1. Acronyms

C&D	Construction and Demolition
DoC	Drop-off Centre
GNHC	Gross National Happiness Commission
GNHC-FS	Gross National Happiness Commission- Flagship Secretariat
MRF	Material Recovery Facility
NECS	National Environment Commission Secretariat
PMO	Prime Minister's Office
PSSF	Primary Collection, Storage and Sorting Facility
RDF	Refuse-Derived Fuel
WCF	Waste Collection Facility

2. Executive Summary

Notwithstanding the strong legislation and strategy governing waste prevention and management in Bhutan, waste management triggered by population growth, rapid urbanization, and rural-urban migration, remains an issue of national concern. Improper disposal practices and lack of appropriate infrastructure and technologies hinders Bhutan from converting wastes into resources.

To address the longstanding, emergent and intertwined issues, the Royal Government of Bhutan endorsed 'Waste Management Flagship Program' on January 23, 2020 during the 46th Lhengye Zhungtshog. Prior to the government endorsement, Her Majesty the Gyaltsuen most graciously launched the Waste Management Flagship Programme on June 2, 2019.

The flagship program intends to embark on a multi-pronged approach. The overall goal is to achieve Zero Waste Bhutan whereby the current trend of disposing over 80% of wastes to the landfill is reversed to less than 20% by the year 2030 based on the principles of circular economy. This can be achieved through the propagation of 100% source segregation and provision of adequate downstream facilities such as provision of segregation bins to all household adequate number of waste collection facilities & drop-off centres at convenient locations, efficient collection, storage and transportation systems, functional material recovery facilities and final disposal facilities such as sanitary landfills and incineration plants.

Furthermore, these facilities will be complemented by education and awareness on the consequences of unmanaged waste to both human health and the environment; policy interventions, particularly on the establishment of a sustainable financial mechanism to realize a self-sustaining model for effective and efficient management of all streams of waste; and private sector involvement in providing waste management services.

With the flagship tag on the program, the government is investing Nu. 4.733 Bn (that includes the land cost of Nu. 1.078 Bn) for a progressive system of waste management that can sustain and evolve into lucrative business opportunities besides creating employment opportunities and reducing greenhouse gas emissions.

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5. Background

Waste management remains an issue of national concern in Bhutan, particularly in the urban areas, due to increasing quantity of waste generation, its improper disposal and the associated pollution problems. The National Waste Inventory Survey (NWIS) 2019 reveals that Bhutan generates 172.16 Metric Tonnes (MT) of solid waste per day of which 46 percent of the total waste comprises food waste. The share of household waste stands the highest at 47.34 percent followed by commercial units at 39.09 percent. In terms of household waste, the average household waste generated is 0.7 kg per day in urban areas compared to 0.4 kg per day in rural areas.

Of the total households, more than 60 percent lacks access to waste collection services in the country. However, more than 75 percent of the urban households has access to waste collection services in contrast to 15 percent of the rural households. In urban areas, 88.5 percent of the households segregate their waste compared to 78.4 percent in rural areas.

In most of the urban centres, the municipal waste collection system, to a large extent, have been established by the local authorities in collaboration with private waste management entities. The local government and the private entities provide waste management services ranging from three days to five days a week. In addition, waste segregation has been initiated but the level of segregation varies widely. However, the perception survey reveals that the frequency of waste collection services, location of collection point and timing of collection are the major hurdles towards effective collection and management of waste as reflected in the figure below.

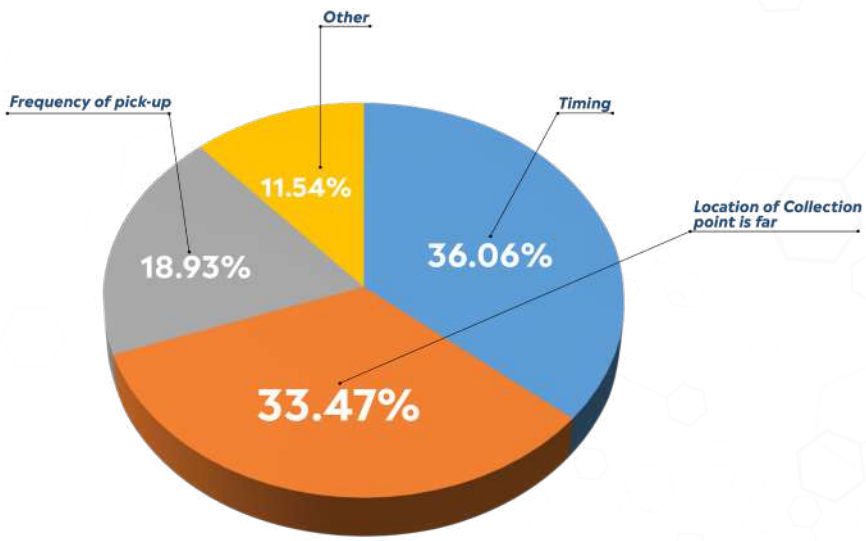


Figure 1. Reasons for not using waste management services (proportion)

Currently, waste treatment, recovery and recycling are minimal. As a result, the landfills in Bhutan are overflowing. While a fraction of valuable dry waste is collected and sold to the recyclers, composting is negligible[2] and there are no systems in place for managing household hazardous waste.

Furthermore, there is no established system for waste management in the rural areas. While some of the wastes are managed by the Dzongkhag, especially in peri-urban areas, most wastes are either left unattended and dumped in open fields or burned. Overall, the local governments are overwhelmed with the growing waste problems.

Against these backdrops, there is a need to institute a holistic waste management practices across the country to address the growing waste related problems. Therefore, in line with the National Waste Management Strategy 2019, the Waste Management Flagship Program will be implemented in the 12th FYP which will provide an end-to-end intervention for waste management in Bhutan.

[2] *Only 1.77% of wastes from the commercial units are composted, for instance.*

6. Goals and Objectives

The vision of the National Waste Management Flagship Program is to realize Zero Waste Bhutan by 2030, in line with the National Waste Management Strategy 2019. Zero Waste means, through effective source segregation, maximum material recovery will be attained with only the absolute waste of approximately 20% requiring safe disposal.

The flagship program will endeavour to achieve the following objectives:

1. To reduce waste going into landfills to less than 20%; and
2. To improve waste management service delivery.

In doing so, the Waste Management Flagship Program will also contribute to both national as well as international goals, key result areas and commitments as depicted in the figure below.

Figure 2. Contribution to higher results

7. Strategic Framework

7.1. Results

In pursuit of Zero Waste Bhutan by 2030, the flagship program intends to achieve the outcome reflected below:

1. Sustainable waste management enhanced

This outcome will be measured by 6 Outcome Key Performance Indicators. Furthermore,8 Outputs have been identified that will be measured by 41 Output Key Performance Indicators.

Figure 3. Summary of results

Of the total outputs, the following are specific to waste management:

1. Waste storage/segregation facilities in place;
2. Waste recovery facilities established;
3. Waste treatment facilities instituted;
4. Waste disposal facilities established;
5. Efficient waste transportation instituted;
6. Advocacy and awareness created;
7. Sustainable waste management financing instituted; and
8. Data management system established.

The Logical Framework of the Flagship Programme is enclosed as *Annexure I* and *Annexure II.*

7.2. Strategies

To achieve the aforementioned results, the following key strategies have been identified towards effectively resolving the prevalent waste management system in the country.

Figure 4. Strategic interventions for NWMS

Sustainable financing for waste management programs; technology development to suit the country's need; capacity building of key stakeholders; entering into voluntary agreements with corporate bodies & business entities; establishment of waste banks/drop-off centres at convenient locations; social engineering & propagation through education & awareness programs for behavioural change; institutionalizing waste management programs in all relevant sector plans & programs; and information & data on waste are identified as critical areas requiring immediate actions to achieve the vision of Zero Waste Bhutan by 2030. Some of the strategies like the sustainable financing and behaviour change will be formulated as standalone documents.

7.3. Programme Module

The Waste Management Flagship Program consists of implementation of integrated waste management (IWM) focusing on the Circular Economy through 3R's (reduce, reuse, recycle/recover) using a combination of waste management techniques and technologies to treat different types of wastes in an environmentally, financially and socially sustainable manner.

Integrated waste management requires intensive use of environmentally sound technologies (ESTs) for activities in the program starting from storage facilities (trash bins) to final disposal of wastes. The program model will implement the waste management system based on the characterization of wastes as it forms the basis for management and intervention. The types of wastes are as follows:

1. ***Municipal solid waste (MSW)*** - MSW are the wastes generated from households, institutions and commercial areas which consists of everyday items such as product packaging, yard trimmings, furniture, clothing, bottles and cans, food, newspapers, appliances, electronics and batteries. Common management methods of MSW include recycling, composting, combustion for energy recovery and sanitary landfilling.

