so that any waste pile and windblown paper/plastic are collected, sorted, and placed in a final disposal cell for covering. The dumpsite will be divided into a number of phases to allow continuation of operation while site preparation and other rehabilitation components can be started simultaneously. A portion or all of the dumpsite will be excavated with the ultimate goal of reducing its volume through separation of materials into recyclable, reusable, and combustible components.

70. **Location Considerations.** Availability of land in Bharatpur town is limited. The selection process has been confined to only one or two sites. The present site in Noh Village has been selected using the site selection criteria recommended in the CPHEEO Manual. The landfill site is not located within (i) 200 m of any lake or pond; (ii) 100 m of a navigable river or stream; (iii) a 100 year flood plain; (iv) within 200 m of the right of way of any state or national highway; (v)

⁴ The Ministry of Urban Development, Government of India constituted an Expert Committee in February, 1998 composed of academic and research institutions, central Ministries/Departments and Urban Local Bodies to develop a manual with a view to assist and guide the Urban Local Bodies for managing the solid waste in an efficient manner.

300 m of a public park; (vi) critical habitat area; (vii) wetland; (viii) an area where water table is less than 2m below ground surface; (ix) the limits prescribed by regulatory agencies such as the Ministry of Environment and Forest, Central Pollution Control Board, and Aviation Authorities; (x) 500 m of any water supply well; (xi) a coastal regulation zone; and (xii) an area of potentially unstable zones such as landslide prone areas and fault zones. It is also already being used as a dumping site thus converting it to an engineered landfill will reduce the impacts to the environment. The CPHEEO Manual recommends that a zone of 500 m around the landfill boundary should be declared a “No-Development Buffer Zone” after the landfill location is finalised.

71. **Liner System Design and Stability.** The liner system for landfill site at Bharatpur is designed based on MoEF recommendations. As per MoEF *“Construction of a non-permeable lining system at the base and wall of waste disposal site area - For landfill receiving residues of waste processing facilities or mixed waste or waste having contamination of hazardous material (such as aerosol, bleaches, polishes, batteries, waste oils, paint products and pesticides) minimum liner specification shall be a composite barrier having 1.5mm HDPE geomembrane or equivalent overlying 90cm of soil (clay/amended soil) having permeability coefficient not greater than 1×10^{-7} cm/sec.”*

72. Therefore for the landfill site liner system of following specifications has been recommended to comply to the MSW (Management and Handling) Rules 2000. The liner system will comprise of following layers below the waste level:

- (i) A drainage layer of 300-mm thick granular material of permeability not greater than 10^{-2} cm/sec;
- (ii) A 150 mm thick protective clay layer;
- (iii) A HDPE geomembrane liner of thickness 1.5 mm;
- (iv) A 6 mm thick synthetic clay liner

73. **Leachate Generation, Handling, and Treatment.** Leachate generation potential was estimated using CPHEEO calculation as shown in the box below. The results show an average flow of be approximately 465 m³/month. Based on the volume of leachate that was predicted to be generated, it was deemed feasible to build a leachate collection tank that will contain at least 3 days leachate i.e. 45 m³ capacity. The leachate storage tank will be made of stone masonry with dimensions of 3m x 3m x 5m.

| | |
|--|--|
| Calculation of Leachate quantity: | |
| Landfill plan area of one phase up to year 2011 | =5400 m ² |
| Average rainfall at Bharatpur | =646 mm/year |
| 80% of rainfall occurs in 3 months | =516.8 mm |
| Average rainfall for one month period | =172.2 mm/month |
| Assuming 50% of rainfall turning as leachate. | |
| Hence, Average volume of leachate collected | =464.94 m ³ /month =15.4 m ³ /day |
| Hence, leachate treatment system shall be designed for a capacity of 15.4 m ³ /day. | |
| Capacity of leachate collection tank | = 15.4 x 3 (Assuming 3 days storage of leachate) |
| Capacity of leachate tank | =46.2 m ³ , say 45 m ³ as designed |

74. Leachate will be pumped into the storage tank using a low head, high volume submersible pump with components that are compatible with the chemistry of the water. This

pump will be situated in the main collection sump, which will be the primary collection point throughout the life of the operation of the landfill. Given this information, the pump was sized to handle the average flow at build-out of the facility, approximately 20 litres per minute.

75. **Leachate Monitoring Program.** Any disposal method for leachate needs to be approved by the CPHEEO and outlined in the EMP. Any leachate to be disposed will need to comply with the Disposal Standards for Treated Leachate as specified in the MSW (Management and Handling) Rules, 2000 (Appendix 4).

76. **Landfill Gas Management System.** For all MSW landfills, the CPHEEO Manual recommends controlled passive venting. Only for small (less than 100 tons per day), shallow (less than 5 m deep) and remotely located landfills, will uncontrolled release be allowed. For the Bharatpur landfill only gas venting system is being considered in design.

77. 5 number of gas vents made up of 110 mm diameter PVC pipes will be installed though the landfill (provide correct information). These pipes will have an average depth 6 m and shall penetrate the in-situ wastes. The gas vents will be equally distributed within the closed waste dump and will have a stick up of at least 2 m relative to the final surface of the compacted and covered site. Gas emissions which may be identified during site clearing and grading will be evaluated and provided with similar vents where necessary. Results of subsequent gas monitoring will be used to determine if flaring will be needed. A gas monitoring program, as part of the EMP will be developed to demonstrate landfill gas is not migrating off-site and does not pose health, fire, and explosion hazards.

78. **Drainage and Hydrology.** To avoid generation of excessive leachate, erosion of cover material and/or waste from the landfill, surface water controls were incorporated in the design and generally conform with the following principle: (i) all water that has entered waste-filled areas, and water that has been contaminated by leachate, will be handled and treated in the same manner as leachate; (ii) the exposed or cleared areas at the landfill site will be minimized at all times, and all topsoil set aside for re-vegetation purposes; and (iii) all completed areas of the landfill will be progressively re-vegetated, and any areas exposed for greater than 30 days will be stabilized so as to prevent soil erosion.

79. At Bharatpur to control storm water drainage kerb stone will be provided at the periphery of the landfill trench, which disallowed the storm water to entering into active landfill.

80. The key design consideration involving the hydrology and drainage analysis involved diverting storm water off of the initial landfill cell which will be approximately 0.5400 ha in size in order to take advantage of economies of scale to obtain the most cost effective installation. Any precipitation that enters the leachate collection and removal system (LCRS) will require treatment and disposal. Any storm water entering the up gradient half of the cell will be diverted out of the LCRS and into a drainage channel outside of the cell. After refuse has been placed in the down-gradient half of the module, the outlet to the drainage channel will be closed and the LCRS from the up-gradient half of the cell will be connected to main collection system. This temporary diversion of storm water will result in a substantial reduction in handling and treatment costs as the cell is developed.

81. **Landfill Operations and Maintenance Manual.** The landfill needs to be operated in a uniform manner so its integrity is maintained and utmost environmental protection is maintained. The Landfill Operations and Maintenance (O and M) Manual will be prepared as part of the subproject by the O and M contractor to detail the operational procedures to be followed and

implemented to ensure compliance with the intended construction and operation standards. Its purposes (**Appendix 5**) include: (i) provide information on the basic components of the landfill; (ii) familiarize the Operator with the various containment units and environmental control/monitoring systems; (iii) familiarize the Operator with the general operational phasing or sequencing of waste filling; (iv) provide basic engineering controls for the landfill construction in conformance to design requirements; (v) provide basic information on the type and purpose of the landfill heavy equipment and their maintenance requirements; (vi) provide instruction on daily waste filling operations including load inspection procedures, spreading and compaction of waste, and application of cover; (vii) provide procedures for operating under inclement or wet weather operations; (viii) provide general procedures for emergency response and management; (ix) provide a detailed description of environmental monitoring and inspections; and (x) familiarize the Operator with safety procedures related to landfill operations.

82. Environmental Monitoring Program. The CPHEEO Manual recommends establishment of the following baseline parameters for one (1) year prior to construction of the landfill:

- (i) Ground Water Quality – minimum of 3 samples from each aquifer analysed in monthly basis for drinking water quality parameters;
- (ii) Surface Water Quality – minimum of 3 samples from a stream/storm water drain analysed on a monthly basis and for parameters relevant for wastewater drains;
- (iii) Landfill Gas – sampling and analysis for methane, hydrogen sulphide and other gases on a monthly basis;
- (iv) Dust – particulate matter less than 10 microns (PM₁₀) monitoring on a monthly basis, specifically at noon, during hot, dry and windy days;
- (v) Odour – monthly analysis at the site and at 200-m intervals from the landfill boundary to the nearest inhabited zone;
- (vi) Noise – Peak noise analysis at the site and nearby inhabited zone on a monthly basis;
- (vii) Vegetative Cover - vegetative mapping on a seasonal basis.

83. Screening of Wastes Received. Waste acceptance and screening procedures will be part of the Landfill O and M Manual to ensure that the site does not accept wastes that are prohibited from entry. Hazardous/biomedical wastes will not be placed in the landfill. Signs will be prominently displayed at the point of entry to clearly indicate the types of wastes that are allowed and those that are not to be accepted.

84. Security. The boundary walls will be marked and a billboard will be placed at the gate and at conspicuous locations in the landfill site to indicate that unauthorized access, illegal dumping, burning, and squatting are prohibited. Security will be provided to ensure that illegal dumping, theft, and unauthorized access do not happen.

85. Traffic Investigation. Traffic investigations will be conducted to identify peak traffic volume as well as the quality of existing roads near the landfill. The influence of increased heavy vehicle traffic due to landfilling will be analysed with a view to widening the existing road.

86. Post-Closure Usage. The landfill once used up to its full capacity will be closed and rehabilitated. Establishment of permanent structures will not be allowed on any part of the closed landfill as decomposition of the underlying waste and release of gases will lead to settlement of the ground.

87. **Climate Change.** Bharatpur will make a significant contribution to reducing the impact of its solid wastes, in terms of reducing greenhouse emissions, predominantly through the management of landfill gases.

1. Storage Waste Bins

88. The main function of the storage and litter bins is to maximize the storage of waste from households to avoid littering and clandestine dumping on vacant lots, public spaces, or along waterways. In addition to the design capacity, recommended management strategies include (i) implement a regular collection schedule with sufficient frequency to avoid accumulation of garbage; (ii) encourage separation of recyclable materials at the point of generation, so that the collection points do not become sorting points for informal sector waste pickers; (iii) encourage residents to put waste out at designated times and locations; and (iv) where possible, blocking off access to dumping sites and fining illegal dumpers.

89. Construction of these facilities will not be large enough to significantly disturb any nearby modern-day social and cultural resources, such as schools, hospitals, and temples. However it will not be desirable to have operating waste handling facilities in the vicinity of these resources, so such locations will be avoided.

90. The existing water supply system comprises mainly of AC pipes, so there is a risk of contact with carcinogenic material if these pipes are uncovered in the course of the work. The locations of all new infrastructures have been planned to avoid locations of existing AC pipes so AC pipes will not be discovered accidentally. DSC will develop an AC Pipe protocol to be applied in any instance that AC pipes are found. This is being based on the approach recommended by the United States Environmental Protection Agency (USEPA)⁵, and amongst other things, will involve:

- (i) 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;
- (ii) Reporting procedures to inform management immediately if AC pipes are encountered;
- (iii) Development and application of a detailed health and safety (H and S) procedure to protect both workers and citizens.
- (iv) Compliance with national and international standards for dealing with asbestos such as removal of all persons to a safe distance and use of appropriate breathing apparatus and protective equipment by persons delegated to deal with the AC material;
- (v) Procedures for the safe removal and long-term disposal of all asbestos-containing material encountered.

2. Waste Collection Vehicles

91. Equipment manufacturers' recommended engine maintenance, along with the mechanical maintenance for the safe operation of the vehicles will be included in the Landfill O and M Manual.

⁵ 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>

3. Construction Camp, Stockpile Areas, Storage Areas, and Disposal Areas

92. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these in the existing dumpsite area. However, if it is deemed necessary to locate elsewhere, sites to be considered will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals near areas which will inconvenience the community. All locations will be included in the design specifications and on plan drawings.

93. **Site selection of sources of materials.** Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. To mitigate the potential environmental impacts, locations of quarry site/s and borrow pit/s (for loose material other than stones) will be included in the design specifications and on plan drawings. Priority will be sites already permitted by the Mining Department. If other sites are necessary, these will be located away from population centres, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas even if some distance from construction activities. It will be the construction contractor's responsibility to verify the suitability of all material sources and to obtain the approval of BNP. If additional quarries will be required after construction is started, then the construction contractor shall use the mentioned criteria to select new quarry sites, with written approval of BNP.

B. Construction

1. Screening of No Significant Impacts

94. The construction work is expected not to cause major negative impacts, mainly because:

- (i) Most of the activities will be on the existing dumpsite in a rural area of Bharatpur thus could be constructed without causing major disruption to road users and any commercial establishments and residential areas;
- (ii) The site is located on a government-owned land which is not occupied or used for any other purpose;
- (iii) Overall construction program will be relatively short and is expected to be completed in 18 months, with activities to be conducted by small teams working on short lengths at a time so most impacts will be localized and short in duration; and
- (iv) Most of the predicted impacts associated with the construction process are produced because the process is invasive, such as involving earth-moving and excavation. However the routine nature of the impacts means that most can be easily mitigated and the impacts are clearly a result of the construction process rather than the design or location, as impacts will not occur if excavation or other ground disturbance is not involved.

95. As a result, there are several aspects of the environment which 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 2**. These environmental factors

are screened out presently but will be assessed again before starting of the construction activities.

96. 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 2** with an explanation of the reasoning in each case.

