

**BEFORE THE NATIONAL GREEN TRIBUNAL**

**PRINCIPAL BENCH, NEW DELHI**

**Original Application No. 199 of 2014**

**IN THE MATTER OF:**

**Almitra H. Patel & Anr.**

....Petitioner

Versus

**Union of India & Ors.**

....Respondent

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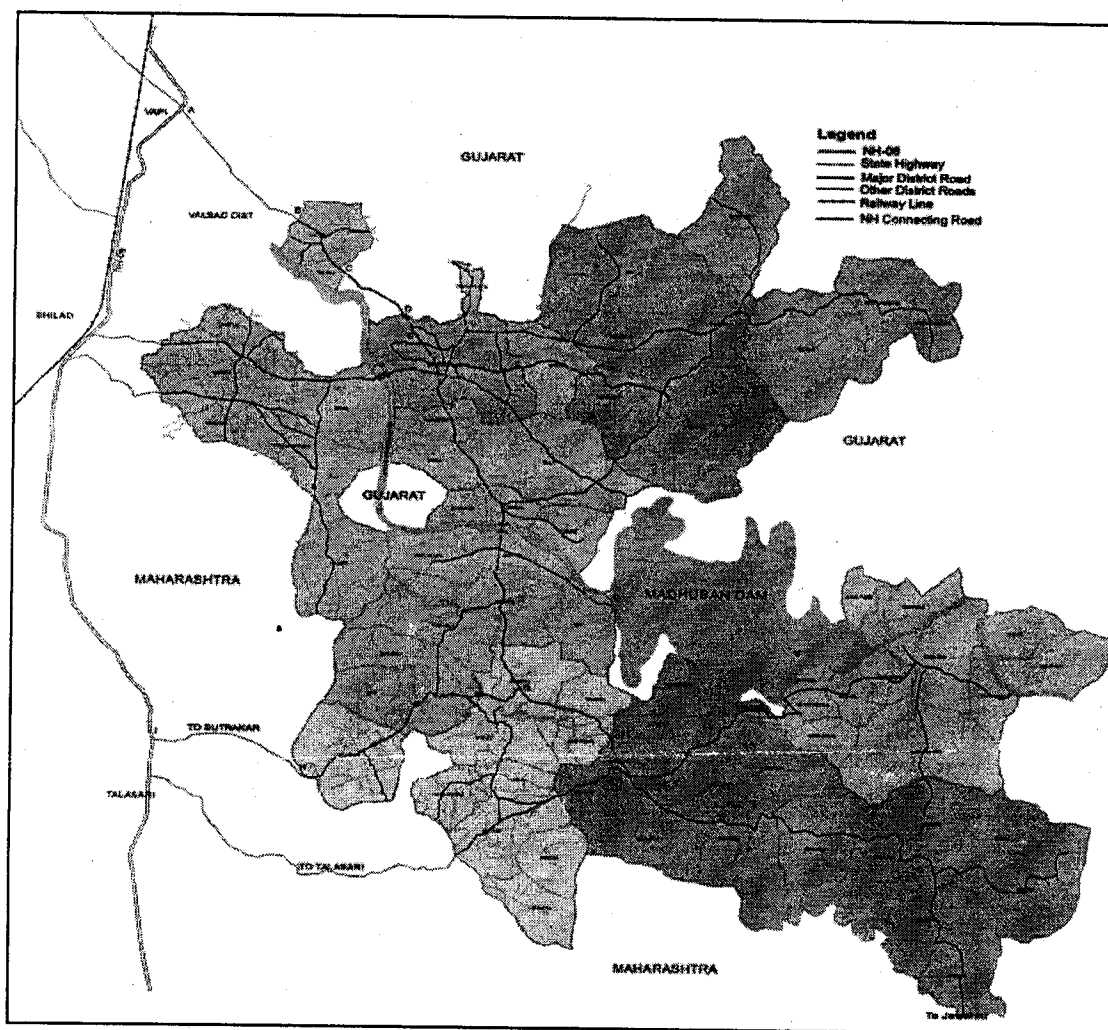
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Yours faithfully,

*Aditi Tomar*

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## U.T. ADMINISTRATION OF DADRA AND NAGAR HAVELI



# MODEL MUNICIPAL SOLID WASTE MANAGEMENT PLAN- 2015 FOR DADRA AND NAGAR HAVELI DISTRICT

UT of Dadra and Nagar Haveli  
April, 2015

## MSW Management Plan For Dadra and Nagar Haveli

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## 1. BACKGROUND

1. The Urban Development Department UT of Dadra & Nagar Haveli, has taken initiatives for implementation of solid waste management programme in Rural areas of Dadra & Nagar Haveli District and up-gradation & systematization of Silvassa Municipal Council Urban waste by establishment of centralized waste processing & disposal facility.
2. M/S BVG India Ltd, Pune has been issued a letter of intent / Work Order vide letter No.DP/DPO/Sanitation/2012/289, dated.19/04/2014 by the District Panchayat, Dadra & Nagar Haveli to implement the Solid Waste Management project in UT of Dadra & Nagar Haveli (Annexure-I).
3. The population of Dadra & Nagar Haveli district as per census 2011 is 343709 Out of which 183114 persons reside in rural areas and 160595 persons in the Urban areas of Dadra & Nagar Haveli.
4. There are 76458 households in Dadra & Nagar Haveli out which in rural area there are 36094 households and in urban area there are 40364 households. This comes to Average 5.00 persons per house.
5. Total geographical area of the Dadra & Nagar Haveli is 491.000 Sq Km, Out of which area under different categories of use is as following:

Residential / Residential Commercial (Mixed):	33.15 Sq Km
Industrial :	53.03 Sq Km
Public / Semi Public :	06.75 Sq Km
Recreation & Tourism Zone :	04.14 Sq Km
Transportation :	16.15 Sq Km
Green Zone (G1) :	89.05 Sq Km
Green Zone (G2) :	37.22 Sq Km

**MSW Management Plan For Dadra and Nagar Haveli**

Water Body	:	23.83 Sq Km
NDZ	:	24.02 Sq Km
Forest	:	203.21 Sq Km

6. Due to highly scenic, natural beauty, and river bodies, Dadra & Nagar Haveli attracts over 5 lakh tourists every year. This tourism holds further more potentials as an anchor to the local economy.

7. Silvassa Municipal Council continue their C&T operations on their own or through contractual arrangements or even may involve the above selected agency as & when they feel it appropriate.

## **2 EXISTING STATUS IN RESPECT OF MUNICIPAL WASTE**

There is only one Urban local body namely Silvassa Municipal Council (SMC) in U.T of Dadra & Nagar Haveli. The total Population of Silvassa Municipal Council is 98265 as per census 2011 the total Municipal Waste of Silvassa Municipal Council area is estimated about 35-40 M.T per day. At present the Collection, Transportation and Dumping of the waste is being done by the Silvassa Municipal Council through outsourced agency as well as through their Sanitary Workers.

### 3. STEP ALREADY BEEN TAKEN FOR IMPLEMENTATION

#### A) Preparation of Detailed Project Report (DPR):

- Project Cost is Rs.14.50 Cr. has been approved
- Collection, Storage & Transportation Processing treatment and recovery of Products disposal of remnants in SLF.
- Project Site(s): The land is available at Naroli Panchayat of Survey No.214 and 216 admeasuring 5.27 hectare of village Kharadpada of Dadra & Nagar Haveli District.

#### B) Selection of Bidder/ Project Developer:

Selection of bidder has already been done and also work order already been issued Vide letter No.DP/DPO/Sanitation/2012/289,dated.19/04/2014.

#### C) Start of Work of Collection & Transportation and Dumping (CT&D)

The Work of Collection, Transportation and Dumping of Solid Waste is already being done by the Silvassa Municipal Council through outsource agency as well as through their Sanitary Workers.

#### D) Start of Work of Construction of Processing & Disposal (P&D) Facilities

The work on Processing plant(RDF & Compost Plant) at village Kharadpada is expected to start by end of December, 2015 and is expected to take one year's time for its completion. The land bearing Survey No. 214 and 216 of village Kharadpada, DNH admeasuring an area 5.27 hectare for this purpose has already been allotted to the implementing agency i.e District Panchayat by the UT Administration.

