International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 06 | June - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Details Construction of Solid Waste Management Project, Dibrugarh (Assam) Implemented by Assam Urban Infrastructure Investment Program (Funded by Asian Development Bank (ADB)

Er. Diganta Mili

M Tech(Structural Engineering),MBA(Project Management) MA (Rural Development)PGDM(Contract Management and Procurement) PGDM(Construction and Project),PGD(Urban Planning and Development) Professional Engineer ,Chartered Engineer

EXECUTIVE SUMMARY:

The Dibrugarh Municipal Board (DMB) is responsible for managing solid waste within the municipal limits while the rest of the Dibrugarh Municipal Planning Area (DMPA) ispresently not covered. Major sources generating municipal solid wastes in Dibrugarh are the households, commercial establishments, institutions, markets, street sweeping, and construction/demolition activities. No recorded estimations on total waste generation and its characteristics are available with DMB. Crude estimates from DMB indicate solid waste generation in the town and DMPA present generation is estimated to be 60 and 78 metric tons per day (MTD) respectively and this is projected to increase to 82 and 112 MTD respectively in 20 years.

The present waste collection frequency is very irregular and inadequate. Wastes are not segregated at source and are a mixture of inert, recyclable and bio-degradable matters.Assam Medical College has the only bio-medical waste treatment facility, with an incinerator of capacity 150 kilograms (kg). DMB provides facility to other health care establishment on chargeable basis.

Three tractor tailors and one truck are involved for collection of wastes which are parked within the DMB office premises as there is no garage and repair facility of these vehicles. The DMB has added a cesspool cleaner of 3000 liter capacity. The present disposal site is located at Maizan, Barsuikiya Gaon. The site 6 km away from the city covers 0.5 ha. There is no leachate collection or protection system installed in the existing disposal site. Due tothe potential to pollute the adjacent surface water and groundwater table, the APCB has issued a closure notification to this dumpsite.

The following key issues were identified:

Need of an extensive public awareness campaign and initiate house-to-housecollection and waste segregation for a sample cluster of households;

Need to improve collection system efficiency;

The unscientific method for disposal of solid waste at the dumping ground shouldbe stopped and the biodegradable organic fraction should be processed;

Non-biodegradable fraction and rejects from processing units should be disposedof by sanitary landfill method;

These physical investments would include, apart from installing of a solid waste management system in conformance to the MSWMHR, an extensive capacity building and awareness Program. The capacity building resulting from the subproject implementation, in terms of the institutional setup and exposure to good subproject implementation practices shall provide a strong base towards the implementation of the master plan for the sector.The urgent improvement needs identified based on situation assessment and consultations include: (i) improvement of collection efficiencies, both primary and secondary; (ii) improvement in the existing system; and, (iii) treatment and disposal of wastes in accordance with MSWMHR.

INTRODUCTION

Solid Waste Management is one of the most essential services for maintaining the quality of life in the urban areas and for ensuring better standard of health and sanitation. In India this service falls short of the desired level, as the system adopted are out dated and inefficient. Institutional weakness, shortage of human and financial resources, improper choice of technology, inadequate coverage and lack of proper planning (short term & long term) are responsible for the inadequacy of MSW services and the town like Dibrugarh in Assam, is not an exception., As per census of 2001 the total population of DMPA (Dibrugarh Master Plan Area) was 1, 74,435 and as per census 2011 the total population was 1, 99,197. Total DMPA area is 66.14 sq km. and DMB area is 15.50 sq.kms. As per census of 2001 the total population of DMB (Dibrugarh municipal Board Area) was 1, 21,893 and as per census 2011 the total population was 138661.The location of Dibrugarh town in Assam State is as shown in Figure-2.1
In order to maximize efficiency and effectiveness of MSW service, it is necessary to tackle this problem systematically dealing all aspects of 'Solid Waste Management' (SWM) and devise cost effective system which may ensure adequate level of SWM services to all classes of the society. An efficient and effective system of collection, transportation and disposal and treatment of waste in an environmentally acceptable manner in line with the Supreme Court Committee recommendations as well as Municipal Solid Waste (Management & Handling) Rules, 2000 shall have to be adopted.

With a view to improve the efficiency of SWM system in the Master Plan area of Dibrugarh; the Detailed Project Report on Solid Waste Management has been prepared by Design and Supervision Consultant in association with Project Management Consultant engaged under AUIIP (ASSAM URBAN INFRASTRUCTURE INVESTMENT PROGRAM). The report envisages modernization of SWM practices, improvement of services/ practices in the DMB area as well as outside areas of DMB for better environment.

PROBLEMS BEING FACED BY URBAN LOCAL BODIES

Except for a few progressive Municipal Corporations in the country, all other urban local bodies lack in managerial, administrative, financial and institutional management as also the technical knowhow of managing urban solid waste. It is, therefore, very essential to provide proper guidance and training to the personnel in the urban local bodies responsible for SWM services and to all the stakeholders, to make them efficient in managing the solid waste generated in their respective areas/towns/cities.

SOLID WASTE MANAGEMENT POLICY GUIDELINES

According to the Constitution of India, Solid Waste Management is a part of Public Health and Sanitation and falls within the purview of the State list. It is the primary responsibility of the respective State Governments and Urban Local Bodies (ULBs) to ensure that appropriate Solid Waste Management practices are introduced in all cities and towns in the state. The role of Ministry of Urban Development, Government of India is broadly to formulate policy guidelines and provide technical assistance to the states and urban local bodies whenever needed. It also assists the State Governments and Urban Local Bodies in Human Resource development and also acts as a facilitator in mobilizing external assistance for implementation of Solid Waste Management projects.

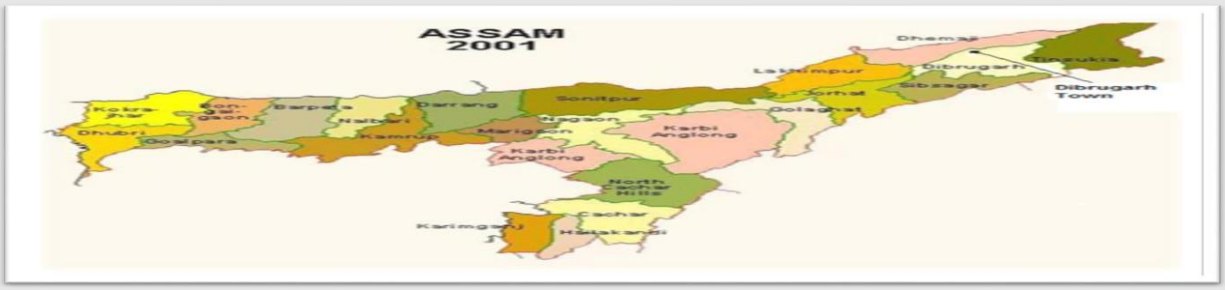
SOLID WASTE MANAGEMENT RULES:

Solid Waste Management Rules were inaugurated in 2016. Highlights include:

- Waste segregation at source is mandatory. Households are required to separate waste into three streams - Organic or Biodegradable waste, Dry waste (such as plastic, paper, metal and wood), and Domestic Hazardous waste (diapers, napkins, mosquito repellents, cleaning agents). Further, bulk waste generators such as hotels and hospitals are expected to treat organic waste either onsite or by collaborating with the urban local body.

- Municipalities and urban local bodies have been directed to include informal waste pickers and rag pickers into their waste management process. This is the first time that national policy has acknowledged and included the informal sector into the waste management process. India has over 1.5 million subsistence informal waste pickers and including them into the formal waste management system represents an opportunity for urban local bodies to streamline their operations, while provide the waste pickers with better income opportunities.
- Manufacturers of fast-moving consumer goods FMCG that use non-biodegradable packaging are required to put in place a system to collect the packaging waste generated due to their production.
- Urban local bodies have been given a provision to charge bulk generators a user fee to collect and process their waste. Additionally, spot fines may be levied on people burning garbage or discarding it in public places.
- No non-recyclable waste having a calorific value of 1,500 Kcal/kg or more is permitted in landfills. These wastes should either be utilized for generating energy or for preparing refuse derived fuel. It may also be used for co-processing in cement or thermal power plants.

Figure 2.1 Geographical location of Dibrugarh Town in Assam



Geographical location of Dibrugarh Town in Assam

Solid Waste Management is an obligatory function of the Urban Local Bodies as envisaged by the 74th Amendment of the Constitution of India. However, this service is poorly performed by most of the ULBs resulting in problems of public health, sanitation and environmental degradation. The situation is becoming more and more critical day-by-day with rapid pace of urbanization.

Infrastructure development is not in position to keep pace with population growth owing to poor financial health management of most of the ULBs. Lack of financial resources, institutional weakness, improper choice of technology, lack of public participation in SWM, non-involvement of private sector etc., have made the SWM service far from satisfactory. Therefore, there is a need to handle this problem in a concert manner and adopt suitable strategies to tackle all aspects of solid waste management scientifically and economically involving private sector wherever necessary and possible. A policy framework is, therefore, necessary to guide and support the ULBs in the country for managing the solid waste more economically in a scientific manner.

SOLID WASTE MANAGEMENT- APPROACH ADOPTED IN DIBRUGARH TOWN

Dibrugarh towns, in the state of Assam, encounter many problems in managing solid waste. These problems are related to various factors such as financial health of the Dibrugarh Municipal Board (DMB) - nodal agency responsible for SWM in Dibrugarh town, lack of institutional and administrative initiatives, lack of community awareness towards

SWM, etc. In view of the importance of the town in Northeastern Region, the Government of India and the Government of Assam have accorded high priority in development of infrastructure facilities including solid waste disposal in Dibrugarh Metropolitan area. Accordingly, a sub project on SWM, "Design, Build and Operation (DBO) of 100 MT processing plant and 60 MT sanitary land fill site and allied works" has been planned in Dibrugarh under ADB funding (Project 1).

Dibrugarh district is located between 27° 5' 38" North to 27° 42' 30" North latitude and 94° 33' 46" East to 95° 29'8" East longitude. It is surrounded on the Southeast by Tirap district of Arunachal Pradesh, on the North by Dhemaji district (Assam), on the East by

Tinsukia district (Assam), on the South and Southwest by the Sibsagar district (Assam). The district covers a geographical area of 3381 sq.km. It is the largest tea exporting town in India. It is also the gateway to Arunachal Pradesh. Dibrugarh is surrounded by tea gardens with the misty outlines of the Himalayas in the background. Sometimes it is referred as the gateway to some districts of Arunachal Pradesh.

Dibrugarh Municipality was established in 1873. The city was since then has become the center of all political, administrative, cultural and commercial activities of the Upper Assam region. Dibrugarh is located along 27028' N latitude and 94054' longitudes. The population of the DMB has increased from 1, 21,893 in 2001 to 1, 38, 661 in 2011. The present DMB spread over an area of 15.50 sq km is divided into 22 wards.
In view of the objective of keeping the Dibrugarh town neat and clean by adopting appropriate technologies which are techno-economically viable, methods for collection, segregation, transportation, processing and disposal of solid waste generated in Dibrugarh Municipal Board (DMB) Area and also for rest of the area in DMPA within a given time frame of 30 years have been suggested. The DPR addresses all the above issues in detail including other relevant issues in their totality to be followed and implemented.
Dibrugarh has direct access by road, railway and air to other parts of Assam and major cities of the country. NH-37 links Dibrugarh and other important towns of Assam. Dibrugarh is linked with Guwahati by a broad gauge railway line. It is also connected with other cities of country by express and superfast trains. Dibrugarh has regular air flight from major cities like Delhi, Kolkata and Guwahati from its Mohanbari airport which is 17 km from the town. A large number of tea estates are located along NH-37 covering large area of Dibrugarh district.

PHYSICAL GROWTH PATTERN

Located south of Brahmaputra River, the growth of the city has been towards southeast and south. The existing structure and growth direction of Dibrugarh town over the last few decades attributed to many factors such as: (a) expansion of agriculture lands, water bodies, Brahmaputra River and frequent flooding of many areas during monsoon, and (b) employment / activity nodes and areas (Institutional, Commercial and Industrial) that have influenced the growth and expansion of the city.