Table 2: Fields in which Construction is not Expected to have No Significant Impacts

| Field | Rationale |
|---|--|
| Topography, Drainage, and Natural Hazards | Activities are not large enough to affect these features. |
| Geology, Geomorphology, Mineral Resources, and Soils | Activities are not large enough to affect these features. No mineral resources in the subproject sites. |
| Climate | Activities are not large enough to affect this feature. |
| Air Quality | Short-term production of dust is the only effect on atmosphere |
| Geohydrology and Groundwater | Activities will not be large enough to affect these features |
| Protected Areas | No protected areas nearby the sub-project at Bharatpur, Bharatpur bird sanctuary is located about 4.5 km from proposed landfill site |
| Flora and Fauna | No rare or endangered species. |
| Land Use | No change in land use. |
| Socio-economic | Subproject site is located entirely on government-owned land so there is no need to acquire land from private owners. |
| Commerce, Industry, and Agriculture | Activities are not large enough to affect these features |
| Population | Activities are not large enough to affect this feature. |
| Health and education facilities | Activities are not large enough to affect this feature. |
| Historical, Archaeological, Paleontological, or Architectural sites | No scheduled or unscheduled historical, archaeological, paleontological, or architectural sites |

2. Construction Methods

a. Landfill Area

97. The wastes had been randomly deposited in the subproject site without any spreading or compaction. A preliminary inspection found that the waste heap was very unstable primarily because of the face angle of the waste, which was in excess of the stable angle of repose. A portion or all of the dumpsite will be excavated with the ultimate goal of reducing its volume through separation of materials into recyclable, reusable, and combustible components.

98. Construction of the 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. 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 HDPE geo linear, 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 20 cm depth of gravel will be added above the geo-textile HDPE linear to allow leachate to drain into the pipes. Initially construction of 1 sanitary land fill trench of size 90 meter x 60 meter in plan 4 m deep from ground level is considered. It is estimated that 1 sanitary landfill trench will be sufficient for 1 year of disposal. Construction of 5m x 3m x 3m deep (internal size) leachate collection sump will also be taken up initially.

b. Storage Bins

99. Waste storage bins will be provided at different locations in the town, from where waste will be collected daily by the municipality. 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, after which the site's 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.

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

3. Anticipated Environmental Impacts and Mitigation Measures

101. **Air Quality.** Operation of construction equipment, transport and stockpiling of soil and sand can cause emission of air pollutants including particulates, hydrocarbons, nitrogen oxides, carbon monoxide, and sulfur dioxide resulting to human health hazards and destruction of vegetation. High concentration of airborne dusts results in deposition and possible damage to vegetation and nearby locators. The potential impacts are negative but short-term and reversible by mitigation measures. DSC will conduct ambient air quality monitoring according to determined sampling locations and schedule. The construction contractor will be required to:

- (i) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly;
- (ii) Reduce dust by spraying stockpiled soil, excavated materials, and spoils;
- (iii) Cover with tarpaulin vehicles transporting soil and sand; and
- (iv) Cover stockpiled construction materials with tarpaulin.

102. **Noise Level.** Increase in noise level may be caused by earth moving and excavation equipment, and the transportation of equipment, materials and people. Impact is negative, short-term, and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan activities in consultation with DSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
- (ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- (iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding locators; and
- (iv) Maximum sound levels shall never exceed 80 dbA when measured at a distance of 10 m or more from the vehicle (s).

103. **Flora and Fauna Resources.** There are no protected areas in or within of the sub-project location, and no special ecological interest at the landfill site (which is covered by secondary scrub vegetation), so construction will have no ecological impacts. There are small numbers of trees on the large plot of government land on which the landfill will be located, and given global concerns regarding the loss of trees worldwide, mature specimens will not be

removed unnecessarily. Land-clearing activities and presence of workers in the landfill site can damage or cause loss of existing vegetation and decrease or cause loss of animals/birds. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractors will be required to:

104. Minimize removal of vegetation and disallow cutting of trees;

- (i) If tree-removal will be required, obtain tree-cutting permit from BNP, earth-ball trees, and transplant to DSC-approved areas;
- (ii) Require to plant three (3) native trees for every one (1) that is removed; and
- (iii) Prohibit employees from poaching wildlife, bird hunting, and cutting of trees for firewood.

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

- (i) Prepare and implement Waste Management Plan (as part of the EMP);
- (ii) Recover used oil and lubricants and reuse or remove from the site;
- (iii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (iv) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and
- (v) Request DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

106. **Traffic Accessibility.** Hauling of construction materials and operation of vehicles on-site can cause traffic problems and conflicts in right-of-way. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan transportation routes so that heavy vehicles do not enter Bharatpur town and do not use narrow local roads, except in the immediate vicinity of delivery sites;
- (ii) Schedule transport and hauling activities during non-peak hours;
- (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) Keep the site free from all unnecessary obstructions;
- (v) Drive vehicles in a considerate manner;
- (vi) Coordinate with Bharatpur Municipal Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours;
- (vii) Notify affected locators; and
- (viii) Provide sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

107. Excavation works for the plinths and placement of the waste bins by cranes can cause traffic impediments particularly in the town centre where roads are narrow and easily congested. The construction contractor will be required to:

- (i) Place all excavated soil off the road wherever possible; and
- (ii) Where this cannot be achieved, conduct the work during periods of low traffic volume (for example on a Sunday).

108. **Socio-Economic.** The landfill and road will be located entirely on government owned land so there is no need to acquire land from private owners, which might affect the income and assets of owners and tenants. The land is also not used for any purpose and there are no industries, housing, shops or infrastructure in the vicinity, so construction will not affect income-generating activities.

109. Manpower will be required during the 18 months construction stage. This can result to generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to:

- (i) Employ at least 50% of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and
- (ii) Secure construction materials from local market.

110. The storage bins will all be located on government land, so there will be no need to acquire land, and thus there should be no impacts on the assets or income of landowners or tenants. The storage bin sites are so small that construction will not impede the access of customers to nearby shops.

111. **Occupational Health and Safety.** Investigation and remediation of the existing dumpsite requires that workers be mindful of the occupational exposures which can arise from working in close contact with contaminated soil or other environmental media (e.g., groundwater, leachate, sediments, and soil vapor). Fires and explosion can result from ignition of flammable gases leading to loss of property as well as possible injury or fatality to workers. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

- (i) Develop and implement an H and S plan (as part of the EMP) which will include measures such as (a) excluding public from the site; (b) ensuring all workers are provided with and use appropriate Personal Protective Equipment; (c) H and S Training⁶ for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- (iii) Provide medical insurance coverage for workers;

⁶ Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

- (iv) Implement safety measures to secure all installations from unauthorized intrusion and accident risks;
- (v) Provide manual fire fighting equipment which are easily accessible and simple to use;
- (vi) Provide supplies of potable drinking water;
- (vii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;
- (viii) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (ix) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (x) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
- (xi) Ensure moving equipment is outfitted with audible back-up alarms;
- (xii) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and
- (xiii) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

112. **Community Health and Safety.** Hazards posed to the public, specifically in high-risk pedestrian areas (e.g., schools, community centers, central business and shopping areas), may include traffic accidents and vehicle collision with pedestrians. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan routes to avoid times of peak-pedestrian activities;
- (ii) Liaise with DSC in identifying high-risk areas on route cards/maps;
- (iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure; and
- (iv) Provide road signs and flag persons to warn of dangerous conditions.

113. **Quarry Sites and Borrow Pits.** Extraction of approximately 9,000-10,000 m³ of clay, soils, stones, aggregates, and loose materials other than stones can cause disruption of natural land contours and vegetation resulting in accelerated erosion, landslides, disturbance in natural drainage patterns, sedimentation/siltation of surface waters, and water pollution. Extraction of rocks and materials from river beds can result in endangerment of bridges and continuous degradation of the river regime. Potential impacts are negative and can be long-term and irreversible thus the construction contractor will be required to:

- (i) Verify suitability of all material sources and obtain approval of DSC;
- (ii) Prioritize government-approved quarries and borrow pits;
- (iii) Obtain approval of DSC if new quarries and borrow sites are necessary;
- (iv) Obtain approval of DSC if extracting rocks, gravel, and sand from small rivers or streams is necessary. The extraction points shall be spread out along the length

of the river to minimize disruption in river flow and to prevent instability to embankments. Local residents and water users shall be consulted to ensure that irrigation intakes, bunds, and local fishing are not adversely impacted; and

- (v) Request DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

114. **Work Camps.** Operation of work camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Consult with DSC before locating project offices, sheds, and construction plants
- (ii) Minimize removal of vegetation and disallow cutting of trees;
- (iii) Provide water and sanitation facilities for employees;
- (iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;
- (v) Train employees in the storage and handling of materials which can potentially cause soil contamination;
- (vi) Recover used oil and lubricants and reuse or remove from the site;
- (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and
- (ix) Request DSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

115. **Social and Cultural Resources.** There are no modern-day social and cultural resources (such as schools and hospitals) near the landfill or access road, and no areas that are used for religious or other purposes, so there is no risk of other impacts on such community assets.

116. Although the landfill will be built on land that is uninhabited, there is a risk that the work could damage social and cultural resources. Rajasthan is an area with a rich and varied cultural heritage so there is a risk that any work involving ground disturbance could uncover and damage archaeological and historical remains. Given that the proposed landfill site is uninhabited and shows no sign of having been used to any extent in the past, then it could be that there is a low risk of such impacts. Nevertheless this will be ascertained by consulting the Archaeological Survey of India (ASI), and steps should be taken according to the nature of the risk. This should involve:

- (i) Consulting ASI to obtain an expert assessment of the archaeological potential of the site;
- (ii) Selecting an alternative location if the site is considered to be of medium or high risk;
- (iii) 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; and
- (iv) 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:
 - (a) Having excavation observed by a person with archaeological field training;

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

C. Operation and Maintenance

1. Screening Out of No Significant Impact

117. The landfill is located outside the town in an uninhabited and unused area while the storage bins will be placed in fixed and relatively small areas within the town. Collection vehicles will be confined to pre-determined routes and will not need to traverse inside communities as collection points will be established. Thus there are several fields that are not expected to have significant impacts during the operation and maintenance stage of the subproject (Table 3).

Table 3: Fields in which Operation and Maintenance of the Completed Solid Waste Management System is Not Expected to have Significant Impacts

| Field | Rationale |
|--|---|
| Climate | No as such impact |
| Fisheries and aquatic biology | No as such impacts on aquatic flora and fauna. |
| Wildlife, forests, rare species, protected areas | There are none of these features adjacent to the project location. Bharatpur Bird Sanctuary is located about 4.5 km from proposed location of landfill |
| Coastal resources | Bharatpur is not located in a coastal area |
| Infrastructure, health and education facilities, physical or cultural heritage, historical or archaeological resources | Locations of waste management facilities (bins, and landfill) has to be selected in detailed design stage to avoid municipal infrastructure and sites and facilities of social or cultural importance |

2. Mode of Operations

118. **Management.** BNP will be responsible for management and implementation of the solid waste management system, and will distribute bins to households in the town (two bins 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 the waste collection and management system.

119. **Collection.** BNP 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. Three-wheeled auto trolleys (in 30% of the town) and hand-operated pushcarts (remaining 70%) will collect waste from each household on a regular cycle every day or every two or three days, and the segregated waste will be deposited into separate storage bins in the locality. Waste will also be removed from bins in slums and from litter bins in the streets, and debris from street sweeping and drain de-silting will also be deposited into the municipal storage bins. These will be removed daily by purpose-made vehicles, and two empty bins will be replaced at each site.

120. **Transportation.** Full containers will be transported to the landfill and deposit the waste in the landfill area.

121. **Disposal.** Waste for land filling will be moved into position in the currently-used cell by bulldozer and backhoe, 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.

122. Excavated soil of the new trench adjacent to the active trench will be used for daily, intermediate, and final soil cover. As far as possible, permeable and porous sand types will be used for daily cover to ensure easy spreading and compaction of the solid wastes, stabilize the landfill waste layers as well as not hindering the waste decomposition process. Porous cover soil is not suitable for preventing bad odours from dispersing, Therefore when such types of soils are used, the cover layers shall be made thin as possible so as to prevent the soil from becoming anaerobic. For immediate soil cover, clayey soil is suitable to prevent gases from dispersing or rainwater from seeping into the waste layers. However, if the area is to be used as a foundation for roads, then crusher stones are recommended as covering materials. The final soil cover shall be resistant to corrosion by rainwater, low permeability and suitable for plants.

3. Anticipated Impacts and Mitigation Measures

123. The greatest physical impacts from the operating system will occur at the landfill, where decomposing waste will rise to an eventual height of up to 2.5-3 m above ground level, which will greatly alter the appearance and topography of the site.

124. **Leachate Control.** The landfill design includes measures to collect leachate and prevent pollution of surface and groundwater, and because there is very low rainfall in the area, the collected liquid will be re-circulated in the active cells of the landfill.

125. **Dust Control.** On-site dust will be controlled by use of water truck (include in budget). Water will be used for dust control only in those areas where no potential for creating leachate exists (such as access roads located outside the refuse filling area). In addition to watering, Bharatpur local government will use the following methods to control dust:

- (i) Placement of daily, intermediate, and final cover⁷ over the waste routinely;
- (ii) The main access road to the active landfill modules is paved over native ground;
- (iii) Continuous attention is given to proper maintenance of haul roads;
- (iv) Water spray or dust palliative will be applied on soil-covered work areas when conditions may result in fugitive dust; and
- (v) Planting and maintenance of vegetation on closed fill slopes.