#### 4. PROJECT EXECUTION MODE

1. The project is proposed to be executed under PPP mode.
2. Approved Project Cost is Rs. 1450 lac.

Private sector will invest 30% of the approved project cost i.e. Rs.435.00 lakh and Govt's contribution will be 70% i.e Rs. 1015.00 lacs.

Selected PPP Agency will be responsible for the following package components.

- Processing & Disposal (SLF) of entire waste from Dadra & Nagar Haveli Rural & Urban areas for 30 years.
- Collection & Transportation from Dadra & Nagar Haveli Rural & Urban areas for 30 years.



## **5. SALIENT FEATURES OF THE MSW MANAGEMENT PLAN THROUGH PPP:**

- Daily Door to Door Collection of waste.
- Segregation at source into Bio-degradable and Non-Biodegradable waste through two bin system to be preferred.
- Bin Free system to be adopted wherever feasible.
- Technology involving Refuse Derived Fuel (RDF), composting etc. would be employed.
- Not more than 20-25% waste would be allowed to be disposed of in the Engineered Sanitary Land Fill (SLF) sites.
- Multi tier management system: Monitoring committees and implementation cells at cluster and local level; an independent expert agency and an independent engineer to monitor the projects.
- Green belt surrounding the processing plant

## 6. THE MSW OPERATION PLAN:

Broadly, the MSW Operation Plan involves:

- Door to door collection of MSW;
- Transportation;
- Segregation and Processing;
- Scientific Disposal in Sanitary Landfill Facility.

### 6.1 Door to door collection

- 6.1.1 The waste from House hold will be collected through 240 Ltr. Bins and vehicles like LCV etc.
- 6.1.2 The entire Dadra & Nagar Haveli District would be divided into zones and the zones should be further divided into beats.
- 6.1.3 The door to door collection will be done from 7.30 AM to 1.30 PM. However, the exact timings will be decided mutually by the Authority and the Bidder.
- 6.1.4 Depending upon the population of the city and no. of commercial/ institutional establishments, approximately 200-400 no. of litter bins of capacity 240 litres will also be placed at designated locations for keeping the waste generated from street sweepings.
- 6.1.5 Depending upon the population of the city approximately 60-100 workers will be deployed by the Company for carrying out the above mentioned work of door to door collection and transportation of waste up to the processing facility.
- 6.1.6 The above quantities may vary depending upon the actual working design, routing and scheduling finalized mutually by the Concessioneing Authority and the Concessionaire (Bidder).

**MSW Management Plan For Dadra and Nagar Haveli**

- 6.1.7 The fleet of vehicles covering Tata Ace or Auto tipper about 800 to 1000 KG capacity covering approx. 2000 houses depending on the workload.
- 6.1.8 Community bins/; secondary collection points would be installed, if no door to door collection is possible in certain areas like congested narrow lanes or slums residents would be made aware of putting their wastes into the bins in segregated manner as specified.
- 6.1.9 Wherever it is feasible Container Free / Bin-less system will be adopted by eliminating the secondary collection points and transporting door to door MSW to efficient MSW fleet like Refuse Compactor with a carrying capacity of 8-11 tonne/vehicle, as per the city then directly transporting the MSW to Transfer Station/ Processing Site as the case may be.
- 6.1.10 Incentives to put dry and wet waste in a separate dustbin by the Urban Local Body (ULB).
- 6.1.11 Education to residents about the need for waste segregation and mode of waste collection and transportation.

**6.1A Other Collection**

- Collection of bio-medical waste should be done in accordance with the rules/direction contained in the Ministry of Environment and Forests, Govt of Indi Notification dated.20<sup>th</sup> July 1998.
- Use of thermo plastic instead of multilayer plastic with the help of concern / appropriate authority.

**6.2 Regulatory Measures for Waste Generators**

**6.2.1 Residents**

Following would be regulated by existing Municipal law and penal action against all the waste generators including households,

restaurants, hotels shops offices, institutions, workers will be levied, in case of defaults. The U.T. Administration of Dadra & Nagar Haveli will regulate the following activities:

- They will not throw any solid waste in their neighbourhood, on the street, open spaces and vacant plots or into drains.
- They will (a) keep the food waste / bio-degradable as and generated, in any type of domestic waste container, with a cover, and (b) keep dry / recyclables wastes in bags or sacks.
- Wet waste will not be disposed of in plastic carry bags.

#### **6.2.2 Vegetable/Fruit Market Waste**

- Large size closed containers with lid or skips would be used for storage of waste in vegetable/fruit market.
- Waste from the shops/fruit market/vegetable market would be removed on a daily basis though Private party selected through MSW-PPP mode.
- Large closed containers kept in the fruit and vegetable markets would be removed during night time or non-peak hours and the waste from meat and fish markets would also be collected in closed containers and picked up by engaging a private party by the local body.

#### **6.2.3 Marriage Hall/Kalyan Mandaps/Community Halls**

- Suitable containers with lids which may match with the primary collection or transportation system of Private Party would be provided by these establishment at their cost and would be directly transported to a finalized place by Private party till the processing facility is not operational. Collection of Waste from marriage halls kalyan mandaps, community halls, etc. would be made on a daily basis on a full-cost recovery basis. The cost of such collection would be built into the

## MSW Management Plan For Dadra and Nagar Haveli

charges for utilizing such halls/ collected by Private Party from such halls on the charges fixed by the U.T. Administration of Dadra & Nagar Haveli.

### 6.2.4 Construction & demolition Wastes

- Construction & Demolition Waste would be collected separately from MSW.
- The Charges/ rates per tonne for C&D collection waste would be fixed and would be levied from the person, who is producing C&D.
- C&D waste from small quantity generators (<2 Tonne) arising from repair/minor renovation/small construction work may be transported to designated locations in the city and the charges may be collected by MSW C&T PPP service provider at a volumetric rates fixed by ULB. Waste Generators have to pay directly to PPP service provider. Large quantity generators or their demolition/construction contractors can transport the waste at their own cost and pay per tonne charges to MSW-C&D PPP service provider at the rates fixed by Local Body.
- A separate site would be designated for collection of C&D Waste.
- Looking at the generation of C&D waste in UL of Silvassa District (Silvassa Municipal Council), a separate agency (s) for collection & management of C&D waste may be selected and accordingly Processing Plants for C&D Waste may be planned.

### 6.2.5 Garden Waste

- Horticulture waste would be collected in separate vehicles
- Wherever the waste quantity is high, separate charges for Horticulture waste would be fixed and charged from the private gardens/lawn plots.
- Private party would collect the horticulture waste and would be allowed to run a compost plant.

## MSW Management Plan For Dadra and Nagar Haveli

- In case of private parks, gardens and lawn plot etc., it would be stored in the premises and kept ready for handing over to the MSW-PPP party and the waste be processed accordingly.

### **6.2.6 Provision of Litterbins on Streets in Public Places**

- With a view to ensure that streets and public places are not littered with waste materials such as used cans, cartons of soft drinks, used bus tickets, wrappers of chocolates or empty cigarette cases and the like generated while on a move. Litter bins would be provided on important streets, markets, public places, tourist spots, bus and railway stations, large commercial complexes etc.
- Similar bin for disposal of animal droppings would be placed in posh areas.
- Removal of waste from these litterbins would be done by MSW-C&T PPP partner.
- Advertisement rights on the bins for a specified period or by allowing them to put their names on the bins as a sponsor may be given to the Private Partner.
- Litterbins would be put in push as well as poor area in the proportion decided by allocation plan of Private Partner and Urban Local Bodies.

### **6.3 Management of Storage Points in the city**

- All the wastes collected through Primary Collection System from the households shops and establishments would be taken to the processing or disposal site either directly necessitating a large fleet of vehicles and manpower or through cost effective systems which are designed to ensure that all the waste collected from the sources of waste generation is transported within reasonable time.

### MSW Management Plan For Dadra and Nagar Haveli

- Out of 100 %, maximum of 10% of Storage Depots/Secondary Collection Points in a city would be allowed, where direct transferring of door to door waste to the larger fleet is not feasible. The storage facilities/ secondary collection point must not create unhygienic and unsanitary conditions around the waste bins. This means that it would be:
  - Out of reach of stray animals.
  - would not obstruct the traffic of spread on road.
  - Easily accessible in terms of distance for the user.
  - Fully covered and not exposed.
  - Able to hold the expected waste generated, depending on the size and population of the area.
  - Concrete / pucca structure with roofing, to prevent Vector and bird menace, under and adjoining areas of dustbins at Secondary Collection Points
  - Aesthetically acceptable.
  - Designed to be easy to operate, handle, transfer and transport.

