THIMPHU WASTE MANAGEMENT PLAN

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Abbreviations

ABI	Association of Bhutanese Industries
APA	Annual Performance Agreement
BAFRA	Bhutan Agriculture and Food Regulatory Authority
BBS	Bhutan Broadcasting Service
BCCI	Bhutan Chamber of commerce and Industry
BEA	Bhutan Electricity Authority
BHU	Basic Health Unit
BNCA	Bhutan Narcotics Control Authority Report
BCCI	Bhutan Chamber of commerce and Industry
BTFEC	Bhutan Trust Fund for Environment Conservation
CC	Cubic Capacity
C & D	Construction & Demolishment
CMD	Compliance Monitoring Division
COP	Conference of Parties
CP	Contingency Plan
DEO	Dzongkhag Environment Officer
DES	Department of engineering Services
DGPC	Druk Green Power Corporation
DGM	Department of Geology and Mines
DM	Disaster Management
DNP	Department of National Properties
DoA	Department of Agriculture
DoFPS	Department of Forest & Park Services
DoI	Department of Industry
DoL	Department of Livestock
DRA	Drug Regulatory Authority
DRC	Department of Revenue and Customs
DRE	Department of Renewable Energy
EVDP	Essential Veterinary Drug Program
GBWM	Green Bhutan Waste Management
GHGs	Greenhouse Gases
GIS	Geographical Information System
GNH	Gross National Happiness
GRF	Government Reserved Forest
HCF	Health Care facility
HDPE	High-density Polyethylene
HRAB	Hotels and Restaurant Association of Bhutan

IA	Implementing Agencies
INDC	Intended Nationally Determined Contribution
ISWM	Integrated Solid Waste Management
ITS	Intelligent transport System
JDWNRH	Jigme Dorji Wangchuk National Referral Hospital
MCH	Maternal and Child Health Care
MEA	Multilateral Environmental Agreements
MoE	Ministry of Education
MoH	Ministry of Health
MoIC	Ministry of Information and Communication
MoWHS	Ministry of Works and Human Settlement
MT	Metric Tons
NAPA	National Adaptation Programme of Action
NCAH	National Centre for Animal Health
NECS	National Environmental Commission Secretariat
NIIT	National Institute for Information Technology
O&M	Operation and Maintenance
PET	Polyethylene terephthalate
PIA	Pasakha Industrial Area
PM_{10}	Particulate Matter
RBG	Royal Body Guards
RBP	Royal Bhutan Police
RGoB	Royal Government of Bhutan
RIM	Royal Institute of Management
RNR	Renewable natural resources
RSPN	Royal Society for Protection of Nature
RSTA	Road Safety and Transport Authority
SDGs	Sustainable Development Goals
SLCP	Short-lived climate pollutants
SJI	Samdrup Jongkhar Initiative
SoE	State of the Environment
TNA	Technology Needs Assessment
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
WCC	Waste and Climate Change
WHO	World Health Organization
YDF	Bhutan Youth Development Fund

Chapter 1 Introduction

Background

The growing volume of waste as a result of incessant economic growth is threatening the environment and sustainability of the country. Thimphu, the capital of Bhutan, has rapidly grown since its establishment as the capital in 1955. The waste problems in the city are expected to escalate because of the increasing population, urbanization, rural-urban migration and the change in consumption habits. Although major efforts have been taken for waste management in the capital, there still seems to be gaps that need to be filled. Private sector involvement in waste management has proven to be advantageous for the city with major recycling and recovery initiatives. Such initiatives can considerably reduce the waste going to the landfills and help manage waste in an efficient manner. Major challenges on waste management in the capital as pointed out by various sectors are; improper waste segregation at source, frequent breakdown of garbage collection vehicles, lack of public cooperation in waste management and lack of coordination among responsible agencies. It is thus important to revisit the waste characteristics and waste quantity generated and come up with strategies and solution for managing waste in Thimphu.

The waste generated per day in Thimphu Thromde is about 40.3 metric tons as per the waste composition and analysis survey carried out in this study. The National Solid Waste Survey carried out by the MoWHS, (2008)[1] found waste generation of 50 tons per day in Thimphu with per household waste generation of 0.6 to 1.2 kg per day. Out of the total municipal waste, about 49% of the total waste generated was found to be organic waste followed by paper waste (25.3%) and plastic (13.7%). This study also found similar results of waste composition with the highest waste composition as organic waste (58%), followed by plastic (13%) and paper (9.2%) signifying higher landfilling of biodegradable waste.

Current Waste Management System in Thimphu

The current waste management system in the capital involves disposal of wastes at the landfill site without proper sanitary disposal practices. Landfill is considered the most preferred method of waste management in the country. The Memelakha landfill in Thimphu was constructed in 1994 with a design capacity of eight years. It has long exceeded its capacity and it is presently operated by removing soil from the slopes above the landfill for waste coverage, which spreads the dumping area. The compost pit at Serbithang which was set up in 2010 for biodegradable waste has been shut down following complaints from the residents in the area. At present both the dry and wet wastes end up at the landfill site although collected separately. While communal composting is done at some places there is still rising concerns on the amount of wet wastes increasing in the capital. A total of 13 community compost plants have been established so far in the capital by the Thromde office along with trainings on household and community composting to the public. The

[1] Waste composition Thimphu Thromde (National Solid Waste Survey 2008, DUDES, MoWHS)

landfill capacity would significantly improve if compost plants could handle all the wet waste in the city.

The landfill capacity was estimated to be around 3.4 years considering waste generation quantities of about 40.3 t/day. Leachate overflow was identified as a major issue at the landfill site in Memelakha, which was supposed to be delivered to the sewage treatment plant regularly. There are numerous agencies and organizations involved in managing waste in the city but there still seems to be coordination issues. There is minimal waste segregation, recovery of recyclable materials and most of the waste is transported to the landfill. However, with the establishment of the first transfer station and manual segregation at the landfill, some of the recyclables are collected and sold to local scrap dealers. The establishment of the first drop-in center for waste at Thimphu near Kelki higher Secondary School has also proven to be effective in enervating illegal waste disposals and improving waste recovery within the city.

Another major problem for the city is the sewage leaks and overflow from the septic tanks of the households within the city owing to improper design and monitoring. Majority of the households rely on individual septic tanks and soak pits and the sewer lines in networked areas are constantly overloaded with sludge from septic tanks, which are pumped into the network lines. There is also lack of facilities in handling wastewater from the workshops. The wastewater from such places ends up in the drains, which is eventually released in the streams.

Medical waste and e-waste are other major concerns for Thimphu because of its growing volume and absence of adequate facilities for handling such waste. There are inadequate storage facilities in the JDWNRH, which has led to medical waste disposal in the municipal waste collection trucks. The sharps from the JDWNRH are disposed in deep burial pits while body parts are incinerated, and infectious wastes are autoclaved. The general waste from the satellite clinics and BHUs are also collected and disposed at the municipal landfill, the sharps are either burnt or disposed in deep pit burials. There is lack of plans on managing e-waste in the country; the scrap dealers from the bordering town of India purchase most of the e-wastes, since there is lack of facilities within the country to handle such wastes. The recycling market is heavily dependent on the scrap dealers across the borders.

The waste outside the Thromde premises are collected by the Dzongkhag and disposed at the landfill as mixed waste. Thimphu Dzongkhag currently has two collector trucks for collecting waste from the gewogs without segregation of any kind.

1.1 Concept and principle for waste management plan - Circular economy concept-4Rs

The TWMP shall follow the concept of circular economy, an alternative to a traditional linear economy in which resources are kept in use for as long as possible while extracting the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life. In a circular economy, all materials are used in loops at each stage of its production, use or disposal. This ensures that there is minimum input of resources, maximum

utilization of goods and services, minimum waste generation followed by extreme reuse and recycling as shown in Figure 1-1. The Thimphu Waste Management Plan shall include waste management activities designed to enable recovery and recycling as much as possible.

Figure 1-1 Circular Economy Concept

1.2 Objective of the study

The main objective of this study is to develop a Thimphu Thromde Waste Management Plan and Thimphu Dzongkhag Waste Management Plan to aid in the overall waste management process both within and outside the city premises.

1.3 Legislative Framework for Waste Management

In order to develop a waste management plan for the capital, it is important to look into the existing legislative framework on waste management in order to assess the existing gaps in the management framework and to ascertain what is lacking in terms of implementation. Bhutan is a signatory to a number of Multilateral Environmental Agreements (MEAs), such as the Basel Convention, the Kyoto protocol, Vienna Convention, Paris agreement, etc. Amidst rising development and urbanization in the country, Bhutan remains committed in conserving its environment. Acknowledging the increasing concerns on waste in the Country, the Waste Prevention and Management Act of Bhutan was formulated in 2009 to manage waste and protect the environment

followed by the Waste Prevention and Management Regulation of 2012, the National Integrated Solid Waste Management Strategy of 2014 and the Waste Prevention and Management (Amendment) Regulation of 2016. However, enforcement of the legislation remains a distinct challenge. Although improvement and unremitting amendments have been made on minimizing waste in the country and with some plausible achievements, there still are concerns and shortcomings in the overall waste management system of the Country. It is therefore necessary to come with a holistic waste management plan for Thimphu, taking into consideration, the exertions taken till now, the gaps and flaws in the system and coming up with ways of handling such issues.

1.4 Methodology

The framework for formulation of the Waste Management Plan for Thimphu Dzongkhag and Thimphu Thromde is shown in the figure below. The methodology for this study should follow the stages as mentioned in the figure below. It is important to have consultations with the relevant stakeholders as much as possible to come up with an all-inclusive waste management plan taking into consideration all the issues and challenges.

The activities undertaken for this study are as follows;

1. Collection of primary waste collection and management data for Thimphu.
2. Collection of feedback and suggestions from Thimphu citizens on how to better manage waste in Thimphu through an online survey.
3. Consultations with relevant stakeholders
4. Review of current status of waste management in Thimphu and compilation of key findings;
5. Review of waste governance, policies and pricing in Thimphu;
6. Review of various technical options for waste minimization and management in Thimphu;
7. Determination of priority waste streams and issues in Thimphu which should include all solid, liquid and gaseous waste;
8. Preparation of plans and proposals for possible solutions and strategies for the prioritized waste streams and issues in Thimphu;
9. Suggest improvements in waste collection system for Thimphu based on the data collected;
10. Understanding of special waste streams such as disaster waste, construction and demolition wastes in Thimphu;
11. Preparation of plans and proposals for special waste streams for Thimphu;

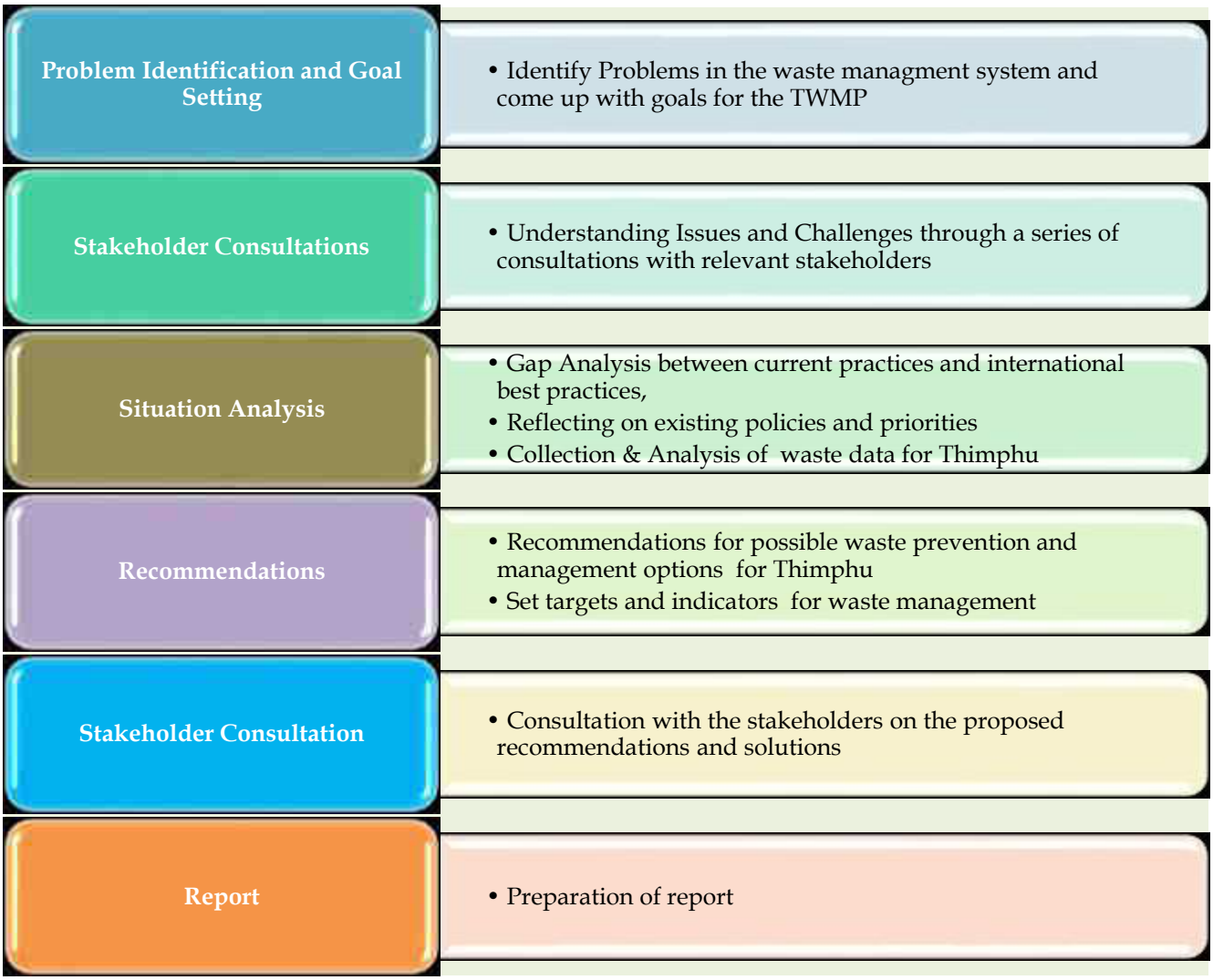

Figure 1-2 Methodology

Chapter 2 Waste Management Plan for Thimphu Thromde

Thimphu Thromde covers a total of 26 sq. km with a population of 120,000 (Bhutan National Urbanization Strategy, 2008) based on a growth rate of 7.3 percent per annum. It encompasses seven constituencies stretching from Dechencholing in the North to Babesa in the South. Development activities in the Thromde are as per the Thimphu Structure Plan (TSP), an Urban Development Plan, which is a 25-year (2002-27) master plan for the capital city of Thimphu, approved by the Government in 2003. The need for a systematic waste management plan for the Thromde has been stressed on various occasions and it was also prioritized and highlighted in the Thromdes eleventh five-year plan. Currently, the percentage of households in the Thromde with access to waste management system is about 70% and the total amount of solid waste recycled on a monthly basis is about 15 MT. The awareness and knowledge level on segregation and 4Rs among Thromde residents is about 40% (2012) and the number of households connected to the sewerage system is about 35%[2]. Although plan of activities is well defined and a National Integrated Solid Waste Management Strategy (2014) has been formulated, there still seems to be gaps in implementation of the activities and management of waste in the city. The Thimphu Thromde Waste Management Plan aims to look into the gaps and limitations of these problems, come up with ways in dealing with such incongruities, and act as a guide for proper waste management for the city.

2.1 Thimphu Thromde - Institutional and Regulatory Frame work

Thimphu City Municipal Corporation was formed through a Royal Decree of 1995 that granted it an autonomous status. However, Autonomy and authority of Thimphu city Corporation is limited due to various provisions of charter. There is no separate division for solid waste management and wastewater management, but it is part of the Environment section. There is one environment officer, one senior technician and nine site inspectors working under the environment division. There are also 2 supervisors and 87 laborers engaged in the field[3]. The roles and responsibilities of the environment division are as follows;

- Awareness, sensitization and organizing cleaning campaigns
- Inspection and Monitoring
- Upgrade and manage disposal facilities
- City cleaning
- Facilitate dumping yards for excavated soil and construction waste
- Collection and disposal of waste
- Facilitate unclaimed dead bodies
- Manage and operate public toilets
- Control hawkers
- Propose new initiatives and review proposals

[2] Thimphu Thromde, 2013 – Eleventh Five Year Plan

[3] Data from Thimphu Thromde - 2018

In addition to the Thromde office, two private entities are involved in waste management in the Thromde, Greener Way and Clean City. Greener Way manages wastes from the south and central parts of the Thromde while Clean City manages wastes from the Northern part of the Thromde. There are a total of 46 workers under Greener Way and 30 under Clean City. The details of monitoring staffs in the Thromde and workers under the waste management private entities at present are as shown in the table below.

Table 2-1 Waste Monitoring Staffs and Capacity in the Thromde[4]

Thimphu Thromde	Greener Way	Clean City
• Environment Officer -1 • Sr. Technician-1 • SI- 9 • Larjab-2 • Laborers - 87 • Landfill staff-2	• Management -9 • Drivers- 12 • Handy man- 12 • Waste Segregators- 13 **Total – 46**	• Management – 5 • Drivers-5 • Handy man-10 • Security -1 • Waste segregators -7 **Total – 30**

The organizational structure of the Thromde is shown in Figure 2-1. The Thrompon performs the executive functions of the City/Thromde assisted by the Executive Secretary. The Thromde faces operating losses each year on waste management. The revenue collections from tax and non-tax resources are inadequate to recover the expenses. As per findings from this study, per capita expenditure on SWM services is Nu 152 per annum per person while realization is only Nu 8 per annum, which is barely 6% of the expenditure. The total expense and the amount of waste generated for Thimphu Thromde for the year 2018 is shown in the table below. It is estimated that for each person in a day, a sum of Nu. 0.48 is spent for waste management. The total waste management cost for 2018 is about Nu. 17.4 million. A fine amount of Nu. 1,983,000/- has been collected by the Thromde from January 2018 till October 2018 for illegal waste dumping and littering. These fines are in turn used for improving the waste management system in the Thromde.