126. Specific dust control measures may be implemented within the active landfill area, if necessary. The options will be:

- (i) Dust control within the Landfill Footprint (Active Areas) – temporary access roads within the landfill footprint will be watered, as required, to prevent dust problems;

⁷ When a landfill layer has reached a specified thickness or when one day's portion of the land filling works is completed, a daily cover is laid to prevent littering of wastes, bad odour from spreading, and harmful vectors like flies from breeding. Intermediate soil cover is laid as landfill works progress. The function is more on providing foundation for roads for the collection vehicles as well as draining the rainwater away from the landfill sites which are to be left for considerably long period. When all the overall land filling works have been completed in a landfill site, final soil cover is laid on the top of the land filled waste layers. The types and thickness of final cover depends on the planned usage of the completed landfill site.

- (ii) Dust control outside landfill footprint – permanent concrete or asphalt and gravel or rock-surfaced roads outside the landfill footprint will be watered periodically to mitigate dust. Soil surfaced roads will require more frequent watering; and
- (iii) Using Leachate for Dust Control – leachate may be used for dust control depending on its concentration. However, leachate will only be used on daily cover or waste within the landfill footprint.

127. **Litter Control.** 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. BNP will attempt to minimize windblown or dropped materials on-site. The sites will be checked daily for waste that has been blown or fallen from the collection vehicles. Ditches will be kept clear of litter material to maintain hydraulic properties and will be checked weekly unless the site conditions require a greater frequency. Waste collectors will be instructed to cover loads and vehicles with improper covered loads will be reprimanded. Public roads adjacent to the site will be checked daily for waste materials. The right-of-way within two (2) kilometres in either direction will be checked periodically for windblown or spilled materials.

128. **Vector Control.** The main concern is that if vectors are allowed to thrive in landfills, diseases could pose a threat to human health and/or the environment. Poorly-managed landfills can cause negative ecological impacts by allowing the development of large colonies of scavenging birds, rodents and other vermin, which can then be a nuisance and health hazard in nearby communities, and can reach pest levels on surrounding agricultural land. BNP will operate the landfill in a manner that it will not be a haven for rodents and insects. Special attention will be given to maintenance of daily, intermediate, and final soil cover as well as to proper drainage. In the event that rodent, bird and/or insect activity becomes apparent, supplemental vector control measures may need to be initiated.

- (i) Rodent control – rats and mice are problems at many landfills. Rats and mice will be controlled by placement of daily cover. An important step is to get rid of waste piles and places where these vectors can live. Setting traps is also a common way to determine if rats and mice are present at the landfill. By tracking the results of the trapping, one can determine not only if there is a problem with rats and/or mice, but also whether or not the problem is increasing. If determined that the landfill has a problem with rats and mice, mitigation measures will include (a) using grain poison however care must be taken that other animals (such as protected birds) do not ingest it; (b) using cover soil to eliminate much food source; (c) using traps to reduce the number of rats and mices; and (d) removing or covering exposed refuse: and
- (ii) Fly control – flies are problem for landfill that receive large amount of putrescible wastes, especially if the waste is not completely covered at the end of each working day. The simplest way to avoid having a fly problem at the landfill is to cover all garbage at the end of each working day.

129. **Odour Control.** Odours at landfill are often results of refuse that is being unloaded or is improperly covered. During landfill operation, daily and intermediate cover placement will help control odours. When highly odorous loads are received, they will be covered immediately with soil. To control odours from in-place refuse (from decomposition of old waste), integrity of soil cover material over all existing wastes will be maintained. Refuse compaction will also help control odour. Planting trees, shrubs, flowers, and other vegetation around the perimeter of the landfill will help mitigate some of the landfill odours.

130. As an additional safeguard, contractors will be required to hose out each bin once it is emptied at the disposal station to ensure that residual waste is not left in replaced bins to decompose over the long term.

131. The design also includes measures to maintain an orderly appearance at the 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 tube 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.

132. **Noise Abatement.** The noise associated with the operation of the landfill will be decreased by fitting all equipment with sound dampening devices (such as mufflers) and keeping the vehicles in good working conditions. Maintenance of the vehicles and equipment will be conducted periodically in accordance with the Landfill O and M Manual.

133. **Periodic Routine Inspections.** BNP will maintain the individual facilities and the waste management system and ensure that it will be kept in good working order in accordance to the Landfill O and M Manual. BNP will also ensure that no waste will accumulate in streets and on open ground.

134. **Traffic Control.** Operating the waste management system will impact traffic and transportation as there will be more heavy vehicles on the roads in and around the town, collecting and transporting the storage bins and transferring waste to the landfill. This will be mitigated by conducting these collections early in the day (when traffic is light) as much as possible.

135. **Ecology.** 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.

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

137. **Social and Cultural Resources.** The main beneficiaries of the improved system of waste management will be the citizens of the 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 town, and the attendant appearance, smell and public health risk should be removed.

138. There will also be socio-economic benefits for people who are able to gain employment with companies involved in operating the system, or with the Municipality, who will need to increase their manpower.

139. **Greenhouse Gas Emission and Control.** The landfill will be considered under the Clean Development Mechanism (CDM) Project of RUIDP if the emission of greenhouse gases (GHG) is substantial. ADB provides parallel financial assistance in any ongoing project where CDM instruments can be applied. The investment incurred in the technological installation for GHG emission mitigation can be recovered by the transaction cost gained by trading-off the Certified Emission Reduction (CER) with other GHG producing projects. Hence, the financial assistance of ADB can be availed to introduce the CDM project into the proposed subproject. The actions to be taken by BNP for such purpose are as follows:

- (i) Assessment of GHG emission from the proposed landfill site;
- (ii) Installation of the landfill gas collection system for arresting GHGs emitted from the landfill;
- (iii) Utilization of 'as generated' carbon dioxide gas and carbon dioxide obtained by burning methane, by bottling it for the use in dry ice manufacturer units; and
- (iv) Documentation for applying the CDM project in the proposed landfill.

140. **Occupational Health and Safety.** It is important that employees understand the risks they may be exposed to. BNP will at least tell them: (i) the likely exposure and the risks; (ii) what BNP is doing to control risks and exposures; (iii) where and how people can obtain protection; (iv) how to report defects in protection and control equipment; and (v) what they shall do to minimize the risk, such as the proper way to use protection and other control equipment, how to look after it and store it, and where to use it. This information will be given in a way the employee can be expected to understand (for example special arrangements might need to be made if the employee does not understand English or cannot read).

141. **Community Health and Safety.** Vehicle movements cause deaths and some of the most serious accidents. Vehicles will be fitted with highly audible reversing alarms and mirrors. These will be checked at least daily and maintained in good working order. Only authorized and competent workers will be allowed to operate the vehicles. Collection routes will be planned to avoid times of high-pedestrian activities. BNP will liaise with communities to position collection points in safe positions and/or collect at quiet times. BNP will also identify high-risk areas on route cards/maps and access pedestrianized areas such as shopping areas during quiet hours.

V. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project stakeholders

142. The primary stakeholders are:

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

143. The secondary stakeholders are:

- (i) LSGD as the Executing Agency;
- (ii) Other government institutions whose remit includes areas or issues affected by the subproject (state and local planning authorities such as Public Health Engineering Department, Local Government Department, Ministry of Environment and Forests, Roads and Highways Division);
- (iii) Non-government organizations (NGOs) and community-based organizations (CBOs) working in the affected communities;
- (iv) Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- (v) The beneficiary community in general; and
- (vi) ADB, GoI, and Ministry of Finance.

B. Consultations and Disclosures Conducted

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

- (i) Awareness and extent of the project and development components;
- (ii) Benefits of Project for the economic and social upliftment of community;
- (iii) Labour availability in the Project area or requirement of outside labour involvement;
- (iv) Local disturbances due to Project Construction Work;
- (v) Necessity of tree felling etc. at project sites;
- (vi) Water logging and drainage problem if any;
- (vii) Drinking water problem;
- (viii) Forest and sensitive area nearby the project site; and
- (ix) Movement of wild animals nearby the project site.

145. Stakeholder consultations and group discussion meetings were conducted by RUIDP on 28 June 2009 after advertising in local newspapers. The objectives were to appraise the stakeholders about the program's environmental and social impacts and present safeguards to mitigate any potential significant impacts.

146. Public consultation was also carried out at proposed landfill areas (nearby village) during design phase. Records of public consultations are attached as **Appendix 6**. The major issues raised are related to traffic interferences and possible dust and noise problems during construction phase. Other comments include construction vehicles creating some disturbances to the local people daily activities, necessity of proper safety arrangements, and widening of roads prior to construction activities. The issues and comments have been considered and incorporated in the design of the subproject and mitigation measures for the potential environmental impacts raised during the public consultations.

147. Informal discussions were held with the local people during site visits for the preparation of this IEE. Issues discussed were:

- (i) Proposed solid waste management project should ensure enough service of waste management in all wards of town;
- (ii) Executive agency should give preference to engage internationally reputed contractor like Gammon, Hindusthan Construction Company (HCC), etc as people do not faith about the local contractors in respect of quality of works as well as timely completion of work;

- (iii) Efforts should be made by government to supply drinking water round the clock;
- (iv) Livelihood affected households should be given assistance in the mode of cash compensation;
- (v) Local people should be employed by the contractor during construction work;
- (vi) Adequate safety measures should be taken during construction work;
- (vii) Mobile kiosks/vendors/hawkers have shown willingness to shift in nearby places without taking any compensation and assistance from the Executing Agency; and
- (iii) Local people have appreciated the water supply proposal of the government and they have ensured that they will cooperate with the Executing Agency during project implementation.

148. Hindi versions of the Environmental Framework were provided during workshops to ensure stakeholders understood the objectives, policy, principles, and procedures. Likewise, English and Hindi versions of the Environmental Framework have been placed in Urban Local Body (ULB) offices, Investment Program Project Management Unit (IPMU) and IPIU offices, and the town library.

C. Future Consultation and Disclosure

149. LSGD extended and expanded the consultation and disclosure process significantly during implementation of RUSDIP. They have appointed an experienced NGO to handle this key aspect of the programme. The NGO (Community Awareness Participation Program, CAPP) continuously (i) conducts a wide range of activities in relation to all subprojects in each town; and (ii) ensures the needs and concerns of stakeholders are registered and are addressed in subproject design.

150. For this subproject, the CAPP consultant will develop, in close coordination with IPIU and DSC, a public consultation and disclosure program which is likely to include the following:

- (i) Consultation during detailed design:
 - (a) Focus-group discussions with affected persons and other stakeholders (including women's groups, NGO's and CBO's) to hear their views and concerns, so that these can be addressed in subproject design where necessary; and
 - (b) Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project.
- (ii) Consultation during construction:
 - (a) Public meetings with affected communities to discuss and plan work programmes and allow issues to be raised and addressed once construction has started; and
 - (b) 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;
- (ii) Project disclosure:
 - (a) Public information campaigns (via newspaper, TV and radio) to explain the project to the wider town population and prepare them for disruption they may experience once the construction programme is underway;

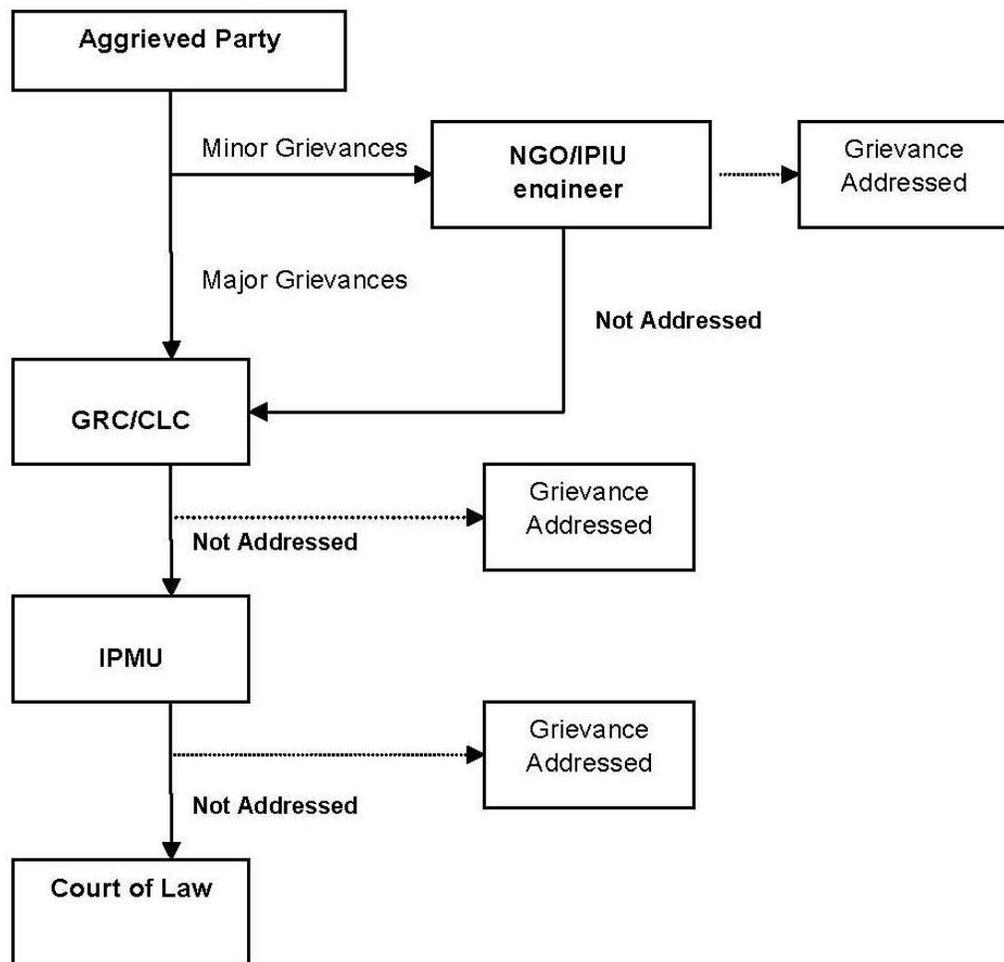
- (b) Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in Hindi; and
- (c) Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and providing a mechanism through which comments can be made.