### **6.4 TRANSPORTATION OF MUNICIPAL SOLID WASTE**

- Segregated transportation of segregated MSW would be ensured.
- Based on the requirement and availability of space, transfer stations would be planned and provided.
- Transportation of the waste at waste storage depots/ secondary collection points (which would be maximum 10%) is essential through covered vehicles to ensure that no garbage bin/container overflows and waste is not seen littered on streets.
- Waste would be transported in covered vehicles like Refuse compactor /dumper placer etc. The waste collected by Primary Collection vehicles would be directly transported to these covered vehicles at Waste Shifting Points.
- A route Plan for Primary and Secondary Collection System would be made

- Daily Transportation of Litter bins, before they start overflowing; if required twice or thrice a day.

## **6.5 Scientific MSW Processing and Safe disposal of MSW**

### **6.5.1.1 The Waste would be processed and disposed of as per the characterization and quantity of waste.**

- MSW-PPP will adopt suitable technology or combination of such technologies to make use of wastes so as to minimize the burden on landfills.
- The biodegradable wastes shall be processed by composting, vermin-composting, anaerobic digestion or any appropriate biological processing for stabilization of wastes as per the standards.
- Mixed waste containing recoverable resources will follow the route of recycling or other appropriate technologies.
- Land filling would be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.
- Maximum 20-25% of the total Waste reaching to the Processing Site would be land filled.

### **6.5.1.2 MSW PROCESSING/ TREATMENT TECHNIQUES**



MSW Management Plan For Dadra and Nagar Haveli

For selection of suitable processing technology several parameters are considered namely Indian experience, quantity and quality of waste, capital investments, scale of operation, Recurring expenditure, environmental impact etc.

**RECOMMENDED INTEGRATED WASTE PROCESSING TECHNOLOGY**

Based on the above criteria, Integrated MSW processing facility for the Dadra & Nagar Haveli District will comprise of:

- a) Compost plant with provision of Biogas plant
- b) RDF Plant

**(a) Compost Plant / Biogas Plant:** It is envisaged that processing rejects would be generated from the RDF plant which would further comprise of organic rejects which will be used for composting by Windrow method.

**(b) Pelletisation/Refuse Derived Fuel (RDF):** The raw MSW is processed for concentrating the combustible fraction of it by segregating the non-combustible portion. The complete process involves drying. Removal of non-combustibles by air separation (density separation, grinding or shredding of combustible fraction usually by a hammer mill, mixing and production of pellets under high pressure. The pellets can be transported easily and stored for many months without any disintegration. These pellets could be used for heating in the boilers and the generated steam, in turn, is used to produce power. Pellets also, can be used along with conventional fuels for industrial operations.

**6.6.1 Common sanitary waste disposal facility** would be planned for the safe disposal of processing rejects and non-biodegradable components of solid waste and it is envisaged that common sanitary landfill site would receive/accommodate about 20% of processing rejects and inerts per day from the total MSW processed at processing plant.

#### **6.6.2 Sanitary Land Fill Facility:**

Development of landfill site should be subjected to rigorous planning. Key elements in developing a common scientific landfill site for a cluster would comprise:

- Site Clearance,
- Sub-division of site into major operational phases,
- Progressive excavation for landfill earthworks,
- ordered development of operational phases in working land filling cells,
- advance preparation of the lining system on the landfill base,
- sequential infilling of land filling cells and operational phases and early and timely capping of land filled cells.

The following sections explain the broad specifications of developing each of the landfill components:

#### **6.6.3 Buffer Zones:**

A vegetative cover comprising of trees and shrubs will have to be provided as buffer zone between landfill site and the nearby localities. In addition to the buffer zone a compound wall/rigid fencing all round the land fill site to a height of 3m or as suitable, shall also to be constructed, to totally seclude the site from outside activities.

**6.6.4 Containment of Potential Pollutants:** Containment measures such as composite liners at the bottom and lateral sides of the landfill, and surface capping after the land filling is completed, are required to control the pollutants and mitigate subsequent impacts on environment.

**6.6.5 Surface Capping:** To minimize the ingress of water into the site after completion, it is proposed to form an engineered capping layer. This will comprise a multi layer system.

#### **6.6.6 Leachate Collection and Removal**

The leachate collection shall be achieved through the following measures:

- a. Gravity drainage and grading of the floor of the landfill cell to fall into a sump, located at the lowest point of the cell. The gradients shall be 2 per cent for main drainage with 1 per cent cross fall.
- b. Installation of leachate drainage blanket above the basal mineral liner over the floor of each cell and partially up the side walls, constructed of free drainage coarse granular fill comprising of graded 50mm crushed rock laid to a depth of 400mm with a permeability of  $1 \times 10^{-4}$  cm/sec.
- c. Inclusion of perforated HDPE pipes in the drainage blanket to facilitated leachate flow with pipes laid on a typical spacing of 50m.
- d. Overlaying granular drainage blanket with 100m thick free draining fine granular fills of medium to coarse sand to act as a filter and protective layer.
- e. Removal of leachate is effected by leachate collection chambers built up with successive lifts of waste and side slope risers located

- on the site perimeter.
- f. The submersible pumps or adductor pumps should be used to remove leachate from the sumps and the collection chambers should be linked by permanent pipe work to the treatment plant.
  - g. The precise methods and degree of treatment shall accommodate the fluctuations in leachate generation.

#### **6.6.7 Landfill Gas and Management**

The primary measures to restrict the uncontrolled migration of landfill gas from the site will comprise,

- Low permeability containment layers and systems installed on the base and side walls
- Permeable gas drainage blanket of 0.3m thickness laid beneath the capping layer and
- Vertical gas vents and extraction wells.

#### **6.6.8 Surface Restoration**

The landfill will be brought up to its pre-settlement level in stages and capped off in a program of progressive restoration, to limit the ingress of water into the site and to facilitate the control of landfill gas. The capping will be a composite structure comprising of four layers of an engineered seal designed to prevent water ingress and egress of landfill gas and an agricultural cap comprising of subsoil drainage layer.

A suitable vegetative cover will have to be established on the closed site to ensure slow surface runoff, promote evapo-transpiration of rainfall, retain moisture in the cap and enhance the formation of a soil structure in the agriculture soil.

#### **6.6.9 Other Measures**

## MSW Management Plan For Dadra and Nagar Haveli

Specific attention shall be paid to mitigate the following undesirable and potentially deleterious effects of:

- a) Litter blown from the disposal / tipping area
- b) Scavenging animals and insects attracted to the sites
- c) Flies and Bird attraction
- d) Odour arising out of waste deposition and degradation
- e) Dust from landfill operations
- f) Mud generated from waste, cover, capping materials and site excavation works
- g) Fire and smoke control and
- h) Noise of operating plant.

These effects can be minimized by providing local litter, arrestor, fencing, strategically placed in relation to the discharge point, erecting site security fencing for excluding scavenging animals, bird scaring techniques for avoiding bird nuisance, etc.