Table 2-2 Waste Amount and Expense for Thimphu (2018)

Particulars	Thimphu (2018)
1. Waste disposal expense	17.4 million Nu
2. Amount of waste	12573.6t/year (40.3*312)
3. Population	114,551
4. Expenses per ton（1/2）	1,383.85 Nu/t
5. Expense per person (1/3)	152 Nu/person
6. Expense per person per day (152/312days)	0.48 Nu. / person
7. Cost of Collection	1.4 Nu. / kg

[4] Tshering Yangzom, Environment Officer, Thimphu thromde – Presentation during the Stakeholder Consultation on preparation of TWMP, 25th October 2018

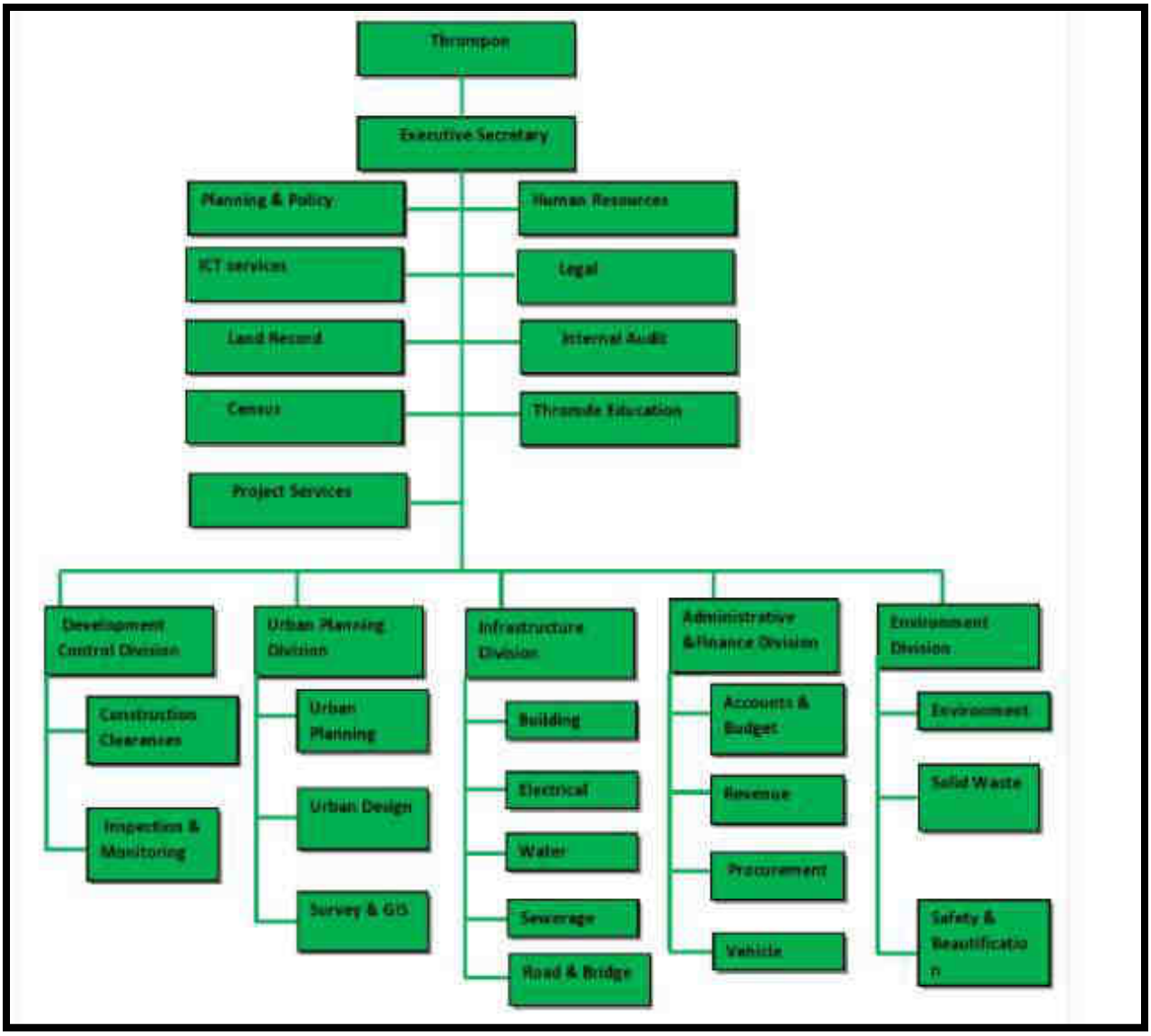

Figure 2-1 Organogram

Existing waste management system in Thimphu Thromde and its challenges

Thimphu Thromde faces major environmental challenges due to the increasing volume of waste in the city. These challenges are further aggravated by rapid urbanization, increasing population and increasing rural-urban migration. It is important to look into the issues and challenges of each waste stream and come up with plans in order to ensure proper and efficient waste management systems. The waste streams considered for this study and their prioritization are given in the subsequent sections.

2.2 Waste Streams and their Prioritization

The waste stream selection and prioritization are based on internationally accepted guidelines, the waste management act and based on review of past reports in the country and a series of consultations with relevant stakeholders in the Thromde. For the current waste management plan, the waste streams that are taken into account are;

i. Municipal solid waste and wastewater;
ii. Medical waste/chemical waste;
iii. Industrial waste;
iv. E-waste;
v. Construction and demolition waste;
vi. Disaster waste
vii. Air pollution

Municipal waste is given the highest priority because of the alarming volume in which they are produced followed by medical waste, industrial waste, e-waste, construction and demolition waste, disaster waste and air pollution. Although medical waste is only a small percentage of the total waste generated in the country, improper management of such wastes can cause harm to both human health and the environment. Industrial waste is another major issue as development activities along with industrial expansion are on the rise and there are no proper systems for coping up with such waste. Similarly, there are no proper systems for managing e-waste generated in the country. There are also no facilities and capacity for handling construction and demolition waste and disaster waste. Air pollution is also a major concern for the city with industrialization and vehicle numbers on the rise.

2.2.1 Municipal waste

Solid waste

The solid waste within the Thromde is managed by the Environment Division of the Thromde office. The Thimphu Thromde office outsourced waste management within the Thromde to two private waste management entities since 2015. Thimphu Thromde is divided into 3 waste management subzones and two subzones are taken care by Greener Way, which accounts for 70 to 80 percent of Thimphu Thromde through 11 collection trips.

Greener Way was the first private firm in the country that was responsible for waste management established in 2010. Waste is collected thrice a week (dry and wet waste depending on the area). Dry waste is brought to the transfer station for segregation, where all recyclable wastes are separated. The common recyclable wastes that are recovered include PET bottles, HDPE pipes, Metals, Papers, and Cardboard boxes etc. The remaining waste is eventually sent for disposal to the Memelakha landfill. The waste collection frequency of Greener Way is as shown in the Table below.

Table 2-3 Waste Collection frequency (Greener Way)

South Zone		
Location	**Wet**	**Dry**
Babesa New lap	Wed & Sun	Fri
Babesa GREF to Serbithang	Fri	Wed & Sun
Babesa Okl lap	Thu	Tue & Sat
Changbangdu & Buddha point	Tue & Sat	Thu
Changedaphu	Fri & Sun	Wed
Changzamtok	Wed	Fri & Sun
Changjiji	Wed & Sun	Fri
Lungtenphu	Fri	Wed & Sun
Police Camp and Hospital Area	Tue & Sat	Thu
Olakha	Tue & Sat	Thu
Simtokha	Thu	Tue & Fri
YHS and Babesa GREF	Thu	Tue & Sat

Table 2-4 Waste Collection frequency (Greener Way)

Central Zone		
Location	**Wet**	**Dry**
Chang Lam & Norzin Lam	Wed & Sat	Tue/Thu/Fri/Sun
Changangkha	Wed	Fri & Sun
Chubachu	Sat	Tue & Fri
CFM Resident	Wed	Thu & Sun
Hongkong market	Sat	Tue & Fri
Lower Motithang	Tue & Sat	Thu
NPPF Colony	Thu	Tue & Sat
PWD Colony	Wed	Thu & Sun
Upper Motithang	Fri & Sun	Wed

The average waste collected by Greener Way in a day is about 36MT/day while clean city collects 24 TL/week, the details are as shown in the table below.

Firm Name	**Waste Type**	**MT/day or MT/week**
Greener Way	Dry	24-25 MT/day
	Wet	12-15 MT/day
Clean City	Total	24 TL/Week, 5trucks

At present, Greener Way is the only waste management entity that has a Transfer-station where wastes are segregated, and the recyclables are collected and sold. The rest of the waste management entities directly dispose their waste into the landfill where it is segregated, and some

are recovered. Community composting for wet waste is also done at some places in the Thromde. The waste collection and disposal system for the Thromde is as shown in the figure below.

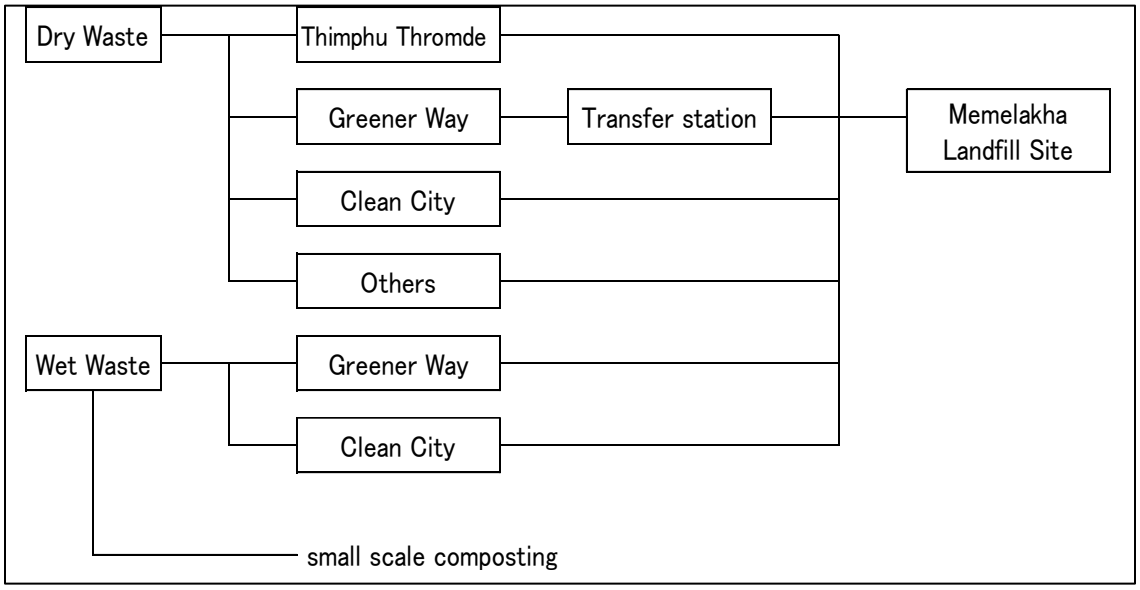

Figure 2-2 Waste collection and management system

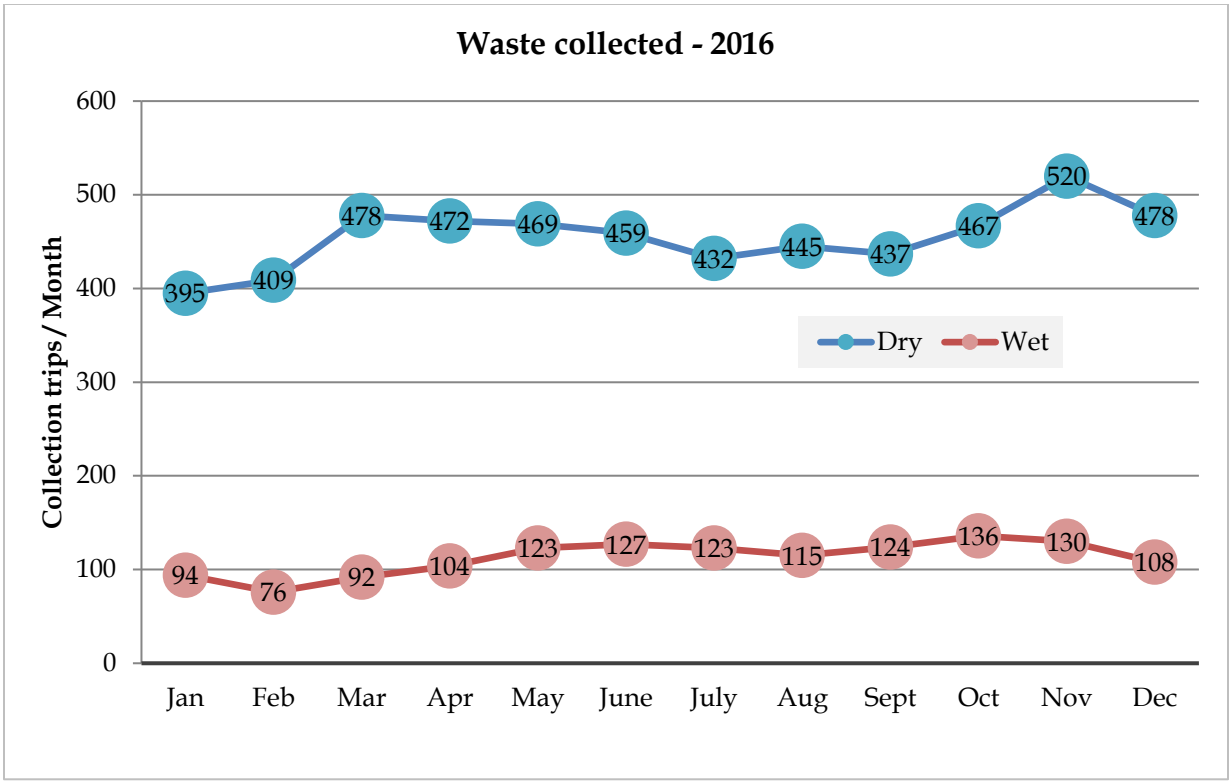

Figure 2-3 Waste Collection Trips (2016)

As per data maintained with the Thimphu Thromde, a total of 6813 collection trips and roughly about 6813 MT of solid waste was collected by the collection vehicles in 2016 (Figure 2-3). At present, the Thromde has 24 garbage trucks, 13 trucks (compactor and open trucks) are with

Greener Way and five with Clean City to collect solid waste from households in the municipality. All the garbage trucks have GPS systems installed for the thromde to monitor their movement. Two dumper trucks collect waste from 15 communal bins of size 3 m^3, which are mostly placed in areas where door-to-door service is not provided and in high waste volume areas such as markets. A PET bottle-crushing unit introduced by TCC and the Bhutan Beverages Company Ltd. in Thimphu produces about 20 kg of shredded plastic per day. The estimated cost on waste management in the Thromde is about 18% of the municipalities budget (11 Million, 2008). The Thromde recovers only six percent of the total cost as service fees. As per data from July 2011–June 2012, the collection and transport of waste was found to be about 85 percent of the total investment, landfill management about 10 percent, and 5 percent on the composting plant, from the total of Nu 10,163,034 spent on waste management services[5].

The status of the waste collection vehicles as of September 2018 are mentioned in the table below along with the amount of waste collected and total collection trips.

Particulars	**GW**	**CC**	**TT**
Carried weight (t/month)	703	324	93
No. of running vehicles	5	4	4
No. of trips (times/month)	400	146	85

[5] Partnerships for Effective Municipal Service Delivery- UNDP, 2012

Memelakha Landfill

Figure 2-4 Memelakha Landfill

The landfill at Memelakha is located 12 km from the city, spread across an area of about 2.7 Acre from which 1.6 Acre is used for dumping and rest as part of the road. It was primarily designed

for a capacity of 8 to 10 metric tons when the population was around 15,000 in 1994. The waste generated at present is about 40.3 MT in the city. There is lack of proper design and management of the landfill site and it is being operated more as a dump yard and not engineered sanitary landfills due to overloading and space constraints. There is no segregation of household hazardous wastes (batteries, glasses, etc.) and no disposal sites for special wastes, both the wet and dry wastes are disposed at the landfill.

Compost pit

The Compost pit was built in Serbithang when there was no settlement in the vicinity at a cost of about Nu 8M (million). The plant was installed in 2010 with support from Japan International Cooperation Agency (JICA). After outsourcing of waste collection and disposal to Greener Way in 2015, the amount of wet waste dumped at the compost plant increased by three folds since all wet waste collected from the city was disposed at the compost plant. The plant had a capacity to decompose only 25 metric tons of wet waste in a month while the plant received at least eight metric tons of wet waste every day. The lack of capacity and complaints from the households near the compost pit led to the discontinuation of the compost plant. At present, mixed waste is dumped at the landfill site although segregated at source.

Current issues with municipal solid waste management system in the Thromde

a. Inadequate frequency and type of waste collection service provided both for door-to-door and communal collection
   - Limitations in terms of availability of vehicle spare parts in the country since most vehicles are very old
   - Lack of capacity of the workshops in the city, which makes it difficult to repair the vehicles on time
   - Another major limitation in providing efficient service is due to the poor road conditions in some areas, particularly during the rainy season which makes it hard to collect waste on a regular basis

Figure 2-5 Illegal waste disposal near road(Source: http://www.nec.gov.bt/nec1/index.php/nationwide-mass-cleanup-campaign/)

b. Lack of facilities in handling different types of waste
   - Lack of facilities for collecting different wastes from different sectors, which includes commercial area waste, institutional wastes and residential wastes
   - Due to the high variability in commercial wastes, irregular amounts of wastes are collected every day leading to improper quantification of wastes and unsystematic waste collection timing
   - There are no provisions for separate waste collection for hazardous wastes from the households and for disposal of the same. Wet and dry wastes are also disposed at the same landfill

c. Inadequate Capacity/ Expertise in managing and monitoring wastes
   - Each environment inspector is assigned designated zones for monitoring wastes, which is done once a week. They do not have the necessary technical capacity
   - Lack of proper delegation of duties
   - No as such work norms for workers and work plan for vehicle operators
   - Shortage of staff

Figure 2-6 Waste piled up near water tank

d. Mindset of the public; upstream challenges
   - Lack of public cooperation in waste management is a major issue for Bhutan. This leads to improper segregation of wastes at source, illegal dumping and littering
   - Limited private sector participation in waste reduction and management

Figure 2-7 Lack of recycling initiatives (Pet bottles a major component)

e. Poor supply chain facilities
   - Although most of the households at present segregate their waste, there are still majority who do not practice proper separation and disposal. This may be due to mindset of the public or due to the irregular collection and timing of garbage collection vehicles or due to lack of monitoring.
   - Lack of budget and resources for managing waste

g. No proper planning and design of structures, no consideration for future in terms of waste collection and disposal facilities,
   - Although major urbanization and development activities are happening followed by drastic change in consumption patterns, the waste management and collection facilities are still primeval
   - Inappropriate size and location of landfill and collection facilities
   - No proper management of waste collection facilities – damaged
   - No processing facility available

h. No effective communication
- Although awareness campaigns and cleaning campaigns are a regular sight, there are still majority of illegal disposals and littering
- There may be actual problems in how things are being communicated to the people

i. Monitoring and compliance issues
- Lack of proper implementation of rules and regulations
- Lack of supervision and monitoring
- There is lack of capacity in monitoring and ensuring rules and regulations are being followed
- There is no proper system for fining
- Open burning of wastes are still common practices in some of the areas within the thromde
- No mechanism for recovery from non-payers/defaulters
- No provision for spot fine – the penalty imposition cases have to route through normal tedious legal procedures

j. Lack of clear roles and delineations of areas
- There is lack of clarity in roles between agencies and no proper delineation of areas for the responsible agencies
- Very less authority and autonomy
- Poor institutional arrangement
- Less importance to SWM section
- Lack of cooperation amongst responsible agencies

k. Financial Limitations
- Revenue is recovered under the head of service charges (SW). Rates decided 16 years ago are still applicable without any revision and reassessment
- Revenue realization is only from 800 residential units and 240 commercial units, which is barely 6% of expenditure

2.2.2 Wastewater

With rapid urbanization, Thimphu Thromde faces a series of challenges with wastewater management. The centralized wastewater stabilization pond at Babesa is the main treatment plant of the Thromde, which is connected to about 30% of the total households in the core town area while the rest rely on septic tanks. The average waste inflow to the treatment plant is about 1200 cu.m/day. Most of the houses in the city rely on septic tanks and soak pits to manage wastewater since the existing sewage treatment plant in Babesa does not have the capacity to cater to all the households within the city. However, due to the improper design of soak pits, there are leakages and outflows, which causes nuisance in the neighborhood. Most of the households have their greywater drains connected to the sewer system, adding a huge amount of flow into the system.