2. ***Hazardous waste*** – Hazardous waste are the wastes generated from hospitals, industries, which consists of biomedical wastes, specialized wastes, expired medicines and confiscated psychotropic substances. Households also produce household hazardous wastes like batteries, lighting equipment, cosmetics, paints, pharmaceutical products, etc.

3. ***e-Waste*** – e-Waste refers to electronic and electrical wastes. Some of the common e-wastes include: home appliances such as televisions, air conditioners, electric cookers and heaters, air conditioners, fans, DVDs, radios and microwaves among others; information technology equipment such as computers, mobile phones, laptops, batteries, circuit boards, hard disks, and monitors among others; and other electronic utilities such as leisur, lighting and sporting equipment.

4. ***Construction and Demolition wastes*** – Construction and demolition (C&D) waste includes all the materials/debris that are generated as a waste either during the construction, repair, re-modelling or demolition (including de-construction and decommissioning) of any civil structure.

5. ***Waste water*** – Waste water comprises liquid waste generated from households, industries and commercial areas including sewage and gray water (dirty water, organic liquids, wash water from washing, laundering, bathing or showering). Waste water also includes storm water/surface runoff. The technology and infrastructure for waste water treatment will be designed and implemented as per the National Hygiene and Sanitation Policy which will be reproduced in a separate document.

Summary of facilities and deliverables of the Programme

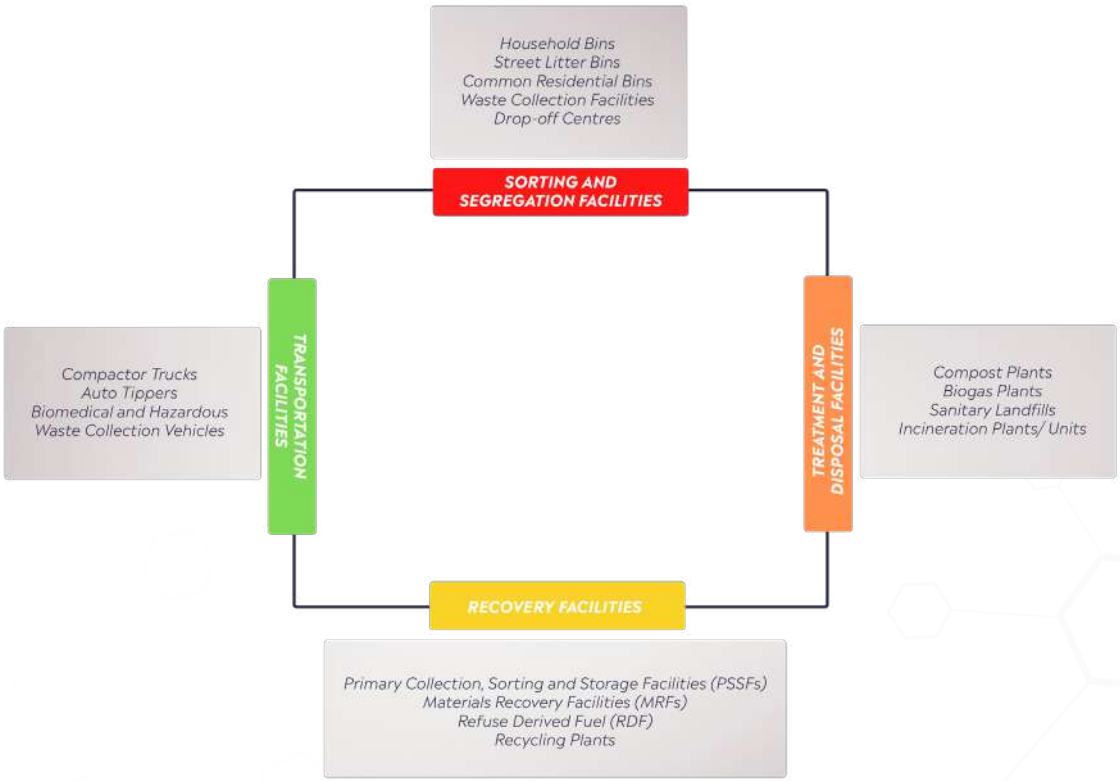


Figure 5. Summary of the program deliverables

The program model includes all aspects of waste management from waste generation and separation/segregation; collection, transfer and transport; sorting, treatment and recovery; and final disposal with an emphasis on maximizing resource efficiency.

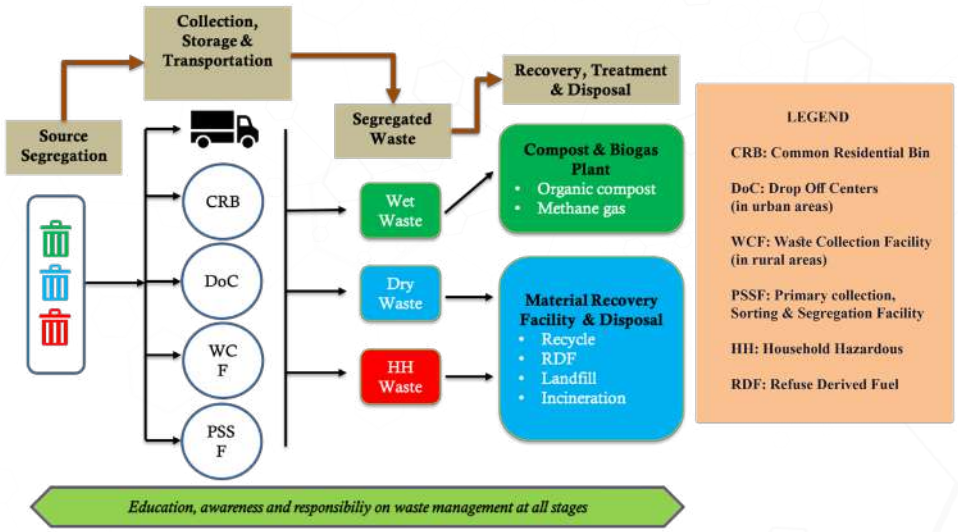


Figure 6. Flow chart of the program model

The program has chains of deliverables which are interlinked for the system to be functional. The preparation for the program implementation plan includes education awareness programs, distribution modalities, procurement plans, execution modalities and infrastructure developments. The technological interventions in the waste management are as follows:

- ***Waste Storage Facilities***

I. ***Household bins:*** At the household level, three colour coded bins (green, blue and red) will be made available for segregation of waste into wet, dry and household hazardous wastes with provision of similar colour coded trash bags for household waste segregation. In the rural areas, only two bins (red and blue) shall be provided as the wet wastes are either used as feed for cattle or used for household composting. The household bins are to be made available to all the households to encourage segregation at source.

II. ***Common residential bins:*** For residential apartments, three colour coded common residential bins with larger capacity will be made available to be maintained by each residential building for collection and storage of wastes from the respective residential units. The waste management service providers shall take care of regular emptying of these bins on a regular basis.

III. ***Drop-off Centres:*** Waste drop-off centres shall be established for residents in Thromdes who either miss their garbage collection timings or for those residing in area where providing regular waste

collection service to empty their waste is challenging. Such waste drop-off centres are to be set up at appropriate and convenient locations. The dry and hazardous waste collected from these facilities will be transferred to the material recovery facilities while the wet waste will be transferred to either compost or biogas plants.

IV. ***Waste Collection facilities (WCFs):*** There are three types of WCFs- WCF I; WCF II and WCF III. While WCF II will be slightly bigger than WCF I and will be installed in rural areas with higher population density, WCF III will be installed in urban areas. WCF I and WCF II will have only two components- one for dry and the other for household hazardous, but WCF III will have an additional compartment for wet waste. WCF I and II will be installed for residents in rural areas who either miss their garbage collection timings or for those residents devoid of collection service. The program proposes to set up around five waste collection facilities in every Gewog on an average for storage and segregation of waste from the rural areas. The WCFs will not be manned. However, the management in terms of monitoring and enforcement will be the responsibility of the respective Gups and the Service Providers. The waste collected from these centres will be transferred to the PSSFs/Drop-off centres/Material Recovery facilities.

V. ***Primary collection, Sorting and Storage Facilities (PSSFs):*** The waste collected from these facilities will be transferred to the material recovery facilities at the Dzongkhag level or to the Recycling Plants. The PSSFs will function like mini MRFs.

- ***Waste Collection and Transportation facilities***

I. ***Wet waste collection vehicles:*** In the current practice, same vehicles are used for collection of both dry and wet waste. This led to poor and unhygienic conditions for sorting and segregating waste. The program proposes to designate specially designed utility vehicles for the collection of wet waste which are seepage-proof with tipping system. Accordingly, the wet waste collection vehicle shall have designated colour code i.e. green colour stickers on it. The wet waste collection vehicles shall collect all the wet wastes from households (rural areas in Dzongkhags and urban area in Dzongkhags and Thromdes), drop-off centres in Thromdes towns and the PSSFs and WCF-IIIs in the Dzongkhags/periurban/satellite. The collected wastes shall then be transported to the treatment and disposal facilities (compost plant or biogas plant).