1. The growth outside the DMB limit has spread up to the DMPA boundary to some extent but major growth is within the municipal area and in surrounding 6 villages, University and Assam Medical College area. The extent of growth is total 15.50 sq. km with a population of 121893 (2001 census), as identified in the master plan, total area of DMPA works out to be 66.14 sq. km.
2. Considering the physical constraints, availability of suitable land, ongoing and committed major activities, it is evident that the city growth would likely to occur on the following pattern;
a..East side of Dibrugarh along the National Highway, and
b..South and South west of the town
The river Brahmaputra flows throughout the North and North-Western boundary of the district. The only tributary falling at Brahmaputra in the district is Buridihing tributary which divides the district from East to West. It touches the town

Naharkatia in the East; Khowang in the middle and at the last part of its course forms the boundary line between Dibrugarh and Sibsagar districts. The Dibrugarh district is mostly a plain district of Assam. The entire area of the district is flat with gradual slop from the East Arunachal hills to the West. The soil of the district is mostly fertile alluvial soil and this adjoining with the river Brahmaputra are composed of sand and clay in varying proportion.

Oil and Tea are the major industries of the district. The Headquarter of the Oil India Ltd. is located at Duliajan, at a distance of about 50 KM from Dibrugarh town. The Fertilizer Corporation of India and Assam Petro-Chemicals Ltd. at Namrup and the Assam Gas Co. at Duliajan, NEEPCO (North Eastern Electric Power Corporation) near Duliajan are some of the other major industries in the district.

CITY PROFILE

BRIEF ABOUT DIBRUGARH DISTRICT

Dibrugarh, which is the Headquarter of the district derived its name from Dibarumukh. The name derived from the mouth (mukh) of the river Dibaru or Dibru (Bodo word dibru,a blister) during the reign of Siuhungmung, Pharsengmung Borgohain, Chao Siulung, Kilong fought against the Chutia king who was defeated in the battle and surrendered before the Ahom King. Dibarumukh was a renowned encampment of Ahoms during Ahom Chutia War. Earlier Dibrugarh was the District HQ of undivided Lakhimpur district but now Dibrugarh is a separate district having its own identity with the District HQ still in Dibrugarh town itself.

GEOGRAPHY

Location and extent

The district is situated in the north-eastern part of Assam between 2705’38” N and 27042’30”N latitudes and 94033’46”E and 95029’10”E longitudes. It occupies 3, 54,500 hectares of area which accounts for 4.52 per cent area of the state. It is bounded on the east by Tinsukia, on the west by part of Sibsagar and Dhemaji districts, on north by Dhemaji district and on south by Sibsager district and part of Arunachal Pradesh.

Physiography and drainage

The Dibrugarh district is characterized by a flat monotonous terrain from the Brahmaputra river southwards up to the upper Dihing Reserve forest where it starts rising slowly in to the broken hills that comprised the foothills of Tirap district of Arunachal Pradesh.

The district is drained by the Brahmaputra River and its main tributary the Burhi Dihing and Maijan rivers. The general course of these rivers is more or less parallel. Navigation by boat is possible throughout the year in the Brahmaputra and Burhi Dihing rivers. The Burhi Dihing River rises from Miao in Tirag district of Arunachal Pradesh and flows through Tirap, Margherita, Jaypur, Telpani, R. F., Kolakhowa and finally meets Brahmaputra at the Dihingmukh R.F. It causes great flood hazards in the riverside tract during the months of May to October every year.

Climate

The district is situated in the humid sub-tropical region and is therefore characterized by heavy rainfall and high humidity. The cold season starts from the beginning of December and ends by the midst of February. This is followed by a period of moderate temperature up to the beginning of May. The hottest months of the year are June, July and August when the heat coupled with high humidity make the climate enervating and unhealthy.

- The average temperature in Dibrugarh, Assam, India is 22.9°C (73 °F).
- The range of average monthly temperatures is 11.5 °C.
- The warmest average max/ high temperature is 31°C (88 °F) in June, July, August & September.
- The coolest average min/ low temperature is 10°C (50 °F) in January.

Rainfall

Dibrugarh, Assam receives on an average 2758 mm (108.6 in) of precipitation annually or 230 mm (9.0 in) each month.

Soils

The soil of the Dibrugarh district varies from sandy loam to clayey in nature. The loamy soil comprises of about 80% of the total cultivable area. Soil of this district are divided in to three distinct categories, viz. new alluvial soils in an area extending few kilometers to the south of the Brahmaputra river, old alluvial soils in the central part of the district and old mountain valley alluvial soil located on the foothills of Arunachal Pradesh and on the south- eastern part of the district. The alluvial deposits can be divided in to two groups – high level or older alluvium mainly brought down by Burhi Dihing river from Patkai Range and low level or recent alluvium brought down by Brahmaputra river from the eastern Himalaya.

Geology and Land use

The district for the most part is composed of alluvium deposited by the Brahmaputra and Burhi Dihing rivers. In the hilly regions in the south, exposures of the rocks show that the underlying stratum is composed of Tertiary rocks. The Joypore Digboi regions exposes the upper Tertiary rocks which can be sub divided in to Tipam sandstone. The Girujan clay stage and Num Rong Khu stage, the first of these stages being characterized by oil deposits. The foothills near the Patkai ranges of hills beyond are composed of lower Tertiary rocks, the oldest among them being the Disang shales which are overlain by coal measures. The oil and coal are the major minerals found in the district.

Existing Land use of Dibrugarh planning area is shown in Figure-3.1

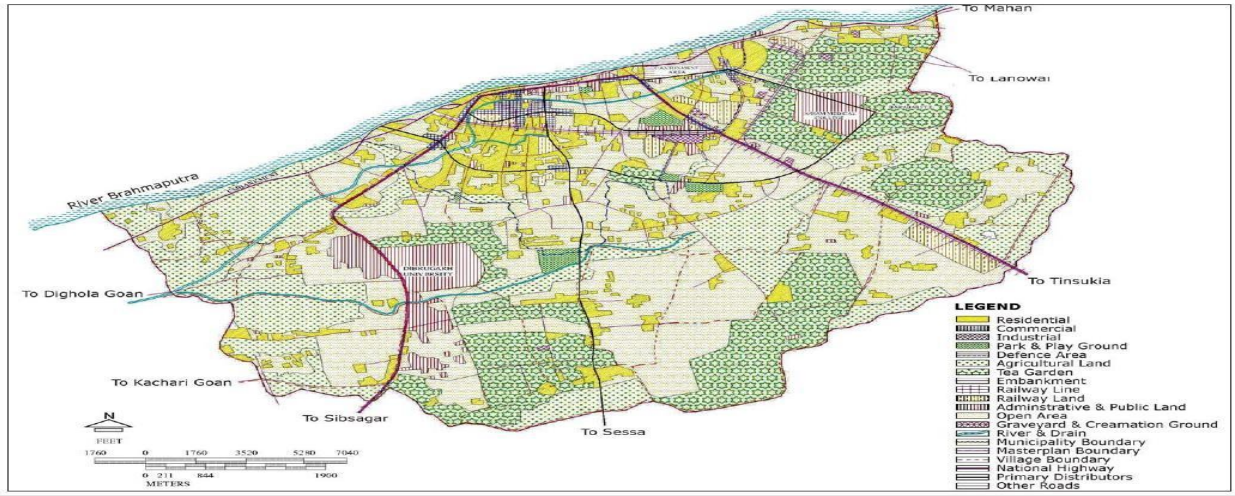


Figure-3.1 Existing Land use Pattern for Dibrugarh

PROJECT OBJECTIVES

Dibrugarh town is one of the major industrial towns in Assam and also a rapidly growing urban city in upper region of the state. Dibrugarh town facing lots of problems in managing Solid Waste in last few decades due to fast development of urban scenario as well as the financial health of the Dibrugarh Municipal Board. In view of the importance and development strategy of the town in northeastern region, the Government of India and the Government of Assam have accorded high priority in development of infrastructure facilities including Solid waste disposal.

The SWM project is located at Latitude- 27°24’43” N and Longitude- 94°55’24” E in the South-East direction of Dibrugarh Town which is around 12 km away from the city. The locality is known as Lekai Thakurthan. The project capacity comprising of total municipal solids collect from the 22 wards within the city area. The project was awarded under Assam Urban Infrastructure Investment Program, Department of Housing & Urban Affairs, Govt. of Assam and also the key initiative of Project Director, AUIIP and the Deputy Commissioner, Dibrugarh during the period 2016-17.

Solid waste scenario in Dibrugarh city at the concept stage:

Before considering the SWM project in Dibrugarh, the scenario of existing Solid waste in the city are highlighted below:

Major Source of Generation	**1.Household**
	2.Commercial Establishment
	3.Institution
	4.Market
	5.Street Sweeping
	6.Construction / Demolition
Per Capita Generation	**355 gms/day for the year 2014**
Generation Per day	**75 TPD**
Waste Collected (Approx.)	**35 TPD**
No. of Community Dustbin	**9**
Frequency of collection	**Irregular**
Segregation at Source	**No**
Transportation	**Tractor with Trailer-9 nos.**
	Dumper-1 nos.
Disposal of Waste	**At Open Dumping Ground**
Location of Existing Dumping Ground	**Maijan**
Distance from City	**6 kms**
Area Available	**1.2 Ha**
Duration of Operation	**22 years**

Effect of Existing Solid waste disposal:

Inadequate collection & transportation system
Un-scientific method of solid waste handling & disposal Dumping into the drainage system
Environmental & habitat safety Health safety

Why to have a new Dumping Site?

Assam State pollution Control Board has issued notice to DMB for immediate closure of existing DG & subsequent rehabilitation of the other site.

Govt. Of Assam under the financial assistance of ADB, has now taken up a new solid waste management project for Dibrugarh at lekai Ghoramara.

Project is executed as Design, Build & Operation Contract.
Design period years :30

Projected Population 421000 (Year 2046)
Projected Solid Waste Generation 225 MT/day (Year 2046)

As per MoEF, EIA notification September, 2006, Common Municipal Solid Waste Management facility falls under Category B type project, and requires Environment Clearance from State Environmental Impact Assessment Authority.

Based on the criteria, the following sites are selected & comparative study made.

1. Existing Solid waste site at Maizan.
2. Alternate site at Malengia 3.Site at Ghoramara

Site-1:

SL No.	Name of Site	Merits	Demerits	Remarks
1	Existing SLF at Maizan Site(I)	1.The location is nearer to the city 2.The site is connected with the road	1. The available land is less than a hectare 2. The location is on the bank of river Brahmaputra 3. The solid waste isneither Treated nor processed.	Assam State Pollution Control Board has issued notice to DMB for immediate closure and Rehabilitation ofthe site.
			4. Leachate is generated in the disposal site andpercolates into ground water. 5. No separate collection system for disposal of bio-medical waste, industrial waste &hazardous waste. 6. Rag-pickers often seen at the disposal site.	

Image showing existing dumping site (1) at Maizan

Site-2

SL No.	Name of Site	Merits	Demerits	Remarks
2	SLF site at Malengia Site (2)	1. The part of required land was available initially for carrying out design of SWM system as a model.	1. The area is lessfor Sanitary Land filling for design period 2. The distance from town is more	It was not feasible as long term sustainable site for Solid waste disposal system in view
		2. The technical approach and layout plan was found appropriate	as such transportation costwill be higher 3. Rivulet Sessa isencircling the SLF site and mandatory distance 0f 100 m is not available 4. The site is too close to busy Dibrugarh – Duliajan road 5. Human settlements are nearby 6.Manually operated railwaygate for longerperiod of halt at thickly populated area andNH-37 7.Closer to Airport 8.Existence of AGCL pipeline inthe vicinity	of nos. of constraints with regard to strategic physical location

Image showing SLF site (2) at Malengia

Site-3

SL No.	Name of Site	Merits	Demerits	Remarks
	SLF site at Ghoramara selected finally Site (3)	1. The site is at a reasonable distance (8 kms) from municipal Board office 2. It has a good access road 3. Prospect of availability of daily waste cover material from the vicinity of the site. 4. It has more area for longterm land fill operation 5. Human activities are lessnear the site 6. It will not hamper normal life of local habitants as no significant households are on both side of rivulet Sessa 7. The total land required were acquired 8. Fuel cost will be less due to closeness to DMB area 9. The distance of site from airport is 22km by road. 10. No significant infrastructure exists nearby	1. Sessa rivulet is in the vicinity of project site. 2. Tea gardens are nearby at Project site. 3. Occasional flooding during rainy season.	1. Protection of stream Sessa by constructing retaining /embankment wall by Gabion packing & other suitable way or any other suitable water Retaining structure along the stream side have been proposed maintaining 100m distance from the river front. 2. Provision of adequate green belt within and surrounding the disposal site to minimize bad smell/ odor 3. Provision of planned surface drainage & pumping arrangement. 4. Same formalities are required for both sites as at SL No. 2 &3 with regard to NOC from SEIAA for Environmental clearance.