The list of wastewater treatment plants available in Thimphu are shown in the table below (Table 2-5) and the areas covered with sewerage network connection lines are shown in Table 2-6. The total length of the sewer lines is about 45 km. In Thimphu, expansion of the present treatment plant at Babesa is being done to increase its capacity from 1.75 MLD to 14 MLD.

Table 2-5 Wastewater Treatment Plants in Thimphu

Sl. no.	Treatment plants	Installed capacity (m^3/day)	Operating capacity (m^3/day)
1	Babesa (Functional)	1750	1750
2	Dechencholing (Functional)	750	750
3	Langjophaka (Functional)	600	600
4	Below River View Hotel [Conventional Activated Sludge Process]	2000	Yet to be commissioned
5	BABESA, Construction (ADB project) SBR [Sequential Batch Reactor]	12000	Under construction
6	Taba, under construction (WB Project) Eco-line	1000	Under construction
7	Hejo, under construction (MOKANJOKA) Dojojoka System	100	Yet to be commissioned

Table 2-6 Sewerage Network of Thimphu

Sl. no.	Zone	Lap/area
1	South	Babesa, Changbangdu, Lungtenphu, Olakha, Olakha workshop, Semtokha and Changjiji
2	Core	Lower Motithang, Changangkha, Kawajangsa, Hejo (in front of supreme court area), Chubachu, Doebumlam, Norzinlam, Changlam, Changedaphu, Changzamtog, Yangchenphu
3	North	Dechencholing (wb) Lower Langjuphaka (wb) Lower Taba (wb), under construction, Pamtsho/ Samteling (wb), Under Construction

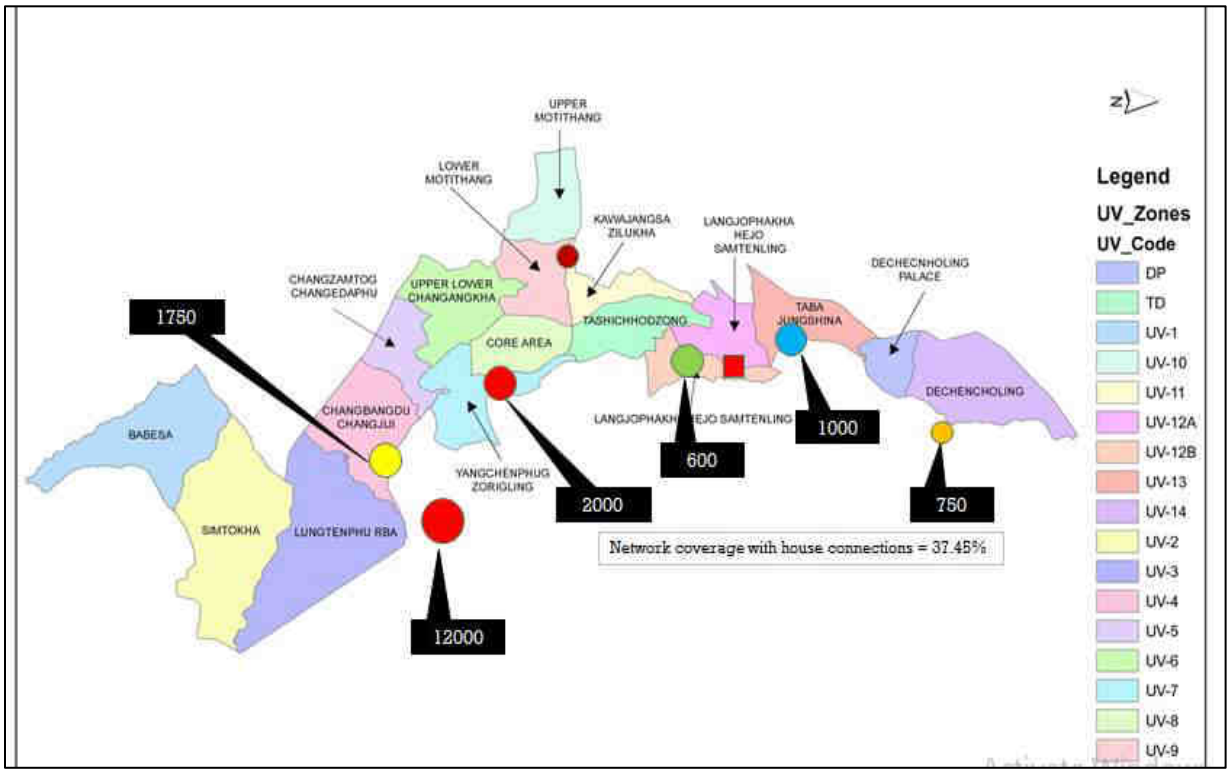

Figure 2-8 Wastewater Plant location

The staffs in the Thromde at present, managing wastewater are as shown in the table below. There are currently only two vacuum tankers and two cesspool cleaners available for emptying the septic tanks in the Thromde.

Table 2-7 Monitoring Staffs and Workers in the Thromde[6]

Sl. no.	Category	Numbers
1	Engineer	2
2	Technician	4
3	Supervisor	1
4	Driver/Operator	4
5	Helper	4
6	Wet Sweepers	8
7	Dry Sweepers	6
	Total	**30**
EQUIPMENT		
Vacuum Tanker 6000 liters capacity = 2 No		
Cesspool Cleaner 3000 liters capacity = 2 No		

[6]Thimphu Thromde, Mr. Nagphel, Principal Engineer, Infrastructure Division – Presentation during the Stakeholder Consultation on preparation of TWMP, 25th October 2018

Current wastewater management challenges in Thimphu Thromde

a. Lack of technology/inappropriate technology

- Most of the households in the city rely on individual septic tanks and soak pits, which do not have proper designs
- The sludge from the septic tanks is also not treated owing to lack of treatment systems, no proper sludge treatment plants
- There is lack of laboratory facilities and shortage of regents

Figure 2-9 Septic tank leaks in Motithang (Source: Kuensel, 1 May 2018)

b. Lack of clear regulations/regulations not followed

- The septic tanks with soak pits are not built as per design standards which causes overflowing and malfunctioning of these tanks leading to nuisance in the town areas
- The storm water drains and grey water drains aren't covered or managed properly. Solid wastes are dumped into drains, which leads to blockages in drains and overflowing. Some of these wastes eventually end up in the streams.

Figure 2-10 Solid waste dumped in drains around Clock tower, Thimphu

c. Lack of proper planning

- The sewer network lines and treatment plants are always over loaded as the sludge from the septic tank areas are pumped into the sewer line
- The wastewater from health centers and other facilities are also dumped into the sewer network, which causes overloading of the network lines

Wastewater management in Thimphu Dzongkhag

Wastewater across Thimphu Dzongkhag, like other places in Bhutan, are treated through Septic Tanks and Soak Pits. Isolated remote places and temporary settlements do not even have sanitary toilets. The main goal is to ensure proper sanitation facilities across all places of the Dzongkhag with proper maintenance of septic tanks.

2.2.3 Medical Waste

Medical waste refers to all categories of waste generated from health facilities, clinics, animal husbandries, veterinary hospitals and other clinical laboratories, and home-based treatment of patients[7]. The medical waste in Thimphu is mainly from the Jigme Dorji Wangchuck National Referral Hospital. Apart from the National Hospital, two Satellite Clinics were established in Motithang and Hejo to facilitate health care services in the city.

The total waste generated from December 2016 to December 2017 for JDWNRH was about 145.4 tons which is 34.0% of the total healthcare waste of the country. Medical waste data is maintained for the four different categories of waste segregated by the hospital, which are infectious, non-infectious waste, sharps and placenta. As per medical waste records from January to July of 2014, on an average JDWNRH produces daily around three hundred kilograms of non-infectious waste, followed by infectious waste of fifty kilograms per day. There is minimal production of sharps and

[7] ICMWM Guideline,

placenta waste with less than ten kilograms on an average per day[8]. The composition of waste generated in the health care facilities in Thimphu are given below in Table 2-8.

Table 2-8 Percentage of waste type generated for 2016

Health Facility	General waste	Infectious waste	Sharps	Organic waste	Total
JDWNRH	66.3%	33%	1.0%	0	100
SC Mothithang	46.6%	45%	8.0%	0	100
SC Hejo	42.5%	19%	38.7%	0	100

Medical waste management System

The medical waste in JDWNRH is segregated at source, weighed and recorded with a weighing scale specifically for waste. There are separate waste storage facilities for chemo waste and infectious waste and waste to be sent for incineration to Gedu. There are two numbers of waste autoclave but only one is functional. General waste is disposed through the municipal system with waste trucks collecting the waste twice a day while organic waste is sent for composting. There are also deep burial pits with two chambers for pathological waste disposal. The Satellite Clinics transport their sharps to Hongtso BHU where it is burnt as is the case with most BHUs. The sharps from JDWNRH are cut prior to disposal and sent to the landfills.

Waste segregation is practiced at all healthcare facilities through a color-coded segregation system. Under the system, waste is segregated as:

- Dry waste- Green bins/buckets and labeled as ‘general waste’
- Biodegradable waste- Blue buckets (JDWNRH)
- Infectious waste- Red buckets labeled “infectious waste”,
- Sharps – Yellow/white cardboard boxes
- Chemotherapy waste- Red bucket labeled ‘Biohazard’ (only JDWNRH)
- Pharmaceutical waste- cartoon boxes
- Chemicals- bottles/containers

Chemotherapy waste from JDWNRH is taken by the old ambulance to be burnt in the incinerator at Gedu/Gomtu each month. At the JDWNRH hospital, a storage site has been designated within the hospital campus with a municipal dumpster. A single storied unused cottage is also used as a storage area for the chemotherapy waste. Since the storage area is very limited and dumpsters cannot accommodate the cumulative garbage, there are plans to design and construct waste storage within the premises.

[8] Medical waste management at JDWNRH, Thimphu – Choden, 2015

Table 2-9 Waste storage and handling

Waste categories	JDWNRH	Satellite Clinics
General waste	Municipal	Municipal waste
Organic waste	Composting	Municipal waste
Infectious waste	Municipal waste after treatment	Municipal waste after treatment
Pathological waste	Deep pit burial	Municipal waste after treatment
Sharps	Shredded, municipal waste / Deep pit burial	Burnt at BHU
Hazardous waste (chemotherapy)	Incineration	None
Pharmaceutical waste	Handed over to pharmacy and MSD	None

Medical wastewater

The wastewater from the JDWNRH ends up in the city sewerage system and eventually to the wastewater treatment plants. There is no treatment as such for chemical waste from the hospitals nor for the grey water generated from HCFs; the most common method of treating the chemicals is by dilution prior to disposal into the drains and sewer. There is a need to assess the sources and quantities of liquid waste generated and to review current procedures for treatment of hazardous wastewater especially, infectious and chemical liquids.

Waste from Veterinary Hospital

Waste generated in the veterinary hospital in Motithang are collected separately in designated waste bins/ collectors and disposed-off according to the nature of the waste. The general wastes are disposed-off through dump trucks, while plastics bottles are collected for recycling at the center. Sharps and needles are collected and destroyed in needle destroyers. Blades and broken ampoules are collected in separate collectors and infectious wastes and biological wastes are collected in biohazard bags and disposed. There are currently four ESPs and one GSP at the hospital to manage the waste in the center. At present there is lack of facilities for disposing biological wastes and lack of incineration facilities for disposal/destruction of sharp wastes. The poor frequency and timing of the dump trucks for picking up general wastes also are a problem for the hospital.

Current Issues with Medical Waste Management System

a. Inadequate storage facilities in the hospitals
b. No accurate data on medical waste since some general recyclable waste are taken directly without account by support staff

c. Poor compliance of staffs
   - Lack of compliance and/or awareness among new staff or interns and students or patients
d. Lack of municipal facilities or vendors to collect segregated waste
   - Difficulty in disposing waste on time due to irregular timing
e. Segregated waste is dumped together into the municipal trucks;
f. There are no initiatives for gaseous waste management in medical facilities though it is covered in the guideline
g. Inadequate manpower and resources
   - There is only one person dealing with programs on medical waste in the Healthcare and Diagnostics Division, the Department of Medical Services, Ministry of Health for the whole country
   - Lack of technology and budget in handling different wastes
h. Lack of public cooperation in managing wastes at the hospitals
   - Despite routine awareness on segregation of food and general waste people availing hospital services dump food waste in the same waste bin which is intended only for general paper waste.

2.2.4 E-waste

There is lack of technical capacity and expertise on e-waste management in the country. Improper handling of such wastes can lead to environmental problems and health problems. Although, the Waste Prevention and Management Regulation of 2012 mandates the e-waste management entity to collect, transport, sort and recycle e-waste in an environmentally sound way ensuring occupational health and safety, due to lack of knowledge in the field of e-waste, lack of management plans, inadequate facilities and advocacies, improper handling and disposal of e-waste is still a common practice.

Figure 2-11 E-waste in an electronic shop in Bhutan

E-waste generated in 2014 was estimated to be about 1,105 – 1,810 metric tons as per research conducted by NIIT, India in 2009 for the 5-year Chiphen Rigpel IT Project. There are hardly any provisions for disposal neither for hazardous wastes nor for e-waste, and no provisions at all at the present landfill. There is no treatment (recovery and recycling) facilities for e-wastes in the country and lack of expertise for the same. There are inadequate storage facilities; some of the materials are stored in the respective agencies. As of now, the e-waste generated by the government is discarded at the warehouse of the Department of National Properties (DNP) in Changzamtog. The Waste Prevention and Management Regulation 2012 requires that government agencies bring their e-waste to the DNP, which is then permitted to auction them to e-waste management entities, or any other entities deemed appropriate by the DITT. A total of 912 e-waste items were generated in between 2016-2017 which includes 106 printers, 51 monitors, 3 scanners, 7 fax machines, 25 telephones, 3 motherboards and rest are other waste. The money generated from the sale of e-waste is deposited by the DNP to the non-revenue account of RGoB. Despite Bhutan being a signatory to the Basel Convention that limits the movements of hazardous wastes across the country, the e-waste generated within the country are mostly sold to the scrap dealers across the borders. The recycling/recovery capacity within the country is very limited.

Current Challenges in managing E-waste in Thimphu

- No treatment facilities (recovery and recycling)
- No proper rules on segregation of e-waste
- No proper system of monitoring e-waste disposal by the winning bidders

- Technical limitations and manpower shortage to really evaluate and assess the actual valuation of the surrendered assets
- No specific disposal sites at the landfill
- Storage facilities is not adequate to store all the waste, some of the materials are stored in the respective agencies.

2.2.5 Air quality

As per records maintained with the NEC, the air quality, particularly in Thimphu is known to be worse during winter months due to increasing use of firewood, forest fires and burning of agriculture debris[9]. Air pollution monitoring at current is restricted to PM_{10} (Particulate Matter). As of 2016, with the technical and financial assistance of ICIMOD, two monitoring stations for BC/ $PM_{2.5}$ was set up in 2016, in the urban center of Thimphu and the other in the Industrial Estate of Pasakha[10]. The longest data available is for measurement of Particulate Matter of less than 10 micrometers in diameter (PM_{10}) in Thimphu. Figure 2-12 shows an increasing trend in the level of PM10 concentration over the period 2004-2015 in Thimphu. Although, the levels are still within the national permissible limits for mixed area, it is exceeding the WHO guidelines and EU directives for annual average levels of PM10 emissions.

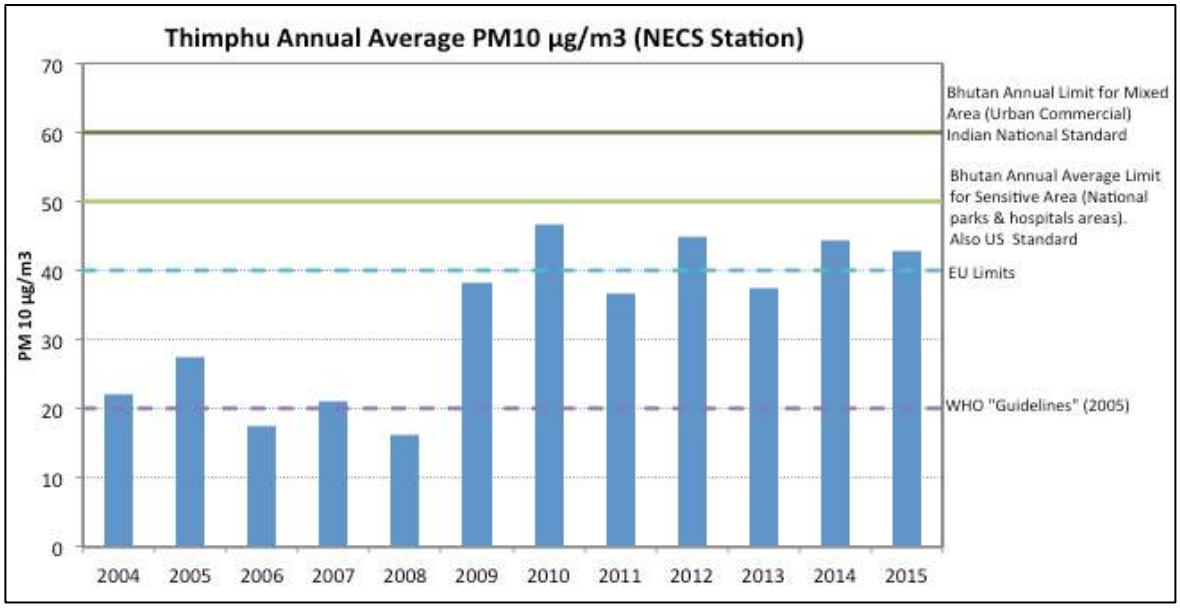

Figure 2-12: Average annual PM10 µg/m^3 for Thimphu (Source: NECS Station)

The recent development activities mostly in the fields of transport and manufacturing industries have led to increased release of pollutants into the atmosphere (NEC, 2016). The PM_{10} level has

[9] BBS – January 22, 2018

[10] We have been informed that a new one is setup in Chelela, Paro but no published data is yet made public from there.

doubled since 2004 to over 42 µg/m^3[11]. The main contributor to air pollution in Thimphu is the construction sector; without regulatory mandates, construction workers often dump sand in the open and on road sides without protection from wind. Other sources of air pollution in Thimphu includes vehicle pollution, mining and quarries almost all of which are open air. Fifty three percent of the registered vehicles in the country are present in Thimphu (43,000)[12].