II. ***Dry waste collection vehicles:*** Separate collection vehicles are proposed for the collection and transportation of dry waste. Accordingly, the dry waste collection vehicles shall have designated colour code i.e. blue colour stickers on it. The dry waste collection vehicles shall collect all the dry wastes from households (rural areas in Dzongkhags and urban area in Dzongkhags and Thromdes), waste drop off centres in Thromdes and waste collection facilities in rural areas of Dzongkhags. The collected wastes shall then be transported to the Material Recovery facilities/Recycling Plants.

III. ***Household hazardous waste collection vehicles:*** Household hazardous also requires proper collection, transportation, treatment and disposal mechanisms. For safe handling and transportation of household hazardous waste to storage and treatment facilities, special vehicles designed for hazardous waste are proposed in the program. Accordingly, the hazardous waste collection vehicle shall have designated colour code i.e. red colour stickers on it. The collected wastes shall then be transported to the MRFs for further sorting & recovery. The residual waste shall be transferred to safe disposal facilities such as Sanitary landfills and incineration plants.

IV. ***Biomedical and hazardous waste collection vehicles:*** Biomedical waste from hospitals are considered hazardous and infectious which requires proper treatment and disposal mechanisms. For safe handling and transportation of biomedical waste to storage, treatment and disposal facilities, special vehicles designed for biomedical waste are proposed in the program. Accordingly, the biomedical waste collection vehicle shall have designated colour code, i.e. red colour stickers on it. The biomedical waste collection vehicles shall collect all the biomedical wastes from Primary Health Centres, hospitals and clinics from Thomdes and Dzongkhags. The collected wastes shall then be transported to the treatment facilities and disposal facilities such as incinerators.

- *Waste treatment facilities*

I. ***Compost Plant:*** For the management of wet waste, compost plants are proposed in the program. The compost produced from these plants are proposed to be used for greening programs, gardens and supplement the manure requirement for organic farming.

II. ***Biogas plants:*** For the management of wet waste, the program intends to collaborate with the Department of Renewable Energy, Ministry of Economic Affairs to set up a few biogas plants. The gas generated from these plants are proposed to be used for cooking and home heating purposes.

III. ***Autoclave:*** Infectious and hazardous waste generated from health care facilities are proposed to be treated using autoclaves prior to disposing. The recyclable waste after autoclaving is proposed to be sent to the MRFs.

IV. ***Microwave:*** Highly infectious and hazardous waste from health care facilities requiring inactivation and subsequent arrest of liquid & sludge are proposed to be treated in microwave units before disposing it in landfills and incinerators. These facilities are proposed to be installed in larger health care facilities with over 60 beds.

- *Waste recovery facilities*

I. ***Material Recovery Facility (MRF):*** Recyclable dry wastes will be recovered in the MRF. In the MRF, the non-compostable waste shall be temporarily stored, to facilitate segregation, sorting and recovery of recyclables from various components of wastes. The wastes from the drop-off centres, Waste Collection Facilities and PSSFs will also be transferred to these MRFs. The dry fraction of the segregated materials transferred to these MRFs shall be further segregated and sent to recycling plants or RDF for waste processing and recovery. The absolute waste from these recovery facilities will then be sent for final and safe disposal (sanitary landfill or incineration).

II. ***Refuse Derived Fuel (RDF):*** RDF is a fuel derived from combustible waste fraction such as plastics, wood, organic waste, paper, textile, rags, leather, non-recyclable plastics, multi-layered packaging, cellophane, melamine, etc. in the form of pellets or fluff produced by shredding, dehydrating and compacting. The fuel derived shall be used for either steam or electricity generation or as alternate fuel in industrial furnace or boilers (co-processing or co-incineration

of waste in cement, lime, and steel industry). From the initial assessment, at least one of the cement plants in the country can be pilot tested for RDF usage.

III. ***Waste Recycling Plants:*** Currently, the country does not have significant waste recycling plants. The program proposes to facilitate in setting up a recycling plant for plastic, paper and others with potential for recycling. The recycling plants can serve as a sink for the wastes generated within the country.

IV. ***Construction and Demolition (C&D) Waste Recycling Plant:*** Currently C&D wastes are used for filling low-lying areas. The recyclables like bags, wood, metals etc. shall be sent for recycling. The flagship program intends to procure a mobile C&D plant to turn the C&D wastes into reusable construction materials. Contingent on the experience, mobile C&D plants could be replicated in the other Dzongkhags.

V. ***e-waste:*** The quantity of e-waste being generated is too small to have an e-waste recycling facility for the reuse and reprocessing of electrical and electronic equipment. However, a centralized e-waste collection and dismantling centre for whole of Bhutan is being proposed.

- ***Waste disposal facilities***

I. ***Sanitary landfill:*** The absolute waste with no potential for material recovery shall be disposed of in sanitary landfills. The proposed sanitary landfills are engineered disposal sites with proper linings, leachate collection & treatment facilities and vents for safe release of methane gas. The flagship program includes construction of sanitary landfills for Dzongkhags and Thomdes. In addition, post closure landfill program shall be initiated to rehabilitate the existing landfills which are currently functioning as open dumps.

II. ***Incineration plants:*** A national level incineration plant is being proposed for the safe disposal of all streams of hazardous waste from various sources such as wastes from health care facilities, expired drugs & pharmaceutical products, seized psychotropic substances, infectious wastes, livestock wastes, obsolete pesticides/herbicides/germicides, waste/expired fertilizers, household hazardous wastes, industrial hazardous waste and hazardous wastes

from automobile and e-waste sectors. In addition, Regional Incineration Plants are proposed in Mongar, Gelephu and Phuntsholing to manage biomedical and hazardous wastes. The program will also explore plasma gasification technology for highly toxic and other hazardous waste that cannot be handled at the national/regional incineration plants.

The detailed design and drawings of the Waste Collection Facilities, Drop-off Centres and the Maps for Phase 1 that were completed during the time of drafting this document has been included as *Annexure III*. While similar maps have to be developed for Dzongkhags and Thromdes in Phase II and III at a later stage, the designs and drawings of the Drop-off Centres and Waste Collection Facilities can be used for Phase II and III.
The designs and drawings of other infrastructure like Material Recovery Facilities, Compost Plants, Biogas Plants, Refused Derived Fuel, E-waste Collection and Dismantling Centre, Sanitary Landfill, etc will be developed in a phased manner as proposed.

- ***Integrated Waste Management Facility***

Some of the storage, recovery, treatment and disposal facilities will be established under the Integrated Waste Management Facilities (IWMF), both at the Dzongkhag and Cluster levels. The IWMF will have facilities such as Material Recovery Facility, Sanitary Landfill, Compost Plant, Biogas Plant, Recycling Plant, Incineration Plant, Construction and Demolition Waste Recycling/Processing Plant and Stocking Yard. The establishment of IWMF has numerous benefits such as:

- avoiding the need for constructing ancillary facilities like road network, electricity and water connection, etc. for each facility;
- reducing transportation cost and improving efficiency in the context of industrial ecology;
- enhancing partnership among various local and national stakeholders and leverage their capacities and resources;
- ensuring optimum utilization of the limited available land and avoiding unnecessary scattering of various waste facilities;
- improving national and local coordination on urban development and waste management policies and programs;
- serving as a one-stop facility to cater to the waste storage, recovery, treatment and disposal amenities;
- enhancing public awareness and adoption of 3Rs; and
- serving as waste research and educational hub.

Support programs

- Laboratory support program: a solid waste management laboratory is proposed to be set up in Bhutan to deal with pollution from the waste sector and to test products like compost;
- Institutions of sustainable waste management financing to ensure sustainability of the waste management activities;
- Setting up of an information management system to collect waste and environment data from local to national level for periodic validation of the national waste inventory;
- Launch of cleanliness and waste management survey and award program to recognize towns/dzongkhags with best waste management practices;
- Launch of school and college waste management education program; and
- Launch of 'Green Academic Institution Award Program' to recognize and award the greenest schools and colleges in Bhutan.

Implementation Timeline

The program implementation timeline has been devised to complete the physical component of the project and subsequent implementation in a phased manner as illustrated in the figure below.