151. Based on ADB requirements, the following will be posted on ADB website: (i) this IEE, upon receipt; (ii) a new or updated IEE, if prepared, reflecting significant changes in the Project during design or implementation; (iii) corrective action plan prepared during Project implementation to address unanticipated environmental impacts and to rectify non-compliance to EMP provisions; and (iv) environmental monitoring reports, upon receipt.

VI. GRIEVANCE REDRESS MECHANISM

152. Grievances of affected persons will first be brought to the attention of the implementing NGO or IPIU engineer. Grievances not redressed by the NGO or IPIU will be brought to the City Level Committees (CLC) set up to monitor project implementation in each town. The CLC, acting as a grievance redress committee (GRC) is chaired by the District Collector with representatives from the ULB, state government agencies, IPIU, community-based organizations (CBO's) and non-government organizations (NGOs). As GRC, the CLC will meet every month. The GRC will determine the merit of each grievance, and resolve grievances within a month of receiving the complaint, failing which the grievance will be addressed by the inter-ministerial Empowered Committee. The Committee will be chaired by the Minister of Urban Development and LSGD, and members will include Ministers, Directors and/or representatives of other relevant Government Ministries and Departments. Grievance not redressed by the GRC will be referred to the IPMU for action; failure at this level will be referred to the appropriate courts of law. The IPIU will keep records of all grievances received including: contact details of complainant, date that the complaint was received, nature of grievance, agreed corrective actions and the date these were effected, and final outcome. The grievance redress process is shown in **Figure 2**.

153. All costs involved in resolving the complaints will be borne by the IPMU. The GRC's will continue to function throughout the project duration.

Figure 2: Grievance Redress Mechanism – RUSDIP

CLC = City Level Committee, GRC = Grievance Redress Committee, IPIU=Investment Program Implementation Unit, IPMU = Investment Program Management Unit, NGO = nongovernmental organization,

VII. ENVIRONMENTAL MANAGEMENT PLAN

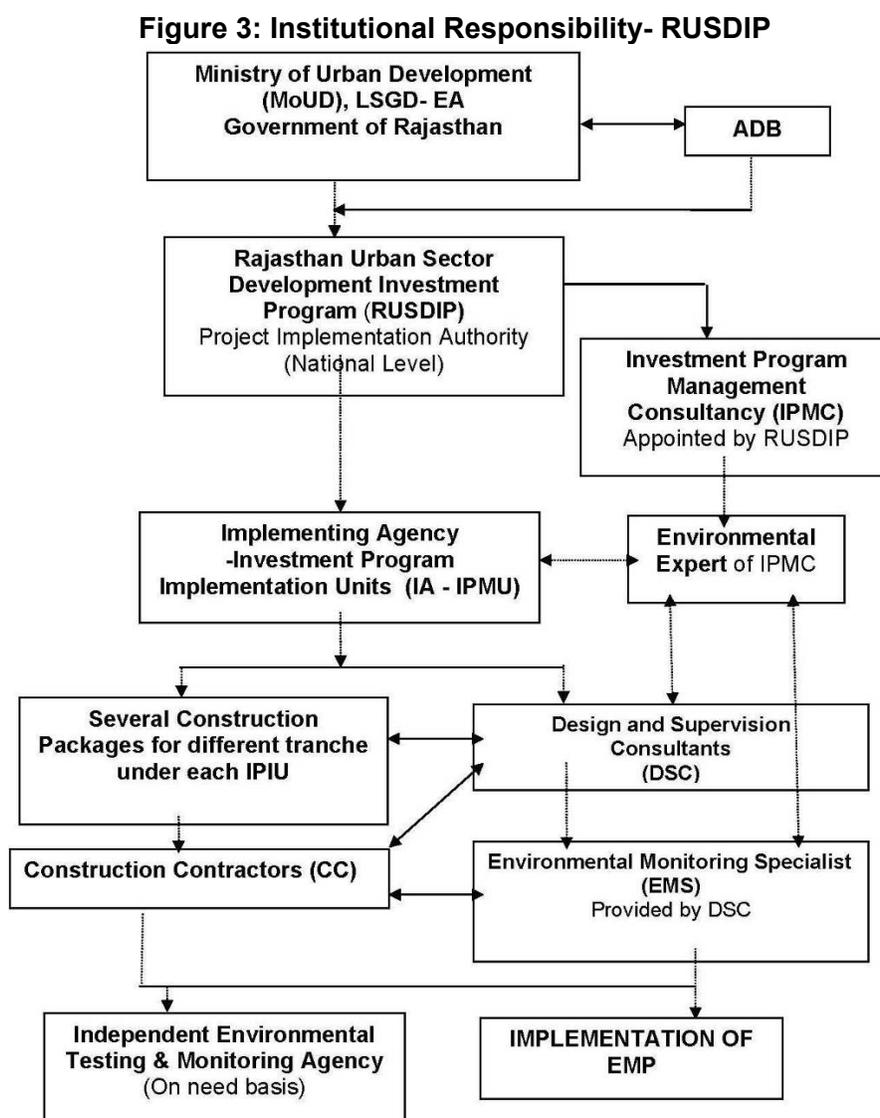
A. Institutional Arrangements

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

- (i) LS GD is responsible for management, coordination, and execution of all activities funded under the loan;
- (ii) IPMU is responsible for coordinating construction of subprojects across all towns, and for ensuring consistency of approach and performance;
- (iii) IPMC assists IPMU in managing the program and assures technical quality of design and construction;
- (iv) DSC's design the infrastructure, manage tendering of Contractors and supervise the construction process;
- (v) IPIU does appoint and manage Construction Contractors to build elements of the infrastructure in a particular town.

- (vi) An inter-ministerial Empowered Committee⁸ (EC) assists LSGD in providing policy guidance and coordination across all towns and subprojects.; and
- (vii) City Level Committees⁹ (CLC's) have also been established in each town to monitor project implementation in the town and provide recommendations to the IPIU where necessary.

155. **Figure 3** shows institutional responsibility for implementation of environmental safeguard at different level.



⁸ The EC is chaired by the Minister of Urban Development and LSG, and members include Ministers, Directors and/or representatives of other relevant Government Ministries and Departments.

⁹ CLC's are chaired by District Collectors, with members including officials of the ULB, local representatives of state government agencies, the IPIU, and local NGOs and CBO's.

1. Responsible for carrying out mitigation measures

156. During construction stage, implementation of mitigation measures is the construction contractor's responsibility while during operation stage, BNP will be responsible for the conduct of maintenance or repair works.

157. To ensure implementation of mitigation measures during the construction period, contract clauses (**Appendix 7**) for environmental provisions will be part of the civil works contracts. Contractors' conformity with contract procedures and specifications during construction will be carefully monitored by IPIU.

2. Responsible for carrying out monitoring measures

158. During construction, DSC's Environment Safeguards Officer and the designated representative of IPIU will monitor the construction contractor's environmental performance.

159. During the operation stage, monitoring will be the responsibility of BNP.

3. Responsible for reporting

160. LGSD will submit to ADB quarterly reports on implementation of the EMP and will permit ADB to field annual environmental review missions which will review in detail the environmental aspects of the Project. Any major accidents having serious environmental consequences will be reported immediately.

B. Environmental Mitigation Plan

161. **Tables 4 to 6** show the potential adverse environmental impacts, proposed mitigation measures, and responsible parties. This EMP will be included in the bid documents and will be further reviewed and updated during implementation.

C. Environmental Monitoring Program

162. **Tables 7 to 9** show the proposed environmental monitoring program for this subproject. It includes all relevant environmental parameters, description of sampling stations, frequency of monitoring, applicable standards, responsible parties, and estimated cost. Monitoring activities during the detailed engineering design stage will form part of the baseline conditions of the subproject sites and will be used as the reference for acceptance of restoration works by the construction contractors.

Table 4: Anticipated Impacts and Mitigation Measures – Pre-construction Environmental Mitigation Plan

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|--------------------------------|--|--|----------------------------|---|
| Location Consideration | Habitation within 500 m from the landfill boundaries | Declaration of “No-Development Buffer Zone” after the landfill location is finalised. | IPMU, DSC | “No-Development Buffer Zone” declared |
| | No available disposal site for collected wastes during landfill construction | (i) Reduce volume of existing dumped waste by separation of materials into recyclable, reusable, and combustible components reducing its volume through separation of materials into recyclable, reusable, and combustible components; (ii) Divide landfill into a number of phases to allow continuation of operation while site preparation and other rehabilitation components can be started simultaneously | IPMU, DSC | Construction Phases and Schedule |
| Leachate Monitoring Program | groundwater contamination | (i) Any disposal method for leachate needs to be approved by the CPHEEO as per MSW 2000 rule (ii) Any leachate to be disposed will need to comply with the Disposal Standards for Treated Leachate as specified in the MSW (Management and Handling) Rules, 2000 | IPMU | (i) Approval from central Ground Water Board obtained; (ii) O and M Manual included Disposal Standards for Treated Leachate as specified in the MSW (Management and Handling Rule), 2000 |
| Landfill Gas Management System | risk of fire, explosion, and contribution to greenhouse gases | Include a gas venting system | DSC | (i) 5 number of gas vents included in the design; (ii) gas monitoring included in the environmental monitoring program; (iii) flaring, if needed |
| Drainage and Hydrology | generation of excessive leachate, erosion of cover material and/or waste from the landfill | (i) all water that has entered waste-filled areas, and water that has been contaminated by leachate, will be handled and treated in the same manner as leachate; (ii) the exposed or cleared areas at the landfill site will be minimized at all times, and all topsoil set aside for re-vegetation purposes; and (iii) all completed areas of the landfill | DSC | (i) drainage control system included in the design; |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|----------------------------------|--|--|----------------------------|--|
| | | will be progressively re-vegetated, and any areas exposed for greater than 30 days will be stabilized so as to prevent soil erosion. | | |
| Landfill O and M Manual | substandard construction and operation | Prepare O and M Manual following CHPEEO Manual | DSC | O and M Manual prepared |
| Environmental Monitoring Program | baseline data not fully established | Conduct baseline study for one month prior to start of construction | DSC | Baseline data completed, documented, analyzed, and reviewed |
| Screening of Wastes | landfill active life shortened; prohibited wastes accepted at landfill | (i) Prepare Waste Acceptance and Screening Procedure; (ii) Include in the design placement of signs at landfill point of entry | DSC | (i) Waste Acceptance and Screening Procedure prepared; (ii) Designs include signs at landfill point of entry |
| Security | unauthorized access | Include in the design signages and billboards | DSC | Design include signs |
| Traffic Investigation | increased traffic in collection routes and to/from landfill site | (i) Conduct traffic investigation to identify peak traffic volume; (ii) Identify existing roads for collection points and routes | DSC | (i) Traffic investigation conducted and report completed and accepted; (ii) Existing roads for collection and to/from landfill site identified and included in maps |
| Post Close Usage | continued groundwater, surface water, air pollution even if landfill has completed its active life | (i) Prepare closure and post-closure plan in accordance with CHPEEO Manual or any internationally recognized good practices on closure and post-closure of landfills | DSC | Closure and Post-Closure Plan prepared |
| Asbestos Cement Pipes | risk of contact with carcinogenic material if these pipes are uncovered in the course of the work | Develop an AC Pipe protocol to be applied in any instance that AC pipes are found | DSC | AC Pipe Protocol developed |
| Social and Cultural Resources | Ground disturbance can uncover and damage archaeological and historical remains | (i) Consult Archaeological Survey of India (ASI) to obtain an expert assessment of the archaeological potential of the site; (ii) Consider alternatives if the site is found to be of medium or high risk; (iii) Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can | IPIU and DSC | Chance Finds Protocol developed |

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

Table 5: Anticipated Impacts and Mitigation Measures – Construction Environmental Mitigation Plan