In 1998, Bhutan joined countries in the South Asia in signing Male' Declaration on transboundary air pollution and initiated number of activities that essentially built up capacity to monitor air pollution level in the country. The Country has also joined regional countries in organizations like the SACEP and ICIMOD, which promote regional cooperation in controlling pollutions in the region. In addition, the Government of Bhutan has developed and disseminated several policy and strategy documents directly related to environment conservation and indirectly to air quality and black carbon management.

Current challenges in air quality monitoring

- Lack of air quality data
- Air quality monitoring restricted to certain air quality parameters
- Inadequate capacity and expertise – (Financial and Manpower)
- Lack of monitoring and enforcement of rules and regulations
- Open burning of wastes still a common practice
- Increasing vehicle numbers and industrial activities

2.2.6 Industrial Waste

There is only one operational engineered industrial landfill site located in Pasakha. The wastes from other industries are dumped in municipal landfills or sold off in the market. As per the Waste Prevention & Management Regulation 2016, the Implementation of the Regulation for Industrial Waste is the "Private Industries Management led by the CEO" of that company, and the Collaborating & Monitoring Authority is the Department of Industry. In Thimphu, the major challenge at present is the waste and wastewater from the workshops. There are provisions for collection of old motor oil at Olakha automobile workshop area in Thimphu, which are collected in drums and transported to different buyers. However, most of it still ends up in the drains. The Department of Trade (DoT) also monitors and regulates use of petroleum products in the country. There is a laboratory in the Department to test fuel quality, collect fuel samples, and run tests. Fuel waste are collected in barrels and not disposed in open space. There is no exact data on wasted petroleum by-products or waste. There is also an industrial estate in Bjemina under Thimphu Dzongkhag. The waste generation and management has not been identified as an issue as of now since the existing industries are wood based, recycling and brick plants.

The glass waste, batteries, and other vehicle wastes are disposed in waste collection vehicles along with municipal waste. One of the members at the Thromde consultation meeting shared his

[11] The State of the Environment Report, 2016

[12] The Bhutanese – March 22nd, 2016

concerns on the windshield waste from automobile workshops in Olakha that have both plastic and glass materials in it, and hence were hard to dispose. These wastes were piled up in the workshops with no place for disposal. A disposal site in Memelakha has been identified after the issue was raised up but there is still lack of treatment and disposal facilities for special waste.
The current challenges in managing automobile/industrial waste are:

- No proper drainage systems for handling effluent from car wash and workshops
- No treatment for the effluent as well
- Lack of service provision and infrastructural facilities (inadequate collection services)
- Glass wastes from workshops are taken to the landfill without treatment of any sort
- Inadequate fund, lack of responsibility and accountability on the side of the workshop and carwash owners
- Lack of clear roles and responsibilities of the agencies
- Lack of guideline for tax incentives for procuring EST

2.2.7 Disaster, Construction and demolition wastes

The construction boom in Thimphu following high demands for houses, apartments, shops and hotels has led to increasing amounts of construction waste in the capital. As of April 2018, Nu 24.381 Billion was provided for building and construction by the RMA[13]. The Thromde is responsible for supervising and allocating appropriate sites for construction waste disposal. While the recyclable wastes are sold to scrap dealers, there are no proper procedures and arrangements for handling construction and demolition waste and no designated site for disposal of the same. The contractors/building owners are required to identify dump yards prior to construction and wastes are dumped in pre-identified dump yards. Excavated earth material dumping is a major issue with numerous illegal soil dumping along road sides.

[13] The Bhutanese News Paper - July 2017

Figure 2-13 Demolishment of an old building in Thimphu

There are no specific disaster waste management plans at present in any of the Dzongkhags or Thromdes. The valuable wastes that are deposited within the vicinity of settlements are cleared and handed over to owner to claim insurance.

2.3 Findings from the Waste Survey

A waste composition and analysis survey was carried out as part of this study in order to understand waste challenges in the Thromde. The findings from the survey are presented in the following paragraphs. As per the waste composition and analysis survey, the total waste generated and disposed at the landfill is about 40.3 tons per day. Waste generated was classified into 11 types and the highest percentage of waste was found to be organic waste (58.1%), followed by Plastic (13%) and Paper waste (9.2%). Organic waste was found to be highest even during the dry waste collection days. Dry waste collected in a day is about 23.5 tons while wet waste is about 16.8 tons. The waste composition for the Thromde is shown in Figure 2-14 and the amount of waste collected by composition during dry and wet collection days are presented in Table 2-10 and Table 2-11 respectively.

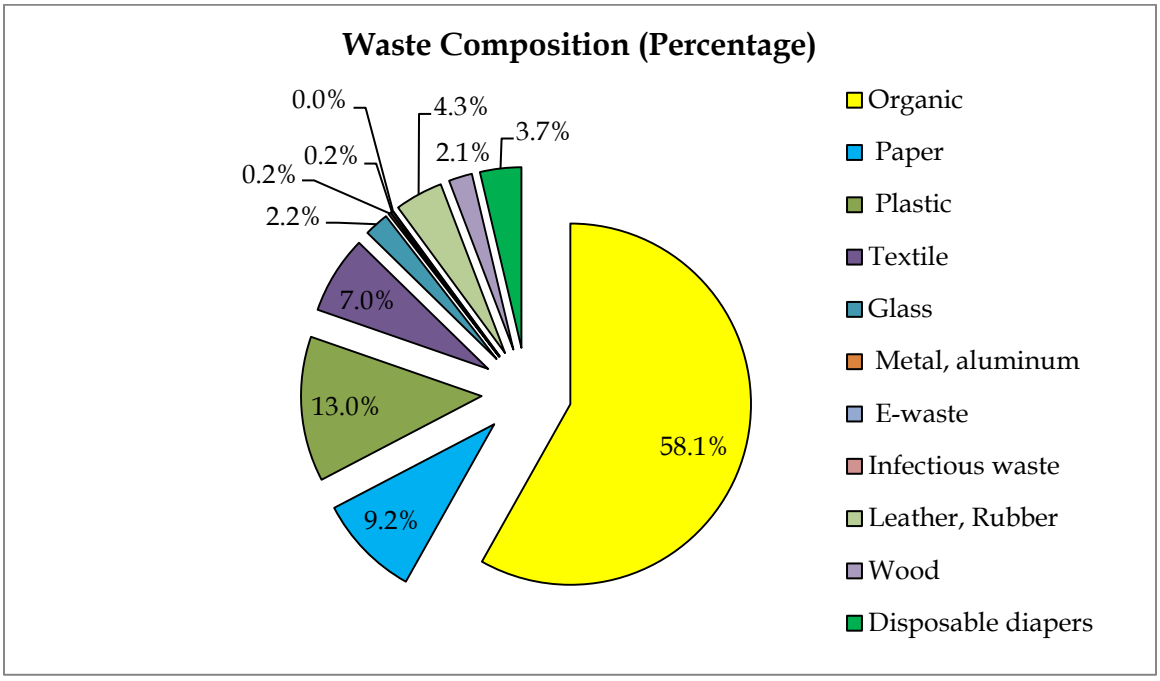

Figure 2-14 Waste Composition for Thimphu Thromde (2018)

Table 2-10 Composition of Dry Waste Collected

DRY						
Sl. no.	**Type**	**GW**	**CC**	**Average**	**t/day**	**%**
1	Organic	40.0	26.1	33.1	23.5	7.77
2	Paper	10.0	20.5	15.3		3.58
3	Plastic	17.4	23.2	20.3		4.77
4	Textile	15.5	8.4	12.0		2.81
5	Glass	5.3	2.3	3.8		0.89
6	Metal, aluminum	0.3	0.2	0.3		0.06
7	E-waste	0.7	0.0	0.4		0.08
8	Infectious waste	0.0	0.0	0.0		0.00
9	Leather, Rubber	8.0	6.6	7.3		1.72

10	Wood	1.9	5.2	3.6		0.83
11	Disposable diapers	1.1	7.4	4.3		1.00
	Total	**100**	**100**	**100.1**		**23.51**

Table 2-11 Composition of Wet Waste Collected

WET						
Sl. No.	**Type**	**GW**	**CC**	**Average**	**t/day**	**%**
1	Organic	87.4	99.4	93.4	16.8	15.69
2	Paper	1.5	0.0	0.8		0.13
3	Plastic	5.0	0.6	2.8		0.47
4	Textile	0.0	0.0	0.0		0.00
5	Glass	0.0	0.0	0.0		0.00
6	Metal, aluminum	0.4	0.0	0.2		0.03
7	E-waste	0.0	0.0	0.0		0.00
8	Infectious waste	0.0	0.0	0.0		0.00
9	Leather, Rubber	0.0	0.0	0.0		0.00
10	Wood	0.0	0.0	0.0		0.00
11	Disposable diapers	5.7	0.0	2.9		0.48
12	**Total**	**100**	**100**	**100.0**		**16.80**

The total waste collected by Greener Way, Thimphu Thromde and Clean city is shown in the table below. The capacity of the current landfill was also calculated to be around 40,000 m³ with a remaining lifespan of 3.4 years. This is shown in Table 2-13.

Table 2-12 Total Waste Collected (Mt)

Agency	**Dry (Mt)**	**Wet (Mt)**	**Total (Mt)**
Thimphu Thromde	3.1	-	3.1
Greener Way	11.6	11.8	23.4
Clean City	5.8	5.0	10.8
Others	3.0	-	3.0
Total	**23.5**	**16.8**	**40.3**

Table 2-13 Landfill Capacity

Landfill area	6,310 m²
Remaining landfill capacity①	40,000 m³
Weight of dry waste	23.5 t/day
Volume in the landfill site②	29.4 m³/day
Volume including cover soil③	32.3 m³/day
Years of remaining landfill capacity ④	3.4 year

2.4 On-going and Planned activities on waste management in Thimphu Thromde

Several initiatives have been taken by Thimphu Thromde to manage waste in the city. A waste drop-in center has been piloted near Kelki Higher Secondary School to facilitate waste segregation and disposal for the residents nearby. Bins are provided for five different kinds of wastes, which includes pet bottles, plastics, food waste, paper and metals. The waste drop-in center is managed by a caretaker who ensures proper waste disposal and segregation. In return, he earns his income by selling the segregated waste. The Thromde has plans on replicating such centers across the city, which will be self-sustaining in the long run.

Figure 2-15 Waste drop-in Center near Kelki Higher Secondary School

A waste recovery center (transfer station) at Ngabiphu, Thimphu was constructed by greener way at a cost of 40 Million and inaugurated in June of 2018 coinciding with the environment day by Her Majesty the Gyaltsuen. The MRF at Ngabiphu is used to segregate dry waste and recover recyclables before transferring the residual waste to Memelakha landfill. The recovered waste including pet bottles, cardboard boxes, tins and aluminum items. These items are labelled and transported to recycling centers in Pasakha and to other recycling agencies in the country such as green roads, and the neighboring towns across the border. The paper waste is sent to Bjemina to be recycled into egg trays.

Figure 2-16 MRF, Ngabiphu

Thimphu Thromde also has plans on constructing recycling plazas, which will include waste drop-in center, compost plants, second hand shops and flea market for selling recyclable items. These would be monitored by a caretaker who would be given incentives for the same. In the long run these recycling plazas will be self-sustaining. Thromde also has plans on raising awareness to schoolchildren through classroom experience and trips to the recycling plazas. A farmer's market in Changbangdu has been constructed, which is yet to be commissioned and there are plans on constructing similar markets in other locations to prevent hawkers and littering in the town areas. Similar initiatives have been taken by the Thromde for promoting composting at communities. Thirteen community compost plants have been constructed till date and the Thromde has plans to construct more across the city.

Figure 2-17 Wet waste composting in communities

Waste banks have also been constructed at various locations across Thimphu in order to facilitate waste recycling and recovery.

Figure 2-18 Waste Banks at various locations

Thimphu Thromde has also integrated waste and wastewater management budgets in their 12th FYP budget. The approximate budget for 12th FYP for waste and wastewater management is as shown in the table below;

Table 14 12 FYP Activities

Activities	Budget
1. Waste Management	75 M
2. Construction of public toilets	13 M
3. Landfill Expansion	10 M
4. Installation of CCTV(s)	10 M

Review of Proposed Waste Management Plans and Strategies

Under the Urban Infrastructure Development Project (Loan 2258-BHU) of 2008, a TA was provided for the preparation of a Comprehensive Master Plan of Solid Waste Management for Thimphu to the Ministry of Works and Human Settlements (MoWHS), Department of Urban Development and Engineering Services (DUDES). The objective of the master Plan Report (MPR) was to prepare a comprehensive report on Thimphu city Solid Waste Management system with relevant description of the existing waste management system, deficiencies in the system and suggestions for improvement in the system. They have suggested improvement measures under categories of short term implementable within one-year, medium term implementable within 1-3 years and long-term measures, which might require more than 3-years. The list of suggested interventions are mentioned below in the subsequent sections. This study has integrated the recommendations and interventions from this masterplan into its proposed activities for the TWMP as applicable.

i) Short Term Measures
- Sufficient importance to SWM sector

- Proper work distribution of staff as per work norms
- Decentralization of duty and authority
- Services of environment inspectors to be utilized on daily SWM activities
- Ensure interdepartmental coordination
- Introduction of containerized push carts
- Appreciate the work. Motivate by calling, sanitation guard/conservator
- Assess the utility of each community point and replace if needed
- Improve repairing system of vehicles and equipment
- Replacement of open collection points and vehicles in phases
- Three trips for heavy vehicles and eight for dumper placers to be ensured.
- Identification and allotment of land for Recycling cum Transfer Station, Processing plant and Sanitary Landfill Site
- Rehabilitation of existing disposal site
- Resolving compost plant related issues and start functioning
- Regular monitoring and supervision
- Mass awareness and training Programme
- Thromde Act to be in place
- Listing of prospective service charge payers

ii) Medium term measures

- More autonomy and authority available to TCC
- SWM services on all seven days and under independent division
- More funds allotment for SWM activities
- Procurement of equipment for sweepers, collection and transport
- Sweeper training, cash award/regularization etc for motivation.
- 100% covered storage/collection and transport system in place
- Deciding areas and activities for Private Sector Participation (PSP)
- Finalization of terms and conditions for PSP operations and begin in few areas
- Initiating door to door collection and segregation at source
- Full operation of compost plant.
- Setting up of Recycling center cum Transfer station
- Initiating process for development of new SLF site
- Continuous mass awareness and training Programme
- Amendment in service charge rates and withdrawal of exemption orders
- Beginning of imposition of User/collection Charges
- Amendment in Corporation regulation regarding legal issues

iii) Long term measures

- 100% sweeping/ covered storage facility/ door to door collection with source segregation/ and transport facility
- Thimphu to become bin free city except few litter bins at important places
- Separate collection system for every category of waste
- Involvement of Private Sector Participation and NGO/CBO/RWAs in all sectors of SWM to provide service to 100% population and area
- Extensive Mass awareness through Media and IEC material
- Strict Monitoring and Supervision by enforcing Thimphu SWM act,2007
- Implementation of user charges and legal provisions against defaulters

The Integrated Solid Waste Management Plan (ISWM) of 2014 provides a stepwise approach for waste management comprising of seven steps which covers the planning phase up to the start of implementation. The strategy has come up with several targets for establishment of an integrated solid waste management system in Bhutan along with action plans for the same. The achievable targets are classified as short-term (5years), medium- and long-term targets (10 years).

The UNDP's Knowledge, Innovation and Capacity Group (KICG), PPP for Service Delivery (PPPSD), in partnership with the Dutch NGO, WASTE (Advisers on Urban Environment and Development), designed a support project on solid waste management for Bhutan in 2009 with its focus on improving municipal service delivery through PPP modalities and an Integrated Sustainable Waste Management system (PPP-ISWM). As per the report, waste generation per day will increase upto131 tons per day by 2030 based on waste generation amount of 50 tons per day at present (Figure 2-19).

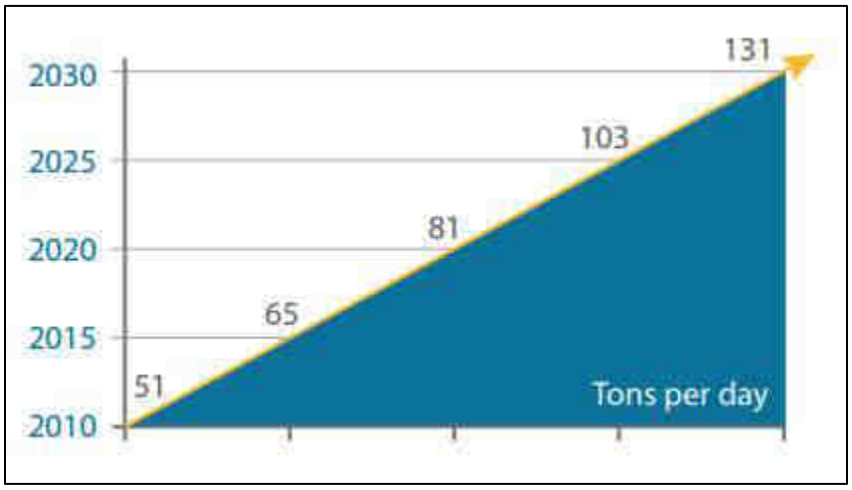

Figure 2-19 Projected increase in waste generation

The report has identified a list of problems in the waste management system and has come up with an ISWM model to reflect the complex reality of underlying causes of waste problems in municipalities, such as organizational capacity, technical or financial constraints, managerial capacities, or institutional weaknesses. The model supports analyses of an enabling environment and the articulation of a system that is technically appropriate, economically viable and socially

acceptable. The ISWM model stresses on three major ISWM system components, the first one is the interrelated elements management strategy in which the municipality makes deliberate and normative decisions about how materials should flow in the waste management process. The second stresses on the stakeholder involvement in the waste management system and the third dimension comprises six aspects of the local context that should be considered when assessing and planning a waste management system. These are Technical, Environmental, Financial/Economic, Socio-cultural, Institutional and organizational and Policy/Legal/Political aspects.

The TWMP shall follow similar procedures and conducts for formulating the waste management plan for both Thromde and Dzongkhag.

2.5 Proposed Management Plan for Thimphu Thromde

The TWMP shall be in line with the implementation and monitoring framework for Strategic Environment Assessment (SEA) of Thimphu Structural Plan (TSP) for solid waste and wastewater. The Strategic Environmental Assessment (SEA) was done by a multi-sectoral core team led by the Ministry of Works and Human Settlement (MoWHS) following internationally established principles and requirements adapted to suit the Bhutanese context for Thimphu Thromde covered by the Thimphu Structural Plan (TSP). The SEA takes into account recent development trends and future challenges pertaining to Thimphu Thromde, as well as the TSP's alignment with relevant international agreements and national Policies Plans and Programmes.

Each indicator of the SEA-TSP are modified and further broken down into activities that need to be undertaken to achieve the objectives of this study. The baseline and target along with the budget required for the activities are mentioned in the table below. The details on each activity and their importance in the waste management plan are explained in the subsequent sections. Various activities with indicators are proposed for TWMP which are listed below.

Proposed Activities for Safe Solid Waste Management

Review of Waste Collection Fees and Contract Services

At present waste management is a liability of the Thromde, which is heavily subsidised by the Government, which will not be sustainable in the long run. Only few households pay a minimal service fee for waste services compared to the high proportion of unserved households. It may be good to look into the current tariff system for waste collection services and explore ways for improving the system and the SWM service fee in consultation with all stakeholders. Innovative financing mechanism to recover O & M cost may be necessary so as to have a fully functional waste management system in place.