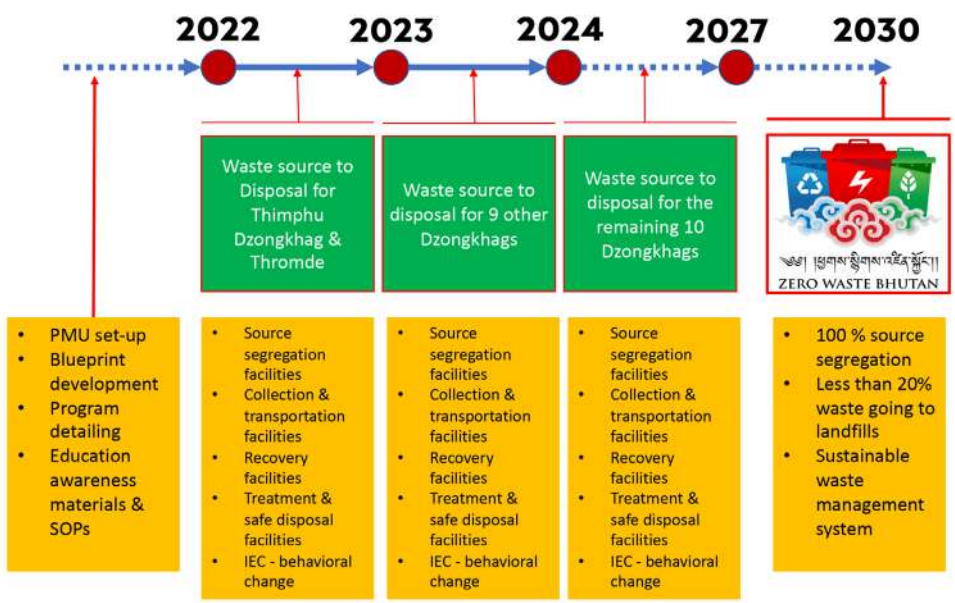


Figure 7. Implementation timeline

A pre-implementation stage of approximately 6-9 months has been set for baseline studies, mapping of implementation plans, education awareness propagation, site selection, design & drawings, procurement plans and implementation SoPs.

The program will be implemented in three phases as follows:

Phase I (FY 2020-2022)

Implementation of the IWM awareness, services, facilities and infrastructures in Thimphu Dzongkhag and Thimphu Thromde in the FY 2020-22.

Phase II (FY 2021-2023)

Implementation of the IWM services, facilities and infrastructure in nine Dzongkhags which include Chukha, Wangdue Phodrang, Samdrup Jongkhar, Sarpang, Paro, Bumthang, Punakha, Tsirang and Samtse in the FY 2021-23.

Phase III (FY 2022-24)

Implementation of the IWM services, facilities and infrastructure in the remaining ten Dzongkhags which include Trashigang, Mongar, Lhuentse, Trashi Yangtse, Gasa, Pema Gatshel, Trongsa, Haa, Dagana and Zhemgang in the FY 2022-24.

A stabilization, monitoring and evaluation phase till 2027 is proposed for the continuation of awareness programs (social engineering), data collection & inventorization, project rating and feedback & troubleshooting. The operationalization of the sustainable financial modality including trial run of the financial model will be put to test including other fine-tuning works for the model during this phase. From thereon, the self-sustaining waste management system is expected to be institutionalized in the government agencies/institutions in partnership with private sectors towards realizing the goal of Zero Waste Bhutan by 2030.

7.4. Program Operation Modality

The proposed options for the operation modality are geared towards optimal utilization of the government's limited resources (technical, human and financial). In doing so, private sector participation will be leveraged in the waste management sector by incentivizing private firms to manage wastes in rural areas which would otherwise remain unattractive due to high operational and transportation costs. In other words, the private firm interested to operate in Thromdes must also cater to the rural areas. The awareness and cooperation of the general public in segregating their wastes in different fractions of dry, wet and

hazardous waste is essential. For this, a concerted multi-year awareness and propagation program, using avenues of Information, Education and Communication (IEC) techniques is required to instil the practice of waste segregation at source. Relevant stakeholders like the CSOs/NGOs, Private entities and media firms will be engaged in propagating the education and awareness programs.

◈ *Option 1: Outsourcing the collection, transport and processing of wastes to two private firms based on zones*

- ***Area coverage:***

This operation modality could be used in Dzongkhags with Thromdes like Thimphu, for instance. The Dzongkhags shall be divided into two zones; north and south, comprising both rural and urban areas.

The waste management within the zones shall be outsourced to private firms. The Local Governments shall select the private firm and award the contract at a set fee through a competitive bidding process as per the Procurement Rules and Regulations 2019. Considerations could be made to engage private entrepreneurs to invest in the sector though long-term contract engagement.

- ***Government support:***

The Government shall provide the following on lease to the private sector:

1. Collection vehicles (wet, dry and house hazardous)
2. Compost and biogas plant(s)
3. Waste collection facilities (WCFs) in the Dzongkhags
4. PSSF(s) in Dzongkhags
5. Drop-off centre(s) (DoC) in Thromdes
6. MRF(s)

- ***Waste collection and transportation services:***

The private sector shall be required to conduct house to house or collection from waste collection facilities as follows:

1. Rural Areas: Private sector shall collect the wastes from WCFs as per the frequency determined based on the volume of the wastes generated. The rural households shall make an effort to drop their wastes during the collection times or drop off at WCFs. Private firms shall not collect wet wastes from rural areas as the volume generated is less and utilized for household composting as well as feeding domestic animals.

2. Peri-urban areas: Waste collection services will be conducted house to house as per the frequency decided by the Local Governments based on the volume of the waste generated. The households who miss the collection time shall either drop their wastes at WCF(s), PSSF(s) and MRF(s).

3. Urban areas: Waste collection services will be conducted house to house in areas where provision of common residential bins is not feasible. The waste service providers shall empty the common residential bins from areas equipped with such facilities. The advantage of common residential bin is that the occupants of the residential apartments need not wait for the waste collection vehicles and vice versa. The collection frequency shall be decided according to the decisions of the Local Governments based on the volume of the waste generated. The households without common residential bins who miss the collection services shall either drop their wastes at DoCs or MRFs.

The Local Government and relevant stakeholders shall determine waste collection schedules and waste collection routes. The overall monitoring and enforcement authority on waste management services provided by the private sector shall rest with the Local Government. The National Environment Commission shall provide overall policy guidance and technical backstopping.

With regard to the treatment of biomedical and hazardous waste, the responsibility shall lie with the Ministry of Health as indicated in the National Management Plan for Biomedical and Hazardous Wastes.

In addition, another option could be outsourcing the management of dry waste based on zones in Thimphu and involving another private firm to manage the entire wet waste value chain.

◈ *Option 2: Outsourcing the waste management services to private firms based on types of wastes*

- ***Area coverage:***

The Local Governments and relevant stakeholders shall involve the private firms in the waste storage, collection, transport, processing and disposal of wastes based on the type of waste streams. The management shall be outsourced to the private firms based on waste streams dividing it into three packages i.e. wet waste, dry waste and hazardous wastes. The overall monitoring and enforcement on waste management by the private sector shall rest with the Local Government.

The Local Governments shall select the private firms sign at a set fee through a competitive bidding process as per the Procurement Rules and Regulations 2019.

- ***Government support:***

Package 1: Wet waste

1. Wet Waste Collection Vehicles
2. Compost Plant
3. Biogas Plant where feasible

Package 2: Dry waste

1. Compactor trucks
2. WCF(s) and PSSF(s)
3. DoC(s)
4. MRF(s)

Package 3: Biomedical and hazardous waste

1. Vehicle for collection of hazardous waste
2. Incineration plants

The management including collection, transportation, treatment and disposal of biomedical and hazardous waste shall be conducted in line with the requirements of Ministry of Health as indicated in the National Management Plan for Biomedical and Hazardous Wastes.

- ***Waste collection and transportation services:***

The frequency of collection services in the rural, peri-urban and urban areas will be determined by the Local Governments in consultation with

the relevant stakeholders as discussed in Option 1. The only difference in Option 2 will be that the firm involved in wet waste management will not have to take care of the dry waste.

Collaboration between Dzongkhags and Thromdes

Both the options elaborated above entails the need for renewed collaboration between the Dzongkhags and Thromdes in Dzongkhags like Chukha, Samdrupjongkhar, Sarpang and Thimphu where the areas allocated for waste management overlaps the jurisdictions of both Dzongkhags and Thromdes.
The objective of selecting these possible options is mainly to address waste management issues in dzongkhags as most private entities do not venture into waste management services. It is because the volume of waste generated is not enough for their business to be lucrative. In addition, there are additional associated transportation and operational cost which discourages private sector involvement.

The figure below depicts the opportunities for collaboration between the Dzongkhags and Thromdes. The operation modality in these four Dzongkhags must cover three crucial aspects- operation, hiring & firing, and enforcement.