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|----------------------|---|--|----------------------------|---------------------------------------|
| Sources of Materials | Extraction of rocks and material may cause ground instability | (i) Use quarry sites and sources permitted by government; (ii) Verify suitability of all material sources and obtain approval of Investment | Construction Contractor | Construction Contractor documentation |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|-----------------------|--|---|----------------------------|---|
| | | Program Implementation Unit (IPIU); (iii) If additional quarries will be required after construction has started, obtain written approval from IPMU; and; (iv) Submit to DSC on a monthly basis documentation of sources of materials. | | |
| Air Quality | Emissions from construction vehicles, equipment, and machinery used for excavation and construction resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) | (i) Consult with IPIU/DSC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; (ii) (iii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; (iv) Use tarpaulins to cover sand and other loose material when transported by trucks; and (v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly. | Construction Contractor | (i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices (iii) ambient air for respirable particulate matter (RPM) and suspended particulate matter (SPM); (iv) vehicular emissions such as sulphur dioxide (SO2), nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons |
| Flora and Fauna | Damage or cause loss of existing vegetation and decrease or cause loss of animals/birds | (i) Minimize removal of vegetation and disallow cutting of trees; (ii) If tree-removal will be required, obtain tree-cutting permit from BNP, earth-ball trees, and transplant to DSC-approved areas; (iii) Require to plant three (3) native trees for every one (1) that is removed; and (iv) Prohibit employees from poaching wildlife, bird hunting, and cutting of trees for firewood. | Construction Contractor | (i) Tree-cutting permit obtained; (ii) Bid documents include requirement for 3 trees for every tree cut; |
| Surface water quality | Chemical contamination from | (i) Avoid stockpiling of earth | Construction Contractor | (i) Areas for stockpiles, |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|--------------|--|---|----------------------------|--|
| | fuels and lubricants during construction works can contaminate downstream surface water quality. | fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with IPIU/DSC on designated disposal areas; (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; (v) Dispose any wastes generated by construction activities in designated sites; and (vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP). | | storage of fuels and lubricants and waste materials; (ii) number of silt traps installed along drainages leading to water bodies; (iii) records of surface water quality inspection; (iv) effectiveness of water management measures; (v) for inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms. |
| Noise Levels | Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people | (i) Plan activities in consultation with IPIU/DSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; (ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach; (iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding | Construction Contractor | (i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers; (iii) equivalent day and night time levels |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|--------------------------|---|---|----------------------------|--|
| | | sensitive receptor; and (iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s. | | |
| Landscape and Aesthetics | Solid wastes as well as excess construction materials | (i) Prepare and implement Waste Management Plan; (ii) Avoid stockpiling of excess excavated soils; (ii) Coordinate with BNP for beneficial uses of excess excavated soils or immediately dispose to designated areas; (iv) Recover used oil and lubricants and reuse or remove from the sites; (v) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (vi) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (vii) Request IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work. | Construction Contractor | (i) Waste Management Plan; (ii) complaints from sensitive receptors; (iii) IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work. |
| Accessibility | Traffic problems and conflicts in right-of-way (ROW) | (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites; (ii) Schedule transport and hauling activities during non-peak hours; (iii) Locate entry and exit | Construction Contractor | (i) Traffic Management Plan; (ii) complaints from sensitive receptors; (iii) number of signage's placed at subproject sites. |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|---------------------------|--|--|----------------------------|---|
| | | <p>points in areas where there is low potential for traffic congestion;</p> <p>(iv) Keep the site free from all unnecessary obstructions;</p> <p>(v) Drive vehicles in a considerate manner;</p> <p>(vi) Coordinate with Bharatpur Municipal Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; and</p> <p>(vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.</p> | | |
| Socio-Economic – Income. | Impede the access of residents and customers to nearby shops | <p>(i) Leave spaces for access between mounds of soil;</p> <p>(ii) Provide walkways and metal sheets where required to maintain access across trenches for people and vehicles;</p> <p>(iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools;</p> <p>(iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and</p> <p>(v) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</p> | Construction Contractor | (i) Complaints from sensitive receptors; (ii) number of walkways, signage's, and metal sheets placed at subproject sites. |
| Socio-Economic Employment | - Generation of contractual employment and increase in | (i) Employ at least 50% of the labour force, or to the | Construction Contractor | (i) Employment records; (ii) records of sources of |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|--------------------------------|---|--|----------------------------|--|
| | local revenue | maximum extent, local persons within the 2-km immediate area if manpower is available; and (ii) Secure construction materials from local market. | | materials |
| Occupational Health and Safety | occupational hazards which can arise from working in infrastructures like roads and bridges | (i) Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; (iii) Provide medical insurance coverage for workers; (iv) Secure all installations from unauthorized intrusion and accident risks; (v) Provide supplies of potable drinking water; (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, | Construction Contractor | (i) Site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H and S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|-----------------------|--------------------|--|----------------------------|--|
| | | <p>and preventing injuring to fellow workers;</p> <p>(viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</p> <p>(ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;</p> <p>(x) Ensure moving equipment is outfitted with audible back-up alarms;</p> <p>(xi) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and</p> <p>(xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</p> | | |
| Asbestos Cement Pipes | Health risk | (i) Train all personnel (including manual labourers) to enable them to understand the dangers of AC pipes and | Construction Contractor | (i) Records of trainings; (ii) AC Management Plan approved by IPIU/DSC |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|------------------------------|---|---|----------------------------|--|
| | | <p>to be able to recognise them in situ;</p> <p>(ii) Report to management immediately if AC pipes are encountered;</p> <p>(iii) Develop and apply AC Management Plan.</p> | | |
| Community Health and Safety. | Traffic accidents and vehicle collision with pedestrians | <p>(i) Plan routes to avoid times of peak-pedestrian activities.</p> <p>(ii) Liaise with IPIU/DSC in identifying high-risk areas on route cards/maps.</p> <p>(iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.</p> <p>(iv) Provide road signs and flag persons to warn of dangerous conditions.</p> | Construction Contractor | <p>(i) Traffic Management Plan;</p> <p>(ii) complaints from sensitive receptors</p> |
| Work Camps | Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants | <p>(i) Consult with IPIU/DSC before locating project offices, sheds, and construction plants;</p> <p>(ii) Minimize removal of vegetation and disallow cutting of trees;</p> <p>(iii) Provide water and sanitation facilities for employees;</p> <p>(iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;</p> <p>(v) Train employees in the storage and handling of materials which can potentially cause soil contamination;</p> <p>(vi) Recover used oil and lubricants and reuse or remove from the site;</p> | Construction Contractor | <p>(i) Complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) IPIU/DSC report in writing that the camp has been vacated and restored to pre-project conditions</p> |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|-------------------------------|-------------------------------------|---|----------------------------|-----------------------------|
| | | (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ix) Request IPIU/DSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work. | | |
| Social and Cultural Resources | Risk of archaeological chance finds | (i) Strictly follow the protocol for chance finds in any excavation work; (ii) Request IPIU/DSC or any authorized person with archaeological field training to observe excavation; (iii) Stop work immediately to allow further investigation if any finds are suspected; and (iv) Inform IPIU/DSC if a find is suspected, and take any action they require ensuring its removal or protection in situ. | Construction Contractor | (i) Records of chance finds |

Table 6: Anticipated Impacts and Mitigation Measures – Operation and Maintenance Environmental Mitigation Plan

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|------------------|------------------------------------|--|-----------------------------|---------------------------|
| Leachate Control | surface, groundwater contamination | Re-circulate leachate to the active parts of the landfill | BNP and O and M Contractors | All leachate recirculated |
| Dust Control | increased PM10 level | (i) Placement of daily, intermediate, and final cover over the waste routinely; (ii) The main access road to the active landfill modules is paved over native ground; (iii) Continuous attention is given to proper maintenance of haul roads; | BNP and O and M Contractors | (i) Records available |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|--------------------------------|---|---|-----------------------------|--|
| | | (iv) Water spray or dust palliative will be applied on soil-covered work areas when conditions may result in fugitive dust; (v) Planting and maintenance of vegetation on closed fill slopes; | | |
| Dust Control | increased PM10 level | (i) Dust control within the Landfill Footprint (Active Areas) – temporary access roads within the landfill footprint will be watered, as required, to prevent dust problems; (ii) Dust control outside landfill footprint – permanent concrete or asphalt and gravel or rock-surfaced roads outside the landfill footprint will be watered periodically to mitigate dust. Soil surfaced roads will require more frequent watering; and (iii) Using Leachate for Dust Control – leachate may be used for dust control depending on its concentration. However, leachate will only be used on daily cover or waste within the landfill footprint. | BNP and O and M Contractors | (i) Records available |
| Litter Control | clogging of drains, unsightly environment | (i) minimize windblown or dropped materials on-site; (ii) daily check for waste that has been blown or fallen from the collection vehicles; (iii) clear drains of litter material; (iv) instruct waste collectors to cover loads and vehicles; (v) reprimand waste collectors with uncovered loads | BNP and O and M Contractors | (i) Records available |
| Vector control | threat to human health and/or the environment | (i) Develop Rodent and Fly Control Plan | BNP and O and M Contractors | Rodents and Flies Control Plan included in O and M Manual |
| Odor Control | nuisance to sensitive receptors | (i) Cover daily and immediately waste materials with soil; (ii) Maintain integrity of soil cover material of covered wastes; (iii) Plant trees, shrubs, flowers, and other vegetation (iv) Hose each bin once it is emptied; (v) Ensure that residual waste is not left in bins and allowed to decompose for a long period of time | BNP and O and M Contractors | (i) Odour Control Plan included in O and M Manual; (ii) complaints from sensitive receptors |
| Noise Abatement | nuisance to sensitive receptors | (i) fit all equipment with sound dampening devices (such as mufflers); (ii) keep vehicles in good working conditions; (iii) Maintain vehicles and equipment periodically | BNP and O and M Contractors | (i) Noise Abatement Plan included in O and M Manual; (ii) complaints from sensitive receptors; (iii) Records of Periodic Maintenance available |
| Occupational Health and Safety | Adverse impacts on the appearance of surrounding environment and exposure of workers to hazardous | BNP will at least tell them: (i) the likely exposure and the risks; (ii) what BNP is doing to control risks and exposures; (iii) where and how people can obtain protection; (iv) how to report defects in protection and control equipment; and (v) what they shall do to minimize the risk, | BNP and O and M Contractors | (i) Records of training available; (ii) H and S Plan included in O and M |

| Field | Anticipated Impact | Mitigation Measures | Responsible for Mitigation | Monitoring of Mitigation |
|-----------------------------|--|---|----------------------------|--------------------------|
| | debris | such as the proper way to use protection and other control equipment, how to look after it and store it, and where to use it. This information will be given in a way the employee can be expected to understand (for example special arrangements might need to be made if the employee does not understand English or cannot read). | | |
| Community Health and Safety | Vehicle movements cause deaths and some of the most serious accidents. | (i) fit vehicles with highly audible reversing alarms and mirrors and check at least daily and maintained in good working order. (ii) allow only authorized and competent workers to operate the vehicles; (iii) Plan collection routes to avoid times of high-pedestrian activities. (iv) Liaise with communities to position collection points in safe positions and/or collect at quiet times; (v) Identify high-risk areas on route cards/maps and access pedestrianized areas such as business areas during quiet hours. | BNP | (i) Records available |

Table 7: Pre-construction Environmental Monitoring Program

| Field | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|-----------------------------|----------------|----------------------------|---|---|--|-----------|----------------------------|
| Location Consideration | Not applicable | IPIU and DSC | "No-Development Buffer Zone" declared | Checking of official record | Declaration papers | Once | IPMU |
| | Landfill site | IPIU and DSC | Construction Phase and Schedule | Checking of official record and lay-out plan | Detailed project report | Once | IPMU |
| Leachate Monitoring Program | Not applicable | IPIU and DSC | (i) Approval from central Ground Water Board obtained; (ii) O and M Manual included Disposal Standards for Treated Leachate as specified in the MSW (Management and Handling Rule), 2000 | Checking of DPR and cross checking of CPHEEO manual | Disposal methodology as mentioned in DPR | Once | IPMU |
| Landfill Gas Management | Not applicable | IPIU and DSC | (i) 5 number of gas vents included in the design; (ii) gas monitoring included in the environmental monitoring program; | Scrutinization of DPR | Detailed project report | Once | IPMU |

| Field | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|----------------------------------|--------------------------------|----------------------------|---|--|--|----------------------------------|----------------------------|
| Drainage and Hydrology | Project location Landfill site | IPIU and DSC | (i) drainage control system included in the design; | Checking of DPR and cross checking of CPHEEO manual | Detailed project report , concerned manual | Once | IPMU |
| Landfill O and M Manual | Not applicable | DSC | O and M Manual prepared | Availability and scrutinization of manual | Concerned manual contain all provision as per CPHEEO and MSW 2000 rule | Once | IPMU |
| Environmental Monitoring Program | Project location Landfill site | DSC | Baseline data completed, documented, analyzed, and reviewed | Checking of available monitoring data sheet | Monitoring Data for observation and comparison with data during implementation | Once before commencement of work | IPMU |
| Screening of Waste | Not applicable | DSC | (i) Waste Acceptance and Screening Procedure prepared; (ii) Designs include signs at landfill point of entry | Scrutinization of DPR | Detailed project report | Once | IPMU |
| Security | Not applicable | DSC, IPIU | Design include signs | Scrutinization of DPR | Detailed project report | Once | IPMU |
| Traffic Investigation | Town area | DSC | (i) Traffic investigation conducted and report completed and accepted; (ii) Existing roads for collection and to/from landfill site identified and included in maps | Checking of data | Traffic data generated during study | Once | IPMU |
| Post-Closure Usage | Not applicable | DSC | Closure and Post-Closure Plan prepared | Scrutinization of DPR and matching with CPHEEO requirement | Detailed project report | Once | IPMU |
| Asbestos Cement Pipes | Not applicable | IPIU and DSC | (i) Asbestos Cement Protocol; (ii) requirement for AC Management included in bid documents | Checking of records | (i) AC Protocol prepared; (ii) bid documents include requirements for AC Management Plan | Once | IPMU |
| Social and | Not | IPIU and DSC | Chance Finds Protocol | Checking of | Chance Finds Protocol | Once | IPMU |

| Field | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|--|----------------|--|--|----------------------|---|-----------|----------------------------|
| Cultural Resources | applicable | | | records | provided to construction contractors prior to commencement of activities | | |
| Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas. | Not applicable | IPIU and DSC to determine locations prior to award of construction contracts. | List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas. | Checking of records | List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas provided to construction contractors prior to commencement of works. | Once | IPMU |
| Sources of Materials | Not applicable | IPIU and DSC to prepare list of approved quarry sites and sources of materials | (i) list of approved quarry sites and sources of materials; (ii) bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary. | Checking of records | (i) list of approved quarry sites and sources of materials provided to construction contractors (ii) bid document included requirement for verification of suitability of sources and permit for additional quarry sites if necessary. | Once | IPMU |