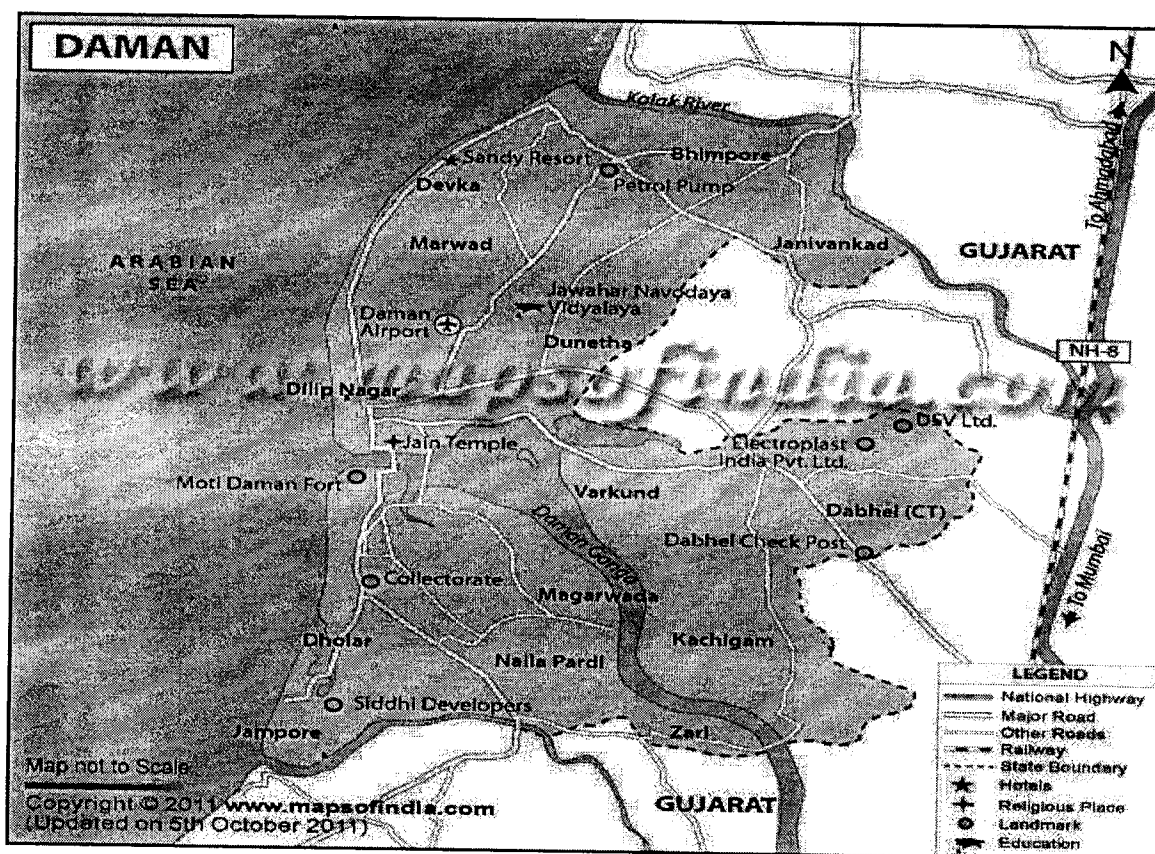
### **6.6.10 Operation and Maintenance**

The whole project shall be implemented in PPP Mode the agency shall be responsible for Collection, Transportation and Processing & Disposable of Solid Waste as well O & M for 30 years.

### **6.6.11 Redressal of Public Grievances:**

Since the project is being implemented for entire district having coverage of Rural and Urban area a public grievances would be attendant at the office of Chief Officer, Silvassa Municipal Council for Urban Area and at the office of the Chief Executive Officer, District Panchayat, Dadra & Nagar Haveli, Silvassa for Rural Area for effective implementation of the project.

# U.T. ADMINISTRATION OF DAMAN & DIU



## MODEL MUNICIPAL SOLID WASTE MANAGEMENT PLAN- 2015 FOR DAMAN DISTRICT

UT of Daman & DIU, Daman

April, 2015

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## 1. BACKGROUND

1. The Urban Development Department UT of Daman & Diu, Daman has taken initiatives for implementation of solid waste management programme in Rural areas of Daman District and up-gradation & systematization of Daman Municipal Council's Urban waste by establishment of centralized waste processing & disposal facility.
2. M/S JITF Urban Infrastructure Limited, Delhi has been appointed as a selected bidder.
3. Ground level field survey for MSW quantification and characterisation from all the 21 villages of Daman District as well as Daman Municipal Council's jurisdiction (Daman Urban) was undertaken during August & September 2013.
4. The population of Daman district as per census 2011 is 191173. Out of which 144355 persons reside in rural areas of 21 villages and 46818 persons in the Urban areas of Daman.
5. There are 25354 households in Daman rural and 12881 households in the district are 38235. This comes to Average 5.00 persons per house.
6. Total geographical area of the district is 72.000 Sq Km, Out of which area under different categories of use is as following:
 

Hotel Restaurants	:	21 ha (about 250 NOS)
Industrial	:	423 ha
Orchards	:	153 ha
Agriculture	:	3006 ha
Water bodies	:	222 ha
Hills/and hillocks	:	110 ha
7. Due to highly scenic, natural beauty, clean sea and river bodies, Daman attracts over 5 lac tourists every year. This tourism holds further more potentials as an anchor to the local economy.
8. Daman Municipal Council continue their C&T operations on their own or through contractual arrangements or even may involve the above selected agency as & when they feel it appropriate.



**2. STEP ALREADY BEEN TAKEN FOR IMPLEMENTATION****A) Preparation of Detailed Project Report (DPR):**

- Project Cost is **Rs. 17.91 Cr.** has been approved.
- Collection, Storage & Transportation Processing treatment and recovery of Products disposal of remnants in SLF.
- Project Site(s): 5.00 hectare, out of which 2.00 ha will be used for processing facility and 3.00 ha for SLF. The land area available at Dunetha village of Daman District.

**B) Selection of Bidder/ Project Developer:**

M/s JITF Urban Infrastructure Ltd., Delhi has been selected as Project Developers after observing codal formalities.

**C) Signing of Execution Agreement:**

The Execution Agreement was signed with the Bidder/ Project Developer, M/s JITF Urban Infrastructure Ltd., on 23.11.2014.

**D) Start of Work of Collection & Transportation and Dumping (CT&D)**

The Work of Collection & Transportation and Dumping will start on 1<sup>st</sup> April 2015.

**E) Start of Work of Construction of Processing & Disposal (P&D) Facilities**

The work on Processing plant(RDF & Compost Plant) at Dunetha is expected to start by November, 2015 and is expected to take one year's time for its completion .

### 3. PROJECT EXECUTION MODE

1. The project is proposed to be executed under PPP mode.

2. Approved Project Cost is Rs. 1791 lac.

Private sector will invest 30% of the approved project cost i.e. Rs.537.28 lacs and Govt's contribution will be 70% i.e Rs. 1253.64 lacs.

Selected PPP Agency will be responsible for the following package components.

- Processing & Disposal (SLF) of entire solid waste from Daman Rural & Urban areas for 30 years.
- Collection & Transportation from Daman Rural & Urban areas for 30 years.

#### **4. SALIENT FEATURES OF THE MSW MANAGEMENT PLAN THROUGH PPP:**

- Daily Door to Door Collection of waste.
- Segregation at source into Bio-degradable and Non-Biodegradable waste through two bin system to be preferred.
- Bin Free system to be adopted wherever feasible.
- Technology involving Refuse Derived Fuel (RDF), composting etc. would be employed.
- Collection of Bio Medical waste in accordance to the applicable rules in this regards.
- Provision of inclinators for unrecyclable waste.
- Separate containers at Vegetable markets & Fish markets and their transportation in closed containers.
- Identifying the rag pickers and providing the training for collection and separation of street wastes.
- Not more than 20-25% waste would be allowed to be disposed of in the Engineered Sanitary Land Fill (SLF) sites.
- Multi tier management system: Monitoring Committees and implementation cells at cluster and local level; an independent expert agency and an independent engineer to monitor the projects.
- Awareness programmes to be conducted in local areas (ward wise) for segregation of wastes and place the same in different bins for the purpose.
- Green belt surrounding the processing plant.

## 5. THE MSW OPERATION PLAN:

Broadly, the MSW Operation Plan involves:

- Door to door collection of MSW;
- Transportation;
- Segregation and Processing;
- Scientific Disposal in Sanitary Landfill Facility.

### 5.1 Door to Door Collection

- 5.1.1 The waste from House hold will be collected through 240 Ltr. Bins and vehicles like LCV.etc.
- 5.1.2 The entire Daman District would be divided into zones and the zones should be further divided into beats.
- 5.1.3 The door to door collection will be done from 7.30 AM to 1.30 PM. However, the exact timings will be decided mutually by the Authority and the Bidder.
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transporting door to door MSW to efficient MSW fleet like Refuse Compactor with a carrying capacity of 8-11 tonne/ vehicle, as per the city then directly transporting the MSW to Transfer Station/Processing Site as the case may be.