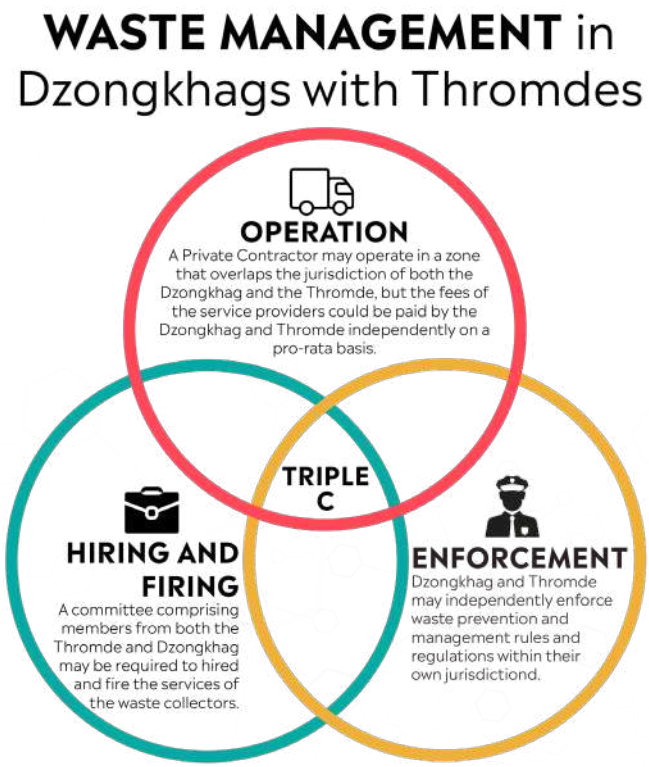


Figure 8. Snapshot of waste management in Dzongkhags with Thromdes

- ***Operation***

A Private Contractor may operate in a zone that overlaps the jurisdiction of both the Dzongkhag and the Thromde, but the fees of the service providers could be paid by the Dzongkhag and Thromde independently on a pro-rata basis.

- ***Hiring and Firing***

A committee comprising members from both the Thromde and Dzongkhag may be required to hire and fire the services of the Waste Service Providers.

- ***Enforcement***

Dzongkhag and Thromde may independently enforce waste prevention and management rules and regulations within their own jurisdictions.

7.5. Major Activities and Budget summary

The total estimated budget outlay for the program amounts to Nu.4.848 billion as reflected in the table below. Of the total amount, Nu. 1.078 billion has been estimated for the cost of land considered as in-kind contribution.

Major Activities	Budget (FY 20-21 in Mn Nu.)	Budget (FY 21-22 in Mn Nu.)	Budget (FY 22-23 in Mn Nu.)	Total Budget (in Mn Nu.)
Waste Management				
1. Make Waste storage/segregation facilities available	216	422.01	314.6	952.61
2. Establish waste recovery facilities	62.7	235	250	547.7
3. Institute waste treatment facilities	41.86	141	35.5	218.36
4. Establish waste disposal facilities	123.05	373.8	265	761.85
5. Institute efficient waste transportation	136	333	240.5	709.5
6. Create advocacy and awareness	45.8	105.3	112.4	263.5
7. Institute sustainable waste management financing	1	2	2	5
8. Establish data management system	4.5	0.3	150.3	155.1
9. PMU Operations	8.94	11.94	11.94	32.82
Waste Management	639.85	1624.35	1382.24	3650.53
Waste Management Expenditure for FY 19-20				4.09
Total				3654.62

Table 1. Summary of Major Activities and Budget

In the first phase, the budget requirement is Nu. 639.85 Mn. In the second and third phase, the flagship program would require Nu. 1624.35 Mn and Nu. 1382.24 Mn respectively.

However, the outlay approved by the government for the flagship program is Nu. 1 billion of which only Nu. 300 million has been mobilized as of July 2020. The resource gap of the flagship program (excluding the land cost) stands at Nu. 3.354 billion which means, only 8.2% of the financial resources have been mobilized at the moment.

8. Implementation Arrangement

The lead agency (PMU) for the National Waste Management and Stray Dog Population Control Flagship Program is Waste Management Division, National Environment Commission. The implementation arrangement has been outlined as per the Flagship Program guidelines approved by the Cabinet as outlined in the figure below:

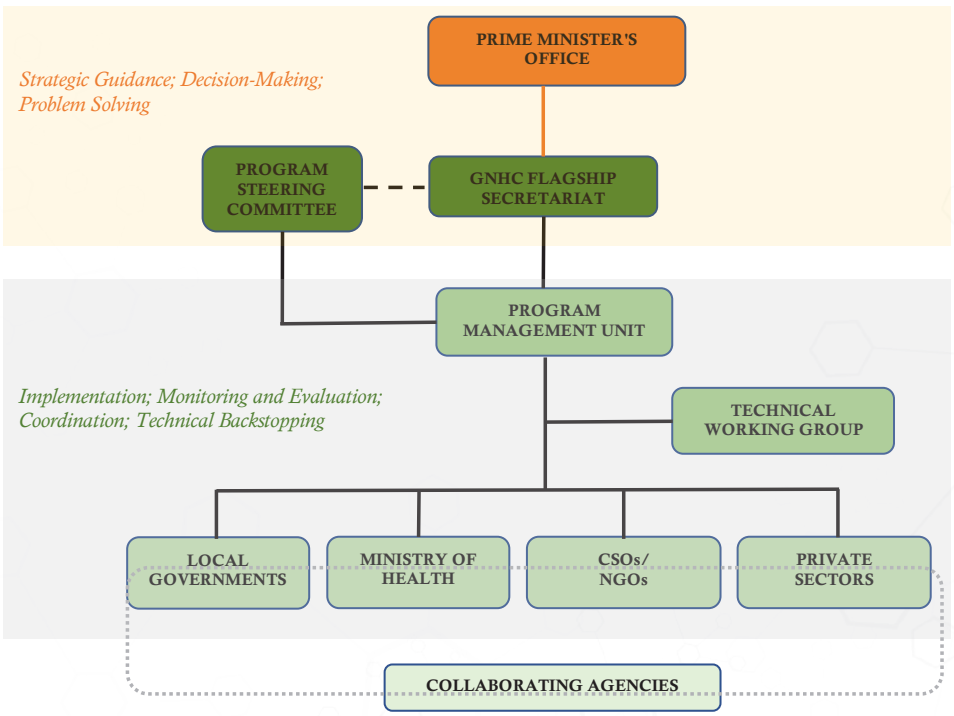


Figure 9. Summary of implementation arrangement

8.1 Prime Minister's Office (PMO)

The PMO will directly monitor the National Waste Management and Stray Dog Population Control Flagship Program. The GNHC Flagship Program Secretariat will support the PMO in regular monitoring.

8.2 Program Steering Committee (PSC)

The PMU shall implement the Program under the strategic guidance of the PSC. The PSC composition comprises senior level officers from the organizations specified below:

1. Secretary, National Environment Commission Secretariat (Chair);
2. Water and Sanitation Division, Ministry of Works and Human Settlement;
3. Department of Livestock, Ministry of Agriculture and Forest;
4. Thimphu Forest Division, Ministry of Agriculture and Forests;
5. Department of Medical Services, Ministry of Health;
6. Department of National Budget, Ministry of Finance;
7. Planning, Monitoring and Coordination Division, Gross National Happiness Commission;
8. Respective Dzongkhag or Thromde Administration; and
9. Program Manager, Waste Management Flagship, NEC – Member Secretary

The responsibilities of the PSC are as follows:

- Provide guidance regarding technical feasibility of the Program components;
- Make consensus-based management decisions when guidance and support are required by the PMU. In case consensus cannot be reached; the final decision shall rest with the PMO. The decisions will be made in accordance with standards that shall ensure management for developing results, best value for money, fairness, integrity, transparency and effective implementation. The PSC is also responsible for monitoring and evaluation of program interventions, achieving project outcomes and objectives of the Program;
- Approve annual work plans and budgets in line with the blueprint;
- Endorse re-appropriation and revisions of budget within the flagship activities;
- Provide strategic technical and management guidance and direction;
- Ensure implementation of the program in line with the overall Flagship objectives and the Blueprint; and
- Monitor progress of the flagship program.

8.3 GNHC Flagship Program Secretariat (GNHC-FS)

GNHC Flagship Program Secretariat shall provide overall direction, strategic guidance for timely delivery of the Program and shall:

- Facilitate implementation of all the activities in the program Blueprint;
- Facilitate resource mobilization and allocation;
- Expedite the approval process for implementation of program activities;
- Facilitate timely disbursement of funds to the PMU;
- Monitor implementation of the program and facilitate problem solving;
- Review the monthly progress reports submitted by PMU; and
- Consolidate progress reports and submit them to GNHC and PMO monthly, quarterly and annually.

8.4 Technical Working Group (TWG)

Based on the requirement, TWG will have members from Ministry of Works and Human Settlement, Ministry of Health, Ministry of Information and Communications, Ministry of Economic Affairs, Dratshang Lhentshog, Royal Education Council, Ministry of Education, Dzongkhag and Thromde Administration, Drug Regulatory Authority, Road Safety and Transport Authority, Tourism Council of Bhutan, National Statistics Bureau, relevant Thromde/Dzongkhag Private Sector, waste service providers, and Flagship Secretariat.

The responsibilities of the TWG are as follows:

- Provide technical support and assistance to ensure that the program interventions are planned and implemented in a coordinated and holistic manner at Central as well as local level;
- Provide guidance and/or clarifications when technical issues arise;
- Recommend technical interventions;
- Provide guidance and ensure greater involvement of the private sector in the program implementation process in various capacities;
- Review and endorse Terms of Reference for consulting tasks;
- Liaise with the implementing partners; and
- Support the PMU and PSC in the implementation of the program.