Table 8: Construction Environmental Monitoring Program

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

| Mitigation Measures | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|---------------------|--|----------------------------|--|--|---|-----------|----------------------------|
| | | | equipment and machinery with air pollution control devices (iii) ambient air for respirable particulate matter (RPM) and suspended particulate matter (SPM); (iv) vehicular emissions such as sulphur dioxide (SO ₂), nitrous oxides (NO _x), carbon monoxide (CO), and hydrocarbons (HC) | | satisfactorily addressed; (iii) air pollution control devices working properly; (iv) GOI Ambient Quality Standards for ambient air quality; (iv) GOI Vehicular Emission Standards for SO ₂ , NO _x , CO and HC. | | |
| Water Quality | (i) construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; | Construction Contractor | (i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) number of silt traps installed along drainages leading to water bodies; (iii) records of surface water quality inspection; (iv) effectiveness of water management measures; (v) for inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms. | visual inspection | (i) designated areas only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and silt from construction activities (iv) GOI Standards for Water Discharges to Inland Waters and Land for Irrigation | monthly | DSC |
| Noise Levels | (i) construction sites; (ii) areas for stockpiles, | Construction Contractor | (i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing | (i) checking of records; (ii) visual inspection | (i) complaints from sensitive receptors satisfactorily addressed; and (ii) | monthly | DSC |

| Mitigation Measures | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|--|--|----------------------------|---|--|--|-----------|----------------------------|
| | storage of fuels and lubricants and waste materials; (iii) work camps | | equipment and sound barriers; (iii) equivalent day and night time levels | | silencers in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary | | |
| Existing Infrastructure and Facilities | (i) construction sites; (ii) alignment of affected utilities | Construction Contractor | (i) Existing Utilities Contingency Plan; (ii) Asbestos Cement Pipes Management Plan | (i) checking of records; (ii) visual inspection | implementation according to Utilities Contingency Plan and Asbestos Cement Plan | as needed | DSC |
| Landscape and Aesthetics | (i) construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps | Construction Contractor | (i) Waste Management Plan; (ii) complaints from sensitive receptors; (iii) IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work. | (i) checking of records; (ii) visual inspection | (i) no accumulation of solid wastes on-site; (ii) implementation of Waste Management Plan; (iii) Complaints from sensitive receptors satisfactorily addressed. | monthly | DSC |
| Accessibility | (i) construction sites; (ii) traffic routes | Construction Contractor | (i) Traffic Management Plan; (ii) complaints from sensitive receptors; (iii) number of signages placed at subproject sites. | visual inspection | (i) implementation of Traffic Management Plan; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) signages visible and located in designated areas | monthly | DSC |
| Socio-economic - Income | construction sites | Construction Contractor | (i) complaints from sensitive receptors; (ii) number of walkways, signages, and metal sheets placed at subproject sites. | visual inspection | (i) complaints from sensitive receptors satisfactorily addressed; (ii) walkways, ramps, and metal sheets provided (iii) signages visible | quarterly | DSC |

| Mitigation Measures | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|--------------------------------|--------------------|----------------------------|--|---|--|-----------|----------------------------|
| | | | | | and located in designated areas | | |
| AC Pipes | construction sites | Construction Contractors | (i) records of trainings; (ii) AC Management Plan approved by PIU/DSC | checking of records | no exposure to AC pipes | as needed | PIU and DSC |
| Socio-Economic - Employment | construction sites | Construction Contractor | (i) employment records; (ii) records of sources of materials | checking of records | number of employees from Bharatpur equal or greater than 50% of total work force | quarterly | DSC |
| Occupational Health and Safety | construction sites | Construction Contractor | (i) site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H and S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; | (i) checking of records; (ii) visual inspection | (i) implementation of Hands plan; (ii) number of work-related accidents; (iii) % usage of personal protective equipment; (iv) number of first-aid stations, frequency of potable water delivery, provision of clean eating area, and number of sign boards are according to approved plan; (v) % of moving equipment outfitted with audible back-up alarms | quarterly | DSC |

| Mitigation Measures | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|-------------------------------|--------------------|----------------------------|---|----------------------|---|-----------|----------------------------|
| | | | (xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. | | | | |
| Community Health and Safety | construction sites | Construction Contractor | (i) Traffic Management Plan; (ii) complaints from sensitive receptors | visual inspection | (i) implementation of Traffic Management Plan; (ii) complaints from sensitive receptors satisfactorily addressed (iii) fences set up to keep public out of construction site. | quarterly | DSC |
| Work Camps | work camps | Construction Contractor | (i) complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) IPIU/DSC report in writing that the camp has been vacated and restored to pre-project conditions | visual inspection | (i) designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed | quarterly | DSC |
| Social and Cultural Resources | construction sites | Construction Contractor | records of chance finds | checking of records | Implementation of Chance Finds Protocol | as needed | DSC |

Table 9: Operation and Maintenance Environmental Monitoring Program

| Mitigation Measures | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|---------------------|---------------------------|----------------------------|--------------------------|----------------------|---------------------------|-----------|----------------------------|
| Leachate Control | Landfill site and service | O and M contractor, BNP | (i) Records available | Checking of relevant | complaints from sensitive | as needed | IPMU |

| Mitigation Measures | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|--------------------------------|--------------------------------|----------------------------|--|---|--|-----------|----------------------------|
| | area | | | records | receptors satisfactorily addressed | | |
| Dust Control | Landfill site and service area | O and M contractor, BNP | (i) Records available | Checking of relevant records | complaints from sensitive receptors satisfactorily addressed | as needed | IPMU |
| Litter Control | Land fill site | O and M contractor, BNP | (i) Records available | Checking of relevant records | complaints from sensitive receptors satisfactorily addressed | as needed | IPMU |
| Vermin Control | Landfill site | O and M contractor, BNP | Rodents and Flies Control Plan included in O and M Manual | Checking of O and M Manual | complaints from sensitive receptors satisfactorily addressed | as needed | IPMU |
| Odour Control | Landfill site | O and M contractor, BNP | (i) Odour Control Plan included in O and M Manual; (ii) complaints from sensitive receptors | Checking of O and M Manual | complaints from sensitive receptors satisfactorily addressed | as needed | IPMU |
| Noise Abatement | Landfill site and service area | O and M contractor, BNP | (i) Noise Abatement Plan included in O and M Manual; (ii) complaints from sensitive receptors; (iii) Records of Periodic Maintenance available | Checking of O and M Manual | complaints from sensitive receptors satisfactorily addressed | as needed | IPMU |
| Occupational Health and Safety | Landfill site and service area | O and M contractor, BNP | (i) Records of training available; (ii) H and S Plan included in O and M | Checking of records and training module | (i) complaints from sensitive receptors satisfactorily | as needed | IPMU |
| Community Health and Safety | Landfill site and service | BNP | (i) Records available | Checking of records | i) complaints from sensitive | As needed | IPMU |

| Mitigation Measures | Location | Responsible for Mitigation | Monitoring of Mitigation | Method of Monitoring | Indicators/ Standards | Frequency | Responsible for Monitoring |
|---------------------|--|---|---|---|---|------------------------------------|----------------------------|
| | area | | | | receptors satisfactorily | | |
| Water Quality | (i) LANDFILL SITE effluent; (ii) nearby water bodies | BNP in coordination with PHED and O and M Contractors | (i) Inland parameters: colour and odour, suspended solids, particle size of suspended solids, pH value, temperature, oil and grease, total residual chlorine, ammonical nitrogen, total Kjeldahl nitrogen, free ammonia, biochemical oxygen demand, chemical oxygen demand, heavy metals, cyanide, fluoride, dissolved phosphates, sulfide and phenolic compounds. (ii) Land for Irrigation: colour and odour, suspended solids, pH value, oil and grease, biochemical oxygen demand, arsenic, and cyanide | Sample collection and laboratory analyses | GOI Standards for Discharges to Inland Waters and Land for Irrigation | Quarterly or as prescribed by CPCB | IPMU |

D. Environmental Management Plan Costs

163. 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.

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

- (i) The environmental monitoring during pre-construction, construction, conducted by the EMS

165. The costs are shown in **Table 10** 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 design, 1 ½ years of construction and the first five years of operation) is INR 420,000.

Table 10: Environmental management and monitoring costs (INR)

| Item | Quantity | Unit Cost | Total Cost | Sub-total | Source of Funds |
|--|-------------|-----------|------------|----------------|-----------------|
| 1. Implementation of EMP | | | | | |
| Domestic Environmental Monitoring Specialist | 1 x 3 month | 140,000 * | 420,000 | | DSC |
| TOTAL | | | | 420,000 | |

DSC = Design and Supervision Consultants, EMP = Environmental Management Plan, INR = Indian rupees.

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

VIII. FINDINGS AND RECOMMENDATIONS

166. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Bharatpur 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. This means that the number of impacts and their significance has already been reduced by amending the design.

167. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the 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 the town, some parts of which are densely populated; and because Rajasthan is an area with a rich history, in which there is a high risk that ground disturbance may uncover important remains. Because of these factors the most significant impacts are on the physical environment, the human environment, and the cultural heritage.

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

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

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

171. There were limited opportunities to provide environmental enhancements, but certain measures were included. For example it is proposed that the project will employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain; and plant trees on and around completed parts of the landfill site once it is operating, to improve the appearance and provide a small ecological gain.

172. Once the system is operating, it will be important that Bharatpur Nagar Parishad(BNP) maintains the facilities and the waste management system as a whole in proper working order, because the town environment will deteriorate rapidly from waste accumulation if the system begins to fail. The project will provide capacity building, public education and financial support to ensure continuation of the operating system.

173. If waste is collected regularly from houses and municipal storage bins, transferred to the landfill and treated as intended, then there should be no significant negative impacts. Even the accumulation of waste to a design height of 3 m at the landfill should not be significant as waste will be compacted and covered with soil daily and when each waste cell is completed, thus limiting pests, odours and visual impacts. There are also no residential areas nearby where people could be affected by such impacts.

174. The main impacts of the operating waste management system will be beneficial as the general environment of the town 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. Some people will also gain socio-economically from being employed in companies engaged to operate the system, or in the expanded Municipality manpower.

175. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. 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 town environment from the improved solid waste management.

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

to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

IX. CONCLUSIONS

177. The environmental impacts of the proposed improvements in solid waste management infrastructure in Bharatpur Town have been assessed by the Initial Environmental Examination reported in this document, conducted according to ADB guidelines. The overall conclusion 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 town environment once the scheme is in operation.

178. During designing stage location of landfill site selected at government land only, no village noted nearby the site (land surrounded by agricultural land). Therefore no additional impact is expected.

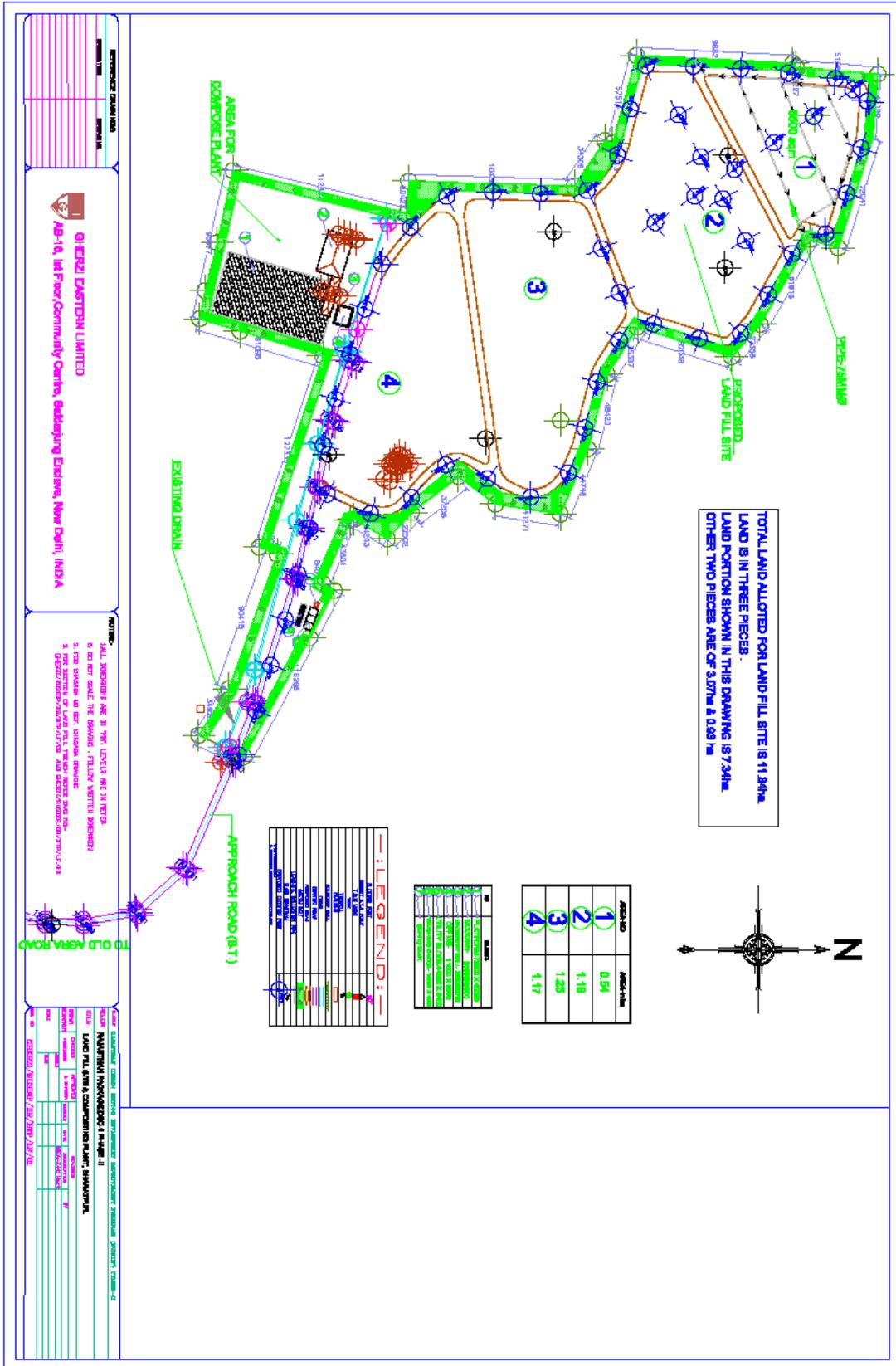
179. There are no uncertainties in the analysis, and no additional work is required to comply with ADB procedure. For satisfying National law environmental clearance is required for construction and operation of Sanitary Landfill site.