## **5.2 Regulatory Measures for Waste Generators**

### **5.2.1 Residents**

Following would be regulated by existing Municipal law and penal action against all the waste generators including households, restaurants, hotels shops offices, institutions, workers will be levied, in case of defaults. The U.T. Administration of Daman & Diu will regulate the following activities:

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- Wet waste will not be disposed of in plastic carry bags.

### **5.2.2 Vegetable/Fruit Market Waste**

- Large size closed containers with lid or skips would be used for storage of waste in vegetable/fruit market.
- Waste from the shops/fruit market/vegetable market would be removed on a daily basis though Private party selected through MSW-PPP mode.
- Large closed containers kept in the fruit and vegetable markets would be removed during night time or non-peak hours and the waste from meat and fish markets would also be collected in closed containers and picked up by engaging a private party by the local body.

### **5.2.3 Marriage Hall/Kalyan Mandaps/Community Halls**

- Suitable containers with lids which may match with the primary collection or transportation system of Private Party would be provided by these establishment at their cost and would be directly transported to a finalized place by Private party till the processing facility is not operational. Collection of Waste from marriage halls kalyan mandaps, community halls, etc. would be

made on a daily basis on a full-cost recovery basis. The cost of such collection would be built into the charges for utilizing such halls/ collected by Private Party from such halls on the charges fixed by the U.T. Administration of Daman & Diu.

#### 5.2.4 Construction & demolition Wastes

- Construction & Demolition Waste would be collected separately from MSW.
- The Charges/ rates per tonne for C&D collection waste would be fixed and would be levied from the person, who is producing C&D.
- C&D waste from small quantity generators (<2 Tonne) arising from repair/minor renovation/small construction work may be transported to designated locations in the city and the charges may be collected by MSW C&T PPP service provider at a volumetric rates fixed by ULB. Waste Generators have to pay directly to PPP service provider. Large quantity generators or their demolition/construction contractors can transport the waste at their own cost and pay per tonne charges to MSW-C&D PPP service provider at the rates fixed by Local Body.
- A separate site would be designated for collection of C&D Waste.
- Looking at the generation of C&D waste in all the ULBs of Daman District, a separate agency (s) for collection & management of C&D waste may be selected and accordingly Processing Plants for C&D Waste may be planned.

#### 5.2.5 Garden Waste

- Horticulture waste would be collected in separate vehicles
- Wherever the waste quantity is high, separate charges for Horticulture waste would be fixed and charged from the private gardens/lawn plots.
- Private party would collect the horticulture waste and would be allowed to run a compost plant.
- In case of private parks, gardens and lawn plot etc., it would be stored in the premises and kept ready for handing over to the MSW-PPP party and the waste be processed accordingly.

#### 5.2.6 Provision of Litterbins on Streets in Public Places

- With a view to ensure that streets and public places are not littered with waste materials such as used cans, cartons of soft drinks, used bus tickets, wrappers of chocolates or empty cigarette cases and the like generated while on a move. Litter bins would be provided on important streets, markets, public places, tourist spots, bus and railway stations, large commercial complexes etc.
- Similar bin for disposal of animal droppings would be placed in posh areas.
- Removal of waste from these litterbins would be done by MSW-C&T PPP partner.
- Advertisement rights on the bins for a specified period or by allowing them to put their names on the bins as a sponsor may be given to the Private Partner.
- Litterbins would be put in push as well as poor area in the proportion decided by allocation plan of Private Partner and Urban Local Bodies.
- The Urban Local Body (ULB) / Municipality should take effort to make the use of thermo plastic instead of multilayer plastic with the help of concern / appropriate authority. The Urban Local Body (ULB) / Municipality should establish centralised MSW plant by optimized more efficiently and with economically viable and in the interest of Environment. The establishment of MSW plant should be followed with cluster approach. Remaining MSW shall be segregated in to recyclable and unrecyclable waste particularly plastic and other waste. The UT Administration will frame policy that waste can be collected from site and can be provided to the firms and individual authorize for handling recyclable waste and on the rag pickers, whether organised or not, which would prevent individual rag pickers from rag picking and further strictly subject to a total prohibition on child workers being involved in such activities within six months.

### **5.3 Management of Storage Points in the city**

- All the wastes collected through Primary Collection System from the households shops and establishments would be taken to the processing or disposal site either directly necessitating a large feet of vehicles and manpower or through cost effective systems which

are designed to ensure that all the waste collected from the sources of waste generation is transported within reasonable time.

- Out of 100 %, maximum of 10% of Storage Depots/Secondary Collection Points in a city would be allowed, where direct transferring of door to door waste to the larger fleet is not feasible. The storage facilities/ secondary collection point must not create unhygienic and unsanitary conditions around the waste bins. This means that it would be:
  - Out of reach of stray animals.
  - would not obstruct the traffic of spread on road.
  - Easily accessible in terms of distance for the user.
  - Fully covered and not exposed.
  - Able to hold the expected waste generated, depending on the size and population of the area.
  - Concrete / pucca structure with roofing, to prevent Vector and bird menace, under and adjoining areas of dustbins at Secondary Collection Points
  - Aesthetically acceptable.
  - Designed to be easy to operate, handle, transfer and transport.

#### **5.4 TRANSPORTATION OF MUNICIPAL SOLID WASTE**

- Segregated transportation of segregated MSW would be ensured.
- Based on the requirement and availability of space, transfer stations would be planned and provided.
- Transportation of the waste at waste storage depots/ secondary collection points (which would be maximum 10%) is essential through covered vehicles to ensure that no garbage bin/container overflows and waste is not seen littered on streets.
- Waste would be transported in covered vehicles like Refuse compactor /dumper placer etc. The waste collected by Primary Collection vehicles would be directly transported to these covered vehicles at Waste Shifting Points.
- A route Plan for Primary and Secondary Collection System would be made.
- Daily Transportation of Litter bins, before they start overflowing; if required twice or thrice a day.



## 5.5 Scientific MSW Processing and Safe disposal of MSW

### 5.5.1.1 The Waste would be processed and disposed of as per the characterization and quantity of waste.

- MSW-PPP will adopt suitable technology or combination of such technologies to make use of wastes so as to minimize the burden on landfills.
- The biodegradable wastes shall be processed by composting, vermin-composting, anaerobic digestion or any appropriate biological processing for stabilization of wastes as per the standards.
- Mixed waste containing recoverable resources will follow the route of recycling or other appropriate technologies.
- Land filling would be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.
- Maximum 20-25% of the total Waste reaching to the Processing Site would be land filled.

### 5.5.1.2 MSW PROCESSING/ TREATMENT TECHNIQUES

For selection of suitable processing technology several parameters are considered namely Indian experience, quantity and quality of waste, capital investments, scale of operation, Recurring expenditure, environmental impact etc.

### RECOMMENDED INTEGRATED WASTE PROCESSING TECHNOLOGY

Based on the above criteria, Integrated MSW processing facility for the Daman District will comprise of:

- a) Compost plant with provision of Biogas plant.
- b) RDF Plant

(a) **Compost Plant:** It is envisaged that processing rejects would be generated from the RDF plant which would further comprise of organic rejects which will be used for composting by Windrow method.

b) **Pelletisation/Refuse Derived Fuel (RDF):** The raw MSW is processed for concentrating the combustible fraction of it by segregating the non-combustible portion. The complete process involves drying. Removal of non-combustibles by air separation (density separation, grinding or shredding of combustible fraction usually by a hammer mill, mixing and production of pellets under high pressure. The pellets can be transported easily and stored for many months without any disintegration. These pellets could be used for heating in the boilers and the generated steam, in turn, is used to produce power. Pellets also, can be used along with conventional fuels for industrial operations.

## 5.6 Sanitary Landfill Site

5.6.1 **Common sanitary waste disposal facility** would be planned for the safe disposal of processing rejects and non-biodegradable components of solid waste and it is envisaged that common sanitary landfill site would receive/accommodate about 20% of processing rejects and inerts per day from the total MSW processed at processing plant.

### 5.6.2 Sanitary Land Fill Facility:

Development of landfill site should be subjected to rigorous planning. Key elements in developing a common scientific landfill site for a cluster would comprise:

- Site Clearance,
- Sub-division of site into major operational phases,
- Progressive excavation for landfill earthworks,
- ordered development of operational phases in working land filling cells,
- advance preparation of the lining system on the landfill base,
- sequential infilling of land filling cells and operational phases and early and timely capping of land filled cells.