The possibility of billing waste management per unit of households using electricity meters is also a good option. Once the building inventory system is completed, it could also be relied upon.

It is also imperative to determine current challenges on waste collection and management by the private waste management entities to ensure smooth operation. It would also be necessary to revise the contract conditions, duration, payment and other criteria of the contract in order to encourage the private waste management entities to take up waste management holistically and sustainably. It has been found that the contract duration and terms are not appropriate for both the parties. While the other issue is non-inclusion of street sweeping and drain cleaning as part of the contract to waste management companies. The need to have clarity on financial status of the private companies through credit worthiness check was felt necessary.

A possibility of completely privatizing the waste collection and management system for the Thromde through a PPP model was deemed possible. A feasibility study to understand the possibility and its benefits and limitations are proposed.

Coordination and Enforcement

In order to ensure implementation of the National Integrated Solid Waste Management Strategy (ISWM 2014) and National Waste Management Strategy 2019[14], it is important to have strict enforcement of rules and regulations on waste management. This can be done by the Royal Bhutan Police (RBP) following special training on waste monitoring and organizing coordination meeting between the RBP and Thromde. The RBP and Thromde may need to deliberate on a proper term of reference on the operation modality, fine collection and return system if they are to work together. The Thromde inspectors shall also have proper dress codes and identification tags to enable effective monitoring and enforcement of rules and regulations.

Coordination with the Thimphu Dzongkhag administration, Zhung Dratshang, Department of Forests and Park Services, Department of Roads, RSTA and Tourism Council for the sub-urban areas, highways, hiking trails, and trekking trails are also necessary to ensure that the neighboring areas are clean and well maintained.

Improving existing Solid Waste Management System

Improving frequency and timing of waste collection vehicles

Planning and updating the collection routes, timing and frequency of the waste collection vehicles for different waste according to the current requirement is necessary. To cater to the increasing demand for waste collection vehicles and to improve frequency and coverage across the Thromde, it will be necessary to procure additional waste collection vehicles to cater to all the households in the city. It is also necessary to maintain budget for fuel and maintenance to provide efficient service to the households in the Thromde. It is also recommended that attention could be paid to explore the use of CNG, electric, bio-diesel and other alternate fuel vehicles for waste management.

Treatment and Disposal of Special Waste

The waste management system lacks in terms of treating/managing different/special wastes (hazardous, medical, e-waste). It is necessary to identify and construct waste disposal sites for special waste if deemed necessary or come up with other options for handling and treating such wastes. Regional waste management facilities for special waste are also possible which could suffice the need of all western districts.

Transfer Stations/ Materials Recovery Facilities (MRF)

Transfer stations/MRFs are a key component of cost-effective solid waste management. Reviewing operation of the MRF center and possibility for construction at other sides maybe a good option for reducing wastes going to the landfill. Constructing MRFs would also reduce the transportation cost and the efficiency of the system minimizing the loss of resources, which would otherwise be dumped as waste along with the wet waste.

Development of a Mobile Application for garbage trucks

[14] The NWMS is at the final draft stage as of Dec 2018 as it has not been endorsed yet by the government. But as the same team is involved in the preparation of the NWMS we have considered the components in this plan.

A mobile application (App) to track garbage collection vehicles which are fitted with GPS would be beneficial to the public and the Thromde officials to get locations of the vehicles, monitor the vehicles and ensure garbage pickup on time. This app can also be used by the public to track the vehicles and prepare beforehand.

Solid Waste Information System

It would also be beneficial to have a solid waste information system that would help in planning and organizing routes and collection timing. The database would also serve as a good reference to track waste reduction, segregation and recycling initiatives. It should be ensured that a proper format, unit, storage, update, and feeding mechanism of the database are clearly planned out in advance.

Operation and Maintenance of Sanitary landfill

The landfill at Memelakha needs to be managed properly. The estimated remaining lifespan of the landfill is about 3.4 years. Operation and maintenance budget for the landfill shall be kept separate so that proper sanitary practices could be implemented at the landfill site.

Establish Community Waste drop-in centers

Setting up proper waste drop-in centers at different locations with proper buy-back mechanism in the Thromde would encourage people to segregate their waste and dispose them when waste collection facilities are not available. A pilot project near Kelki Higher Secondary School has proven to be beneficial for Thromde residents. Such practices could promote recycling of wastes and reduce waste going to the landfill. It is proposed that such centers are set up across the Thromde.

Pilot Household level Dumpsters

Piloting household level dumpsters in selected areas maybe a good initiative to encourage public to segregate waste and dispose waste in a proper manner. Household level dumpsters were implemented previously in 2010 but had failed. Bringing back such initiative may prove to be effective given the change in outlook of the public towards waste management in the recent years. It is proposed that a system like this could be set up in a particular zone/ settlement and lessons learnt noted for further replication.

Biodegradable Waste Management

Since most of the waste generated was found to be organic waste (58%), it will be a good opportunity to promote organic waste composting at source to decrease the pressure on the landfill. Thimphu Thromde has already initiated household/community composting and established 13 community compost pits across the Thromde. Replication of such units across the city and promoting individual household composting would profoundly benefit waste management in the Thromde. Promotion of a community/ Thromde level composting plant and household level composting plants are proposed for the Thromde. For both the initiatives, proper study and design should be done which should then be followed by construction and operation.

Monitoring and Evaluations

Formulation of a Standard Operating Procedures (SoP) for the waste managers is essential so that there are no confusions in area delineation of waste management. The SoP shall contain clear roles and responsibilities for each person along with designated areas for monitoring and managing waste.

A monitoring and reporting framework shall also be set up to ensure that the waste management plans are being implemented properly. The NECS shall be the overall monitoring agency for waste management, while the execution of the work in the Thromde is the responsibility of Thromde management. The Thromde management in turn could delegate the task to respective officers, their Individual Work Plan (IWP) and also included in the Thromde's Annual Work Plan and Five-Year Plans with proper indicators.

Creation of Public Awareness

Instilling waste management practices on the public through regular awareness and sensitization is important in order to ensure that there are no gaps in implementation of the waste management plan. Public participation and creating a sense of responsibility in the public is important to ensure proper waste management. In the absence of proper mass awareness and education on solid waste management, there won't be recycling of useable products which would reduce the economic value of waste and increase labor and cost for re-segregation. Periodic and sustained public awareness program with proper allocation of budget and manpower are necessary to be planned and implemented.

A communication and awareness plan should be prepared so that awareness campaigns are effective. Currently, awareness programs are disorganized and haphazard proving to be futile. Communicating to the public in the right way is also important so that the public cooperate and participate in waste management practices.

Capacity Building Program for ISWM service providers to be developed and enhanced

In order to ensure strict enforcement and monitoring of waste, capacity building of the service providers and monitoring staffs are essential. There is also a need to organize coordination meetings between relevant stakeholders to ensure synchronization and harmonization in waste management activities across the city. The attendees of these trainings would include the Thromde officials, Police personnel, and also the community representatives including the voluntary coordinators (Meday Tshogpas).

Table 2-15 SWM Activities

Intervention	Activities	Baseline	Target	Timeline	Budget (Million Nu.)
1. Implementation of National Integrated Solid Waste Management Strategy 2014 and National Waste Management Strategy 2019	**Review of Waste Collection Fees and Contract Services** a. Review Tariff Structure for collection of waste and explore innovative financing mechanisms to recover O&M costs b. Review and feasibility of PPP model for SWM in Thimphu Thromde. c. Revise the contract conditions, duration, payment and other criteria as necessary both from Thromde and Private parties' views.	1	1	2019-2023	0.3
	Coordination and Enforcement a. Strict enforcement of rules and regulations by the RBP and Thromde - Meeting and Coordination between RBP and Thromde	0	Annually	2019-2023	2.0/year
	b. Coordination meetings with Thimphu Dzongkhag, Zhung Dratshang, DOR, RSTA, DOFPS, TCB etc. for common areas.	Occasional			
2. Improving existing Thromde SWM services	a. Update waste collection routes, frequency of waste collection, and timing for waste collection (General waste, hazardous waste and industrial waste)	1	1	2019-2023	0.3
	b. Procurement of garbage collection vehicles	25 nos	5 nos	2023-2030	80.0
	c. Fuel and maintenance budget for increasing number of vehicle collection trips and their frequency			2019-2023	17 m/annum
	d. Identification and construction of waste disposal/treatment sites for special waste (Medical/Veterinary, Hazardous)	0	1	2023-2030	10.0

	e. Review of the existing MRF/ Transfer Station and its services. Explore the need to have more MRF/Transfer Stations and set up MRF/ Transfer Stations	1	1	2019-2023	6.0
3. Data and IT Systems Development	a. Solid Waste Management Information System	0	1	2019-2023	1.0
	b. Development of Mobile Apps for tracking garbage vehicle	0	1		0.5
4. Management of Memelakha Landfill	a. O&M of the landfill as sanitary landfill	0	100%	2019-2023	1.0/year
5. Establish community waste drop-in center	a. Identification of possible drop-in center locations	7	13	2019-2023	0.5
	b. Construction of drop-in centers				1.0
	c. Establishment of a modus operandi for Drop-in Centers (document)				0.5
6. Pilot HH level Dumpsters	a. Selection and design of a HH level dumpster system	0	1	2019-2023	0.5
	b. Pilot HH dumpster system in a locality	0	1		5.0
	c. Review of HH dumpster system and recommendation	0	1		0.5
7. Thromde/Community compost plant	a. Feasibility study and consultations with households in the city	13 (2018)	1 Thromde compost plant and Community compost plants at all schools/army/ police camp	2019-2023	1.0
	b. Design of compost plant and determination of compost plant sites				1.0
	d. Construction of Thromde compost plant and community compost plants				5.0
	e. Operation and maintenance and regular monitoring budget (constant support till the operating group is confident and the system is self-sustaining) Monitoring - 2 times per month per compost plant by Thromde officials				5.0
8. Promote HH composting	a. Replication of household composting units across the city	1025 HH in 2018	1000HH/ year	2019-2023	5m for 5 years

9. Monitoring and Enforcement	a. Capacity development on ISWM/ trainings /workshop for relevant officers/private sector/relevant CSOs, etc. on new technologies, waste recovery /recycling options	Ad-hoc	Bi-annually	2019-2023	4.5/year
	b. Preparation of SoP for waste management in Thimphu Thromde	0	1	2019-2023	0.5
	c. Each agency/organization to set up monitoring and reporting framework for waste management	0	1	2019-2023	0.5
	d. Consultation meetings with public /coordination with stakeholders	Occasional	Annually	2019-2023	0.3/year
	e. Training of RBP personnel on Waste Management, Regulations and Monitoring - RSTA, Desung for monitoring purpose only	0	Annually	2019-2023	0.3
10. Awareness programs	a. Awareness and communication plan (develop a Document)	0	1	2019-2023	0.3
	b. Community awareness on 4R's concept, waste minimization/segregation, household composting and trainings on composting	Ad-hoc	Annually	2019-2023	0.5/year

Proposed Activities under Wastewater Management

The wastewater management activities under the TWMP are mentioned in the table below along with the budget required and target and timeline. The details on each of the activities are mentioned in the following sections.

Development of sewerage masterplan

Developing a long-term sewerage masterplan would enable effective planning and management of sewerage system. The planning of water supply schemes in Thimphu Thromde is done for each LAP. Disorganized augmentation of networks poses risks to efficient planning and provision of infrastructure and services. Hence, the need to formulate a long-term infrastructure plan for water and wastewater management.

Monitoring of Septic Tanks and Soak pits Design and Operation

While, most of the households in the Thromde are planned to be connected with sewerage network and treatment plants, there are parts that will continue using septic tanks. The results of the river water quality tests show high presence of E. coli due to overflow from septic tanks. In order to avoid such cases, the environment inspectors should do regular and proper monitoring. Capacity development of the environment inspectors maybe needed to make them technically sound. Strict checking in construction approvals should also be done on septic tank designs and construction.

Advocacy and awareness on sewerage and its management

Awareness and advocacy for behavioral change must be done. The public must be made aware that storm water and grey-water should not be drained into the sewer network, as this leads to overflowing manholes and diminished treatment capacity of STPs. The house owners should be made responsible for proper design and construction of septic tank, soak pits and grey water drains. Regular awareness should be given to the public and they should understand the health risks of improper wastewater management. Awareness on water saving and management shall also be given to the public.

Extend sewerage network to all Households

With the expansion of the treatment plants in Babesa and construction of new plants across the Thromde, all the households would be connected to sewer lines and treatment plants. This would decrease septic tank overflows and aid in the overall wastewater management process.

Construction of STP (7.5 MLD) and Augmentation of existing STP capacity

In order to cater to all the households in the Thromde, construction of more STP is necessary. The capacity of the exiting STPs will also need to be augmented to be able to cater to the needs

of the increasing population. It is also necessary to reserve some area in the decommissioned STPs in Babesa to accommodate for the construction of a new STP in the future. The expansion of the Babesa STP to 14 MLD is presently going on.

Design and Built a Fecal Sludge Management System

The sludge from the wastewater treatment plants and Septic tanks in the city are currently disposed without treatment of any sort. This could be problematic on the environment and human health in the long run. Thus Fecal Sludge Management systems are required to be designed and set up for the waste water treatment plants' and septic tanks' sludge in Thimphu. This would also allow the treated sludge to be used as manure and ensure environmentally safe.

Conduct study to come up with recommendations on grey water management

Presently, some of the households discharge their grey water into septic tanks/sewer lines while others let off in storm water drainage system, which causes overflowing of septic tanks and nuisance in the town.

While, greywater is not a major problem presently for the city, improper practices in grey water management would turn out to be problematic in the future. Hence, the need for a grey water management plan for the Thromde.

Storm Water Master Plan

Thimphu Thromde and the Flood and Engineering and Management Division under MoWHS are currently preparing the Storm Water Master Plan. Most storm water drainage follows the alignment of natural watercourses. Rather than disturbing and channelizing natural watercourses for draining storm water, it is recommended that they be protected and restored to their natural course.

Efficient treatment of automobile workshop waste

Treatment of effluent waste from the automobile workshops should be made mandatory. The effluent should be tested and monitored before releasing them into the streams. Innovative technology that is efficient in treating effluent and wastes from the automobile service sector must be explored and utilised. In order to ensure efficient treatment of automobile workshop waste, it is essential to carry out a feasibility study for treatment/disposal sites for wastes from the workshops and construct disposal/ treatment sites as needed.

Table 2-16 Wastewater management plan activities

Intervention	**Activities**	**Baseline**	**Target**	**Timeline**	Budget (Million Nu.)	Remarks
1. Sewerage Masterplan	a. Review of existing sewer network, STP and fecal sludge management	**0**	**1**	**2019-2023**	0.2	High priority
	b. Feasibility study and survey for sewerage network extension and construction	0	1		0.4	
	c. Design and development of sewerage masterplan	0	1		0.5	
2. Extend sewerage network to all HH excluding E4 Precinct Areas	a. Construction of extended sewerage network to all households	0	1	2019-2023	50.0	Short/medium term
3. Construct STP (7.5 MLD)	a. Detailed Design of STP	0	1	**2023-2024**	0.4	To cater to additional households in the future, (long-term)
	b. Construction of STP	1	1		30.0	
	c. Operation and maintenance plan and budget	0	1		1.0/year	
4. Fecal Sludge Management	a. Detailed Design of Fecal Sludge Treatment Plant (FSTP)	0	1	**2019-2023**	0.3	Presently no management as such for fecal sludge
	b. Construction of FSTP	0	1		20.0	
	c. Operation and maintenance plan and budget for FSTP	0	1		1.0/year	
5. Augmentation of existing STPs	a. Design and construction of STP expansion	6 Nos.	9 Nos.	**2019-2023**	30.0	Medium/long-term
	b. Operation and maintenance plan and budget	-	-		1.0	
6. Grey water management Plan	a. Grey water management plan for all the households in the city	0	1	**2023-2030**	0.5	Long-term
7. Efficient treatment of automobile waste	a. Survey and feasibility study for treatment/disposal sites for wastes/wastewater from	0	1	**2023-2030**	0.3	Medium/long term

	b. Construction of workshop disposal/ treatment sites	0	1		2.5	
	c. Construction of drainage system	0	1		5.0	
8. Monitoring and Enforcement	a. Capacity building of environment officers/inspectors on wastewater	Occasional	Annually	2019-2023	2.0	High priority
	b. Standardize construction of septic tanks and soak pits as per septic system manual	0	1	2019-2023	1.0	
	c. Strict and regular monitoring by the officers	Ad hoc	Bi-annual	2019-2023	1.0	
9. Advocacy and awareness on sewerage and its management	a. Awareness programs for the households in the city on wastewater management	0	Annually	**2019-2023**	3.0/year	May need to involve media for fee consideration on environment protection related ads
	b. Advocacy through news channels, radio, print media	0	Periodic	**2019-2023**	3.0/year	

Proposed e-waste management plans

The DITT under MOIC is responsible for the overall direction, planning and monitoring of e-waste management in the country. But the DITT does not have any field presence and it is the responsibility of the Thromde to manage the e-waste generated within the Thromde. In view of this, certain measures and activities are required to be implemented by the Thromde on e-waste management which as are follows.

Design and implementation of e-waste management plan

A concise e-waste management plan should be designed, and each agency should be made accountable for their own e-waste management.

Organizing coordination meetings between agencies on handling e-waste

Regular meeting between responsible agencies shall be done to have coordination among the implementing agencies.

E-waste recovery center for the Thromde

Presently, there are lack of e-waste treatment facilities in the country and lack of expertise in the field of e-waste management. Setting up an inventory of e-waste by type would help in the overall management and planning process. An e-waste recovery center within the country with proper mechanism would encourage people to recycle and sell their e-waste. Lack of facilities for recovery and recycling of e-waste discourages public to take effort on e-waste management.

Creation of awareness on e-waste

Creating awareness on the impacts of improper management of e-waste and its negative health impacts is important. Presently, e-waste such as old computers and TV sets are dumped into municipal waste collection vehicles and there are no proper facilities for treatment of such waste.

Capacity building of the staffs managing e-waste

The staffs within agencies should be given capacity building trainings to improve e-waste reduction, management and handling capacity within the agency.

Table 2-17 Proposed activities for e-waste management

Intervention	Activities	Baseline	Target	Timeline	Budget (Million Nu.)	Remarks
1. Study and Design an E-waste management plan at Thromde level	a. Design of a concise e-waste management plan (document)	0	1	2019- 2023	0.6	In collaboration with DITT
2. Construction of e-waste recovery center for the Thromde	a. Identification of suitable location and	0	1	2019- 2023	0.4	Capacity building and trainings are necessary alongside advancement in waste management activities/technologies
	b. Construction of e-waste recovery center	0	1	2019- 2023	10.0	
	c. Construction of collection centers along side drop-in centers for municipal waste	0	3	2019- 2023	5	
3. Creation of awareness on e-waste and its management	a. Advocacy and awareness on e-waste and its management	Occasional	Annually	2019- 2023	1.0	Can be conducted along with awareness on general waste
4. Capacity and technical skills development	a. Training on technical aspects of e-waste reduction, management and handling	Occasional	Annually	2019- 2023	3.0	For waste management entities, Thromdes relevant stakeholders

Proposed activities for Construction and Demolishment waste Management

Proper management and handling of C&D waste

In order to have a proper system for C&D waste management, it is important to review the existing system of C&D waste management and come up with plans to improve the system. It is also important to ensure strict monitoring and enforcement of the rules and regulations on construction waste and demolishment waste disposal. Awareness to the stakeholders and construction owners should be given timely in order to aid in the management process.