Image showing SLF site at (3) Lekai Ghoramara

Land Use in Proposed SWM Project:

The final site has been selected at Ghoramara (Site 3) based on the criteria and the detail of land used in the project as below:

Sanitary Landfill Area (Phase-1)1.91
Compost Plant Area with other facility 0.80
Leachate Treatment Plant Area 0.57

Raw Waste Storing Yard and other components of processing unit
1.11
Internal Road, facility – building 1.62
Green Belt Development Area 1.85
Total 7.86
Sanitary Landfill Area (Phase-2)2.70
Grand Total 9.77 Hec.

Details of Project:

Construction of Solid Waste Management Project is divided in to three parts:
1) Construction of Compound wall, River protection work, Access Roads, Security Guard Room, and allied works at Dibrugarh: 11.97 Cr
2) Build and Operate 100 MT Solid Waste Processing Plant and 60 MT Sanitary Landfill and Allied Works at Dibrugarh: 43.15 Cr.
3) Procurement of equipment for Primary, Secondary collection and Transportation vehicles for Municipal solid waste Management at Dibrugarh: 10.00 Cr
Construction of Cover Shed: 9.14 Cr
Total Cost of SWM Project: 74.26 Cr

Contract award details of Solid Waste Management Project:

Package: 01
Name of work: Construction of Compound wall, River protection work, Access Roads, Security Guard- Room, and allied works at Dibrugarh.
Name of Contractor: M/S Badri Rai & Co Date of commencement of work: 08.11.2017
Original Contractual date of Completion: 07.11.2019 Extension 1: 12.05.2020
Extension 2: 11.11.2020
Completed: 24.09.2021
Original Contract amount: 11.79 Cr. Revised Contract amount: 10.75 Cr. Provisional sum: 0.50 Cr.

Package: 2
Name of work: Build and Operate 100 MT Solid Waste Processing Plant and 60 MT Sanitary Landfill and Allied Works at Dibrugarh.
Name of Contractor: M/s Milan Dutta - Blackberry Overseas Pvt. Ltd - Alfa-Therm Ltd (JV) Date of commencement of work: 21.08.2017
Original Contractual date of Completion: 24.09. 2019 Extension (EOT)1: 31.05.2020
Extension (EOT)2: 10.12.2020
Completed: 24.09.2021
Original Contract Cost: 26.75 Cr. Revised total Contract Cost: 43.15 Cr. Civil Cost: 35.61 Cr.
Operation & Maintenance: 5.04 Cr Provisional sum: 2.50 Cr
Package: 3

Name of work: Construction of cover shed at SWM Site, Dibrugarh. Name of Contractor: M/s Milan Dutta
Date of commencement of work: 30.11.2020 Original Contractual date of Completion: 31.03.2021 Completed: 24.09.2021
Original Contract Cost: 8.72 Cr. Revised total Contract Cost: 9.14 Cr.

Package: 4

Name of work: Procurement of equipment for Primary, secondary collection and Transportation vehicles for Municipal solid waste Management at Dibrugarh.

Lot-1 Primary Storage (Waste Bins):
Household Bins (2x25000) =50,000 nos. Public Bins 1100 L – 100 nos.
120 L – 850 nos.
60 L Twin – 50 nos.
Lot- 2 Primary Collection Vehicles:
Contractor: M/s Bora Automobiles Pvt Ltd Tipper Trucks – 50 nos.
Tractors – 02 nos.
Lot- 3A & 3B Secondary Transport / Landfill machineries:
Waste Compactor Vehicles.
Skid Steer Loader and Crawler Bull Dozer. Lot-4
GPS and Suitable software for vehicle tracking system Lot-5

PPEs and Workshop minor equipment & tools for vehicle maintenance.

Major Activities of the project

Sl. No.	Objectives	Project Deliverables
1.	Improvement of Collection	• House to House Collection • Segregation of Waste at Source • Waste Collection from inaccessible area • Waste collection from Commercial markets/institutions • Separate collection of Bio Medical Waste • Collection of Construction/ demolition waste separately.
2.	Storage facilities	• Installation of Bins with adequate capacity • Proper placement & Daily cleaning of Bins
3.	Transportation	• proper Designed vehicles to reduce multi handling
4.	Processing of Bio Degradable waste	• Processing of Organic Waste • Production of compost free from toxic • Recycling of recoverable material
5.	Design of new Disposal site	• Complete avoidance of crude dumping & burning of waste • Adoption of sanitary landfilling practice • Restrict landfill site for inert & rejects from compost plant.
6.	Enhancing Stakeholders awareness	• Awareness campaign • Involvement of NGO, CBO, private sector etc.
7.	Introduction of necessary reforms	• Introduction of MSW Rules • Involvement of private sector

House To House Collection: -

(a) Engagement of tipper vehicles
(b) Vehicles will make 3-trips
(c) Mapping of routes Segregation of waste at source: -
(a) Separate storage of bio-degradable and non-biodegradable waste at every HH
(b) Providing two bucket type HH-bins of different colors to every household for segregating the waste.

Waste collection from inaccessible areas: -

(a) Tipper vehicles of smaller wheelbase has been proposed
(b) Containerized Handcarts have been proposed for areas not accessible by any vehicle.

Separate Collection of Bio-Medical Waste: -

(a) Bio-Medical Waste (BMW) will not be allowed to mixed up with MSW
(b) BMW will be collected and disposed of as per the guidelines of BMW Rules-1998.

Collection of Construction/Demolition waste: -

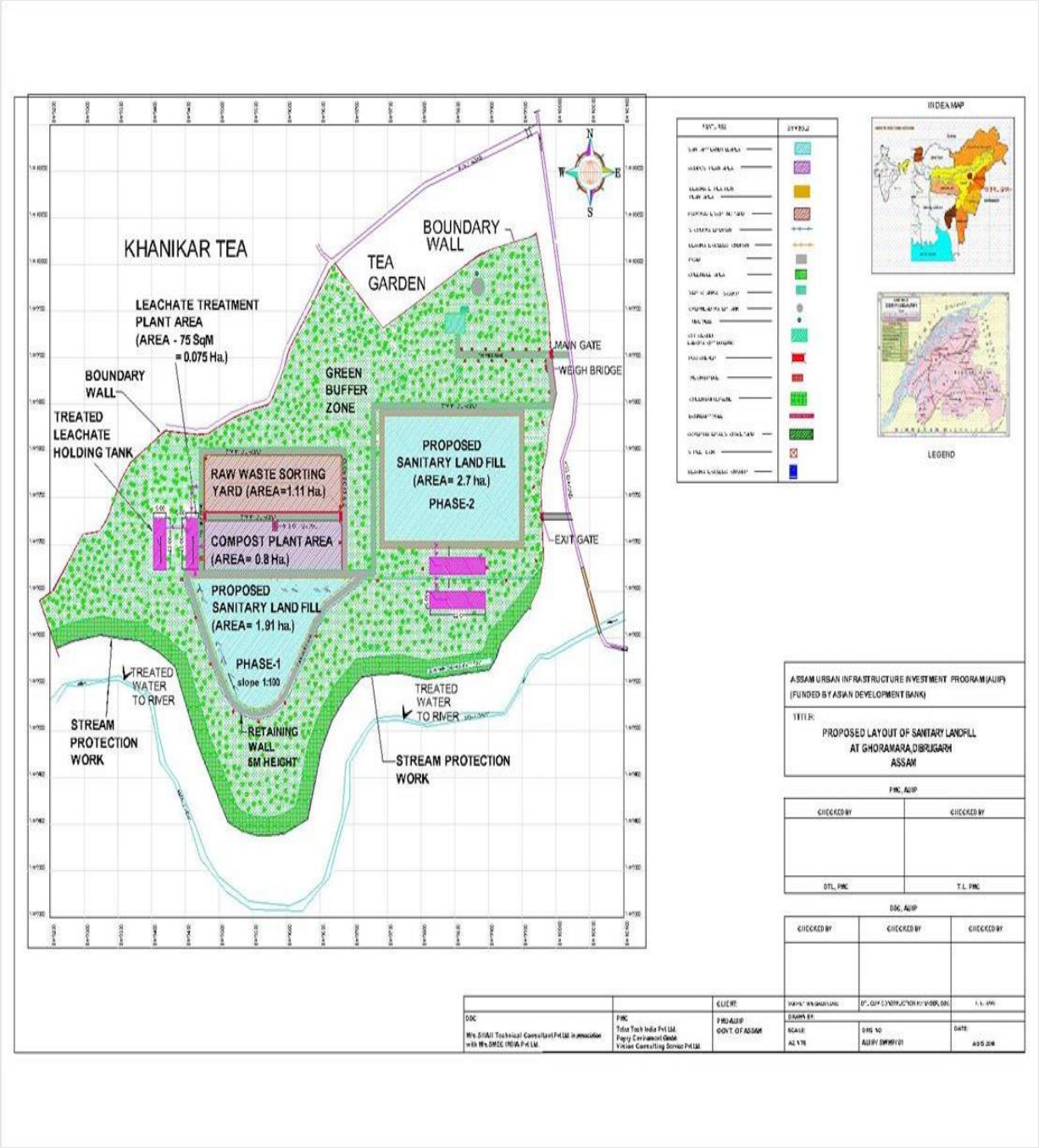
(a) C & D waste shall not be allowed to mix up with MSW
(b) The waste will be collected by DMB on chargeable basis Installation of bins with adequate capacity: -
(a) Mobile Garbage Bins of 1100 ltrs.capacity has been proposed.
(b) Pole Mounted litter bins have been proposed.

Proper Placement and daily cleaning of bins:-

(a) The Mobile Garbage Bins will be placed in commercial areas as far as possible
(b) A programme will be chalked out for cleaning of bins periodically Proper vehicle design to reduce multiple handling:-
(a) Tipper vehicle will unload the waste hydraulically into hopper of compactor.
(b) The compactor will be parked at Transfer Station point.
(c) The compactor can be shifted to any convenient place thus the Transfer Station will be a mobile one.

MAJOR COMPONENTS

- Weigh- Bridge
- Sanitary Land-fill Area
- Compost Plant
- Leachate Treatment Unit
- Retaining wall for flood protection
- Compound wall
- Green belt and buffer zone.
- Internal Service roads, Storm Water Drains
- Office cum laboratory
- Garage cum workshop


KHANIKAR TEA
TEA GARDEN
BOUNDARY WALL
LEACHATE TREATMENT PLANT AREA (AREA - 75 SqM = 0.075 Ha.)
BOUNDARY WALL
TREATED LEACHATE HOLDING TANK
GREEN BUFFER ZONE
MAIN GATE
WEIGH BRIDGE
PROPOSED SANITARY LAND FILL (AREA= 2.7 ha.) PHASE-2
RAW WASTE SORTING YARD (AREA=1.11 Ha.)
COMPOST PLANT AREA (AREA= 0.8 Ha.)
EXIT GATE
PROPOSED SANITARY LAND FILL (AREA= 1.91 ha.)
PHASE-1
slope 1:100
TREATED WATER TO RIVER
STREAM PROTECTION WORK
RETAINING WALL 6M HEIGHT
TREATED WATER TO RIVER
STREAM PROTECTION WORK
INDEX MAP
LEGEND
ASSAM URBAN INFRASTRUCTURE INVESTMENT PROGRAM (AUIP)
(FUNDED BY ASIAN DEVELOPMENT BANK)
TITLE:
PROPOSED LAYOUT OF SANITARY LANDFILL
AT GHORAMARA, DIBRUGARH
ASSAM
PMC, AUIP
CHECKED BY
CHECKED BY
DTL, PMC
T.L. PMC
DSC, AUIP
CHECKED BY
CHECKED BY
CHECKED BY
CLIENT:
PMU-AUIP
GOVT. OF ASSAM
DRAWN BY:
SCALE:
DRG NO
DATE:

The project is categories as under:

A) SWM Civil Work Contract:

SWM Contract Package 01A:

This sub package is comprising of Construction of Compound wall, Security guard room, River protection work, Internal Access Road and allied works. The work was awarded with an amount of Rs 13.64 Crore to M/s Badri Rai & Co on 8th November 2017 and the work was commenced in the same day. The construction of compound wall was initiated by the contractor as the 1st component. The target completion for the package was 8th November 2019 in original contract. But the progress was delayed due to some public interruption, curfew on Citizen Amendment Bill protest and also the force measures of COVID-19 Pandemic at that period from December 2019 to June 2020. Finally, the project was revised and completed on 10th September 2021.