Appendix 1: List of “No Objection Certificates” from Line Agencies

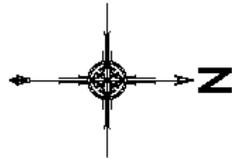
Project: Construction of Landfill Site at Bharatpur

- Nagar Palika – Municipal Board- They have no objection for project work of RUIDP within Municipal area
- Town planning Department – Department have no objection for improvement of solid waste management facility at Bharatpur
- Forest Department – They have no objection for construction of landfill site at Noh Village
- Letter from Bird Sanctuary authority
- Archaeological Department – As per NOC “proposed landfill area not belongs to Archaeological Survey of India.”
- Gram Panchyat Department- They verified the Khasra land record number for allotted land and gave “ No Objection”
- Central Ground Water Board – They have no objection for construction of landfill at Noh village. Only they requested not to pollute ground water during operation of landfill.
- Public Works Department- They allow construction of landfill at Noh subject without-encroaching their land
- Public Health Engineering Department- They have no objection for construction of landfill at Noh village
- Irrigation department – No objection from irrigation department for construction of landfill at village Noh
- District Collector – Allotment of land for construction of landfill site

Appendix 2: Lay-Out Plan of the Landfill



TOTAL LAND ALLOTTED FOR LAND FILL SITE IS 11.84ha.
 LAND IS IN THREE PIECES.
 LAND PORTION SHOWN IN THIS DRAWING IS 7.34ha.
 OTHER TWO PIECES ARE OF 3.07ha & 0.69 ha.



| SECTION | AREA (ha) |
|---------|-----------|
| 1 | 0.54 |
| 2 | 1.18 |
| 3 | 1.25 |
| 4 | 1.47 |

| NO. | DESCRIPTION |
|-----|-------------------------|
| 1 | PROPOSED LAND FILL SITE |
| 2 | EXISTING DRAIN |
| 3 | APPROACH ROAD (R.T.) |
| 4 | COMPOSITE PLANT |

LEGEND:

| SYMBOL | DESCRIPTION |
|---------------------|-------------------------|
| (Green line) | PROPOSED LAND FILL SITE |
| (Blue line) | EXISTING DRAIN |
| (Orange line) | APPROACH ROAD (R.T.) |
| (Black line) | COMPOSITE PLANT |
| (Circle with cross) | SPOT HEIGHT |
| (Dashed line) | CONTOUR |
| (Arrow) | DRAINAGE DIRECTION |

REVISIONS:

| NO. | DESCRIPTION | DATE |
|-----|-------------|------|
| | | |

PREPARED BY: G. R. SINGH
CHECKED BY: M. K. SINGH
DATE: 10/01/2018

PROJECT: LAND FILL SITE AT AGRA, U.P.

CLIENT: G. R. SINGH & CO., AGRA, U.P.

SCALE: 1:1000

DATE OF ISSUE: 10/01/2018

PROJECT NO.: G. R. SINGH/2017/01/01

PROJECT LOCATION: AGRA, U.P.

PROJECT AREA: 11.84 HA

PROJECT PERIOD: 12 MONTHS

PROJECT BUDGET: 10000000000

PROJECT STATUS: ON GOING

PROJECT CONTACT: 9896000000

PROJECT WEBSITE: WWW.GRSINGH.CO.UK

PROJECT EMAIL: GRSINGH@GMAIL.COM

PROJECT ADDRESS: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT PHONE: 9896000000

PROJECT FAX: 9896000000

PROJECT CHARTER: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT TERMS: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT CONDITIONS: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT AGREEMENT: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT DISPUTE: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT TERMINATION: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT CANCELLATION: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT RESIGNATION: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT WITHDRAWAL: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT SURRENDER: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT ASSIGNMENT: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT DELEGATION: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT SUBCONTRACTING: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT ASSIGNMENT: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT DELEGATION: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

PROJECT SUBCONTRACTING: 10/10, 1st Floor, Community Centre, Saksham Enclave, New Delhi, INDIA

Appendix 3: Rapid Environmental Assessment (REA) Checklist

Instructions:

- ❖ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department.
- ❖ This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- ❖ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.
- ❖ Answer the questions assuming the “without mitigation” case. The purpose is to identify potential impacts. Use the “remarks” section to discuss any anticipated mitigation measures.

Country/Project Title: India/Construction of Landfill at Village Noh in Bharatpur.

| SCREENING QUESTIONS | | Yes | No | REMARKS |
|---------------------|--|-----|----|--|
| A. | Project Siting | | | |
| | Is the project area | | | |
| ♦ | Densely populated ? | | ✓ | The proposed Sanitary Landfill site is not located near densely populated area. |
| ♦ | Heavy with development activities? | | ✓ | There is no developmental activities sited near the proposed site and which is about 6.5 kms away from the town. |
| ♦ | Adjacent to or within any environmentally sensitive area | | | The Bharatpur Bird Sanctuary, a UNESCO World Heritage site, is located 4 km from the STP site. According to the Bharatpur Bird Sanctuary Management Plan, the identified buffer zone is 500 meters from the periphery of the bird sanctuary and all activities beyond this range are acceptable. |
| | • Cultural heritage site | ✓ | | A very ancient statue of "Yaksha"(Colossal Image of Yaksha commonly called as Yaksha Temple) is located 596 m away from the site which has been declared as protected and heritage statue by government of India (Archeological survey of India) |

| SCREENING QUESTIONS | | Yes | No | REMARKS |
|------------------------------|--|-----|----|--|
| • | Protected Area | ✓ | | Keoladeo Bird Sanctuary is about 4.5 km from the subproject site. |
| • | Wetland | | ✓ | The nearest wetland (11 km ² of marshes) is located inside the Bharatpur Bird Sanctuary. |
| • | Mangrove | | ✓ | No mangroves in Bharatpur. |
| • | Estuarine | | ✓ | No estuarine in Bharatpur. |
| • | Buffer zone of protected area | | ✓ | Distance is more than the 500-m buffer zone. |
| • | Special area for protecting biodiversity | ✓ | | The Bharatpur Bird Sanctuary (total area: 29 km ²) hosts more than 300 species of birds and animals. |
| • | Bay | | ✓ | Bharatpur is not located in a coastal area. |
| B. | Potential Environmental Impacts | | | |
| Will the Project cause | | | | |
| ◆ | impacts associated with transport of wastes to the disposal site or treatment facility | ✓ | | Collection routes are congested and narrow in many places, and the landfill site is located far from town. Anticipated impacts during operation include community safety and generation of litters along the routes. Mitigation measures are included in the EMP. |
| ◆ | impairment of historical/cultural monuments/areas and loss/damage to these sites? | | ✓ | The land fill site is very close to the Noh where archaeological protected monument site (596 m away) but will be not impacted from development of SLF. A protocol will be developed in consultation with the Archaeological Survey of India (ASI) to ensure mitigation measures are in place in case of chance finds. |
| ◆ | degradation of aesthetic and property value loss? | | ✓ | The subproject will improve present condition of indiscriminate waste dumping. |
| ◆ | nuisance to neighboring areas due to foul odor and influx and insects, rodents, etc.? | | ✓ | The Operation and Maintenance (O and M) Manual, which will be developed as part of the subproject, will include vermin control. |
| ◆ | dislocation of involuntary resettlement of people | | ✓ | All sites are government-owned lands. |

| SCREENING QUESTIONS | | Yes | No | REMARKS |
|---------------------|---|-----|----|---|
| ♦ | public health hazards from odor, smoke from fire, and diseases transmitted by flies, insects, birds and rates? | | ✓ | No anticipated developments in the landfill area for the next 20 years. Maintenance for collection bins in the town area will be included in the O and M manual |
| ♦ | deterioration of water quality as a result of contamination of receiving waters by leachate from land disposal system? | | ✓ | The geo-membrane, high density polyethylene (HDPE), and clay landfill liners have been designed in accordance to India Municipal Solid Waste (MSW) Rules, 2000 and Central Public Health and Environmental Engineering Organisation (CPHEEO) Manual on MSW. |
| ♦ | contamination of ground and / or surface water by leachate from land disposal system? | | ✓ | Leachate will be collected in the tank and recirculated to the active cells of the landfill. |
| ♦ | land use conflicts? | | ✓ | No change in land use classification. The landfill site is government-owned. Surrounding barren vacant lands are also owned by the government. |
| ♦ | pollution of surface and ground water from leachate coming from sanitary landfill sites or methane gas produced from decomposition of solid wastes in the absence of air, which could enter the aquifer or escape through soil fissures at places far from the landfill site? | | ✓ | Leachate (maximum of 13 m ³ per day during monsoon period) will be collected in the tank and recirculated to the active cells of the landfill. Gas vents have been included in the landfill design to purge, and flare if necessary, any gases that will be produced. |
| ♦ | inadequate buffer zone around landfill site to alleviate nuisances? | | ✓ | A landfill buffer zone/greenbelt, as prescribed in Central Pollution Control Board (CPCB) norms, has been included in the design. |
| ♦ | social conflicts between construction workers from other areas and community workers? | | ✓ | Local labours will be given priority in employment. |
| ♦ | road blocking and/or increased traffic during construction of facilities? | | ✓ | Landfill site: no settlement within 5 km Collection bins: limited only to 1 m ² areas in and around the town |
| ♦ | noise and dust from construction activities? | | | Temporary and short-term. Mitigation measures included in the EMP. |

| SCREENING QUESTIONS | | Yes | No | REMARKS |
|---------------------|--|-----|----|--|
| ♦ | temporary silt runoff due to construction? | | ✓ | Civil works will be scheduled during dry season. Management of quarry sites, stockpiles, storage areas, and disposal areas for materials that may cause soil erosion/silt run-off are included in the EMP. |
| ♦ | hazards to public health due to inadequate management of landfill site caused by inadequate institutional and financial capabilities for the management of the landfill operation? | | ✓ | O and M for the first 5 years of operation and capacity building are included in the subproject. Thereafter will be the responsibility of BNP. |
| ♦ | emission of potentially toxic volatile organics from land disposal site? | | ✓ | BNP will construct a composting facility (not included in the subproject) to ensure that only non-biodegradable and residual wastes will be landfilled. Thus expected generation of toxic organic gases is low. Nevertheless, gas management (collection, flaring if needed, and monitoring) is included in the EMP. |
| ♦ | surface and ground water pollution from leach ate and methane gas migration? | | ✓ | Landfill liner, leachate, and gas management systems have been designed to prevent water pollution and gas migration |
| ♦ | loss of deep-rooted vegetation (e.g. tress) from landfill gas? | | ✓ | No deep-rooted vegetation in the proposed landfill site. |
| ♦ | explosion of toxic response from accumulated landfill gas in buildings? | | ✓ | Gas vents have been included in the design to prevent accumulation of landfill gases. |
| ♦ | contamination of air quality from incineration? | | ✓ | Not applicable. |
| ♦ | public health hazards from odour, smoke from fire, and diseases transmitted by flies, rodents, insects and birds, etc.? | | ✓ | O and M Manual will include vermin control and emergency (fire and explosion) management. |
| ♦ | health and safety hazards to workers from toxic gases and hazardous materials in the site? | | ✓ | O and M Manual will include occupational health and safety. Workers will be (i) required to undergo H and S training; and (ii) provided with personal protective equipment. |

Appendix 4: Disposal Standards for Treated Leachate

| Sr. No. | Parameter | Standards (Mode of Disposal) | | |
|---------|--|------------------------------|---------------|---------------|
| | | Inland Surface Water | Public Sewers | Land Disposal |
| 1 | Suspended solids, mg/1, Max | 100 | 600 | 200 |
| 2 | Dissolved solids (inorganic) mg/1 | 2100 | 2100 | 2100 |
| 3 | pH | 5.5 to 9.0 | 5.5 to 9.0 | 5.5 to 9.0 |
| 4 | Ammonical nitrogen (as N), mg/1 | 50 | 50 | - |
| 5 | Total Kjeldahl nitrogen as N, mg/1 | 100 | - | - |
| 6 | BOD in mg/1 (3 days @ 27°C) | 30 | 350 | 100 |
| 7 | Chemical oxygen demand, mg/1 | 250 | - | - |
| 8 | Arsenic (as As), mg/1 max | 0.2 | 0.2 | 0.2 |
| 9 | Mercury (as Hg) mg/1, max | 0.01 | 0.01 | |
| 10 | Lead (as Pb), mg/1, max | 0.1 | 1.0 | |
| 11 | Cadmium (as Cd) mg/1 max | 2.0 | 1.0 | |
| 12 | Total chromium as Cr, mg/1 | 2.0 | 2.0 | |
| 13 | Copper as Cu, mg/1 | 3.0 | 3.0 | |
| 14 | Zinc A as Zn, mg/1 | 2.0 | 15.0 | |
| 15 | Nickel as Ni, mg/1 | 3.0 | 3.0 | |
| 16 | Cyanide as CN, mg/1 | 0.2 | 2.0 | 0.2 |
| 17 | Chloride as Cl, mg/1 | 1000 | 1000 | 600 |
| 18 | Fluoride as F, mg/1 | 2.0 | 1.5 | - |
| 19 | Phenolic compounds (C ₆ H ₅ OH) mg/1 | 1.0 | 5.0 | - |