8.5 Program Management Unit (PMU)

The Program Management Unit (PMU) housed in Waste Management Division, National Environment Commission Secretariat shall coordinate and manage the National Waste Management and Stray Dog Population Control Flagship Program. The PMU consists of one Program Manager, Program Coordinators and relevant officials.

The PMU is responsible for:

- The day-to-day operation, overall direction, strategic guidance to the implementing partners and timely delivery of the Program;
- Decision making for the project in order to ensure that the program produces the results specified in the logical framework to the required standard of quality and within the stipulated time;
- Preparation of annual work plans and budget;
- Preparation of Flagship Program annual performance agreement;
- Monitoring and reporting in close consultation with implementing partners;
- Submission of monthly and annual report to Flagship Program Secretariat;
- Coordination of PSC meetings for approval of annual work plans and budget, and as and when required;
- Coordination of TWG meetings as and when required;
- Coordination of progress review meeting;
- Ensuring uniformity and consistency of the equipment and infrastructure procured and established through the flagship program; and
- Liaising with the Implementing Partners such as Dzongkhag Administration, Thromde Administration and other relevant stakeholders.

8.6. Implementing partners (IP)

Respective Dzongkhag Administration, Thromde Administration and other relevant stakeholders like Ministry of Health, CSOs, NGOs and Private Sectors shall identify relevant focal persons to oversee, coordinate and implement the flagship activities assigned to respective stakeholders. The implementing partners should liaise with the PMU. The TWG member from the agency or any other relevant official can also be appointed as the focal person.

The responsibilities of the Implementing Partners are to:

- Provide support in preparatory phase of flagship activities including, but not limited to site selection and clearances;
- Alignment of Local Government and other waste management plans, programs and projects with the Waste Management Flagship Program;
- Implement the flagship activities including, but not limited to construction of infrastructure, and distribution of facilities;
- Develop and implement operations modality of waste management;
- Submit progress report to the PMU on time; and
- Flag any implementation issues and problem-solving request to the PMU.

8.7. Collaborating Agencies

The Collaborating agencies of the flagship program are Ministry of Education, Royal Education Council, Ministry of Economic Affairs, Ministry of Information and Communication, Road Safety and Transport Authority, Department of Roads, Department of National Properties, Drug Regulatory Authority, Bhutan Narcotic Control Agency, Ministry of Agriculture and Forests, Private Sector, Civil Society Organizations, Media House, Tourism Council of Bhutan, Dratshang Lhentshog, Armed Force Personnel, Druk Holding and Investments, Private Sectors, Thromde and Dzongkhag Administration, Automobile Association of Bhutan, Taxi Association of Bhutan, Association of Bhutanese Industries and National Commission for Women and Children.

The stakeholder analysis is annexed to the document as Annexure V.

8.8. Fund flow mechanism

The construction/establishment of waste management infrastructure shall be delegated as deposit work to Dzongkhags and Thromdes and other implementing agencies. However, some machineries, vehicles and facilities will be centrally procured to ensure uniformity and consistency, but the support of the implementing agencies will be vital in ensuring efficient distribution of such equipment.

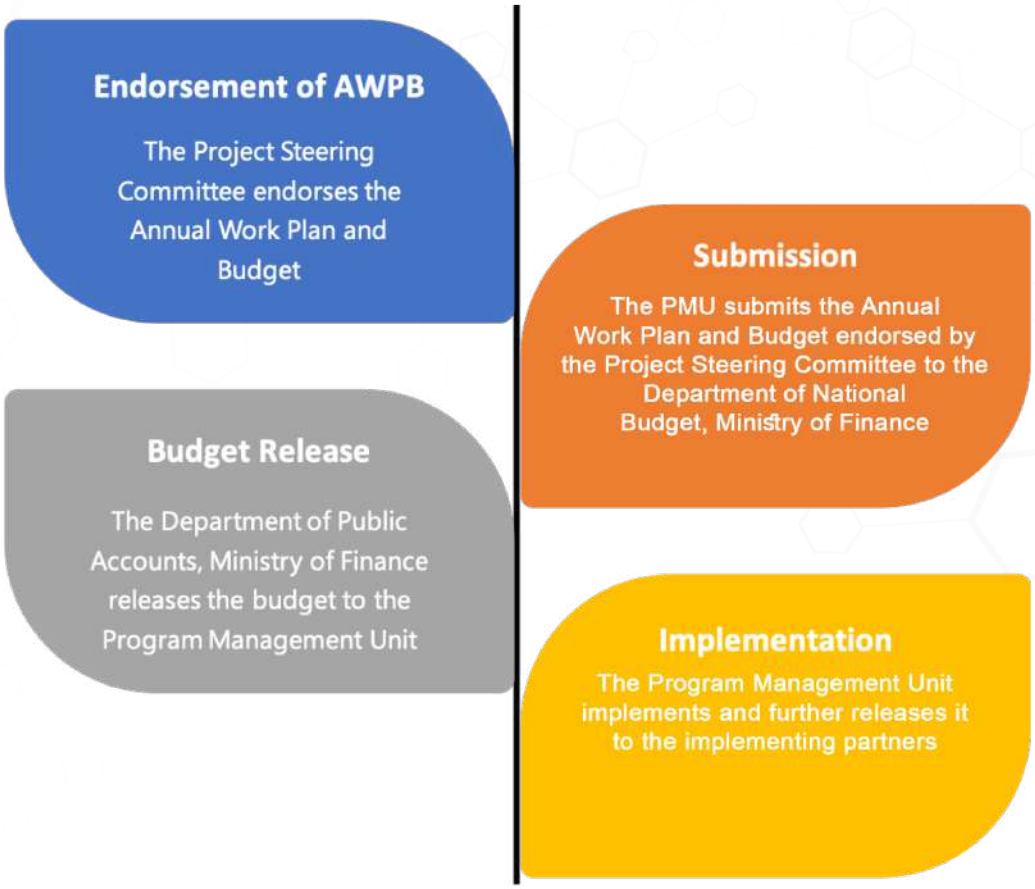


Figure 10. Fund flow summary

9. Risk Management

Risk management is the systematic process of understanding, evaluating and addressing risks to maximise the chances of achieving objectives and ensuring organisations, individuals and communities are sustainable (World Bank 2014[3]).

Risk management enables an organization to brainstorm various risks that a project/program entail, and explore ways to mitigate the risks early on, thereby saving valuable time and resources. Doing so transforms risks into opportunities. However, the prerequisites of an effective risk management are informed understanding of relevant risks; assessment of their relative priority; a rigorous approach to monitoring and controlling them; and a strong partnership approach.

The following rubric has been used to conduct risk rating for the flagship program.

Probability of Risk Occurring	Impact of Risk				
	Negligible= 1	Minor= 2	Moderate= 3	Major= 4	Severe= 5
Almost certain= 5	Moderate= 2	Moderate= 2	High= 3	Very high=4	Very high=4
Likely= 4	Moderate= 2	Moderate= 2	High= 3	High= 3	Very high=4
Possible= 3	Low= 1	Moderate= 2	High= 3	High= 3	High= 3
Unlikely= 2	Low= 1	Low= 1	Moderate= 2	Moderate= 2	High= 3
Rare=1	Low= 1	Low= 1	Moderate= 2	Moderate= 2	High= 3

Table 2. Risk rating rubric

As reflected in the table below, the overall 'initial risk rating' is 'high'. However, through the treatment of the risks using six broad parameters, the overall 'residual risk rating' is alleviated to 'moderate'

[3] *World Development Report 2014*

Summary of Major Risks

Risks	Probability	Impact	Initial Risk Rating	Treatment/ Amelioration	Responsible Entity	Residual Risk Rating
Political and Governance	3	4	3	Incorporate waste management as one of the key interventions in economic roadmap/ five-year plans	NEC and NTF for the 21st Century Economic Roadmap GNHC, GPMD, PMO MoF	2
				Establish linkage with the APAs of Local Governments and relevant central government agencies		
				Develop and operationalize sustainable financial modality		
Environmental (All environmental safeguards needs have to be assessed, Climate and Disaster)	2	4	3	Undertake thorough EIA and develop Mitigation measures	NEC, PMU and	2
				Ensure proper site selection and develop Climate Resilient Infrastructures		
Development and Social Risks	3	4	3	Advocacy and Awareness	NEC, PMU, Implementing Partners	2
				Monitoring and Evaluation		
				Capacity Development		
Operational Risks in Dzongkhags with Thromdes	4	4	4	Define the roles and responsibilities of Dzongkhags and Thromdes for Waste Management	NEC, LG, TT and task force member	2
				Ensure proper coordination between the Dzongkhags and Thromdes		
Sustainability of the program	4	4	3	Develop and operationalize sustainable financial modality	NEC, PMU, GNHC,	1
				Mobilize a Transition Fund		
Stakeholders (Multi-sector involvement)	3	4	4	Conduct Stakeholder Analysis	NEC, PMU,	2
				Develop Communication Strategies		
Overall Risk Rating			3			2

Table 3. Risk Management Matrix (Major Risks)

9.1. Political and Governance

Currently, the flagship program is privileged to be endowed with the support of the government. However, as the stabilization, monitoring and evaluation phase extends way beyond the 12th Five-Year Plan period, probability of the risk of not receiving similar support in the subsequent plan periods is high. If it occurs, the impact on the program would be very high. This risk could be mitigated through the incorporation of waste management as one of the key interventions of the 21st Century Economic Roadmap and five-year plans. It is also important to establish linkages with the Annual Performance Agreements of Local Governments and relevant central government agencies. Further, the formulation and operationalization of sustainable financial mechanism could also enable waste management in Bhutan to have a life of its own.