SWM Contract Package 01B:

This sub package is comprising of Build and Operate 100 MT Compost plant, 60 MT sanitary landfill and allied works. The notice to proceed was given to the contractor M/s Milan Dutta- Blackberry-Alfa Therm (JV) on 21st August 2017 with an amount of Rs 42.88 Crore and the work was commenced on the same day. The Administrative Building was initiated to execute on 1st of February 2018 by the contractor. The target completion for the package was 10th September 2019 in original contract. But the progress was delayed due to some public interruption, curfew on Citizen Amendment Bill protest and also the force measures of COVID-19 Pandemic at that period from December 2019 to June 2020.



Finally, the project was revised and completed on 24th August 2021.

SWM Contract Package 01C:

This Sub Package is comprising of construction of two sheds named as construction of cover shed and construction of Machinery shed. The contract was awarded (Notice to Proceed) to M/s Milan Dutta on 4th December 2020 with an amount of Rupees 10.57 Crore and the contractor has commenced the work from very next day of receipt of the NTP.



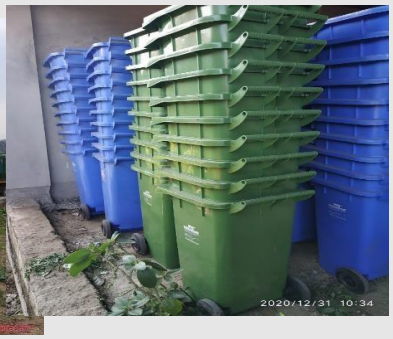
This contract inclusive of Two cover Shed (Compost & Machinery) with installation of Three machine section from preparation of garbage to finishing product of dry compost.

B) SWM Procurement:

Contract Package SWM/02:

Solid Waste Management project is also comprising of one sub contract named as SWM Procurement. Under this contract, the waste collection and transportation vehicles with GPS tracking facility, operational equipment and house hold bins were procured for smooth functioning of the plant.





SCOPE OF PROJECT

The SWM project, Dibrugarh is comprised with the salient components as under

•Administrative Building with equipped laboratory setup.
•Weigh-bridge for daily measuring of collected waste.
•Cover shed for segregation of collected waste.
•Machinery shed for composting and organic manure production.
•Sanitary landfill for dilution of inert materials.
•Leachate treatment plant.
•River protection work.
•Internal road and drainage network.

Sl. No.	Land Use	Area in Hac.
1	Sanitary Landfill Area (Phase-1)	1.91
2	Compost Plant Area with other facility	0.80
3	Leachate Treatment Plant Area	0.57
4	Raw Waste Storing Yard and other components of processing unit	1.11
5	Internal Road, facility – building	1.62
6	Green Belt Development Area	1.85
7	Sanitary Landfill Area (Phase-2)	2.70
	Grand Total	9.77

(A)ESTIMATES FOR BINS AND OTHER EQUIPMENT

Sl.No.	Item	Number	Cost per unit INR	Estimated cost Rs.in Lacs
1	Household bins for Door to Door collection (2 bins to each HH of 25 lit. Capacity each)	25000x2=50000	400.00	200.00
2	HDPE mobile garbage bins-1100 lit. Capacity	100	43000.00	43.00
3	Pole mounted litter bins 50 lit. capacity	100	3000.00	3.00
4	Push type handcart with 6pcs of 30 ltr capacity hand bucket	200	11000.00	22.00
	Total			268.00

Cost per unit item is based on quotations collected from dealers.

(B)ESTIMATES FOR PRIMARY AND SECONDARY COLLECTION VEHICLES

Sr. No.	Description	Unit	Quantity	Unit Cost INR (in lacs)	Total Cost INR (in lacs)
1	Garbage Tippers-1.8 cum capacity	Nos.	28	6.00	168.00
2	Refuse Compactors	Nos.	7	26.00	182.00
	Total				**350.00**

(C)ESTIMATES FOR LANDFILL MACHINERY

Sr.No.	Description	Unit	Quantity	Unit Cost INR (in lacs)	Total Cost INR (in lacs)
1	Bulldozer[(Komatsu-D39EX-22)crawler dozer]	Nos.	1	99.64	99.64
2	Excavator cum Loader(PC 71 Komatsu-Poclain)	Nos.	1	28.50	28.50
3	JCB(CASE 770)	Nos	1	26.10	26.10
	Total				**154.24**

(D)ESTIMATES FOR INSTALLATION AND COMMISSIONING OF COMPOST PLANT

Sr. No.	Description	Unit	Quantity	Unit Cost IN (in Lacs)	Total Cost INR (in Lacs)
1	Installation of Compost Plant of 45/50 MT/DAY capacity including testing and commissioning	--	---	750.00	750.00
	Total			**750.00**	**750.00**

(E)COST ON ACCOUNT OF POWER SUPPLY /SHIFTING OF UTILITIES/ENVIRONMENT PROTECTION ETC.

Sr.No.	Description	Unit	Quantity	Unit Cost INR	Total Cost INR(in Lacs)
1	Providing Power Supply to the proposed New Landfill Site at Gharamara	--	--	--	30.00
2	Electrical works	--	--	--	50.00
3	Providing Fire Fighting System at Compost Plant, Garage cum Workshop, Landfill site etc.				10.00
4	Shifting of utilities/temporary structures etc.	--	--	--	14.00
5	Environmental Protection Cost	--	--	--	40.00
6	Exploring the market availability and investor study	--	--	--	5.00
7	Public Awareness campaign/capacity building	--	--	--	5.00
	Total				**154.00**

(F)ESTIMATION FOR PPEs (PERSONAL PROTECTIVE EQIPMENT) AND WORKSHOP MACHINERY

(i) Personal Protective Equipment **Total conservancy staff with DMB=200 Nos. It has been proposed to provide following PPEs to staff.(25% extra quantities have been proposed)**					
1	Hand Gloves	Pairs	250	50.00	0.125
2	Gumboots	Pairs	250	650.00	1.625
3	Cotton Masks(250x12 months)	Nos.	3000	20.00	0.600
4	Rain coats	Nos.	250	700.00	1.75
	Total				4.10

(ii) Workshop Machinery					
1	5 HP Air Compressor	No.	1	70000.00	0.70
2	Car Washing Machine-Double Gun, Base Mounted	No.	1	25000.00	0.25
3	Welding Machine-200 Amp.	No.	1	13000.00	0.13
4	Grinding Machine	No.	1	3000.00	0.03
5	Hand Drill Machine	No.	3	2800.00	0.84
6	Bench Vices (Heavy Duty)	Set	2	4000.00	0.08
7	Battery Charging Unit 12V 6 Batteries	Set	1	8500.00	0.09
8	Tube Vulcanising Machine	No.	2	1850.00	0.04
9	Tyre Inflator	No.	1	8900.00	0.09
10	Hammers-5 kgs and 10 kgs.	Set	1	2000.00	0.02
11	Bottle Jacks	Nos.	5	3800.00	0.19

12	Chain Pulley Block-5T	No.	1	11500.00	0.12
	Total				2.58

(G)ESTIMATION FOR CIVIL WORKS

Sr. No.	Description of work	Estimated Cost INR(in lacs)
1	Construction of Garage cum Workshop	
	(a) Permanent Structure at city- (540 sqm)	111.70
	(b) Local shed-(60sqm)	38.70
2	Construction of Internal Roads at Landfill Site at Ghoramara (2300 mx6 m)	326.00
3	Construction of administrative office building (358.00sqms)	71.60
4	Construction of ground water level reservoir (110390 ltrs)	41.03
5	Construction of common toilets	8.28
6	Construction of septic tank (25 users-3.79 mx1.45 m x 2 m)	2.52
7	Construction of soak pit(25 users-1.44mx5.75m)	1.11
8	Construction of security guard's room (23.4 sqms)	11.14
9	Construction of Leachate Treatment Unit (79.52 sqm)	9.52
10	Construction of Bore Well (250 ft. deep)	3.89
11	Construction of Rest Room (78.84 sqms)	19.10
12	Construction of weighbridge operator's room (10.44 sqms)	7.37
13	Construction of Retaining Wall for flood Protection (950m lengthx3.5m height)	370.00
14	Construction of Retaining Wall along the landfill site (400m length x 6m height)	300.00
15	Construction of Sanitary Landfill (Phase-1) (From 2016-2031)(first 15 years)	368.00
16	Construction of Sanitary Landfill (Phase-2) (From 2032-2046)(next 15 years)	368.00
17	40T Electronic Weighbridge 9mx3m with all accessories including civil works for pit less type of load cell & platform	15.97
18	Lump sum provision for infrastructure development such as water distribution network,. sewerage work, street lighting, gates, landscaping, paving works ,construction of ramp at Transfer points,etc.	100.00
	Total	2173.93

SUMMARY OF COST ESTIMATES

Sl. No.	Components	Estimated cost (Rs.) In Lacs
1	Bins and other Equipment	268.00
2	Vehicles for Primary and Secondary collection	332.00
3	Landfill Machinery	154.24
4	Installation and Commissioning of Compost Plant	750.00
5	Cost on account of Power Supply /Shifting of Utilities/Environment Protection/providing fire fighting system etc.	154.00
6	PPEs and workshop equipment	6.680
7	Civil works	2173.93
	Total	3838.85
8	Contingency-3%	115.17
9	Grand Total	3954.02

6. Following methodology has been proposed for primary and secondary collection;

(i)Segregation of wastes (recyclables and non-recyclables) at source and its appropriate disposal has been suggested.

(ii)For the collection of road side garbage/litters etc. 100 bins (HDPE materials) with 50 liters capacity at strategic locations have been proposed. The existing litter-bins (App.300 in no.) will be retained.

(iii)Nearly 100% sweepings of the roads and cleaning of road side storm water drains has been proposed.

(vi) Nearly 100% daily collection of solid waste generated by various generators in DMB area is proposed. Primary and secondary collection of waste will be done using 22 numbers of mechanized 4-wheelers (TATA-ACE-HOPPER TYPE TIPPER) with 1.8 cum capacity each hydraulically operated vehicle. Waste collected by these vehicles will be unloaded hydraulically into hopper of the compactor vehicle. (6 nos.) 7.00 cu m capacity each for onward transportation of waste to treatment site at Ghoramara. The collection vehicle will make 3 trips and compactor vehicles will make 2 trips a day during the scheduled timings.

While arriving at the numbers of additional collection and transportation of solid waste under the proposed SWM project for Dibrugarh, the present strength of fleet for the purpose with DMB (8 nos. of tractor & trolley and one tipper truck) has been taken in to account.

Composting and Sanitary Landfill

Following approach has been adopted in designing of sanitary landfill and compost plant as detailed out in the DPR on SWM for Dibrugarh.