The following sections explain the broad specifications of developing each of the landfill components:

### 5.6.3 Buffer Zones:

A vegetative cover comprising of trees and shrubs will have to be provided as buffer zone between landfill site and the nearby localities. In addition to the buffer zone a compound wall/rigid fencing all round the land fill site to a height of 3m or as suitable, shall also to be constructed, to totally seclude the site from outside activities.

5.6.4 **Containment of Potential Pollutants:** Containment measures such as composite liners at the bottom and lateral sides of the landfill, and surface capping after the land filling is completed, are required to control the pollutants and mitigate subsequent impacts on environment.

**5.6.5 Surface Capping:** To minimize the ingress of water into the site after completion, it is proposed to form an engineered capping layer. This will comprise a multi layer system.

#### **5.6.6 Leachate Collection and Removal**

The leachate collection shall be achieved through the following measures:

- a. Gravity drainage and grading of the floor of the landfill cell to fall into a sump, located at the lowest point of the cell. The gradients shall be 2 per cent for main drainage with 1 per cent cross fall.
- b. Installation of leachate drainage blanket above the basal mineral liner over the floor of each cell and partially up the side walls, constructed of free drainage coarse granular fill comprising of graded 50mm crushed rock laid to a depth of 400mm with a permeability of  $1 \times 10^{-4}$  cm/sec.
- c. Inclusion of perforated HDPE pipes in the drainage blanket to facilitated leachate flow with pipes laid on a typical spacing of 50m.
- d. Overlaying granular drainage blanket with 100m thick free draining fine granular fills of medium to coarse sand to act as a filter and protective layer.
- e. Removal of leachate is effected by leachate collection chambers built up with successive lifts of waste and side slope risers located on the site perimeter.
- f. The submersible pumps or adductor pumps should be used to remove leachate from the sumps and the collection chambers should be linked by permanent pipe work to the treatment plant.
- g. The precise methods and degree of treatment shall accommodate the fluctuations in leachate generation.

#### **5.6.7 Landfill Gas and Management**

The primary measures to restrict the uncontrolled migration of landfill gas from the site will comprise,

- Low permeability containment layers and systems installed on the base and side walls

- Permeable gas drainage blanket of 0.3m thickness laid beneath the capping layer and
- Vertical gas vents and extraction wells.

#### 5.6.8 Surface Restoration

The landfill will be brought up to its pre-settlement level in stages and capped off in a program of progressive restoration, to limit the ingress of water into the site and to facilitate the control of landfill gas. The capping will be a composite structure comprising of four layers of an engineered seal designed to prevent water ingress and egress of landfill gas and an agricultural cap comprising of subsoil drainage layer.

A suitable vegetative cover will have to be established on the closed site to ensure slow surface runoff, promote evapo-transpiration of rainfall, retain moisture in the cap and enhance the formation of a soil structure in the agriculture soil.

#### 5.7.9 Other Measures

Specific attention shall be paid to mitigate the following undesirable and potentially deleterious effects of:

- a) Litter blown from the disposal / tipping area
- b) Scavenging animals and insects attracted to the sites
- c) Flies and Bird attraction
- d) Odour arising out of waste deposition and degradation
- e) Dust from landfill operations
- f) Mud generated from waste, cover, capping materials and site excavation works
- g) Fire and smoke control and
- h) Noise of operating plant.

**U.T. ADMINISTRATION  
OF DAMAN & DIU**

**MODEL MUNICIPAL SOLID  
WASTE MANAGEMENT PLAN-  
2015 FOR DIU DISTRICT**

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**1. BACKGROUND**

- 1. The UT Administration of Daman and Diu has taken initiatives for implementation of Solid Waste Management Programme for Rurals as well as urban areas of Diu District and up-gradation & systematization of Diu Municipal Council's Urban waste by establishment of centralized waste processing & disposal facility.
- 2. Diu Municipal Council has already prepared the Detailed Project Report through the Consultant in the last financial year 2013-14 and processed it further for award of work through open tender process.
- 4. The population of Diu district as per census 2011 is 52074 Out of which 28083 persons reside in rural areas of 04 villages and 23991 persons in the Urban areas of Diu.
- 5. There are 8300 households in Diu rural and 5584 households in the Diu town and total household in district are 13884. This comes to Average 3.75 persons per house.
- 6. Total geographical area of the district is 40.00 Sq Km, Out of which area under Diu town is 17.74 Sq. Kilometre and different categories of use in Diu town is as following:

Residential	:641.03 ha	
Mixed Residential	: 4.56 ha	
Commercial	: 37.19 ha	
Industrial	: 26.71ha	
Public & Semi Public	:198.50 ha	
Traffic & Transport	:157.43 ha	
Recreation	: 13.12 ha	
Agriculture	: 31.12ha	
Defence	: 215.14 ha	
Forest	: 102.69 ha	
Mangroves	: 13.82 ha	
Water bodies	: 46.58 ha	
Burial ground	: 10.01 ha	
Roads	:130.11 ha	



Vacant : 145.68 ha  
**Total** : **1774.00** ha

7. Due to highly scenic, natural beauty, clean sea and river bodies, Diu attracts over 5 lac tourists every year. This tourism holds further more potentials as an anchor to the local economy. While formulating the DPR, the waste generation due to tourists has also taken into account.

## **2. EXISTING SCENARIO OF MUNICIPAL WASTE**

The Diu town is the only town namely-Diu Municipal Council of Diu District which is having population of 23991 as per Census 2011. The solid waste generation at present is estimated as 12-15 MT per day. At present, the Diu Municipal Council is doing door to door collection of solid waste, transportation and dumping the same at the identified site.

## **3. STEP TAKEN FOR IMPLEMENTATION**

### **A) Preparation of Detailed Project Report (DPR):**

- Project Cost is about **Rs. 13.37 Cr.**
- Collection, Storage & Transportation Processing treatment and recovery of Products disposal of remnants in Sanitary Land Fill (SLF).
- Project Site(s): 2.20 hectare, out of which about 1.00 ha will be used for processing facility and 1.20 ha for SLF.

### **B) Selection of Bidder/Project Developer:**

Diu Municipal Council has already initiated the tendering process for award of work.

### **C) Signing of Execution Agreement:**

After finalising the agency for implementation of the project, the required agreement would be made by the Diu Municipal Council with the selected agency.

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**D) Start of Work of Collection & Transportation and Dumping (CT&D)**

At present collection, transportation and dumping of municipal waste is being done by the Diu Municipal Council through outsourced agency and through own sanitary workers.

**E) Start of Work of Construction of Processing & Disposal (P&D) Facilities**

The work on Processing plant(RDF & Compost Plant) at is expected to start by November, 2015 and is expected to take one year's time for its completion .

**4.PROJECT EXECUTION MODE**

1. The project would be executed by the Diu Municipal Council
  2. Approved Project Cost is Rs. 13.37 lac.
- The components include Collection, Transportation, Processing & Disposal (SLF) of entire waste from Diu Rural & Urban areas for 30 years.

**5.SALIENT FEATURES OF THE MSW MANAGEMENT**

**PLAN:**

- Daily Door to Door Collection of waste.
- Segregation at source into Bio-degradable and Non-Biodegradable waste through two bin system to be preferred.
- Bin Free system to be adopted wherever feasible.
- Technology involving Refuse Derived Fuel (RDF), composting etc. would be employed.
- Not more than 20-25% waste would be allowed to be disposed of in the Engineered Sanitary Land Fill (SLF) sites.
- Multi tier management system: Monitoring committees and implementation cells at cluster and local level; an independent

expert agency and an independent engineer to monitor the projects.

## **6. THE MSW OPERATION PLAN:**

Broadly, the MSW Operation Plan involves:

- Door to door collection of MSW;
- Transportation;
- Segregation and Processing;
- Scientific Disposal in Sanitary Landfill Facility.