Thimphu Thromde currently collects around Nu 20,000 per construction site as security deposit when applicants request for dumping yards. The security is refunded after the waste has been dumped at the designated sites. The best way to avoid illegal dumping of C&D waste is through ensuring a reporting mechanism with proper pictures and other evidences when applications come for release of the security deposit. The same could also be incorporated as part of all building approvals for new or renovation works.

Implement and enforce recovery and reuse of C&D waste

Recovery facilities for C&D waste shall be provided to encourage people to recycle and reuse the materials as much as possible along with strict monitoring. Stakeholder coordination meetings shall also be conducted on a regular basis to encourage coordination among agencies and stakeholders managing and handling C & D waste

Disaster Waste Management Plan

Another Waste stream to consider is disaster waste, which will be produced in gigantic masses in case of disaster and will be difficult to manage. The disaster waste management plan shall be a part of the Disaster Management and Contingency Plan so that waste management plans are in place in case of disasters

Table 2-18 Proposed activities for C&D waste management and Disaster waste management

Indicator	Activities	Baseline	Target	Timeline	Budget (Million Nu.)	Remarks
1. Proper management and handling of C&D waste	a. Review of existing system on C&D Waste management	0	1	2019-2023	0.1	High priority
	b. Strict enforcement of rules and regulations - Enhancing capacity and resources for monitoring	Cases of illegal dumping	No illegal dumping	2019-2023	0.5	Currently there are human resource constraints, lack of support from other collaborating agencies and enforcement bodies
2. Implement and enforce recovery and reuse of C&D waste	a. Recovery facilities Options and Incentives	0	1	2023-2030	5.0	Very limited facilities at present for handling construction waste
3. Disaster Waste Management Plan	a. Inclusion of Disaster Waste Management in DM Contingency Plan	1	1	2019-2023	0.2	Disaster waste not specifically covered under the WPMA and Waste Regulation

Proposed activities for Air Quality management

Transport and mobility Plan

A mobility plan for the Thromde to manage vehicle congestion and encourage public transport services is important. The plan must provide for improvement to routes, frequencies, terminal arrangements for every route, bus stops, bays and shelter that are inclusive for commuters and the differently-abled, and integrated with pavements, wheelchair ramps, footpath network and cycle path.

Neighborhood Nodes (NN)

Providing NN at strategic areas would reduce the frequency of trips made by the local resident to the core area. The concept of NN should be promoted and implemented through proper coordination with key stakeholders.

Intelligent Transport System (ITS)

It will be necessary to enable the adoption of appropriate technologies to improve efficiency of transport services with time. Using Intelligent Transport Systems for efficient surveillance and maintenance of a smooth traffic flow, including the use of modern methods for parking control and parking revenue collections.

Electric vehicle

Electric vehicles must be promoted at least in the government offices to reduce emissions and the necessary infrastructure facilities such as service centres and fast charging stations should be set up within Thromde. To start off, it is recommended that the Thromde start using a fleet of electric, hybrid and plug-in-hybrid cars for its pool and office use including that of maintenance vans.

Limit Opening Burning and Wood Stoves

Open burning or wood burning are both not major issues in Thimphu. But, if not controlled, the issue may become serious due to increase in population and rise in electricity prices. Therefore, it would be ideal to already look at ways to limit opening burning and use of wood stoves.

Chapter 3 Thimphu Dzongkhag Waste Management Plan

Thimphu Dzongkhag has an area of about 1,795,868 sq. km. located in the western region of the Country. It has one Drungkhag, Lingzhi and eight gewogs namely Chang, Kawang, Dagala, Genekha, Mewang, Lingzhi, Soe and Naro. The population in the Dzongkhag is about 24,185 as of 2017[15]. Thimphu Dzongkhag Administration who is the implementing agency as per the Waste Prevention and Management Act of 2009 manages the waste in the Dzongkhag. The Dzongkhag Administration collaborates with the Gups and Mangmis of the gewogs and conducts awareness programs on waste management, periodical cleaning campaigns in respective villages and timely monitors and ensures that wastes are not dumped along the roadsides. A waste collection system for the periphery Gewogs of Chang, Kawang, Genekha, Mewang and Darkala was also set up by the Dzongkhag Environment and Engineering section. The Dzongkhag currently has two collector trucks for waste collection from the gewogs, which is dumped in the Memelakha Landfill. There is no segregation of waste at source and mixed waste are collected and disposed at the landfill.

Existing issues with the waste management system in the Dzongkhag

There is no segregation of wastes in the Dzongkhag at present, the wastes are collected as mixed waste and dumped at the Memelakha landfill by two garbage collection vehicles. Major challenges faced by the Dzongkhag at present are insufficient budget for maintenance and operation of waste collection vehicles, which has led to prolonged days with no waste collection facilities and illegal waste dumping and littering in the Dzongkhag. There is lack of facilities within the gewogs to facilitate waste management and lack of resources for the same.

Initiatives on Waste Management in the Dzongkhag

Dzongkhag Waste Management Plan (Thimphu)

A Dzongkhag Waste Management Plan has been prepared by the Thimphu Dzongkhag Gewogs. According to the draft of the plan shared, all Gewogs have their own goals and objectives with activities. There are also ideas on formation of Gewog Waste Management Plan (GWMP) and Management Committees in some of the Gewogs. The proposal also covers issues on lack of awareness and the gewogs have proposed activities of mass cleaning, awareness programs and putting up of waste bins at all necessary locations.

As per the Dzongkhag waste management plan, the Dzongkhag Administration identified five routes for garbage collection. The Dzongkhag Administration has agreed to take lead role in implementing and monitoring of the waste management plan. The MTO shall cordially work with engineering sector for deploying garbage truck(s) as per scheduled time and respective mapped routes. The routes identified are as follows;

Route-1

(Start): Thimphu - Rama -Thimphu Gate area – Nyzergang – Dochula – Hongtsho – Yusipang - Memelhakha(End)

[15] Dzongkhag Statistics, 2018

Route-2

(Start): Thimphu – Depsi – RTC – Chamgang area – Gewog Center – Yangchen Gatsel LSS – Settlement area – Memelhakha(End)

Route-3

(Start):Thimphu – Chimithangka – Yum Thuji Zam School – Bjimina LSS – Gidagom – Khasadrapchu town – Simu – Namselling – Memelhakha (End)

Route-4

(Start): Geney Gewog Center/BHU/RNR – Chizhi Goenpa – Wangbama Central School – Schumdo – Chuzom – Pungzhi – Wangsisina – Langdo – Along Highway – Khasadrapchu MLSS – Memelhakha (End)

Route-5

(Start): Thimphu – Dechenphug Lhakhang – Changtagang – Guru Lhakhang – Tango base – Dodena – Begena BPC – Kuzhugchen BHU – Kuzhugchen MSS – RNR/Gewog Center – Menchu area – Kabesa – Pangrizampa – Memelhakha (End)

Existing Implemented route map

1. BG-1A-0813

Monday- Sharithangka (Depsi) & Ramtokto

Tuesday- RTC, Nyzergang & Gamchey

Wednesday- Tshaluna &Bjimina

Thursday-Chunzom, Khasadrapchu & Wangsimu

Friday- Geneykha & Tshochilu

2. BG-1A-0796

Monday- Sharithangka(Depsi), Rama & Namseling

Tuesday- Chamgang

Wednesday- Dochula, Hongtsho & Yusipang

Thursday- Dechenphu, Tango-base, Chari-base & Changtagang

Friday-Kuzhugchen, Dazhi, Chamina & Kawang Gewog

The report also includes a list of activities for effective management of wastes within the gewogs which are summarized as below:

a. Formation of waste management committees/ Tshogpas – Most of the gewogs have already identified the committee members and formed waste management groups.
b. Routine Cleaning Campaigns – All of the gewogs have come up with cleaning campaigns and frequency for the mass cleaning campaigns
c. Identification of waste collection points
d. Strict Monitoring and Enforcement - Penalties and fines – Tshogpas and committee members to be given booklet receipt for imposing fines to defaulters
e. Frequency of waste pick up
f. Household composting
g. Dustbins for Communities

h. Mines, quarries, factories to dispose their own waste - Mewang Gewog has also suggested for mines and quarries to use their own garbage disposal trucks to dump their waste to Memelakha for which an authorization letter will be issued by the Gewog Administration

Waste Management Plans of other Dzongkhags – (Wangdue and Chukha Dzongkhag Waste Management Plan)

Similar to the Thimphu Gewog Waste Management Plan, other Dzongkhags have also formulated plans for managing waste within their region. Chukha Dzongkhag has formulated an action plan along with the roles and responsibilities for the Dzongkhag and gewog waste management committee under the purview of WPM Act 2009 and Regulations 2012 in 2016. The report describes the roles and responsibilities of the members of the waste management committee along with proper delineation of areas and responsibilities. Similarly, an Integrated Solid Waste Management (ISWM) has been piloted in Bajothang, Wangdue Dzongkhag. The report provides an implementation strategy along with action plans for each target outcome for Bajothang. Both the reports provide a simplistic yet extensive overview of the issues within the waste management system and the strategy proposed. The TWMP shall also follow similar structure of activities and plans.

3.1 Proposed Management Plan for Thimphu Dzongkhag

The Dzongkhag Waste Management Plan shall be similar to the Thromde Waste Management plan in aspects of its structure and organization plan. The planned activities for the Dzongkhag were prepared after consultations with the Dzongkhag office in Thimphu and review of the proposed waste management plans for Thimphu and other Dzongkhags.

3.1.1 Recommendations for waste management

The recommendations proposed under the TWMP are as follows;

a. Formation of Dzongkhag Waste Management Committee (DWMC) and Gewog Waste Management Committee (GWMC)

Dzongkhag Waste Management Committee (DWMC) shall comprise of members as described in the figure below with chair as Dasho Dzongda.

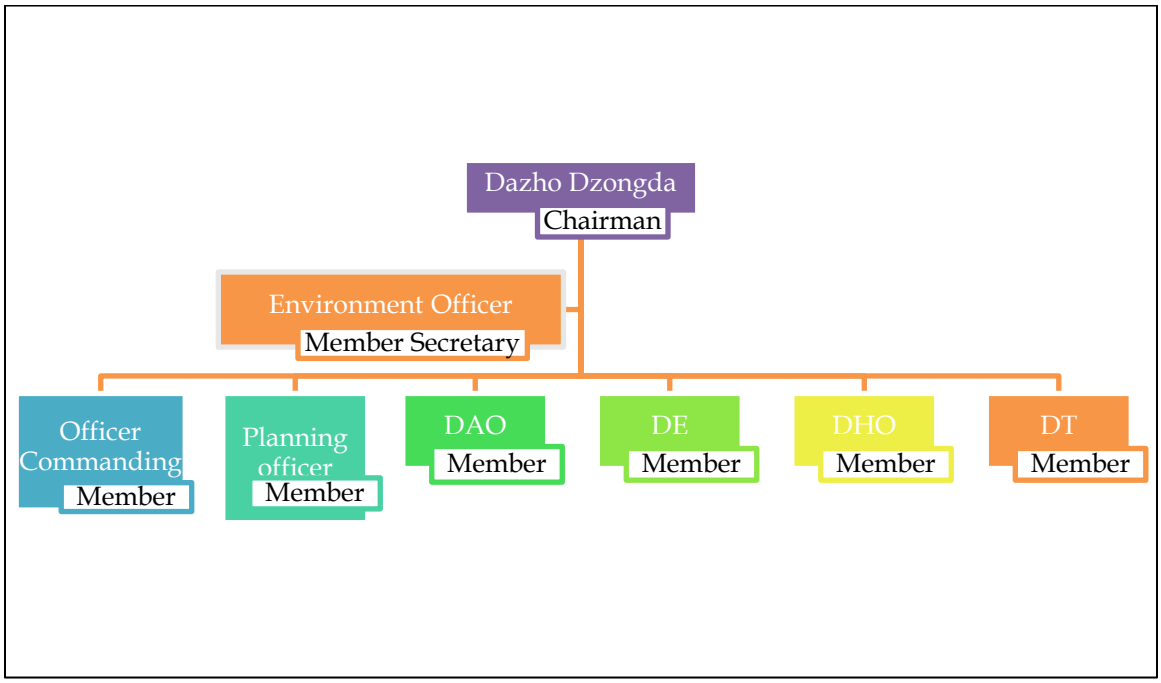

Figure 3-1 Dzongkhag Waste Management Committee

Their roles and responsibilities of the DWMC shall be as follows:

- Coordination of waste management activities in the Dzongkhag with regional offices/Institutions/Corporations and other responsible implementing agencies;
- Issue directives on waste management;
- Monitor compliance of implementing stakeholders;
- Strict enforcement of WPMA 2009 and its Regulations;
- Conduct waste advocacy program
- Ensure waste management programs are incorporated in their annual work plan and every financial year budgeting

Similarly, Gewog Waste management for the Dzongkhag should have the following members;

- Gup-Chairman
- GAO-Member Secretary
- GAEO-Member
- GLEO-Member
- Health Assistant/s-Member
- School Principal/s-Member

Their roles and responsibilities shall be as follows;

- Clear waste management plan within the Gewog jurisdiction (including highway & roads) with proper delegation of duties and area demarcations;
- Coordination and supervision of Gewog level waste management;
- Ensure waste management programs are incorporated in their annual work plan and every financial year budgeting
- Submit monthly report to the Dzongkhag Waste Management Committee on the monitoring, penalties and waste management programs
- Strengthen fining on the and 50% penalty amount to be awarded to the informant as incentive
- Dzongkhag Waste Management Committee should authorize them to monitor and impose fines/penalties to the defaulters and report accordingly as also granted by Waste Prevention and Management (Amendment) Regulation, 2016

The organogram for the Dzongkhag Waste Management shall be as shown in the figure below.

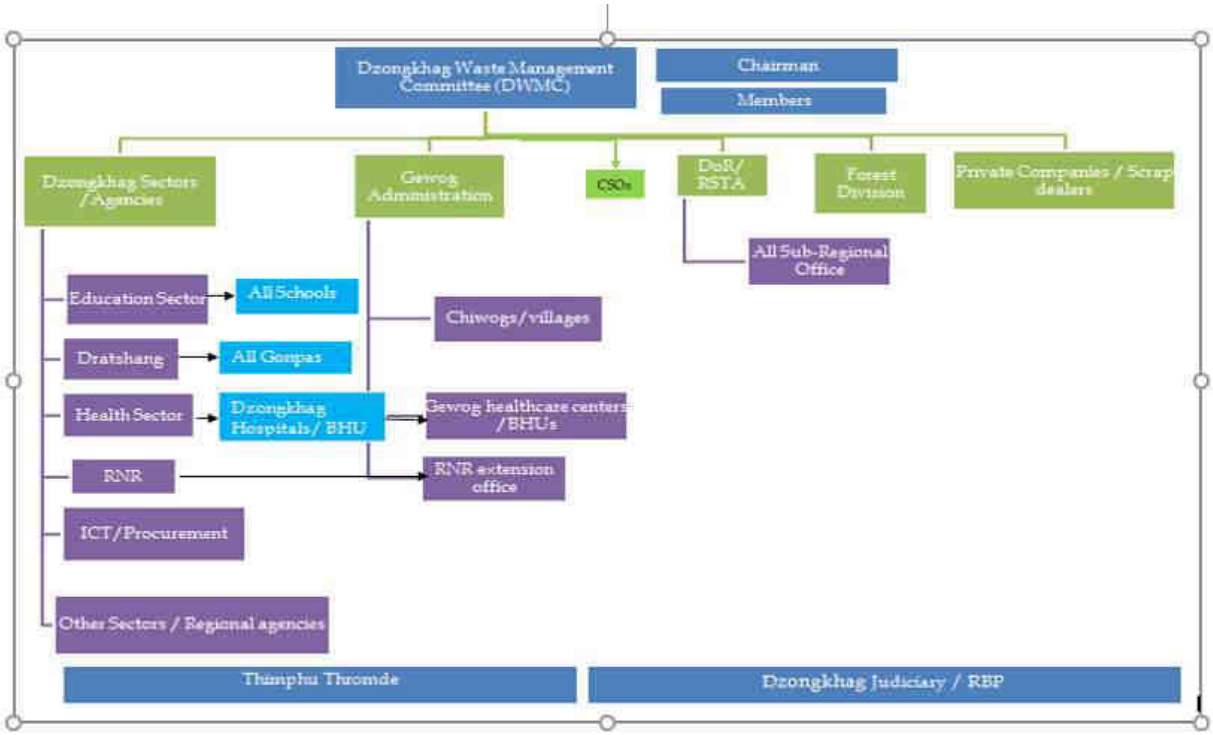

Figure 3-2 Organogram for Dzongkhag Waste Management

b. Management of wastes along roads

- The wastes along the Thimphu - Chunzom Highway shall be managed by the Regional Office of the Department of Roads (DoR), and Project Dantak in close collaboration with the RSTA
- The wastes along the Feeder Road and GC Roads within their jurisdiction shall be managed by the Regional Office of the Department of Roads, in close collaboration with concerned Gewog Administration
- Dzongkhag should also ensure proper placing of signage along roads and ensure labor camps along the highways and ensure other roads within their jurisdiction have proper waste management practices including dustbins, and disposal systems at all project colonies and road constructions sites
- A waste management plan along the highways and roads should be developed with proper delineation of areas and designated waste inspectors to look after the waste
- Strict enforcement of rules and fining on defaulters
- Ensure waste management programs are incorporated in their annual work plan and every financial year budgeting

c. Involvement of RSTA and Transport Sector

- RSTA with support from Traffic Police shall develop clear waste management plan for transport sector under the Thimphu Dzongkhag.

- RSTA shall ensure that waste offences are included as part of traffic offences, including open defecation at the bus stop, washing of vehicles along the highway and roads and open littering from vehicles.

b. Waste Management within State Reserved Forest Land

- The Dzongkhag Forest Division shall develop clear waste management plans to look after the waste management within the State Reserved Forest Land and all wastes beyond the Road Right of Way (RRoW) as mandated under the Waste Prevention and Management Act 2009
- Strict enforcement of rules and fining on defaulters within the reserved forest land
- Ensure waste management programs are incorporated in their annual work plan and every financial year budgeting.
- Conduct awareness campaigns aa needed

c. Waste Management within the jurisdiction of Dzongkhag Sectors/Regional Offices

- The Cultural Office and the concerned organizer shall be held responsible for waste management for any event/any celebrations and management of wastes within the boundary of Dzongkhag HQ;
- All concerned Dzongkhag Sectors & Regional Offices shall ensure that the waste management programs are incorporated in their annual work plan and every financial year budgeting.
- ICT Sector and Procurement section shall be made responsible for e-waste management and institutionalization of paperless operations in Government Offices (Dzongkhag/Regional/Thromde/Gewog);

d. Role of Judiciary and the RBP

- The Royal Bhutan Police shall render full support to the implementing agencies in monitoring and enforcement of waste management activities mandated under the WPMA, 2009;
- They shall ensure that the waste management programs are incorporated in their annual work plan and every financial year budgeting.