(i)A compost plant of 45/60 mtpd capacity has been suggested with proper infrastructure facilities as recommended by Ministry of urban Development, Government of India,

(ii)It has been proposed to approach Tea Estate Owners' Association and to hold no. of meetings with them to decide Marketing strategy for sell of compost,

(iii)Proper design of sanitary landfill with leachate collection and treatment arrangements have been suggested in the DPR, as per the Municipal Solid Waste (management & Handling) Rules,2000,

(iv)An approach road for the sanitary landfill site and compost plant and roads inside the facility with adequate drainage facilities for facilitating the movement of vehicles have been proposed,

(v)All the necessary requirements for providing electricity to the disposal site including the compost plant have been made in the DPR.
(vii)All other infrastructure facilities such as, weigh bridge, security post, administrative block, rest room for workers, operators room, bore-well with power pump, ground water storage R.C.C. tank, leachate collection and treatment plant, septic tank etc. required for efficient functioning of the compost plant and sanitary landfill site have been suggested and estimates have been prepared accordingly. Constructions of outer retaining wall of 950 m length and 3.5 m height (average) for protection from Sessa stream and 400 m of length and 6 m height around sanitary landfill have been proposed.
(viii)Constructions of storm water drains around the compost plant of 112 m length and size 250 x 300 mm and 350 m length with a size of 450 mm x 450 mm along the internal roads have been suggested. Outfall of storm water drains is in the Sessa stream.
(ix)Adequate precautions have been taken to maintain a minimum distance of 100 m for landfill site from the water course i.e. Sessa stream.
(x)The soil used as base with a thickness of 0.90 m for landfill site will be amended with 10% Bentonite. The soil used for preparing base for landfill is available within 5 km radius of the landfill site at Ghoramara.
(xi)Two layers of sand 30 cm thick each is provided at the top of the amended soil base of 90 cm thick at the landfill site to abate the pollution due to leachate. This is in conformity to the MSWMH-Rule 2000 of Govt. Of India.

(xii)Adequate provisions for green buffer about 3 m wide around the SWM site and internal roads near retaining wall have been proposed to facilitate movement inside the SWM site.
(xiii)Proper protection works for SWM site from the Sessa stream has been designed considering all the specifications as mentioned in IS code of practices for such constructions.

Action Plan Suggested for SWM Project Sustainability

Sustainability of the SWM project for DMB/DMPA area mainly depends on and complied with;
(i)To ensure sustainability of the SWM system the DPR recommended transfer of functions and devolution of responsibilities as per 12th Schedule in accordance with the 74th Constitution Amendment Act of Government of India by the State Government to DMB.
(ii)Door-to-door collection system should be encouraged and practiced. Separate collection of bio-degradable and non-bio-degradable of waste be practiced. Community should be made aware of segregation of waste with particular reference to recyclable waste. Segregation of waste should be encouraged through community awareness campaign.
(iii)Separate collection system for solid waste should be adopted, as suggested in DPR, for hotels, restaurants, vegetable markets, and commercial areas on user charges basis.
(iv)The hospital and nursing home wastes should be collected separately and treated as per Bio-medical Waste (Management & handling) Rules, 1998 of Ministry of Environment & Forests, Govt. of India.
(v)Revenue generation from all the beneficiaries in DMB area so as to manage adequate funds for the self-sustainability of the SWM project. Slum dwellers should be given due consideration.
(vi)Creation of awareness amongst all the stakeholders regarding benefits of SWM in DMPA and their roles and responsibilities for the success of the SWM program and ensure community engagement/participation.

(vii)Public involvement through various campaigns involving and using different media like TV, print media, school children, poster competition etc. should be encouraged.
(viii)Capacity Building, and Human Resource Development for the DMB staff, N.G.Os, and C.B.Os involved in SWM.
(ix)Initiating Reforms in financial management of DMB.
(x)SWM activities as proposed in the DPR should be the responsibility of only one private party for efficient and smooth functioning of SWM program. A proper agreement is drawn up, between the agencies involved, for such arrangements for the involvement of Private Sector.

(xi)In order to utilize full designed capacity of the compost plant (45 tpd), compostable waste from outside DMB area and within DMPA should also be taken to the compost plant by the DMB.
(xii)Coordinating agency involving qualified and experienced personnel at state level to oversee and coordinate the SWM activities should be nominated.
(xiii)For effectively managing the SWM system, a solid waste management cell/division should be created in DMB headed by an Environmental Engineer as suggested in the Manual on Municipal Solid Waste Management published by the Ministry of Urban Development, Government of India.
(xiv)Work audit section under the control of an officer of appropriate designation to monitor the activities at various levels should be created.
(xv)An appropriate reporting system in the form of Management Information System (MIS) and decision support system should be developed and implemented.
(xvi)Work norms should be developed and implemented for improved organizational efficiency.
(xvii)A Redressal Cell should be created in individual ward to assist in the identification and redressal of problems in waste management.
(xviii)Proper agreement be drawn up between State Government, DMB, and Private Party for discharging SWM services to the satisfaction of the community. For the purpose a strict monitoring system involving community must be evolved.

ENVIRONMENTAL REGULATORY COMPLIANCE

Broad activities proposed for the efficient implementation of SWM in Dibrugarh town are highlighted in Table: 1.4 as under;

TABLE 1.4: SOLID WASTE MANAGEMENT ACTIVITIES IN DMB/DMPA

Sub-projects	**Components**
Solid waste management	
	• Improvement of collection efficiency by way of efficient collection of wastes from various generators.
	• Segregation of waste at source and storage facility to avoid unhygienic / unsanitary conditions
	• Efficient transportation of waste to SWM site to avoid deterioration of surrounding environment
	• Processing of bio-degradable waste for cost recovery
	• Disposal of solid wastes scientifically at Landfill site
	• Enhance stakeholders awareness and marketability of compost produced
	• Scientific disposal of Bio-Medical waste and Slaughter House waste as per the guidelines prescribed by the Ministry of Environment & Forests, Government of India

Projects (as the proposed SWM project for Dibrugarh) which fall under the ambit of environmental regulations and mandatory requirement, are indicated in Table 1.5 will require Environmental Clearance from the appropriate authority.

TABLE-1.5 ENVIRONMENTAL REGULATORY COMPLIANCE

subject	Applicability of	Compliance Criteria
Solid Waste Management	Environmental (Protection) Act, 1986 Municipal Solid Wastes (Management and Handling) Rules, 2000	As per MoEF EIA notification September 2006, Common Municipal Solid Waste Management Facility falls under Category B type project. The project requires Environmental Clearance from State Environment Impact Assessment Authority

N.B: It will remain category B project, but it can be B1 or B2. For B1 project EIA will be suggested by MoEF/SEIAA and for B2 project no EIA is required. Under the circumstances, the Government of Assam shall apply for prior Environmental Clearance and approval of standard TOR for EIA study for which consultants have requested DMB/State Govt. to take up the issue with appropriate authority.

The Govt. of Assam is yet to constitute the State Environmental Impact Assessment Authority (SEIAA) and State Level Environmental Appraisal Committee (SEIAA). And therefore, in the absence of these committees, as mentioned in Table 1.5 the State Government will have to initiate action with the ministry of Environment and Forest, Govt. Of India, enclosing a copy of Form-1 duly filled along with the TOR for its concurrence for carrying out Environmental Impact Assessment Study for SWM project in Dibrugarh Town.

25. The ADB guidelines, on the other hand, stipulate addressing environmental concerns, if any, of a proposed activity in the initial stages of Project preparation. For this, the ADB Guidelines categorizes the proposed components into categories (A, B or C) to determine the level of environmental assessment required to address the potential impacts.

PROJECT BENEFITS

Following benefits have been envisaged from the implementation of the solid waste management project in Dibrugarh town;

(i)Reduction in unhygienic conditions resulting in cleaner surroundings and environment;

(ii)Reduction in choking of drains and streams resulting in floods during rains due to obstruction created by waste accumulated restricting the flow of storm water;

(iii)Reduction in vulnerability to water and air-borne diseases;

(iv)Utilization of waste to useful resources such as recyclables and organic compost;

(v)Reduction in the hazards of surface and ground water pollution by control and treatment of leachate from sanitary landfill;

(vi)Efficiency in segregation, collection and transportation of solid waste;

(vii)Increase in area coverage of waste collection;

(viii)Improvement in quality of life of the community.

IMPLEMENTATION SCHEDULE

The investment program is implemented over a period of 5 years, commenced in FY 2012.Completion is scheduled by 2017.The implementation of the solid waste management projects in Dibrugarh is proposed to be undertaken in the Project 1

DESIGN CONSIDERATION FOR LANDFILL SITE

A sanitary landfill site with composting facilities is proposed at a site about 8 km from center of Dibrugarh town. The DMB has acquired the land of 28.812 ha for solid waste disposal purpose. The proposed site, although situated near small; Sessa stream, with proper technological approach adopted as recommended in the MSWMH-Rules, 2000 as at Annexure-1, the site is deemed sufficient for its landfill purpose and a much-needed improvement over the existing unsanitary dumping conditions the city currently maintains. The proposed solid waste disposal site at Ghoramara is given in Figure: 6.3.

LANDFILL DESIGN

The sanitary landfill site consists of waste filling area and infrastructure support facilities. The support infrastructure (i.e., the access road, equipment shelters, weighing bridge, temporary waste storage space, demarcation of landfill areas for stockpiling cover materials, and liner material, drainage facilities, leachate collection, and treatment facilities)

will be located in the layout. Since there is an availability of adequate cover material at the site, and the water table is high, trench landfill is more suitable. Grading required for landfill development will produce excavate which will be safely stockpiled and used as cover material for the landfill operations. In order to avoid surface and groundwater contamination, the excavated site is lined with low permeability natural clay of about 900 mm thick and 1.5 mm thick HDPE geo-membranes.

LEACHATE COLLECTION AND TREATMENT

A schematic diagram of leachate collection mechanism at sanitary landfill site is

Shown in Figure 6.4. Leachate collection lateral pipes shall be provided above the membranes in 300 mm thick silt sand. The 150 mm collection pipes shall be provided at a spacing of 20 m c/c. with perforations shall be laid at a slope of 1 in 100. Header pipes (250 mm dia) will be provided connecting up to the leachate holding tank.

CHARACTERISTICS OF MSW:

Sl. No.	Parameters	Contents
1.	Compostable matter	40 %
2.	Inert matter	30 %
3.	Recyclable material	30 %
4.	C/N Ratio	26
5.	Calorific Value	952 K cal/kg

Compost Plant Flow Process:

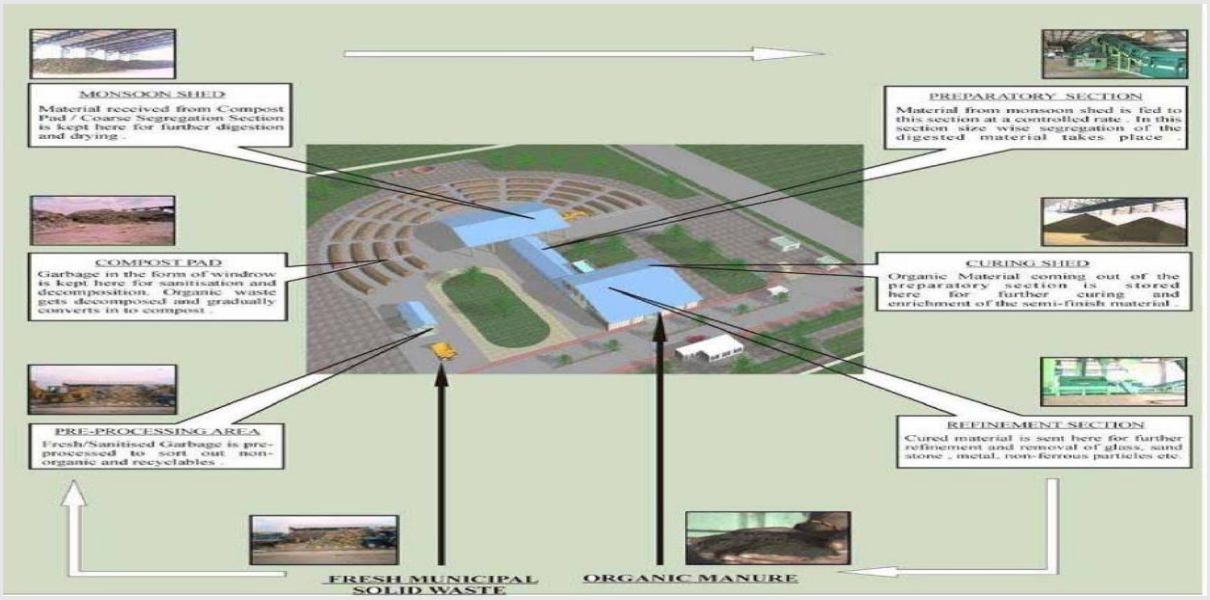


Figure 6.4 Constructional details of SLF and Leachate Collection pipes

DESIGN IMPACT

In order to protect the SWM site from flooding RCC retaining walls of proper length and height and adequate storm water drainage systems have been proposed. To protect landfill site from flooding adequate storm water drainage system around the site has been proposed. Out falls of storm water drainage system will be in the Sessa stream.
Adequate and proper collection system of leachate from compost plant and landfill site has been suggested. Collected leachate will be treated in the leachate collection and treatment tank and the treated leachate conforming to the standard as prescribed in MSWMHR-2000 will discharged into the Sessa stream.