9.2. Environmental Risks

The risk of appropriate environmental safeguards, and climate and disaster resilience measures not being ensured during the

implementation of the flagship program is moderate. It is because the Program Management Unit of the flagship program is housed under Waste Management Division, National Environment Commission- the agency entrusted with the responsibility of providing environmental clearances. In fact, there is no room for such oversights. However, if it occurs, the impact on the program will be high. To ameliorate this risk, thorough Environmental Impact Assessment will be undertaken to develop appropriate mitigation measures. In addition, the site selection will be properly carried out and the infrastructure constructed through the flagship must be climate resilient.

9.3. Development and Social Risks

The probability of development and social risks occurring is high and if it occurs, like any other major risks mentioned above, the impact on the program will be indisputably high. So, to ensure smooth implementation of the program, the PMU and implementing partners must create rigorous awareness and education, develop the capacity of the relevant stakeholders and conduct periodic monitoring and evaluation.

9.4. Operational Risks in Dzongkhags with Thromdes

Unlike other Dzongkhags, the operational aspects of waste management in Dzongkhags with Class A Thromdes such as Chukha, Samdrupjongkhar, Sarpang and Thimphu are multifaceted. The likelihood of such risk is as high as its impact on the program. To mitigate this risk, it is important to ensure proper coordination between the Dzongkhag and Thromde administrations and clearly spell out their roles and responsibilities.

9.5. Sustainability of the Program

While government may pump in billions of Ngultrums into the flagship program, the risks related to the sustainability is highly likely to occur if the program is not implemented in a logical manner. The impact of such risks on the program would be very high. To overcome this risk, the formulation and operationalization of a sustainable financial modality and the mobilization of a Transition Fund/Waste Management Fund is highly imperative.

9.6. Stakeholders

While the program is confident of receiving support from the relevant stakeholders, the likelihood of risks associated with inappropriate inadequate engagement of the stakeholders is high. As the impact of such risks on the flagship program will be high, stakeholder analysis will be carried and a communication strategy will be developed to ensure that the stakeholders are appropriately engaged.

Through these mitigation measures the program intends to transform the risks that we foresee into instrumental opportunities.

10. Annexures

10.1. Logical Framework

Results	KPI	Unit	2020-21 (Phase I)	2021-22 (Phase II)	2022-23 (Phase III)	Overall Flagship target
Outcome 1: Sustainable waste management enhanced	1. Ratio of waste recycled to sanitary landfill disposal	Ratio	N/a	60:40 for Thimphu; N/a for 9 districts in Phase II	70:30 for Thimphu; 60:40 for 9 districts in Phase II; N/a for Phase III Dzongkhags	85:15 for the whole country (zero waste)
	2. Number of employment opportunities generated	Number	200	660	650	1500
	3. Percentage of GHG emission from the waste sector reduced	Percent	N/a	70	80	80
	4. Percentage of wet waste converted to compost (the achievement of Thimphu extrapolated at the national level in the first phase)	Percent	20	60	80	80
	5. Percentage of households segregating waste at source (the achievement of Thimphu extrapolated at the national level in the first phase)	Percent	20	60	90	90
	6. Percentage of households satisfied with the service delivery	Percent	N/a	80	90	90
Output 1.1: Waste storage/ segregation facilities in place	1.1 Number of three coloured bins made available to households	Number	127700	248200	129050	504950
	1.2 Percentage of Common Residential Properties provided with three-coloured Common Residential Bins	Percentage	100	100	100	100
	1.3 Number of Waste Collection Facilities (WCF I- Smaller) established	Number	25	505	480	1042
	1.4 Number of Waste Collection Facilities (WCF II- Bigger) established	Number	N/a	15	15	30
	1.5 Number of drop-off centres constructed	Number	9	N/a	N/a	9
	1.6 Number of Street Litter Bins installed in commercial areas	Number	296	370	165	831
	1.7 Percentage of road side amenities (developed through Tourism Flagship Program) equipped with bins	Percent	100	100	100	100
	1.8 Number of Waste Storage Houses Constructed	Number	3	N/a	N/a	3

Results	KPI	Unit	2020-21 (Phase I)	2021-22 (Phase II)	2022-23 (Phase III)	Overall Flagship target
Output 1.2: Waste recovery facilities established	2.1 Timeline by which Primary Sorting and Storage facilities (PSSFs) are established	Number	June, 2021	N/a	N/a	June, 2021
	2.2 Number of Material Recovery Facilities (MRFs) constructed	Number	2 *(30 TPD) *Note: One to be constructed and the other to be augmented*	10 *(2TPD- 1; 3TPD-2; 5 TPD 2; 10TPD- 4; 15TPD- 1)*	10 *(2TPD- 5; 3TPD- 3; 5TPD- 1; 10TPD- 1)*	**22 *(2TPD- 6; 3TPD- 5; 5TPD- 3; 10TPD- 5; 15TPD- 1; 30TPD- 2)***
	2.3 Timeline by which the RDF plant is constructed	Timeline	N/a	N/a	Jun-23	Jun-23
	2.4 Timeline by which a recycling plant is established	Timeline	N/a	N/a	June, 2023	June, 2023
	2.5 Number of mobile C&D waste plant established	Number	N/a	2	6	8
	2.6 Number of multi shredders procured and distributed	Number	3	N/a	N/a	3
	2.7 Number of weighing scale procured and distributed	Number	3	N/a	N/a	3

Results	KPI	Unit	2020-21 (Phase I)	2021-22 (Phase II)	2022-23 (Phase III)	Overall Flagship target
Output 1.3: Waste treatment facilities instituted	3.1 Number of biogas plants constructed	Number	0	1 (for Thimphu)	0 *(The target will depend on the success/ failure of the pilot in Thimphu)*	1
	3.2 Number of compost plants established	Number	2 *mechanized compost plants (150 pits each)*	23 *(30 pits- 1; 60 pits- 4; 80 pits- 4; 90 pits- 3; 100 pits- 7; 170 pits- 4)*	13 *(20 pits- 2; 30 pits- 4; 40 pits- 1; 60 pits- 2; 80 pits- 4)*	***38 (20 pits- 2; 30 pits 5; 40 pits- 1; 60 pits- 6; 80 pits- 8; 90 pits- 3 100 pits- 7 170 pits- 4; 600 pits-2)***
	3.3 Percentage of wet waste transfer station constructed	Percent	100	N/a	N/a	100
	3.4 Number of autoclaves procured and distributed	Number	101 *(70 ltrs- 3; 40 ltrs- 98)*	N/a	N/a	101 *(70 ltrs- 3; 40 ltrs- 98)*
Output 1.4: Waste disposal facilities established	4.1 Number of sanitary landfills constructed (with weighbridge, fencing, lighting, gate)	Number	1 ***(10 TPD)***	9 ***(1 TPD- 4; 1.5 TPD- 2; 2 TPD- 3)***	10 ***(1 TPD- 9; 2 TPD- 1)***	20 ***(1 TPD- 11; 1.5 TPD- 2; 2 TPD- 4; 10 TPD- 1)***
	4.2 Number of landfill compactor procured and distributed	Number	2 ***(1 landfill compactor and 1 excavator for Thimphu)***	9	10	19
	4.3 Number of Incineration Plants established	Timeline	4 ***(1 300kg/ hr National Incineration Plant and 3 200kg/ hr Regional Incineration Plants)***	N/a	N/a	0
	4.4 Timeline by which the National E-waste collection and dismantling centre is constructed	Timeline	N/a	N/a	June, 2023	June, 2023