Source MSW (Management and Handling) Rules, 2000

Water Quality Standards for Surface and Ground Water Quality Monitoring

| Sr. No. | Parameters | IS 10500:1991 Desirable Limit |
|---------|--|-------------------------------|
| 1 | Arsenic, mg/1 | 0.05 |
| 2 | Cadmium (as Cd) mg/1 | 0.01 |
| 3 | Chromium, mg/l | 0.05 |
| 4 | Copper as Cu, mg/1 | 0.05 |
| 5 | Cyanide as CN, mg/1 | 0.05 |
| 6 | Lead (as Pb), mg/1, | 0.05 |
| 7 | Mercury (as Hg) mg/1 | 0.001 |
| 8 | Nickel as Ni, mg/1 | - |
| 9 | Nitrate as NO ₃ , mg/l | 45 |
| 10 | pH | 6.5 - 8.5 |
| 11 | Iron, mg/l | 0.3 |
| 12 | Total Hardness (as CaCO ₃), mg/l | 300 |
| 13 | Chloride as Cl, mg/1 | 250 |
| 14 | Dissolved solids, mg/1 | 500 |
| 15 | Phenolic compounds (as C ₆ H ₅ OH), mg/1 | 0.001 |
| 16 | Zinc A as Zn, mg/1 | 5 |
| 17 | Sulphate (as SO ₄), mg/l | 200 |

Source MSW (Management and Handling) Rules, 2000

Ambient Air Quality Standards

| Sr. No. | Parameters | Acceptable Level |
|---------|------------------------------|--|
| 1 | Sulfur dioxide | 120 µg/m ³ (24 hours) |
| 2 | Suspended particulate matter | 500 µg/m ³ (24 hours) |
| 3 | Methane | ≤ 25 % of the lower explosive limit (650 mg/m ³) |
| 4 | Ammonia (24 hour average) | 0.4 mg/m ³ (400 µg/m ³) |
| 5 | Carbon Monoxide | 1 hour average: 2 mg/m ³ 8 hour average: 1 mg/m ³ |

Source MSW (Management and Handling) Rules, 2000

Appendix 5: Suggested Outline for Bharatpur Engineered Landfill Operation and Maintenance (O and M) Manual

- I. Introduction
- II. Purpose of the Manual
 - A. Purpose and Scope of the Manual
 - B. Limitations
 - i. Owner's Responsibility
 - ii. Operator's Responsibility
 - C. Organizational Structure
- III. Landfill Design and Operation
 - A. General
 - B. Basis of Design
 - i. Master Design
 - a. Description of Facilities
 - b. Landfill Containment System
 - c. Final Cover Design
 - ii. Cell and Liner Construction
 - iii. Monitoring Systems
 - a. Groundwater Monitoring
 - b. Landfill Gas Monitoring
 - c. Surface Water Monitoring (Effluent and Receiving Body)
 - C. Operations Plan
 - i. Landfill Phasing and Life
 - ii. Landfill Operations
 - a. Basic Landfill Operation
 - 1. Initial Load Inspection
 - 2. Refuse Unloading
 - 3. Spreading of Refuse
 - 4. Refuse Compaction
 - 5. Refuse Lift and Daily Cover
 - 6. Interim (Intermediate) Cover
 - 7. Final Cover
 - b. Basic Landfill Equipment
 - 1. Spreading of Refuse
 - 2. Refuse Compaction
 - 3. Landfill Cover
 - c. Equipment Maintenance
 - d. Wet Weather Operations
 - 1. Access to Working Area
 - 2. Wet Weather Tipping Pads
 - e. Grade Control
 - 1. General
 - 2. Landfill Survey Staking
 - 3. Periodic Topographic Surveying
 - 4. Volume Calculations
 - D. Landfill Closure and Post-Closure
 - i. Closure Plan
 - ii. Closure Procedures

- iii. Post-Closure Maintenance and Monitoring
- IV. Environmental Control and Mitigation
 - A. Leachate Control
 - i. Leachate Removal
 - ii. Leachate Storage
 - iii. Leachate Recirculation/Treatment
 - B. Dust Control
 - i. Dust Control Within the Landfill Footprint (Active Areas)
 - ii. Dust Control Outside the Landfill Footprint
 - iii. Using Leachate for Dust Control
 - C. Litter Control
 - i. Litter Fence
 - ii. Other
 - D. Vector Control
 - i. Rodent Control
 - ii. Fly Control
 - E. Odor Control
 - i. Odor from Incoming Refuse
 - ii. Odor from In-place Refuse
 - iii. Odor from Leachate Tank
 - F. Noise Abatement
 - G. Bird Control
 - i. Cover Soil Placement
 - ii. Monofilament Line Shield
 - iii. Anti-Perch Strips
 - iv. Predator Decoys
 - v. Acoustic Controls
 - H. Other Controls
 - i. Erosion Control
 - 1. Slope Damage
 - 2. Exposed Garbage
 - 3. Downstream Sedimentation
 - I. Periodic Routine Inspections
- V. Emergency Management
 - A. Types of Emergencies
 - B. Emergency Management and Contingency Plan
 - C. Emergency Response
 - i. Unauthorized Loads
 - ii. Hazardous, Toxic, and Infectious Wastes
 - iii. Spills
 - iv. Fire
 - v. Earthquake
 - vi. Inclement Weather
 - vii. Other Emergencies
- VI. Environmental Monitoring and Inspection
 - A. Groundwater Monitoring
 - i. Sampling and Analysis – Procedures, Parameters, and Frequency
 - ii. Monitoring Well Inspection
 - B. Leachate Monitoring

- i. Leachate Sump Level Monitoring
 - ii. Leachate Storage Tank Monitoring
 - iii. Leachate Discharge Sampling and Analysis – Procedures, Parameters, and Frequency
 - C. Surface Water Monitoring (Effluent and Receiving Body)
 - i. Sampling and Analysis – Procedures, Parameters, and Frequency
 - D. Gas Monitoring
 - i. Landfill Perimeter Probe Monitoring
 - ii. Confined Spaces
 - C. Other Monitoring
- VII. Landfill Safety Procedures
 - A. Site Specific Procedures
 - i. Fire and Explosion Prevention
 - ii. Unauthorized Loads
 - iii. Toxic and Hazardous Waste Exposures
 - iv. Hazardous Material Handling
 - v. Employee Health and Safety
 - vi. Baseline Health Monitoring
 - vii. Routine Health Monitoring
- VIII. Annexes and Other Relevant Information
 - A. Master Plan Drawings
 - B. Environmental Quality Standards
 - C. Monitoring Checklists

Appendix 6: Public Consultation

Issues discussed

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

Date & time of Consultation 16.03.10, 02.45 pm

Location - Noh village

Table: Issues of the Public Consultation: Design phase

| Sr. No. | Key Issues/Demands | Perception of community |
|---------|--|---|
| 1 | Awareness of the project – including coverage area | People know the project. It is a part of Municipal Solid Waste management project |
| 2 | In what way they may associate with the project | They do not like to associate with the project |
| 3 | Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area | No such area. The area is surrounded by agriculture land |
| 4 | Presence of historical/ cultural/ religious sites nearby | 600 m from the land fill site with in the Naoh village one monument has been declared as Protected monument by archaeological survey of India. |
| 5 | Un favourable climatic condition | As per local people climatic condition is not a big problem but wind direction is a big problem for them because it carries bad smell and odour. Even some time difficult for them to work in the field. |
| 6 | Occurrence of flood | The area is not flood prone area but due to bad drainage provision by the land fill site authority some houses get flooded during heavy monsoon and houses get badly damaged. |
| 7 | Drainage and sewerage problem facing | Some part of the village facing drainage problem due to the existing land fill site drainage system. The area is not flood prone area but due to bad drainage provision by the land fill site authority some houses get flooded during heavy monsoon and houses get badly damaged |
| 8 | Present drinking water problem – quantity and quality | Problem of quantity and quality not reported by any body. |
| 9 | Present solid waste collection and disposal problem | Local villagers are not concern about their collection and disposal of solid wastes, because wastes are not collected properly from their house holds. |

| Sr. No. | Key Issues/Demands | Perception of community |
|---------|---|---|
| 10 | Availability of labour during construction time | Local labours are available for construction works. |
| 11 | Access road to project site | Good access road to the project area from the village connectivity road has been provided. |
| 12 | Perception of villagers on tree felling and afforestation | There is no tree felling activity in this project .People are very much interested for afforestation program on the land fill site. |
| 13 | Dust and noise pollution and disturbances during construction work | This is not a problem |
| 14 | Setting up worker camp site within the village/ project locality | Not applicable for this project |
| 15 | Safety of residents during construction phase and plying of vehicle for construction activities | Villagers are concern of the safety aspects of the movement of the vehicles during construction of the site. |
| 16 | Conflict among beneficiaries down stream users – water supply project using of river water | Not applicable |
| 17 | Requirement of enhancement of other facilities | Enhancement of road condition and proper management of land fill site especially rodents, flies, mosquitoes and plastics. |
| 18 | Whether local people agreed to sacrifice their lands (cultivable or not) for beneficial project after getting proper compensation | Land is government land. |

NAME AND POSITION OF PERSONS CONSULTED

1. Balbeo : villager
2. Jagadish : villager
3. Anjani Kumar : villager
4. Vishmdeo : villager
5. Harcharan : villager
6. Rumni devi: villager
7. Minakshi devi :villager

Summary of out come:

The proposed land fill site is close to the settlements like Noh, Asthaban nagala, Lodha nagla and Mehendibag (900- 1000 m from landfill site). So development of landfill site will have some impact on aesthetic and property values of these settlements. Village Naoh is closer to the land fill site. The site is surrounded by agriculture field. The land fill site is very close to the Colossal Image of Yaksh (Yaksh Temple) archaeological protected monument site (600 m away) but will be not impacted from development of SLF People of Noh are facing some problems during transportation of the wastes, bad smell and odour, rodents from the land fill site damaging the crops, plastics creating problems for the

farmland and cattle. Inadequate drainage is creating problem for the villagers during rain and some house are already damaged. Proper drainage arrangement is required along the development of landfill site.

Appendix 7: Recommended Contract Clauses

- A. Sources of Materials
- (i) Use quarry sites and sources permitted by government;
 - (ii) Verify suitability of all material sources and obtain approval of Investment Program Implementation Unit (IPIU);
 - (iii) If additional quarries will be required after construction has started, obtain written approval from IPMU; and;
 - (iv) Submit to DSC on a monthly basis documentation of sources of materials.
- B. Air Quality
- (i) Consult with IPIU/DSC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
 - (ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
 - (iii) Measurement of air quality at sub-project locations as per EMP
 - (iv) Use tarpaulins to cover sand and other loose material when transported by trucks; and
 - (v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.
- C. Surface Water Quality
- (i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
 - (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with IPIU/DSC on designated disposal areas;
 - (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
 - (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
 - (v) Dispose any wastes generated by construction activities in designated sites; and
 - (vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP).
- D. Noise Levels
- (i) Plan activities in consultation with IPIU/DSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
 - (ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
 - (iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and
 - (iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.
 - (v) Measurement of noise levels at sub-project locations as per EMP
- E. Existing Infrastructure and Facilities
- (i) Obtain from IPIU and/or DSC the list of affected utilities and operators;
 - (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of services; and
 - (iii) Develop and implement an Asbestos Cement Pipes Management Plan
- F. Accessibility
- (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
 - (ii) Schedule transport and hauling activities during non-peak hours;
 - (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
 - (iv) Keep the site free from all unnecessary obstructions;

- (v) Drive vehicles in a considerate manner;
- (vi) Coordinate with Bharatpur Municipal Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; and
- (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

G. Landscape and Aesthetics

- (i) Prepare and implement Waste Management Plan;
- (ii) Recover used oil and lubricants and reuse or remove from the sites; (iii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (iv) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and
- (v) Request IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

H. Socio-Economic – Income

- (i) Leave spaces for access between mounds of soil;
- (ii) Provide walkways and metal sheets where required to maintain access across trenches for people and vehicles;
- (iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools;
- (iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and
- (v) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

I. Socio-Economic – Employment

- (i) Employ at least 50% of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and
- (ii) Secure construction materials from local market.

J. Occupational Health and Safety

- (i) Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- (iii) Provide medical insurance coverage for workers;
- (iv) Secure all installations from unauthorized intrusion and accident risks;
- (v) Provide supplies of potable drinking water;
- (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;
- (vii) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;

- (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
 - (x) Ensure moving equipment is outfitted with audible back-up alarms;
 - (xi) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and
 - (xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
- K. Asbestos Cement Pipes
- (i) Train all personnel (including manual labourers) to enable them to understand the dangers of AC pipes and to be able to recognise them in situ;
 - (ii) Report to management immediately if AC pipes are encountered;
 - (iii) Develop and apply AC Management Plan.
- J. Community Health and Safety.
- (i) Plan routes to avoid times of peak-pedestrian activities.
 - (ii) Liaise with IPIU/DSC in identifying high-risk areas on route cards/maps.
 - (iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
 - (iv) Provide road signs and flag persons to warn of dangerous conditions.
- L. Work Camps
- (i) Consult with IPIU/DSC before locating project offices, sheds, and construction plants;
 - (ii) Minimize removal of vegetation and disallow cutting of trees;
 - (iii) Provide water and sanitation facilities for employees;
 - (iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;
 - (v) Train employees in the storage and handling of materials which can potentially cause soil contamination;
 - (vi) Recover used oil and lubricants and reuse or remove from the site;
 - (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
 - (viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and
 - (ix) Request IPIU/DSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.
- M. Social and Cultural Resources
- (i) Strictly follow the protocol for chance finds in any excavation work;
 - (ii) Request IPIU/DSC or any authorized person with archaeological field training to observe excavation;
 - (iii) Stop work immediately to allow further investigation if any finds are suspected; and
 - (iv) Inform IPIU/DSC if a find is suspected, and take any action they require ensuring its removal or protection in situ.