ENVIRONMENTAL IMPACTS AND MITIGATION: CONSTRUCTION

Likely there will be fairly large physical changes at the site as a result of the excavation and other construction works. The Geo-Technical Survey and Soil-Investigation for the landfill site at Ghoramara, Dibrugarh were conducted before selection of site.
Re-use as much excavated material in this project as possible (for example using as landfill cover) and retain suitable soil in stockpiles for use when the landfill is in operation, to cover waste periodically and for the final covering when each cell is full.
Most excavation is likely to be conducted in the dry season to avoid the difficult conditions that can occur when earthworks are carried out during rain. There will be a risk of generation of dust. Although the project area is at rural location where there is no habitation nearby, precautions will nevertheless be needed to reduce dust to provide a suitable and safe environment for workers. Therefore, it is required to cover or damp down working areas and stockpiled soil in dry, windy weather; use tarpaulins to cover loose material during transportation to and from the site.
Another physical impact associated with large-scale excavation is the effect on drainage and the local water table if groundwater and/or surface water collected in the cavities as they are dug. Conducting the work in the dry season will reduce these impacts. Since Sessa stream flowing close to the SWM site, precautionary measures will have to be taken during construction and operation phases at SWM site.

The other construction work at the landfill site (applying HDPE sheeting, installing pipes and brick aggregate, leveling and paving the composting area and constructing the office buildings and weighbridge) will all have physical impacts, but those will be small compared to those of the landfill operation.

No toxic materials (fuel, oil, cement, etc) will be stored at or near the site. Standard Specification for contractor will includes adequate safety measures to prevent fuel and other spills as a result of accidents. The other aspect of the work that may have economic implications is the transportation of waste material to a disposal site and to locations where it can be put to beneficial use as recommended above. This will require a large number of truck movements, which could disrupt traffic, particularly if such vehicles were to enter the thorough road. This activity will be implemented by the contractor in liaison with DMB, supervisor engineer and necessary precautions should be taken to reduce effects on traffic.

Construction activities inevitably will produce noise and dust, and these plus the visual appearance of the site and restrictions in access caused by excavation and the presence of vehicles and machinery, are generally the factors that disturb people who live or work in the vicinity. These should however not be major problems in this case as the facilities are located in rural areas outside the town, and there are no people living nearby.

The health and safety of workers will be maintained by applying measures included in a Health and Safety Plan. Even though rural areas are sparsely populated, mitigation measures will be taken to assure the safety of the public. The plan must include:

Exclusion of the public from all sites;

Provision and use of appropriate Personal Protective Equipment (PPE) by all workers; Health and Safety Training for all site personnel;

Documented procedures to be followed for all site activities; Accident reports and records, etc.

Construction work can provide short-term socio-economic gains for local communities if contractors employ local people in the workforce. To ensure that these benefits are directed to communities that are most affected by the work, contractors should be encouraged to employ at least 50% of their workforce from communities in the vicinity of construction sites. This will help to mitigate the impacts of any disturbance as well as creating a positive impression of the project. Building a workforce from mainly local people will also avoid problems that can occur if workers are imported,

CONSTRUCTION IMPACTS

There are certain impacts associated during construction and operation of landfill and compost plant. These impacts are as under;

(i) Construction activities associated with sanitary landfill site and compost plant will result in increase in daytime noise levels. Short terms Impacts can be mitigated through procurement of equipment's / vehicles with inbuilt mechanism to arrest high noise levels. Construction during the night time to be avoided as far as possible

(ii) Leveling, compaction and construction of haul road to the bottom of the landfill site will result in generation of fugitive dust, which needs to be suppressed with regular water sprinkling.

(iii) Health impact on construction workers associated with dust and noise generation. Workers to be provided with appropriate PPEs

ENVIRONMENTAL IMPACTS AND MITIGATION: O&M

Environmental impacts and mitigation during the operation and maintenance of the landfill and composting site are;

(i) DMB will be responsible for operating the waste management facilities and will be given further support by the project in the form of staff training and financial assistance. All solid waste management activity is required to comply with the
Municipal Solid Waste (Management and Handling) Rules, 2000 of GoI.

(ii) Waste for landfill will be moved into position by bulldozer, and will be compacted by compactors when the vehicles move over the surface. When a cell is full, vertical gas venting pipes will be installed and the waste will be covered with compacted clay, sand and layer of topsoil, to seal the cell and control odor and pests.

(ii) At the compost plant, waste will be sorted manually and any unsuitable material with rejects from the compost plant will be removed and transferred to the landfill. Biodegradable waste will be left to decompose in a series of piles ("windrows") in the open air, and material will be turned periodically by a machine provided by the project. Once the compost has been formed it will be loaded into bags and taken away on a truck for sale to retailers or direct to farmers.

(iii) If the composting plant is to be successful, DMB will need to ensure that residents separate out their biodegradable waste into a "green" waste bin at source, and that segregation is maintained during secondary transfer and transportation. The project will fund community awareness education programs to inform the community about the facility and their role in waste separation.

(iv) Clearly, it is imperative that DMB maintains both the transfer points and the SWM site in proper order, because if the system begins to fall into disrepair then waste will rapidly accumulate in the streets and the sanitary landfill will become an insanitary dumpsite, with consequent adverse impacts on environmental health. Capacity building, public education campaigns and other allied subjects suggested in this SWM project are aimed at promoting the long-term successful operation of the system in Dibrugarh.

(v) The greatest physical impacts will occur at the landfill, where decomposing waste will rise to heights from ground level, which will alter the topography and appearance of the site. Although these impacts would be significant at certain locations that should not be the case here as there are no people living in the

Vicinity whose views of that landscape would be impeded. However, the landfill design includes effective screening by the planting of densely-leaved trees at the perimeter of the site.

(vi) The landfill design includes measures to collect leachate and prevent pollution of surface- and ground- water. Leachate will be treated by simple method of filtration. Sludge that deposited in the inlet and outlet chambers will be recirculated to the landfill. Given the amount of rain that falls in this region, and the pollution of land and water that can occur if a landfill is subjected to flooding, the design of SWM site taken into consideration the following;

a. Surface water drains at the site are adequate to retain and dispose of the heaviest rains;

b. O&M procedures require drains to be kept in working order at all times and checked regularly and cleared of any sediment or other debris.

(vii) Landfill management must involve the covering of waste until a cell is full and is being closed. The site therefore will need to operate as a sanitary landfill as noxious odors and pests that are associated with open dumping are also present. Two actions are required in order to prevent this:

a) Operating procedures should involve periodic covering of deposited waste, not simply when a cell is full; and
b) O&M procedures for the transfer points and landfill should be prepared by an experienced solid waste management

expert.

(ix)Poorly-managed landfills can cause negative ecological impacts by allowing the development of large colonies of scavenging birds, rodents and other vermin, that can be a nuisance and result health hazard to nearby communities, and can damage crops on surrounding farmland. Such animals are discouraged by regular covering of waste, so this reinforces the need to adopt this mitigation measure. DMB should also routinely monitor the incidence of pests at the site so that controlling action (for example by regular culling) can be taken if necessary.

(x)There can be small ecological gains as well as improvements in the appearance of such sites if trees are planted at the periphery and on completed waste cells, so this should be done.

(xi)There should also be a significant economic benefit in the long term from the commercial sale of organic fertilizer produced at the composting plant. There should also be economic gains from increased yields in farms where the compost is used to fertilize the land, and these could be significant in areas where nutrients have been leached out by tea and paddy cultivation and denuded by regular planting of the same or similar crops.

(xii)The only negative economic impact from the operating waste management system will be on traffic and transport in and around the transfer points in the town and on roads leading to the landfill, as there will be more heavy traffic on roads at these locations. This should be mitigated by carrying waste to the landfill outside peak traffic periods, even in the early morning if necessary. Remaining economic impacts should be counterbalanced by the economic and other benefits of the scheme.

(xiii)The main beneficiaries of the improved waste management infrastructure and system will be the citizens of the town, whose general environment, and in some cases living conditions, will be improved considerably. There should be fewer unsightly mounds of garbage in the town, including in slum areas, and the attendant appearance, smell and public health risks should be reduced considerably.

(xiv)There will also be socio-economic benefits for people who are able to gain employment to operate the scheme and/or with DMB if they operate elements of the system themselves. Farmers who benefit from fertilizer produced at the composting plant should also experience an increase in their income.

(xv)O&M Impacts pertain to:

a. Noise pollution due to movement of the heavy solid waste carrying vehicles to the site to be reduced through development of vegetative buffer.

b. Everyday earth covers of 2-3 cm above the garbage layer will require significant quantities of borrow materials. Earth obtained from excavation of ground around the SWM site likely to create some type of water storage ponds. These ponds could be utilized as fisheries which would help villagers as source of income.

c. Early filling of leachate tank during rainy season cause spillage and pollution in the nearby stream should be prevented by providing adequate storm water drainage system around the SWM site including leachate collection and treatment tank.

d. Washing waters from the transfer points loaded with grit may lead to choking of nearby storm water drains. A grit chamber to be provided to arrest such particles at the outfall line of the washing platform.

e. Floor washing in the garage and workshop may have oil and grease which can contaminate the storm water drain and ultimately the nearby streams. An oil and grease trap to be provided at the outfall

line from the garage.

f. Routing and scheduling of refuse vehicles may not match with user's waste dumping behavior. The mismatch to be minimized with adequate awareness programs through NGOs, CBOs, and the media.

DESIGN OF COMPOST PLANT

COMPONENTS OF MUNICIPAL SOLID WASTE PROCESSING, TREATMENT AND DISPOSAL

5 The Municipal Solid Waste Disposal facility proposed for Dibrugarh Municipal Board will have various units associated with semi-mechanized compost plant. The provisions for MSW handling units within the solid waste disposal facility site have been made in accordance with the Manual on 'Municipal Solid Waste Management', Government of India. A compost plant flow process is shown in Figure 7.1. The composting has been found to be the most suitable option for the treatment of MSW in Dibrugarh town. Composting has least environmental problems amongst municipal solid waste treatment technologies.

6 Compost is considered as a slow release of fertilizer material where nutrients are released slowly and for a long period. The chemical fertilizers on the other hand, are fast acting and therefore give yield within a relatively short period. However, soils undergo high stress and degradation due to prolonged use of chemical fertilizer. Compost is a good soil conditioner and helps to enrich the soil quality by enriching the oxygenation rates and organic content. It also improves the texture of the soil. In non- harvesting agricultural practices like plantation, the compost is most useful and the benefit can be maximized by dual application of chemical fertilizers and compost. Assam state has extensive tea gardens where compost can be effectively and economically used. Assam already has a good demand for organic compost and will not be difficult to market the compost, provided it meets the required quality in a consistent manner.

7 Furthermore, the rejects of the compost plant will have to be disposed in a scientific manner, and therefore, sanitary landfill will form a necessary and integral part of the holistic solid waste management solution for Dibrugarh.