### **6.1 Door to Door Collection**

- 6.1.1 The waste from House hold will be collected through 25Ltr. Bins and vehicles like LCV etc.
- 6.1.2 The entire Diu District would be divided into zones and the zones should be further divided into beats.
- 6.1.3 The door to door collection will be done from 7.30 AM to 1.30 PM. However, the exact timings will be decided mutually by the Authority and the Bidder.
- 6.1.4 Depending upon the population of the city and no. of commercial/ institutional establishments, approximately 13884 no. 25litre capacity bins will also be placed at designated locations for keeping the waste generated from street sweepings.
- 6.1.5 Depending upon the population of the city approximately 178 workers will be deployed by the Company for carrying out the above mentioned work of door to door collection and transportation of waste up to the processing facility.
- 6.1.6 The above quantities may vary depending upon the actual working design, routing and scheduling finalized mutually by the Concessioning Authority and the Concessionaire (Bidder).
- 6.1.7 The fleet of vehicles covering Tata Ace or Auto tipper about 150 no. to 100KG capacity covering approx. 13884 houses depending on the workload.
- 6.1.8 Community bins/; secondary collection points would be installed, if no door to door collection is possible in certain

areas like congested narrow lanes or slums residents would be made aware of putting their wastes into the bins in segregated manner as specified.

- 6.1.9 Wherever it is feasible Container Free / Bin-less system will be adopted by eliminating the secondary collection points and transporting door to door MSW to efficient MSW fleet like Refuse Compactor with a carrying capacity of 8-11 tonne/ vehicle, as per the city then directly transporting the MSW to Transfer Station/Processing Site as the case may be.

## **7. Regulatory Measures for Waste Generators**

### **7.1 Residents**

Following would be regulated by existing Municipal law and penal action against all the waste generators including households, restaurants, hotels shops offices, institutions, workers will be levied, in case of defaults. The U.T. Administration of Daman & Diu will regulate the following activities:

- They will not throw any solid waste in their neighbourhood, on the street, open spaces and vacant plots or into drains.
- They will (a) keep the food waste / bio-degradable as and generated, in any type of domestic waste container, with a cover, and (b) keep dry / recyclables wastes in bags or sacks.
- Wet waste will not be disposed of in plastic carry bags.

### **7.2 Vegetable/Fruit Market Waste**

- Large size closed containers with lid or skips would be used for storage of waste in vegetable/fruit market.
- Waste from the shops/fruit market/vegetable market would be removed on a daily basis though Private party selected through MSW-PPP mode.

Large closed containers kept in the fruit and vegetable markets would be removed during night time or non-peak hours and the waste from meat and fish markets would also be collected in closed containers and picked up by engaging a private party by the local body.

### 7.3 Marriage Hall/KalyanMandaps/Community Halls

Suitable containers with lids which may match with the primary collection or transportation system of Private Party would be provided by these establishment at their cost and would be directly transported to a finalized place by Private party till the processing facility is not operational. Collection of Waste from marriage halls kalyan mandaps, community halls, etc. would be made on a daily basis on a full-cost recovery basis. The cost of such collection would be built into the charges for utilizing such halls/ collected by Private Party from such halls on the charges fixed by the U.T. Administration of Daman & Diu.

### 7.4 Construction & demolition Wastes

- Construction & Demolition Waste would be collected separately from MSW.
- The Charges/ rates per tonne for C&D collection waste would be fixed and would be levied from the person, who is producing C&D.
- C&D waste from small quantity generators (<2 Tonne) arising from repair/minor renovation/small construction work may be transported to designated locations in the city and the charges may be collected by MSW C&T PPP service provider at a volumetric rates fixed by ULB. Waste Generators have to pay directly to PPP service provider. Large quantity generators or their demolition/construction contractors can transport the waste at their own cost and pay per tonne charges to MSW-C&D PPP service provider at the rates fixed by Local Body.
- A separate site would be designated for collection of C&D Waste.
- Looking at the generation of C&D waste in all the ULBs of Diu District, a separate agency (s) for collection & management of C&D waste may be selected and accordingly Processing Plants for C&D Waste may be planned.

### 7.5 Garden Waste

- Horticulture waste would be collected in separate vehicles

- Wherever the waste quantity is high, separate charges for Horticulture waste would be fixed and charged from the private gardens/lawn plots.
- Private party would collect the horticulture waste and would be allowed to run a compost plant.
- In case of private parks, gardens and lawn plot etc., it would be stored in the premises and kept ready for handing over to the MSW-PPP party and the waste be processed accordingly.

#### **7.6 Provision of Litterbins on Streets in Public Places**

- With a view to ensure that streets and public places are not littered with waste materials such as used cans, cartons of soft drinks, used bus tickets, wrappers of chocolates or empty cigarette cases and the like generated while on a move. Litter bins would be provided on important streets, markets, public places, tourist spots, bus and railway stations, large commercial complexes etc.
- Similar bin for disposal of animal droppings would be placed in posh areas.
- Removal of waste from these litterbins would be done by MSW-C&T PPP partner.
- Advertisement rights on the bins for a specified period or by allowing them to put their names on the bins as a sponsor may be given to the Private Partner.
- Litterbins would be put in push as well as poor area in the proportion decided by allocation plan of Private Partner and Urban Local Bodies.

#### **7.7 Management of Storage Points in the city**

- All the wastes collected through Primary Collection System from the households shops and establishments would be taken to the processing or disposal site either directly necessitating a large feet of vehicles and manpower or through cost effective systems which are designed to ensure that all the waste collected from the sources of waste generation is transported within reasonable time.

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- Out of 100 %, maximum of 10% of Storage Depots/Secondary Collection Points in a city would be allowed, where direct transferring of door to door waste to the larger fleet is not feasible. The storage facilities/secondary collection point must not create unhygienic and unsanitary conditions around the waste bins. This means that it would be:
  - Out of reach of stray animals.
  - would not obstruct the traffic of spread on road.
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  - Concrete / pucca structure with roofing, to prevent Vector and bird menace, under and adjoining areas of dustbins at Secondary Collection Points
  - Aesthetically acceptable.
  - Designed to be easy to operate, handle, transfer and transport.

## **7.8 TRANSPORTATION OF MUNICIPAL SOLID WASTE**

- Segregated transportation of segregated MSW would be ensured.
- Based on the requirement and availability of space, transfer stations would be planned and provided.
- Transportation of the waste at waste storage depots/ secondary collection points (which would be maximum 10%) is essential through covered vehicles to ensure that no garbage bin/container overflows and waste is not seen littered on streets.
- Waste would be transported in covered vehicles like Refuse compactor /dumper placer etc. The waste collected by Primary Collection vehicles would be directly transported to these covered vehicles at Waste Shifting Points.
- A route Plan for Primary and Secondary Collection System would be made.
- Daily Transportation of Litter bins, before they start overflowing; if required twice or thrice a day.

The detailed Operation Plan for Collection & Transportation of MSW from Rural area of Diu which is proposed selected bidder/project developer -----and is enclosed as **Annexure- I**

## **7.9 Scientific MSW Processing and Safe disposal of MSW**

### **7.9.1.1 The Waste would be processed and disposed of as per the characterization and quantity of waste.**

- MSW will adopt suitable technology or combination of such technologies to make use of wastes so as to minimize the burden on landfills.
- The biodegradable wastes shall be processed by composting, vermin-composting, anaerobic digestion or any appropriate biological processing for stabilization of wastes as per the standards.
- Mixed waste containing recoverable resources will follow the route of recycling or other appropriate technologies.
- Land filling would be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.
- Maximum 20-25% of the total Waste reaching to the Processing Site would be land filled.

### **7.9.1.2 MSW PROCESSING/ TREATMENT TECHNIQUES**

For selection of suitable processing technology several parameters are considered namely Indian experience, quantity and quality of waste, capital investments, scale of operation, Recurring expenditure, environmental impact etc.

### **RECOMMENDED INTEGRATED WASTE PROCESSING TECHNOLOGY**

Based on the above criteria, Integrated MSW processing facility for the Diu District will comprise of:

- a) Compost plant
- b) RDF Plant



- (a) **Compost Plant:** It is envisaged that processing rejects would be generated from the RDF plant which would further comprise of organic rejects which will be used for composting by Windrow method.
- (b) **Pelletisation/Refuse Derived Fuel (RDF):** The raw MSW is processed for concentrating the combustible fraction of it by segregating the non-combustible portion. The complete process involves drying. Removal of non-combustibles by air separation (density separation, grinding or shredding of combustible fraction usually by a hammer mill, mixing and production of pellets under high pressure. The pellets can be transported easily and stored for many months without any disintegration. These pellets could be used for heating in the boilers and the generated steam, in turn, is used to produce power. Pellets also, can be used along with conventional fuels for industrial operations.