3.1.2 Indicators and Activities proposed for TWMP

Proposed Activities under Solid Waste Management for Thimphu Dzongkhag

The proposed activities under solid waste management plan for the Dzongkhag are as below;

a. Design and implementation of a systematic segregated waste collection system (Outsourcing/contracting)

In order to have an organized waste management system in place, it is important to first examine the waste generated in the Dzongkhag and analyze the composition of waste which would enable planning and prioritizing of waste collection timing, frequency and route selection. Waste segregation into dry and wet components is essential to enable recovery of waste. Privatizing or

outsourcing waste management would be a good initiative to encourage private sector participation in waste management and reduce pressure off the Dzongkhag in handling waste issues.
Once the study has been completed, the routes for effective and efficient collection should be redesigned and implemented in the Dzongkhag.

b. Upgradation of Waste Management Facilities

To enable waste segregation and disposal, procurement of extra garbage trucks is necessary. Construction of waste drop of centers with proper buy back mechanism such as the one near Kelki Higher Secondary School may give good opportunity for the Gewogs to earn some revenue from the waste generated while implementing better management services.
Similarly, initiating community composting of wet waste would reduce the pressure on the landfill. Since the households in the Dzongkhag are scattered household level composting would be valuable. While some initiatives do exists, it needs further support and consistent monitoring. General composting systems should be implemented for all wet waste across the Dzongkhag.
Waste collection and treatment facilities for special wastes such as e-waste, medical waste, industrial waste and hazardous waste needs to be constructed or collection systems should be provided so that such waste do not end up in the municipal landfill.
The need for a landfill for the two Gewogs that are not connected with motor roads Soe and Lingshi are also proposed in the near future instead of hauling their waste all the way to the capital.

c. Capacity Building Program for ISWM service providers to be developed and enhanced

Conducting workshop on ISWM (SW treatment and recycling activities, Composting plant, introduction of participatory approach in waste management etc.), Consultation meetings/coordination with the stakeholders and capacity building/ trainings for environment officers /engineers /inspectors and others on ISWM is necessary to enable proper monitoring, enforcement and management of waste by the responsible agencies

d. Creation of Public Awareness

Conducting awareness campaign and workshops on waste segregation, the 4 R's concept, training on composting of wet waste etc. would encourage proper management of waste in the Dzongkhag.

e. Monitoring and Enforcement

Along with awareness campaigns, regular monitoring and enforcement of rules and regulations on waste management is essential. It would be necessary to have waste management committees at Gewog, Dungkhag and Dzongkhag level. A Standard Operating Procedure (SoP) for the monitoring staffs with specific responsibilities, timing and area delineations would aid in the overall monitoring process.
Setting up a monitoring and reporting framework with proper format for the waste management agencies should be done. The monitoring and reporting schedule shall be as shown in the table below.

Table 3-1 Monitoring and reporting framework

Waste management activity	Responsible Agency	Monitoring schedule	Reporting schedule

Waste management in all public transport/private vehicles, roads	RSTA, RBP	Daily	Monthly
Waste management within Highway Right of Way Areas	DoR,	Daily	Monthly
Waste Management in State Reserved Forest Land	Forest Division	Monthly	Quarterly
All Gewogs and Chiwogs	Respective Gups	Monthly	Quarterly

Table 3-2 Solid Waste Management Activities

Intervention	Activities	Baseline (2018)	Target	Timeline	Budget (Million Nu.)
Design and Implementation of a systematic segregated waste collection system (Outsourcing/contracting)	a) Baseline survey on the SWM services delivery	0	1	2019-2023	1.0
	b) Develop Optimum waste collection routes, frequency of waste collection, and timing for waste collection (General waste, hazardous waste and industrial waste) and its operation.	5 Gewogs	All Gewogs	2019-2023	10.0
	c) Implementation of waste segregation at source (dry and wet)	0	All Gewogs	2019-2023	0.6
Upgradation of Waste Management Facilities	a) Purchase of 2 extra garbage compactor trucks for collection of segregated waste	2	2	2019-2023	40.0
	b) Construction of waste drop off centers (North and South) with proper buy back mechanism	0	6	2019-2023	2.0
	c) Construction of mini sanitary landfill for Soe and Lingshi Gewogs	0	1	2023-2030	10.0
	d) Replication of community composting units across the Dzongkhag in all Gewogs	Not significant	8 Gewogs	2019-2023	1.0
	e) Provision of Special Waste Treatment Facilities/ collection services in the Dzongkhag (e-waste, medical, industrial etc.)	0	1	2019-2023	2.0
Creation of Public Awareness	a) Conducting awareness campaign and workshops on waste segregation, the 4 R's concept, Composting plant, etc.	Ad-hoc	Annually in all Gewogs	2019-2023	1.0/year

Capacity Building Program for ISWM service providers to be developed and enhanced	a) Conduct workshop on ISWM (SW treatment and recycling activities, Composting plant, introduction of participatory approach in waste management etc.)	Ad-hoc	Bi-annual, 12th FYP (Gewog Administrations, Institutions (schools, Dratsang, NFE instructors, private entities engaged in waste management)	2019-2023	1.5/year
	b) Capacity building/ trainings for environment officers /engineers /inspectors and others on ISWM/ in-country exchange programs	Ad-hoc	Bi-annual	2019-2023	2.0/year
Monitoring and Enforcement	a) Formation of waste management committees at gewog, Dungkhag and Dzongkhag level	Informal Committee	Formalized Committee at all levels	2019-2023	1.0
	b) Preparation of SOP for waste management	Informal Gewog and Dzongkhag Waste Management roles	Formalized Gewog and Dzongkhag Waste Management SOP	2019-2023	0.8
	c) Set up a monitoring and reporting framework	Verbal	Proper monitoring and reporting at Dzongkhag and Gewog level	2019-2023	0.5

Proposed activities for wastewater management in Thimphu Dzongkhag

Wastewater in Thimphu is currently treated by septic tanks. There is a need to look into the issue and propose measures to treat them as the concentration of households are increasing in the Dzongkhag. Some of the initiatives proposed are as below.

a. Design and implementation of Sewerage plant and network for the Dzongkhag

Designing a masterplan for sewage management taking into consideration future challenges and changes are important. For proper waste management system in the Dzongkhag, designing and construction of sewerage network and constructing STP may also be considered in places with high wastewater inflow. These works are particularly important for the Local Area Plans (LAPs) of Debsi and Kabesa the town of Kharsadapchu.

b. Monitoring of septic tanks

Since most of the houses in the Dzongkhag have individual septic tanks and soak pits, it is important to have proper septic tank and soak pit designs for private homes. Field inspection and ensuring construction is done as per design and approval plans is necessary from the Dzongkhag. The construction approval for traditional structures in the Gewogs should also be scrutinized for proper septic tank design and operation. Capacity building of the inspectors and Gewog administration is necessary to improve their technical knowledge and monitoring capability.

c. Awareness creation

Awareness on wastewater management to be given regularly to the public and organizing coordination meetings between responsible agencies such as the Thromde and the Dzongkhag to harmonize waste management activities and plans is essential.

d. Grey Water Management Plan

Grey water discharge from residences are diverted into the septic tank in some cases, leading to septic tank overflows and pungent odours. While in most other cases, the grey water is directly released into the drains and streams without proper treatment. It is important to look into grey water management and come up with solutions/recommendations for handling grey water from the start so that there are no adverse impacts in the future.

Table 3-3 proposed Activities for Wastewater Management

Out put	Intervention	Activities	Baseline	Target in 5 Years	Timeline	Budget (Million Nu.)
Wastewater Safely Managed	1. Design and implementation of Sewerage plant and network for the Dzongkhag	a. Feasibility study and survey	0	1	2019-2023	0.8
		b. Design of sewerage plant and network in the 2 LAPs and 1 town	0	1	2019-2023	0.6
		c. Construction of sewerage plant and network	0	2	2019-2023	20.0
	2. Grey Water management Plan in urban areas of the Dzongkhag	a. Study on grey water and formulation of management plan	0	1	2023-2030	0.5
	3. Monitoring and Enforcement	a. Monitoring Septic Tank and Soak pits Design and Operation - Incorporation of septic tank design and construction as part of building construction approval – both from Dzongkhag and Gewog	Ad-hoc	100% at Dzongkhag and Gewog	2019-2023	-
		b. Capacity building of environment officers/engineers/ inspectors on wastewater management technologies/	Occasional	Annual	2019-2023	
		c. Consultation/coordination with relevant stakeholders	Occasional	Annual	2019-2023	
	4. Creation of awareness on sewage and its management	a. Awareness programs for households in the gewogs	Ad-hoc	1/year	2019-2023	1.0

Chapter 6 Implementation Plan

The implementation plan for the TWMP is presented in this chapter. The proposed activities along with the implementation timeline are mentioned in the following tables.

Table 6-1 Implementation plan for solid waste management (Thimphu Thromde)

Activities	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1. Implementation of National Integrated Solid Waste Management Strategy 2014												
Review Tariff Structure for collection of waste and explore innovative financing mechanisms to recover O&M costs	■											
Review and feasibility of PPP model for SWM in Thimphu Thromde.	■											
Revise the contract conditions, duration, payment and other criteria as necessary both from Thromde and Private parties' views.	■											
Strict enforcement of rules and regulations by the RBP and Thromde - Meeting and Coordination between RBP and Thromde	■	■	■	■	■							
Organizing Coordination meetings between RBP, Thromde, Zhung Dratsang, Dzongkhag, DoR, RSTA, DoFPS, TCB	■	■	■	■	■	■	■	■	■	■	■	■
2. Improving existing Thromde SWM services												
Update waste collection routes, frequency of waste collection, and timing for waste collection (General waste, hazardous waste and industrial waste)	■											
Review of the existing MRF/ Transfer Station and its services. Explore the need to have more MRF/Transfer Stations	■											
Procurement of garbage collection vehicles		■				■						
Fuel and maintenance budget for increasing number of vehicle collection trips and their frequency	■	■	■	■	■	■	■	■	■	■	■	■
Identification and construction of waste disposal/treatment sites for special waste (Medical, Veterinary, Hazardous)							■	■	■	■		
3. Data and IT Systems Development												

Solid Waste Management Information System	■											
Development of apps for tracking garbage vehicle	■											
4. Management of Memelakha Landfill												
O&M of the landfill as sanitary landfill	■	■	■	■	■	■	■	■	■	■	■	■
5. Establish community drop-in center												
Identification of possible drop-in center locations	■											
Establishment of a modus operandi for Drop-in Centers (document)		■										
Construction of drop-in centers		■	■	■								
6. Pilot HH level dumpsters												
Selection and design of a HH level dumpster system	■											
Pilot HH dumpster system in a locality		■										
Review of HH dumpster system and recommendation		■										
7. Construction of community compost plant												
Feasibility study and consultations with households in the city for organic waste composting	■											
Design of compost plant and determination of compost plant sites	■											
Construction of compost plants		■	■	■	■							
Operation and maintenance plan and budget and regular monitoring					■	■	■	■	■	■	■	■
8. Promote HH composting												
Replication of Household composting units across the city	■	■	■	■	■							
9. Monitoring and Enforcement												
Capacity development on ISWM/ trainings /workshop for relevant officers/private sector/relevant CSOs, etc. on new technologies, waste recovery /recycling options	■	■	■	■	■	■	■	■	■	■	■	■
Preparation of SoP for waste management in Thimphu Thromde	■											
Each agency/organization to set up monitoring and reporting framework for waste management	■											

Consultation meetings with public /coordination with stakeholders												
Training of RBP personnel on Waste Management, Regulations and Monitoring -RSTA, Desung for monitoring purpose only												
10. Awareness Programs												
Conducting awareness campaign and workshops on waste segregation, the 4 R's concept, waste minimization etc.												

Table 6-2 Implementation plan for wastewater management (Thimphu Thromde)

Activities	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1. Development of Sewerage Masterplan												
Review of existing sewer network, STP and fecal sludge management practices												
Feasibility study and survey for sewerage network extension and construction												
Design and development of sewerage masterplan												
2. Extend Sewerage network to all HH excluding E4 Precinct Areas												
Construction of extended sewerage network to all households												
3. Construct STP (7.5 MLD)												
Detailed Design of STP												
Construction of STP												
Operation and maintenance plan and budget												
3. Construct STP (7.5 MLD)												
Detailed Design of Fecal Sludge Treatment Plant (FSTP)												
Construction of FSTP												
Operation and maintenance plan and budget for FSTP												
4. Augmentation of existing STP												
Design and construction of STP expansion												
Operation and maintenance plan and budget												
5. Grey water management plan												

Grey water management plan for all the households in the city						■						
6. Efficient treatment of automobile waste												
Survey and feasibility study for treatment/disposal sites for wastes/wastewater from workshops					■							
Construction of workshop disposal/ treatment sites						■						
Construction of drainage system							■					
7. Monitoring and Enforcement												
Capacity building of environment officers/inspectors on wastewater	■	■	■	■	■	■	■	■	■	■	■	■
Standardize construction of septic tanks and soak pits as per septic system manual	■											
Strict and regular monitoring by the officers	■	■	■	■	■	■	■	■	■	■	■	■
8. Monitoring and Enforcement												
Awareness programs for the households in the city on wastewater management	■											
Advocacy through news channels, radio, print media	■											

Table 6-3 Implementation plan for e-waste management (Thimphu Thromde)

Activities	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1. Study and Design an E-waste management plan at Thromde level												
Design of a concise e-waste management plan (document)	■											
2. Construction of e-waste recovery center for the Thromde												
Identification of suitable location and design	■											
Construction of e-waste recovery center		■	■	■								
Construction of collection centers alongside drop-in centers for municipal waste		■	■	■								
3. Creation of awareness on e-waste and its management												
Advocacy and awareness on e-waste and its management	■	■	■	■	■	■	■	■	■	■	■	■
4. Capacity and technical skills development												

Training on technical aspects of e-waste reduction, management and handling												

Table 6-4 Implementation plan for C&D waste management (Thimphu Thromde)

Activities	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1. Proper management and handling of C&D waste												
Review of existing system on C&D Waste management												
Recommendations for improvements												
Strict enforcement of rules and regulations												
Awareness on C&D waste management												
2. Implement and enforce recovery and reuse of C&D waste												
Recovery facilities Options and Incentives												
3. Disaster Waste Management Plan												
Inclusion of Disaster Waste Management in DM Contingency Plan												

Table 6-5 Implementation plan for solid waste management (Thimphu Dzongkhag)

Activities	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1. Design and Implementation of a systematic segregated waste collection system (Outsourcing/contracting)												
Baseline survey on the SWM services delivery												
Develop Optimum waste collection routes, frequency of waste collection, and timing for waste collection (General waste, hazardous waste and industrial waste)												
Implementation of waste segregation at source (dry and wet)												
2. Upgradation of Waste Management Facilities												
Purchase of 2 extra garbage compactor trucks for collection of segregated waste												
Construction of waste drop off centers (North and South) with proper buy back mechanism												

Construction of mini sanitary landfill for Soe and Lingshi Gewogs					■	■						
Replication of household composition units across the Dzongkhag	■	■	■	■	■							
Construction of composting plants in gewogs		■	■	■	■							
Provision of Special Waste Treatment Facilities in the Dzongkhag			■	■	■							
3. Creation of Public Awareness												
Conducting awareness campaign and workshops on waste segregation, the 4 R's concept, Composting plant, etc.	■	■	■	■	■							
4. Capacity Building Program for ISWM service providers to be developed and enhanced												
Conduct workshop on ISWM (SW treatment and recycling activities, Composting plant, introduction of participatory approach in waste management etc.)	■	■	■	■	■	■	■	■	■	■	■	■
Capacity building/ trainings for environment officers /engineers /inspectors and others on ISWM	■	■	■	■	■	■	■	■	■	■	■	■
5. Monitoring and Enforcement												
a. Formation of waste management committees at gewog, Dungkhag and Dzongkhag level	■											
b. Preparation of SOP for waste management	■											
c. Set up a monitoring and reporting framework		■										

Table 6-6 Implementation plan for wastewater management (Thimphu Dzongkhag)

Activities	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1. Design and implementation of Sewerage plant and network for the Dzongkhag												
Feasibility study and survey	■											
Design of sewerage plant and network		■										
Construction of sewerage plant and network			■	■	■							
2. Gray Water management and implementation Plan in urban areas of the Dzongkhag												
Study on grey water and formulation of management plan	■											

3. Monitoring of Septic Tanks and Soak pits Design and Operation												
Capacity building of environment officers/inspectors												
Incorporation of septic tank design and construction as part of building construction approval												
Consultation/coordination with relevant stakeholders												
4. Creation of awareness on sewage and its management												
Awareness programs for the households in the gewogs												

Chapter 7 Communication Plan

In order to ensure that there are no gaps in the plan of action put forward in this study, it is important for the public to be on board with the activities and cooperate with the waste management agencies. Communicating to the public in the right way is important so that it would minimize waste generation and aid in the overall waste management process. Effective communication is a must for proper waste management in the city. A behavior change strategy on waste management was developed by Thimphu Thromde in 2017 for Thimphu city. The strategy presents approaches to changing community attitude and behavior, changing consumerist behavior, improving infrastructure and financial capacity and formulating legal tools for waste accountability. The communication plan for TWMP shall be in line with the behavior change strategy.

Recommendation under the Communication Plan are as follows;

a. Waste management in schools
   - Waste management activities should be practiced in school so that students are aware of the issue and are familiar with the waste management activities
   - Implementing segregation programs in all schools at pre-primary level would get them habituated to the practice

b. Advocacy and awareness should be a continuous process and innovative means of reaching to different sections of society should be explored through different platforms. The awareness programs shall be action-oriented awareness programs to encourage and support local engagement of schools and communities

c. Celebrating Champions in waste management
   - Dedicated citizens whose contribution in waste management is significant should be rewarded and recognized which will motivate other citizens

d. Effective implementation of "Polluter pays principle" (PPP)
   - The Polluter pays principle is a principle, which holds the polluting party liable for the damage caused to the environment. The defaulters are responsible for the damage and should pay accordingly, or compensate the ones affected by it.
   - Effective implementation of the PPP will ensure littering and illegal waste dumping is eliminated

e. Community involvement in waste management activities
   To improve waste management practices of the public, providing facilities to encourage recycling activities and giving incentives for such activities would be a good step towards improving and initiating recovery.

f. Implement the 4Rs (refuse, reuse, recover, recycle) and explore other alternatives such as eco-friendly plastic bags such as jute bags, etc.

g. Providing economic incentives for waste management activities and ESTs would encourage private involvement in waste management

h. Timely Inspection and monitoring by the inspectors
   - Creating awareness alone won't be enough to solve problem of waste. The monitoring inspectors should without fail make a timetable for inspection. The Thromde/Dzongkhag should make inspectors accountable for wastes visible in their designated areas.

e. Managing waste at Construction sites
   - Make it mandatory for the contractors/expatriate human resource hirers to provide their laborers with bins for segregation;
   - Educating laborers on existing rules and on ways of waste segregation;
   - Fining the contractor or such concerned personnel for waste littering but the latter may penalize his laborers

7.1 Awareness and Communication Implementation Plan

Effective communication and awareness plan should be formulated to enable, facilitate and support better awareness and practice of waste refusal, reduction, reuse, recycling, and recovery. In line with the initiatives taken on waste awareness so far in the country, the following activities are recommended for effective awareness and communication (Table 7-1). Figure 7-1 shows the importance of public education and partnership as a significant measure to ensure proper waste management.