WINDROW COMPOSTING – PROCESS AND DESIGN

Composting Process

8Aerobic composting is the process of degradation of biodegradable waste matter into simple organic compound by certain micro-organisms in the presence of air. The main requirements are adequate supplies of air and moisture. Compared to anaerobic process, aerobic conversion process is preferable as it is fast, exothermic and free from odour. Aerobic process also helps to eliminate pathogenic organisms, weed seeds, larva etc. as a result of high temperature developed during the process. Main factors affecting the composting through aerobic process are listed in Table 7.1

TABLE 7.1: **MAIN FACTORS AFFECTING COMPOSTING**

Factors Affecting Composting	**Desirable Ranges**
Moisture Content	50% to 60% optimum
Temperature	50^0 to 60^0 (5 to 7 days for pathogens to get killed)
C/N Ratio	Between 20 – 40
	If C/N Ratio is less – straw, saw dust, paper to be added as carbon
	If C/N Ratio is more – sewage sludge, slaughter house waste to be added as nitrogen source
	At the end of composting C/N Ratio=20. As per MSW regulations C/N permitted = 20-40
Aeration	Adequate oxygen throughout the mass-normally ensured by the turning every 5-7 days

9. However, this should always be kept in view that aerobic composting is a natural process and the final quality of the product (Physical, chemical and biological) and the quantity (end product) both may vary from time to time depending on various factors such as:
•Physical and chemical composition of raw solid waste inputs;
•Seasonal variations;
•Yard management and monitoring efficiencies.

10. The complete process of MSW composting can be summarized as follows:
•Reception of raw MSW;
•Visual inspection of waste;
•Weighing of vehicle to assess the quantity of waste;
•Manual sorting of inert material and removal of rejected material to landfill site;
•Sorted material moved to windrow pads;
•Windrows management activities;
•Periodic turning of windrows;
•Process monitoring and controlling activities;
•After two turning, shifting of material to monsoon shed;
•After two weeks stabilization into monsoon shed, feeding of material to coarse segregation section;
•Oversized (+35mm) rejects to be sent to landfill site;
•Medium sized (+16mm) rejects either sent to landfill or for windrow covering;
•Under sized (<16mm) material stocked in curing section godown;

•After two further weeks, coarse material to fed to refinement section;
•Small sized (<6mm) to be grounded and mixed in curing section;
•Under sized fine compost to be enriched with useful organisms, herbal extract (optional);
•Final product as compost to be packed in 50 kg bags and stacked in finished goods godown;
•Compost to be picked up by marketing agency for distribution and selling in the market

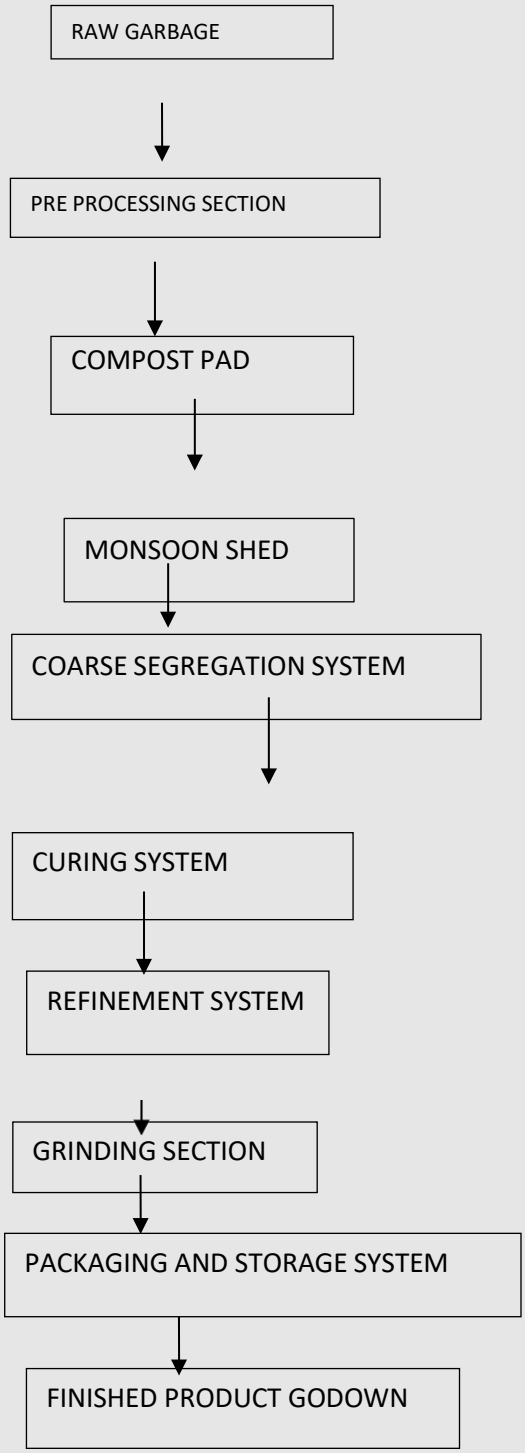


Figure-7.1 COMPOST PLANT FLOW PROCESS CHART

Design of Compost Plant

Projected biodegradable waste generation in the year 2036 will be 44 TPD (Ref Table 6.3 of Section 6). The proposed compost plant is being designed for 45 tons per day capacity of MSW for a period of 20 years. The compost plant is based on the concepts of open windrow aerobic composting of biodegradable material of solid waste (semi-mechanized compost plant). The infrastructure for the plant has been proposed in such a way that the capacity of the plant can be increased suitably to cater the needs up to its design period. The complete process of the compost plant can be divided into various components which are explained below.

Material intake system

All incoming vehicles containing MSW should be visually inspected and weight of the same should be recorded with the electronic weigh bridge at the entry gate. If the vehicle contains more inorganic material than the prescribed limit should be directed to the landfill.

Pre-Processing System

The material accepted for composting is spread on the tipping area, where the unwanted materials like plastics, rags, tyres, etc. and all other large sized recyclables/inert materials etc. should be sorted out manually. Sorted waste containing mostly the organic portion of the fresh garbage is taken to the compost pad for windrow formation.

Yard Management System

In the yard, the fresh MSW is stacked on the composed pad (non-permeable concrete platform) in the form of Trapezoidal Heaps called Windrows. Here the waste is sprayed with inoculums and water to accelerate the digestion process. Windrows are periodically turned using front-end loader with backhoe arm to provide proper aeration and temperature control. This waste is then stacked in the form of windrows again. The cross section of the windrows is so adjusted that it would get optimum surface area to volume ratio. Adequate spaces are allotted for fresh garbage for windrows. On composed pad, digestion of composting mass is achieved and for further stabilization, the material is shifted to monsoon shed using a backhoe unit and dumper. The material is kept in monsoon shed for 15 days for further stabilization

(i) During windrowing water is added to windrows by sprinkling to maintain requisite moisture content,
(ii) Just after windrowing, bacterial activity starts within 2-3 days. Inside, temperature of the windrow may go up to 650.

Assessment of Windrow Size

The compost plant is designed for 45 tons of solid waste every day which may be under-utilized for few years due to less quantity of compostable material. However, it could attain its full capacity when sufficient quantity of compostable waste is available. Initially, the waste is spread in one windrow and after aerobic decomposition of waste; the same will be transferred to second windrow. Thus, the process is repeated 4 to 5 times till the waste is fully aerobically decomposed.

Monsoon Shed

For further stabilization of waste and for drying, the waste is kept in monsoon shed which is open from all the sides for ventilation and easy movement of vehicles.

Coarse Segregation System

A steel structure shed with 6 m high CGI roofing and concrete flooring is required for placement of coarse segregation equipment. The building must be properly ventilated for sufficient light and air circulation. Proper side outlets are provided for removal of rejects.

Curing System

Material coming out of the coarse segregation section is stored in curing section for 2 weeks for further stabilization and moisture control. Some additive, if required may be added at this stage to improve the quality of the final product as organic manure. A steel structure with CGI roofing and concrete flooring is required for storage of material. The building must be properly ventilated for proper light and air circulation. A centrally hanging platform is provided to support storage conveyors.

Refinement System

A refinement system is incorporated in the machine line to remove impurities such as glass, plastics, and other inert etc. and to maintain the size below 6 mm as per the compost quality norms. A two storied steel structure with 5.25 m high floor and concrete flooring is required for placement of refine section equipment. The compost plant must be designed for dynamic loads and earthquake resistance.

Grinding Section for Recovery of Organic Compost

Grinding section ensures recovery of material which is otherwise rejected from the plant. Rejects coming out from the refinement section or any other section containing organic matter can be passed through this section for recovery of useful material here undigested organic material are fractionized and re-added to the curing section for further digestion. A strong steel structure with 1.5m high floor is required for placement of grinding section equipment. The structure must be properly designed for dynamic loads. Proper louvers must be provided to avoid dusty atmosphere.

Packaging and Storage System

From the refinement section, high quality compost is then passed through the packing spout for final packing. At packing spout, material is packed in 50 kg bags and then weighed. Begs are then stitched using portable sewing machine and finally stacked in the finished goods godown with three days storage facilities. There should also be provision for three days storage of recyclable materials.

Testing Laboratory

To achieve efficient various composting process parameters must be periodically monitored and controlled in time. A well-equipped laboratory helps in in-house testing of various parameters required such as temperature, moisture, C/N ratio etc. For the purpose laboratory should be well equipped with quality instruments and equipment. Based on the industrial practice, it can be considered that a well operated 45 TPD MSW plant can generate about 12 TPD of good quality compost or organic manure (The finished product which looks like organic compost is shown in Figure: 7.2).

Leachate, Litter Flies and Odor Control Management System

During composting, some liquid/concentrated wastewater may percolate through the MSW due to leaching, known as leachate. It should not get percolated in the ground or else it will pollute the groundwater. To avoid this, proper concreting of compost pad is done and a peripheral drain is provided to collect the leachate generated during the process. Leachate generated is collected through a network of drains and pipes in the RCC leachate collection and treatment tank provided at the SWM site. The air borne litter is controlled by providing a dense green belt around the plant. In green belt creepers are provided to act as green curtain. To control odor, the sanitizer is added at the concrete pad. Sanitizer suppresses the odor generating from the waste. The odor control also helps in creating workable atmosphere for the people working at the compost plant.

Process Monitoring and Control System in Yard Management

Yard management process needs to be monitored in order to achieve proper digestion and obtaining good quality finished product. Corrective measures have to be taken by the yard controlling person for proper maintaining of moisture, temperature, C/N ratio etc. for proper and efficient functioning of the plant to produce good quality of compost.

Control panel

Centrally located control panel shuts down the plant automatically in case of temperature, pressure and current fixed readings exceeds the stated value. The person in-charge should take at least three readings of these parameters daily from the control panel and see that all these readings are within the limits.

Removal of Oversized Rejects

Oversized rejects (mainly from Trommel-35 and gravity separator) must be regularly removed from the rejection yard.

All the rejects will be loaded in dumpers or tractor-trolleys and directed to adjoining landfill site.

AREA REQUIREMENT FOR A 45 TPD MSW COMPOST PLANT

Following Table 7.1 shows the area required for a typical design of a 45 TPD municipal solid waste compost plant for its various unit processes. The approach adopted is based on the report on 'Waste to Wealth' prepared by the Inter-Ministerial Task Force on Integrated Plant Nutrients Management constituted by the Ministry of Urban Development,

Government of India, May 2005.