## 7.10 Sanitary Landfill Site

**7.10.1 Common sanitary waste disposal facility** would be planned for the safe disposal of processing rejects and non-biodegradable components of solid waste and it is envisaged that common sanitary landfill site would receive/accommodate about 20% of processing rejects and inerts per day from the total MSW processed at processing plant.

### 7.10.2 Sanitary Land Fill Facility:

Development of landfill site should be subjected to rigorous planning. Key elements in developing a common scientific landfill site for a cluster would comprise:

- Site Clearance,
- Sub-division of site into major operational phases,
- Progressive excavation for landfill earthworks,

- ordered development of operational phases in working landfilling cells,
- advance preparation of the lining system on the landfill base,
- Sequential line filling of land filling cells and operational phases and early and timely capping of land filled cells.

The following sections explain the broad specifications of developing each of the landfill components:

**7.10.3. Buffer Zones:**

A vegetative cover comprising of trees and shrubs will have to be provided as buffer zone between landfill site and the nearby localities. In addition to the buffer zone a compound wall/rigid fencing all round the land fill site to a height of 3m or as suitable, shall also to be constructed, to totally seclude the site from outside activities.

**7.10.4 Containment of Potential Pollutants:** Containment measures such as composite liners at the bottom and lateral sides of the landfill, and surface capping after the land filling is completed, are required to control the pollutants and mitigate subsequent impacts on environment.

**7.10.5 Surface Capping:** To minimize the ingress of water into the site after completion, it is proposed to form an engineered capping layer. This will comprise a multi layer system.

**7.10.6 Leachate Collection and Removal**

The leachate collection shall be achieved through the following measures:

- a. Gravity drainage and grading of the floor of the landfill cell to fall into a sump, located at the lowest point of the cell. The gradient shall be 2 per cent for main drainage with 1 per cent cross fall.
- b. Installation of leachate drainage blanket above the basal mineral liner over the floor of each cell and partially up the side walls, constructed of free drainage coarse granular fill

- comprising of graded 50mm crushed rock laid to a depth of 400mm with a permeability of  $1 \times 10^{-4}$  cm/sec.
- c. Inclusion of perforated HDPE pipes in the drainage blanket to facilitated leachate flow with pipes laid on a typical spacing of 50m.
  - d. Overlaying granular drainage blanket with 100m thick free draining fine granular fills of medium to coarse sand to act as a filter and protective layer.
  - e. Removal of leachate is effected by leachate collection chambers built up with successive lifts of waste and side slope risers located on the site perimeter.
  - f. The submersible pumps or adductor pumps should be used to remove leachate from the sumps and the collection chambers should be linked by permanent pipe work to the treatment plant.
  - g. The precise methods and degree of treatment shall accommodate the fluctuations in leachate generation.

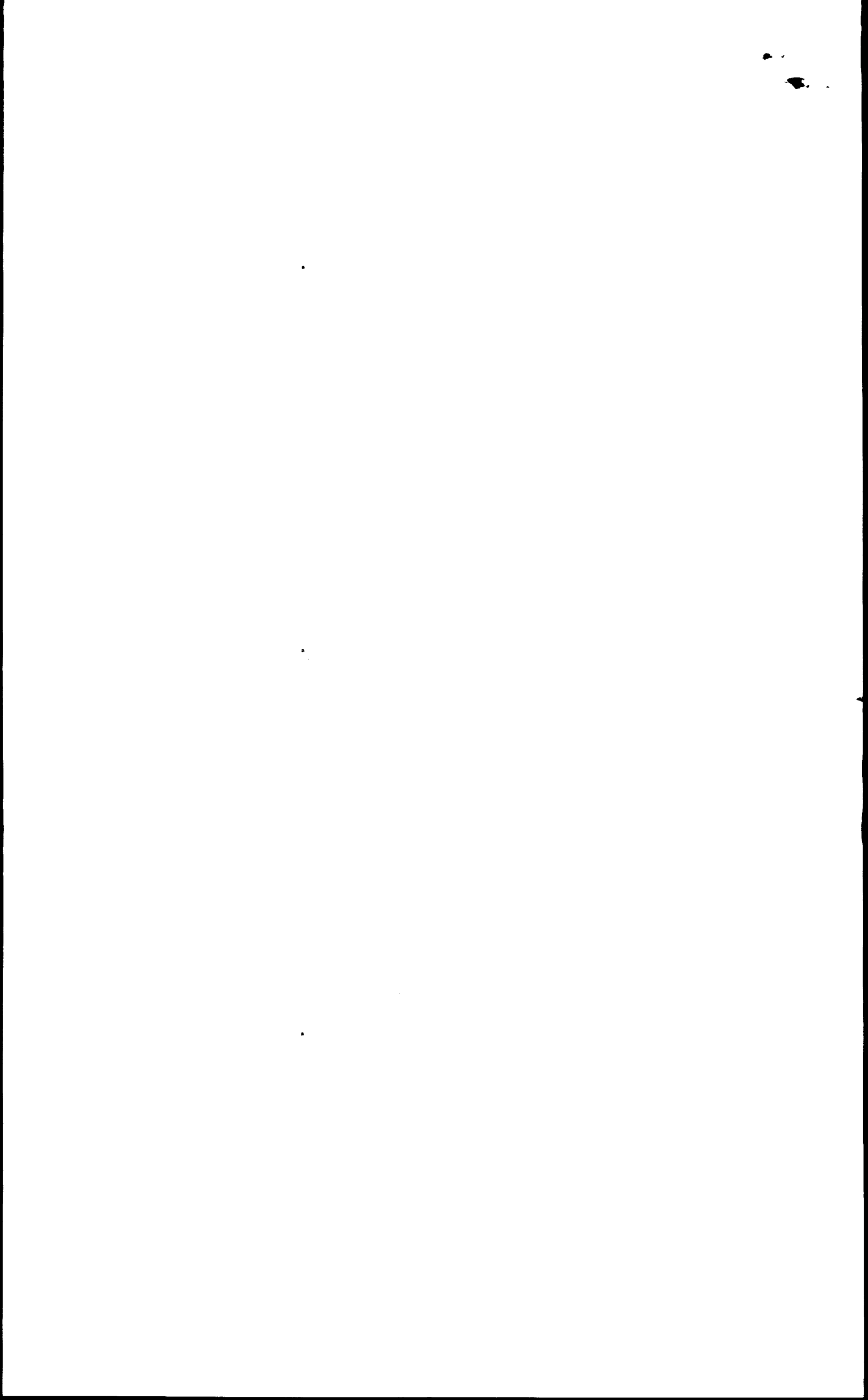
#### 7.10.7 Landfill Gas and Management

The primary measures to restrict the uncontrolled migration of landfill gas from the site will comprise,

- Low permeability containment layers and systems installed on the base and side walls
- Permeable gas drainage blanket of 0.3m thickness laid beneath the capping layer and
- Vertical gas vents and extraction wells.

#### 7.10.8 Surface Restoration

The landfill will be brought up to its pre-settlement level in stages and capped off in a program of progressive restoration, to limit the ingress of water into the site and to facilitate the control of landfill gas. The capping will be a composite structure comprising of four layers of an engineered seal designed to prevent water ingress and egress of landfill gas and an agricultural cap comprising of subsoil drainage layer. A suitable vegetative cover will have to be established on the closed site to ensure slow surface runoff, promote evapo-



transpiration of rainfall, retain moisture in the cap and enhance the formation of a soil structure in the agriculture soil.

### **8. OTHER MEASURES**

Specific attention shall be paid to mitigate the following undesirable and potentially deleterious effects of:

- a) Litter blown from the disposal / tipping area
- b) Scavenging animals and insects attracted to the sites
- c) Flies and Bird attraction
- d) Odour arising out of waste deposition and degradation
- e) Dust from landfill operations
- f) Mud generated from waste, cover, capping materials and site excavation works
- g) Fire and smoke control and
- h) Noise of operating plant.

These effects can be minimized by providing local litter, arrestor, fencing, strategically placed in relation to the discharge point, erecting site security fencing for excluding scavenging animals, bird scaring techniques for avoiding bird nuisance, etc.