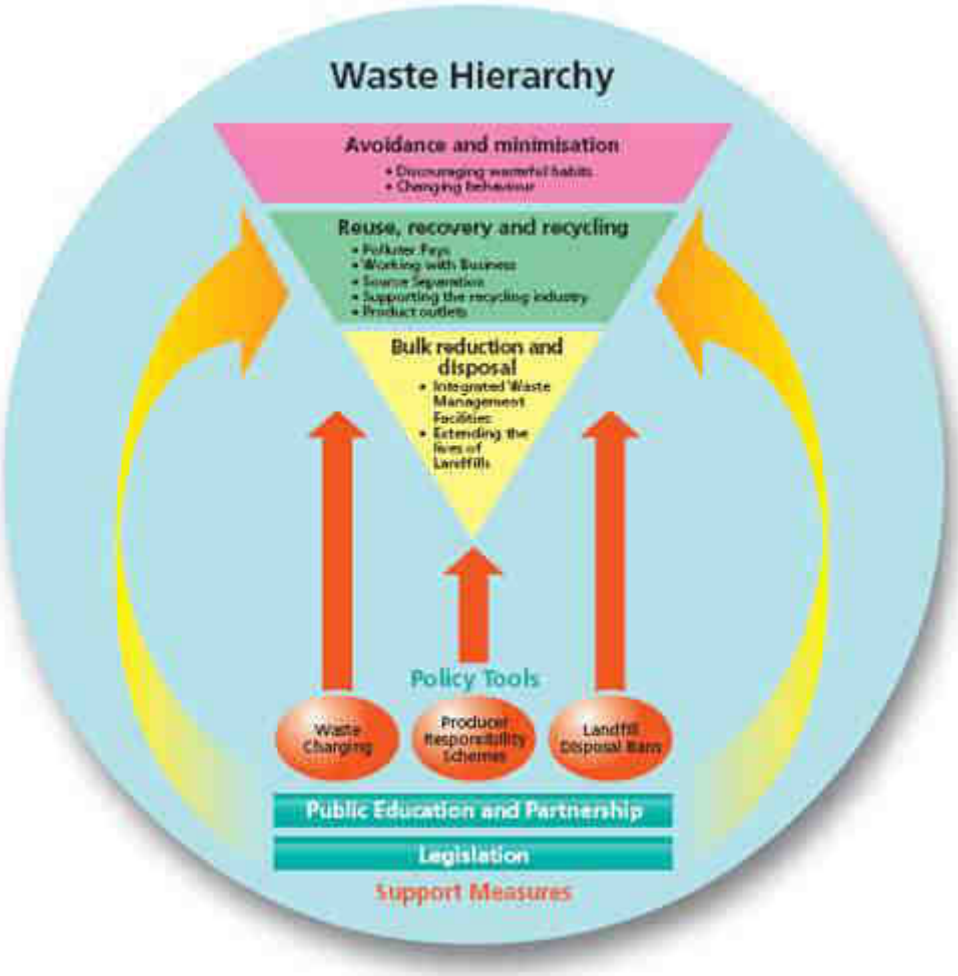

Figure 7-1 Policy tools and Support Measures for Waste Management (Source; https://www.epd.gov.hk/epd/msw/htm_en/ch04/main.htm)

A community education and awareness strategy for waste management developed in Southern Australia has accentuated on activities for effective awareness and education on waste management for achieving zero waste in the region (EPA, 2003)[16]. The activities acknowledged are apropos in the context of Bhutan and can be replicated in Bhutan. The activities for the awareness and communication plan for the current study shall be as shown in the table below.

[16] Community Education and Awareness Strategy for Waste Management, EPA -2003

Table 7-1 Awareness and Communication Plan - Activities

Activities	Timeline/Duration	Estimated Cost in Million Nu.	Target Audience	Priority
1. Website with data base on waste, and links to waste management organizations along with tips for waste management/ recycling/ recovery	2019-2023	0.1	Public with access to computers and internet	High
2. Toll - Free Call line for complaints related to waste management and littering, also as an information guide to public on recycling, reuse and recovery	2023-2030	1.0	Public	Medium
3. Timely awareness in schools and awareness at working level. The schools play an important role in cultivating waste management actions and responsibilities in the student. Target community events to raise awareness which should also include parents/ DEO/ TEO.	2 to 3 times a Year (2019-2023)	5.0	Schools and Office goers	High
4. Marketing and Promotion of products made from recycled materials	2019-2023	1.0	Public	Medium
5. Community volunteer programs to encourage members of the community to undertake training and initiate waste minimization activities and face-to-face communication and awareness raising within their local communities.	2019-2023	2.0	Schools and Communities	Medium

6. Television/radio awareness campaign/program on waste management and recovery	Three-month period each year for the first 5 years (2019-2023)	30.0	Public	High
7. Awareness Raising Signage at recreational/holiday/tourist locations on littering and regulations	2019-2023	1.0	Public	High
8. Educational Displays in City buses, hospitals	2019-2023	5.0	Public	High
9. Responsible' Shopping Guide at large commercial centers so that the public can make informed choices. Options for recyclable packaging of goods by the seller by mediating with supermarket and shopping centers	2023-2030	1.0	Public	Medium

Chapter 8 Crosscutting Issues between the Dzongkhag and Thromde

The waste from the extended areas outside of the Thromde such as Kabesa, Ngabiphu, Yoeselpang, Ramtokto and Depsi are currently managed by the Dzongkhag. The collection routes and areas are common for both the Dzongkhag and Thromde for such areas. There are no waste collection and management tariffs applicable and these areas are getting populated and evolving as town areas. With the increasing number of residents and commercial zones in these areas and no proper tariff system in place, the wastes from such areas are becoming a major issue for the Dzongkhag. It may be practical to privatize waste management for such areas and work with the private companies managing waste in the Thromde. Since these areas fall just outside the Thromde and the collection routes for these areas are similar to the Thromde pick up routes. Leasing waste management in these extended areas to the private waste management entities currently managing waste in the Thromde would be advantageous. These private companies could be paid by the Dzongkhag for their waste management duties. It would also facilitate the Dzongkhag to concentrate more on waste management in the rural areas. This could be considered during the renewal of the contract agreement between the Thromde and the private waste management entities and with meetings and deliberations between the Thromde and Dzongkhag.

The other issue of contention is the illegal waste dumping and littering along the highway and district roads to Kabesa, Chamgang and Yoselpang. For this coordination and initiatives needs to be set out between Department of Roads, RSTA, Dzongkhag, Thromde and Project Dantak. Similarly, there is also issues and challenges on managing waste along the hiking and trekking trails to Phajoding, Sangaygang, Kuenselphodrang, Tango and Cheri. These places are technically in the Dzongkhag boundary, but the trails are used mostly by the Thromde residents and tourists. Coordination and common solution need to be framed by the concerned agencies such as Tourism Council, Zhung Dratshang, Dzongkhag, Thromde and Department of Forests and Park Services.

In addition to the above, there is also a need for regular coordination meetings between the Thromde, the Dzongkhag and other stakeholders so that there are no gaps in waste management both within the Thromde premises and the Dzongkhag. It is also necessary to revise the tariff structure for waste collection to include extended town areas in order the make the system a self-sustaining system rather than a one-way outlay. These need to be looked into before the renewal of the contract between the Thromde and the private companies managing waste in the Thromde.

Appendix – Details of Stakeholder Consultations and Meetings

1. National Stakeholder Consultation – A

Initial consultation workshop for formulating the NWMS and TWMP was held on 11th September 2018.
Venue – Namgay Heritage Hotel, Thimphu
Date: 11th September 2018

Table 2 List of participants

Name	Organization/agency
Sonam P. Wangdi	NECS
Karma C Ngyedrup	NECS
Sonam Wangchuk	RBP
Tandin Dorji	JDNP, DoFPS
Dorji Gyeltshen	JDNP, DoFPS
Tendril Zangpo	JDNP, DoFPS
Jigme Dorji	DRA
Jambay Dorji	BAFRA
Kaling Dorji	BAFRA
Sonam Dorji	BCCI
Jigme Choki	DoI
Ram Badur	Thimphu Dzongkhag
Sonam Gyelpo	Thimphu Dzongkhag
Binu V.	IBFH Thimphu
Tobden	NSB
Dechen Yangden	DES/MoWHS
Ugyen Wangchuk	DES/MoWHS
Shacha	RSTA/MoH
Chundu Gyem	PHED/MoH
Rigzin Dorji	Greener Way
Tshering Penjor	UNDP
Tshewang Dorji	NEC
Tshering Nidup	DoT, MoEA
Bhawana Chhetri	DHS, MoWHS
Karma Tenzin	Ascab
Rinzin Jamtsho	TCB
Ugyen Lhendup	BTF
Nsdup Tshering	Clean Bhutan
Radhika Waiba	Clean City
Ugyen Tshering	BNCA
Major K. L. Dorji	RBA
Rinzin Dorji	JDNP
Tashi Namgay	NSB
Kumbu	JAL, MHAP

Kezang Lhaden	NEC
Sonam Zangmo	NEC
Rinchen Penjor	NEC
Yadap Koirala	Green Road
Bhawana Kafley	WWF
Tashi Jamtsho	WWF
Karma Yedon	DNP, MoF
Ugyen Tshering	DoFPS
Yeshi Wangdi	Thromde
Damchen Zangmo	DITT/MoIC
Tenzin Choden	DoR/MoWHS
Tshewang Zangmo	NECS
Ugyen Tshomo	NECS
Chador Wangdi	MoH
Sonam Choden	NSB
Kezang Choden	NEC
Tandin Wangchuk	DRC
Chhimi Dorji	ChhimiD Consulting
Kinley Wangmo	ChhimiD Consulting

2. Waste composition survey, sensitization on waste baseline study report and objectives of National Waste Management Strategy (NWMS)

Venue: Metta Resort, Paro
Date: September 27-28, 2018,
The two days' workshop on "Waste composition survey, sensitization on waste baseline study report and objectives of National Waste Management Strategy (NWMS)" was held in Paro on the 27th and 28th of September. Fifty-seven participants attended the workshop including the organizers. The list of participants included representatives from relevant government agencies, private sectors and civil service organizations.

Table 3 List of Participants

Name	Designation
Phub Tshering	Punakha Dzongkhag
Dorji Wangdi	Tsirang Dzonkhag
Ngawang Tenzin	Punakha Dzongkhag
Chimi Dema	Sarpang Dzongkhag
Bishnu Bhakha	Municipal Engineer, Damphu
Rinchen Pelzang	Municipal, Paro
Pema Lhamo	Chhukha Dzongkhag
Lhamo	Chhukha Municipal
Jampel Choeda	Wangdue
Khencho Dorji	Haa Dzongkhag

Tobden	NSB
Lange Dorji	DEO/Samtse
Singye Dorji	Thmphu Thromde
Ugyen Wangchuk	WSD/MoWHS
Samten Choden	Thimphu Thromde
Sonam Tshewang	Thimphu Thromde
Rigzin Dorji	Greener Way
Tenzin Dakpa	Samtse Dzonkhag
Tashi Namgay	NSB
Drodel Zangpo	NEC
Rinchen Dorji	NEC
Tanshen Bhattarai	Gasa Dzongkhag, Municipal Engineer
Sonam jamtsho	P/ling Thromde
Jamtsho Dukpa	P/ling Thromde
Lhadup	Gelephu Thromde
M. Osana	JESC
Nima Norbu	Thimphu Dzongkhag
Wangdi Phuntsho	NECS
Tshering Yangzom	Thimphu Thromde
Dechen Yangden	MoWHS
Jyoti Gurung	Clean city
Sonam Dorji	Interpreter
Tenzin Choden	Sarpang Dzongkhag
Tshering Dorji	NEC
Diso Seku	JICA
Karma Gyeltshen	Gelephu Thromde
Karma C. Nyedrup	NEC
Tshering Tashi	CCD/NECS
Tshewang Dorji	CCD/NECS
Jigme Zangmo	CCD/NECS
Passang Dema	WRCD/NECS
Tshomo	CCD/NECS
Dechen	WRCD/NECS
Kunzang DR	EACD/NECS
Kezang Choden	NEC
Bhawana Kafley	WWF
Tshering	NEC
Rinchen Penjor	NEC
Kesang Jatsho	NEC
Ugyen Tshomo	NEC
Sonam Zangmo	NEC
Thinley Dorji	NEC
Kezang Choden	NEC
Jangchu Dema	NEC
Karma Yangden	NEC

Chhimi Dorji	ChhimiD Consulting
Kinley Wangmo	ChhimiD Consulting

3. **Meeting with Thimphu Dzongkhag on formulation of Thimphu Waste Management Plan (TWMP)**

Venue: Thimphu Dzongkhag Office,
Date: 24 October 2018

Table 4 participants list

Name	Designation
Dasho Dorji Tshering	Dzongda
Dasho Chewang Jurmi	Dzongrab
Sangay Wangdi	Namseling Tshogpa
Kinlay Penjor	Tshogpa
Tenzin Yeshi	Tshogpa
Tashi Wangchuk	Tshogpa
Phurba	Tshogpa
Jamyang Lhamo	Tshogpa
Rinchen Penjor	NEC
Kezang Choden	NEC
Sonam Zangmo	NEC
Kezang Lhaden	NEC
Shakha Choden	Tshogpa
Dawa Drakpa	Participant
Paga Wangchuk	Participant
Dhodo	Dy. Chief DHO
Chhimi Namgay	
CL Das	Chief DE
Sonam Gyelpo	EO
K. B Gurung	DLO
Kencho Wangdi	DHO
Gado	Thrizin
Chhimi Dorji	ChhimiD Consulting
Kinley Wangmo	ChhimiD Consulting

4. **Meeting with Thimphu Thromde on formulation of Thimphu Waste Management Plan (TWMP)**

Venue: Thimphu Thromde Office,
Date: 25 October 2018

Table 5 Participants List

Name	**Designation**
Kinlay Dorji	Thrompon
Tsheten Wangchuk	Thromde

Nima Gyeltshen	Thromde
Singye Dorji	Thromde
Ugyen Penjor	Thromde
Jyothi Tamang	Thromde
Sonam Tshewang	Thromde
Tshring Yangzom	Thromde
Nakphel Drukpa	Thromde
Rinzin Om	Thromde
Ugyen	Taba Tshogpa
Kinga Yonten	Norzin Thuemi
Namgay Tshering	Babesa Thuemi
Phub Dem	Olakha Bangdu
Dorji Dema	Motithang
Srijana Cheetri	Engineer Sewerage/ Thromde
Sonam Zangmo	NECS
Chhimi Dorji	ChhimiD Consulting
Kinley Wangmo	ChhimiD Consulting

5. **Meeting with Thimphu Thromde on formulation of Thimphu Waste Management Plan (TWMP)**

Venue: Thimphu Thromde Office,
Date: 23rd November 2018

Table 6 Participants List

Name	**Designation**	**email**
Sonam Jamtsho	Urban Planner	sjamtsho@thimphucity.gov.bt
Pema Thekcho	AE, Water Supply	pthekcho@thimphucity.gov.bt
Ram Badhur Rai	AE, Sewerage	rbrai@thimphucity.gov.bt
Karma Dorji	Planning Officer	karmadorji@thimphucity.gov.bt
Yeshi Wangdi	Head, Env Division	
Tshering Yangzom	EO, Env. Division	tsheringyangzom@thimphucity.gov.bt
Nima Gyeltshen	Inspector	nimathimphu17@gmail.com
Chhimi Dorji	ChhimiD Consulting	
Kinley Wangmo	ChhimiD Consulting	

6. **Meeting with Thimphu Thromde on formulation of Thimphu Waste Management Plan (TWMP)**

Venue: Thimphu Thromde Office,
Date: December 19, 2018

Table 7 Participants List

Name	**Designation**
Kinlay Dorji	Thrompon
Srijana Chhetri	Sewerage Engineer
Yeshi Wangdi	Env. Division
Tshering Yangzom	AE, Sewerage

Karma Jatsho	Chief Engineer
Karma Namgyal	ES
Karma Dorji	Planning Officer
Chhimi Dorji	ChhimiD Consulting
Kinley Wangmo	ChhimiD Consulting

7. Final Consultation on NWMS and TWMP

Venue: Metta Resort Paro,
Date: December 20th and 21st 2018

Name	Agency/Division
Desang Dorji	DSE, MoE
Pem Zam	MoH
Wangdi	Thimphu
Demchen Zangmo	DITT, MoICC
Pema Samdrup	TCB
Karma C. Nyedrup	NECS
Tobden	NSB
Tshering Dorji	NECS
Dr. V Rai	NCAH/DoL
Jigme Dorji	DRA
Jigme Choki	DoI, MoEA
Kunzang Rinzin	NECS
Ugyen Wangchuk	MoWHS
Dorji Wangdue	Tsirang
Sonam Gyelpo	Thimphu Dzongkhag
Chhimi Namgyal	Thimphu Dzongkhag
K. B. Gurung	Thimphu Dzongkhag
Sangay Norbu	Chhukha Dzongkhag
Ngawang Dorji	Paro
Tshering Yangchen	Paro, intern
Tobgay	Paro
Tshering Yangzom	Thimphu Thromde
Karma Dorji	Thimphu Thromde
Yeshi Wangdi	Thimphu Thromde
Rinchen Dorji	Environment officer, Wangdue
Bhawana Kafley	WWF
Chhabilal DB	Thimphu Dzongkhag
Ngawang Chojey	NEC
Pema Chophel	WMD
Sonam Dagay	NEC
Tashi Dhendup	NEC
Ugyen Tshomo	WMD

Kunzang Rinchen	EACD, NECS
Kezang Choden	WMD, NECS
Rinchen Dorji	NEC
Nedup Tshering	Clean Bhutan
Kunzang	NECS
Rinchen Penjor	NEC
Ugyen Tshering	BNCA
Penjor Tshering	NEC
Drodel Zangpo	NEC
Thinley Dorji	NEC
Rinchen Tshering	NEC
Kezang Jamtsho	NEC
Choki Wangmo	NEC
Tshewang Dorji	NEC
Phuntsho Wangdi	NEC
Kezang Lhaden	NEC
Sonam Zangmo	NEC
Kalpana Tirwa	NEC
Chhimi Dorji	ChhimiD Consulting
Kinley Wangmo	ChhimiD Consulting