Sl. No.	Compost plant layout details	Covered / Uncovered	Area required	Remarks
1	**Total area required for the plant**		**0.8Hectare**	
2	a. Tipping Area	Uncovered	300sqm	All values may vary to the tune of +-10% to 15% depending on the site condition
	b. Processing Area	i) Covered	100 sqm	
		ii)Uncovered	200 sqm	
	Total		**600 sqm**	
3	**Compost Pad Area**			
	a. Compost pad area	Uncovered	2785sqm	
	b. Rain Shed Area	Covered	1190 sqm	
	Total		**3975 sqm**	
4	Monsoon shed area	Covered	1190 sqm	
5	Machine shed area	Covered	150 sqm	
6	Control room area	Covered	25 sqm	
7	Curing shed area	Covered	180 sqm	
8	Refinement area	Covered	65 sqm	
9	Finished product godown	Covered	300sqm	
10	Administrative office and laboratory	Covered	100 sqm	
11	Garage security etc.	Covered	415 sqm	
12	Area required for demonstration space	Uncovered	1000 sqm	

(Source: Report of Inter-Ministerial Task Force constituted by the Ministry of Urban Development, GoI)

Note: Space for other components such as internal roads, Green Belt, Buffer Zone covered within 3.47 ha, as considered under land use data

DATA ANALYSIS AND INTERPRETATION

The SWM project, Dibrugarh has been designed for a total capacity of 100 TPD compost plant and 60 TPD sanitary landfill in 1st phase for a period of 30 years. According to the statistical data recorded by Dibrugarh Municipal Board, only 60 TPD solid waste generated and collected under the capacity of DMB since 2016. The present statistical analysis for the operation of SWM plant is as under:

Daily Waste collection		60 TPD	Source from 22 nos. ward	
Segregation and composting		24 TPD (Max. 40% from collection)	5-8TPD from recovery and recycling	
Disposed to Sanitary Landfill		25-30 TPD	Inert materials	
Production of Organic Manure		16-20 TPD	Final compost product	
Waste collection	Waste composition	Total mixed Garbage per day (TPD)	Recyclable recovered qty (TPD)	Tons per year
Paper	3.00%	60	1.80	657.00
Plastic	2.00%	60	1.20	438.00
Metal	0.30%	60	0.18	65.70
Glass	0.10%	60	0.06	21.90
Rubber	3.00%	60	1.80	657.00
Rags(cloths)	3.00%	60	1.80	657.00

In addition to the above, 18.60% of combustible waste as Refuse Derive Fuel (RDF) for cement factory is also mixed as waste composition per day Collection and transportation of Municipal Solid Waste:

SL no.	Description of Items	Qty	Unit	Remarks
1	Garbage Tipper	50	Nos.	Under DMB operation
2	Tractor 48 HP with Trailor	2	Nos.	At SWM plant
	Tractor 48 HP	1	Nos.	At SWM plant
3	Refuse Compactor	5	Nos.	Handed over to DMB
4	Dumper 6-wheel 10.50 cu.m (19 Ton) capacity			
4.i	TATA make	1	Nos.	At SWM plant
4.ii	EICHER make	1	Nos.	Handed over to DMB
5	Windrow Turner with 90 HP 2WD Tractor	1	Nos.	At SWM plant
6	Skid Loader	1	Nos.	At SWM plant
7	Front end Loader with Backhoe (Mahindra)	2	Nos.	At SWM plant
8	Water tranker trolley mounted with slurry pump (5000 Lts Capacity) with hand pallet	2	Nos.	At SWM plant
9	Tractor Trolley 4 cu.m capacity	2	Nos.	At SWM plant

10	GPS Tracking with RFID technology	62	Nos.	Vehicles & Plant

List of Bins & allied Items:

SL no.	Description of Items	Qty	Unit	Remarks
1	Household Bins (Blue & Green)	50000	Nos.	Handed over to DMB
2	Public Bins 1100 Ltr. Capacity (Blue & Green)	100	Nos.	Handed over to DMB
3	Public Bins 120 Ltr. Capacity (Blue & Green)	850	Nos.	Handed over to DMB
4	60 Ltr. Twin Set (Blue & Green)	40	Nos.	Handed over to DMB
5	Personal Protective Equipment	Lot	Pair	At SWM plant

Annual O & M Cost and Revenue estimation for Solid Waste Management Facility in Dibrugarh:

The probable O & M Cost of the SWM Plant is estimated with the actual observations during the trial run of the plant and presented in this Note. The garbage generation in the first year is expected to be around 60 tonnes per day. Considering the CPHEEO guidelines on manpower requirement the revised O & M estimates are prepared. As per the contract agreement the defect liability period (DLP) involves certain maintenance cost (if any) to be carried out by the contractor. The same is considered and reflected in the subsequent section.

Summary of Operation & Maintenance Cost and Revenue Estimation for 60 TPD capacity Compost Plant & Landfill Facility at Dibrugarh			
SL	**EXPENDITURE**	**COST/YEAR (RS, IN LAKHS)**	**Reference**
1	Manpower for 30 persons	48.94	Annexure 1
2	Maintenance Cost of SWM Plant Machineries per year	14.41	Annexure 4 First Year no maintenance cost
3	Cost for operating Skid Steer loader, Loader Backhoe, tractor, dumper - Fuel Cost	64.61	Annexure 2
4	Electrical/Power charges for entire plant	26.41	Annexure 3
5	Laboratory chemicals, consumables. (L/S Rs. 10,000/ month)	1.2	
6	Personnel Protective Equipment (PPE - Helmets, Masks, Gloves, Gum Boot, Uniform, Rain Coat) as	0.0	For 1st year by AUIIP procurement
7	Compost Bagging	1.2	Annexure 5
8	Internet, Office Stationary, drinking water etc. (L/S Rs. 5000 per month)	0.6	

	Total Cost (In lakhs)	**157.37**	
	Revenue	**INCOME/YEAR (RS, IN LAKHS)**	
1	Revenue from Sale of Compost	112.00	Annexure 6
2	Cost Recovery from Sale of Recycling Materials	89.00	Annexure 7
	Total Revenue (In lakhs)	**201.00**	

Annexure 1

Cost Break up for Manpower

Sl	**Grade**	**For 60 TPD**		
		Minimum Required	**Rate (Rs./Month)**	**Total Cost (Rs. Per Month)**
1	Plant Manager	1	30,000	30000
2	Supervisor/Shift Incharge	1	16,768	16768
3	Mechanic, welder, electrician	1	13,487	13487
4	Plant Operator	1	13,487	13487
5	Chemist for Laboratory	1	16768	16768
6	Office Manager Cum Marketing Manager (Compost, RDF and Recyclables)	1	16768	16768
7	Skilled Worker	2	13,487	26974
8	Semi Skilled Worker - Leachate sprinkling	1	10,569	10569
9	Lab Assistant (Semi Skilled worker)	1	10,569	10569
10	Unskilled Worker at Reject Conveyor	3	9,113	27339
11	Drivers (1 skid loader, 1 windrow turner, 3 Backhoe loader, 2 Tractor, 2 Tipper Truck, 1 Water Tanker)	10	12838	128380
12	Marketing Manager (Compost/ RDF/Dry Recyclable)	1	30000	30000
13	Computer Operator cum Accountant at Admin Building	1	16768	16768
14	Security Guard	2	10569	21138
15	Office Boy at Admin Building	1	9113	9113
16	Maintaining office premises/ sweeping/Admin Building	1	9113	9113
17	Weigh Bridge Operator	1	10569	10569

	Important Plant Operation per Month	**30**		**407810**
	Per Year			**4893720**
	Amount (Rs. In lakhs/Year)			**48.94**

N.B. Rag pickers will be engaged for Manual Sorting

Annexure 2

COST OF FUEL

SL. No.	Name of the equipment	Nos.	Fuel per day per equipment	Fuel per day	Fuel per month (25 days)	Cost of Fuel per month	Cost of Fuel per year
1	Skid Steer Loader	1	26	26	650	57850	694200
2	Loader Backhoe	3	40	120	3000	267000	3204000
4	Windrow Turner	1	24	24	600	53400	640800
5	Dumper 6 wheel	2	16	32	800	71200	854400
6	Tractor	2	20	40	1000	89000	1068000
	Total	9		242	6050	538450	6461400
					Rs in Lakh	**5.38**	**64.61**
Cost of Diesel as on 24.09.2021 Rs89.00							

Annexure 3

COST OF ELECTRICITY & GENERATOR

Sl. No.	**Period**	**(Actual Cost) APDCL BILL Rs**
1	7.7.21 to 31.7.21	83005
2	1.8.21 to 31.8.21	119696

Cost of electricity per month: Rs140000
Cost of electricity per year : Rs16.80 lakh
Generator running daily average 2 hrs Total running in a month 60 hrs
Diesel consumption by 200KVA generator per hr = 15 lit Cost of generator running per month (60x15x89) = Rs80,100
Cost of generator running per year = Rs 9.61 lakh
Total cost of electricity and generator running per year = 26.41

Annexure 4

MAINTENANCE COST
Vehicles and Equipment for SWM Plant

	Status as	**on 24.09.20**	**21**	
Sr. No	**Items**	**Quantity**	**Contract Amount (Rs)**	**Status**
1	Windrow turner with 90 HP 2WD tractor - 01 No	1	**59,50,000**	Received at site.
2	Tractor 48 HP and Tripper Trolley 4 cum capacity		**16,76,000**	
	Tractor 48 HP	1		Supply Completed
	Tripper Trolley 4 cum capacity	6		Supply Completed.
3	Water Tanker Trolley Mounted with Slurry Pump & Leachate Sprinkler (5000 Lt. Capacity) and Hand Pallet (3 Ton capacity)	2	**8,00,000**	Supply Completed
4	Dumper 6 Wheel 10.5 CUM (19 Ton Capacity)	2	**5800000**	Supply Completed
5	Tractor 48 HP	1	**800000**	Supply Completed
6	Front End Loader with Backhoe (1.1 and 0.25-0.3) cum	3	**9000000**	Supply Completed

Total Cost of equipment Rs 2, 40, 26,000

Annual Maintenance Cost @6% Rs 14.41 lakh

Annexure 5
Calculation for Cost of Compost Bags of 50 Kgs

Cost Estimate for PP Bag for packing Compost in 50 Kgs		
Total compost Production per Year	3650	Ton
Bulk Compost Sold per year @75%	2737.5	Ton
Compost stored in Bag sold per year	912.5	Ton
Compost stored in Bag sold per year	912500	Kgs
Kgs of Compost packed in Bag	50	kg/bag
Number of Compost Bags required per year	18250	
Cost of compost Bag	6.5	Rs/Bag
Cost for Total bags required per year	118625	
Say	120000	per year
Amount (Rs. in Lakhs) per year	1.2	

Annexure 6
Revenue from Sale of Compost

Year	Quantity of Compost Production (Tons/Year)	Revenue Recovery (Rs. In lakhs)	
		Revenue at Rs. 5000/Ton	Revenue at Rs. 3000/Ton
2021-22	3650	183	110
2022-23	3725	186	**112**
2023-24	3800	190	114
2024-25	3875	194	116
2025-26	3950	198	119
2026-27	4025	201	121
2027-28	4100	205	123
2028-29	4175	209	125
2029-30	4250	213	128
2030-31	4325	216	130
2031-32	4400	220	132

Annexure 7
Cost Recovery from Sale of Recycling Materials

Waste Composition	Waste Composition	Total Mixed Garbage per day (TPD)	Quantity of Recyclable Recovered (TPD)	Tons per year	Rate Rs. /Ton	Amount (Rs in lakhs /Year)
Paper	3.0%	60	1.80	657.0	5000	32.9
Plastic	2.0%	60	1.20	438.0	10000	43.8
Metal	0.3%	60	0.18	65.7	18000	11.8
Glass	0.1%	60	0.06	21.9	2000	0.4
Rubber	3.0%	60	1.80	657.0		0.0
Rags (Clothes)	3.0%	60	1.80	657.0		0.0
Combustibles as Refuse Derived Fuel (RDF) for Cement Factory	18.6%	60	11.16	4073		0.0
	30.0%	60	18	6570		88.9
					Say	**89.00**

CONCLUSION / FINDINGS

Following benefits have been envisaged from the implementation of SWM project in Dibrugarh:
•Reduction in unhygienic conditions resulting in cleaner surrounding environments.

•Reduction in choking of drains and streams resulting in flood during monsoon due to obstruction created by waste accumulated restricting the flow of storm water.
•Reduction in vulnerability to water and air borne diseases.

•Utilization of waste to useful resources such as recyclables and organic compost.

•Reduction in the hazards of surface and ground water pollution by control and treatment of leachate from sanitary landfill.
•Efficiency in segregation, collection and transportation of solid waste.

•Increase in area coverage of waste collection.

•Improvement in quality of life of the community.

•Revenue generation and employment opportunities.

SUGGESTIONS / RECOMMENDATIONS

The newly constructed Solid Waste Management Plant is covering 210 Bighas of land, and only 40% of the land is occupying in the 1st phase for the plant, and the remaining land can be proposed for the 2nd phase for extension of the project. In view of the availability of vacant land, it can be proposed that refuse derive fuel (RDF), CNG, diesel production may be initiated for better utilization of municipal solid waste.

REFERENCES / BIBLIOGRAPHY

Writing Reference for a Web link/Website

1. https://www.adb.org/projects/42265-023/main

2. http://www.adb.org/forms/request-information-form?subject=42265-023

3. https://dmb.assam.gov.in/swm/about_swm

4. http://auiip.nic.in/swm.html
5. https://cpcb.nic.in/municipal-solid-waste-rules/