Results	KPI	Unit	2020-21 (Phase I)	2021-22 (Phase II)	2022-23 (Phase III)	Overall Flagship target
Output 1.5: Efficient waste transportation instituted	5.1 Number of compactor Trucks procured and distributed to the LGs	Number	15 *(8 Cubic Meter Compactor Trucks- 10; 4 Cubic Meter Compactor Trucks- 5)*	43 *(8 Cubic Meter Compactor Trucks- 12; 4 Cubic Meter Compactor Trucks- 31)*	27 *(8 Cubic Meter Compactor Trucks- 8; 4 Cubic Meter Compactor Trucks- 19)*	85 ***(8 Cubic Meter Compactor Trucks- 30; 4 Cubic Meter Compactor Trucks- 55)***
	5.2 Number of electric compactor trucks procured and trialled	Number	2	N/a	N/a	2
	5.3 Number of wet waste collection vehicles procured and distributed to the Thromdes/ Dzongkhags	Number	20	32	19	71
	5.4 Number of Biomedical wastes collection vehicles procured and distributed to the LGs	Number	2	4	2	8
	5.5 Number of Hazardous wastes collection vehicles procured and distributed to the LGs	Number	4	16	20	40
	5.6 Number of Dzongkhags with route optimization conducted	Number	1	9	10	20
Output 1.6: Advocacy and awareness created	6.1 Percentage of HHs covered by door to door campaigns	Percent	80	80	80	80
	6.2 Number of panel discussions held on the national television/ radio	Number	5	3	3	11
	6.3 Timeline by which teachers/ monks are trained on Ecology note (ToT)	Timeline	June, 2021	N/a	N/a	June, 2021
	6.4 Timeline by which awareness materials are produced and distributed (documentaries, music videos, brochures, flyers)	Timeline	June, 2021	N/a	N/a	June, 2021
	6.5 Percentage of local TV operators involved in disseminating waste management awareness materials	Percent	100	100	100	100
	6.6 Number of updates on social media pages/websites	Number	24	24	24	72
Output 1.7: Sustainable waste management financing instituted	7.1 Timeline by which the financing modality for sustainable waste management is developed and operationalised	Timeline	N/a	N/a	June, 2023	June, 2023

Results	KPI	Unit	2020-21 (Phase I)	2021-22 (Phase II)	2022-23 (Phase III)	Overall Flagship target
Output 1.8: Data management system established	8.1 Timeline by which a website for waste management is launched	Timeline	June, 2021	N/a	N/a	N/a
	8.2 Timeline by which an information management system is established	Timeline	June, 2021	N/a	N/a	June, 2021
	8.3 Timeline by which an integrated app is developed	Timeline	June, 2021	N/a	N/a	June, 2021
	8.4 Timeline by which a laboratory for waste management is established	Timeline	N/a	N/a	June, 2023	June, 2023

10.2. Description of KPIs

KPI	KPI Description	Unit	Means of Verification	Data Source	Frequency
1. Ratio of waste recycled to sanitary landfill	This indicator measures the ratio of waste recycled to waste disposed at the sanitary landfills	Ratio	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
2. Number of employment opportunities generated	This indicator measures the number of employment opportunities generated	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
3. Percentage of GHG emission from the waste sector reduced	This indicator measures the percentage of GHG emission from the waste sector reduced		1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
4. Percentage of wet waste converted to compost	This indicator measures the percentage of wet waste converted to compost	Percent	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
5. Percentage of households segregating waste at source	This indicator measures the percentage of households segregating waste at source	Percent	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
6. Percentage of households satisfied with the service delivery	This indicator measures the percentage of households satisfied with the service delivery	Percent	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly

KPI	KPI Description	Unit	Means of Verification	Data Source	Frequency
1.1 Number of three coloured bins made available to households	This indicator measures the total number three coloured bins made available to households within Dzongkhags and Thromdes to promote the segregation of wet (green), dry (blue) and household/domestic hazardous waste (red). Wet waste includes biodegradable waste such as cooked food waste, fruit and vegetable peels, etc.... Dry waste includes paper, plastic, metal, glass... Domestic hazardous waste includes discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicine, broken mercury thermometers, used batteries, needles and syringes, and contaminated gauges, etc.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
1.2 Percentage of Common Residential Properties provided with three-coloured Common Residential Bins	This indicator measures the Percentage of Local Area Plans with common residential bins of the same colour code with larger capacity to be maintained by each residential apartment for collection and storage of wastes from the respective residential units.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
1.3 Number of Waste Collection Facilities (WCF I- Smaller) established	This indicator measures the number of unmaned Waste Collection Facilities constructed in the rural areas, including the schools and institutions. The facility will have two chambers- one for the dry waste and the other for the hazardous wastes.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
1.4 Number of Waste Collection Facilities (WCF II- Bigger) established	This indicator measures the number of Waste Collection Facilities (with wet waste compartment) established.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly

KPI	KPI Description	Unit	Means of Verification	Data Source	Frequency
1.5 Number of drop-off centres constructed	This indicator measures the number of drop-off centres established at appropriate and convenient locations where people who either missed their garbage collection timings or those residents where there is no waste collection service can empty their waste bins.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
1.6 Number of Street Litter Bins installed in commercial areas	This indicator measures the number of Street Litter Bins procured and installed in the cities/ commercial areas	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
1.7 Percentage of road side amenities (developed through Tourism Flagship Program) equipped with bins	This indicator measures the percentage of road side amenities developed through Tourism Flagship Program equipped with bins.	Percent	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
1.8 Number of Waste Storage Houses Constructed	This indicator measures the number of waste storage houses constructed in the health care centres.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
2.1 Timeline by which Primary Sorting and Storage facility (PSSFs) are established	This indicator measures the total number Primary Sorting and Storage Facility (PSSF) constructed. PSSF will function as a temporary storage and sorting facility. The materials from PSSF will be transferred to the larger Material Recovery Facility (MRF) mostly located at Dzongkhag centres. Transportation vehicles such as compactor trucks are to be provided for transportation/collection of waste from PSSFs to MRFs.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly

KPI	KPI Description	Unit	Means of Verification	Data Source	Frequency
2.2 Number of Material Recovery Facilities (MRFs) constructed	This indicator measures the total number of Material Recovery Facilities (MRFs) constructed for the dry waste located within the urban areas. MRFs will facilitate temporary storage, segregation, sorting, and recovery of recyclable dry waste. MRFs at the Dzongkhags can be manual/ mechanized or both depending upon the scale of operations and level of mechanization. Dzongkhags to be provided with vehicles for the waste transportation from the gewogs PSSFs.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
2.3 Timeline by which the RDF plant is constructed	This indicator measures the timeline by which the RDF plant is constructed. RDF is a fuel derived from combustible waste fraction such as plastics, wood, organic waste, paper, textile, rags, leather, non-recyclable plastics, multi-layered packaging, cellophane, melamine, etc. in the form of pellets or fluff produced by shredding, dehydrating and compacting of wastes. From the initial assessment, at least one of the cement plants in the country can be pilot tested for RDF usage.	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
2.4 Timeline by which a recycling plant is established- at cluster levels?	This indicator measures the timeline by which a recycling plant for plastic and paper wastes is established. The plastic recycling plant can serve as a sink for the plastic waste generated within the country.	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
2.5 Number of mobile C&D waste plant established	This indicator measures the number of mobile C&D waste plants established.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly

KPI	KPI Description	Unit	Means of Verification	Data Source	Frequency
2.6 Number of multi shredders procured and distributed	This indicator measures the number of multi shredders procured and distributed to Lungtenphu RBA Hospital, National Institute of Traditional Medicine and Tencholing RBA hospital.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
2.7 Number of weighing scale procured and distributed	This indicator measures the number of weighing scale procured and distributed to Lungtenphu RBA Hospital, National Institute of Traditional Medicine and Tencholing RBA hospital.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
3.1 Number of biogas plants constructed	This indicator measures the total numbers of biogas plants constructed within Dzongkhags and Thromdes for wet waste management.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
3.2 Number of compost plants established	This indicator measures the number of compost plants established at Dzongkhags and Thromdes.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
3.3 Percentage of wet waste transfer station constructed	This indicator measures the construction progress of the wet waste transfer station in terms of percentage	Percent	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
3.4 Number of autoclaves procured and distributed to BHU II (40 ltrs)	This indicator measures the number of autoclaves procured and distributed to the health care facilities	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
4.1 Number of sanitary landfills constructed (with weighbridge, fencing, lighting, gate)	This indicator measures the total number of landfills constructed in the Dzongkhags and Thromdes	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly

KPI	KPI Description	Unit	Means of Verification	Data Source	Frequency
4.2 Number of landfill compactor procured and distributed	This indicator measures the number of landfill compactors procured and distributed to be used in the sanitary landfills.	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
4.3 Number of Incineration Plants established	This indicator measures the timeline by which the National Incineration plant is established.	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
4.4 Timeline by which the National E-waste collection and dismantling centre is constructed	This indicator measures the timeline by which the centralized e-waste collection and dismantling centre is established.	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
5.1 Number of compactor Trucks procured and distributed to the LGs	This indicator measures the total number of compactor trucks procured and distributed to LGs	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
5.2 Number of electric compactor trucks procured and trialled	This indicator measures the number of electric compactor trucks procured and trialled	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
5.3 Number of Auto Tippers procured and distributed to the Thromdes/Dzongkhags	This indicator measures the total number of auto tippers procured and distributed to LGs	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
5.4 Number of Biomedical and wastes collection vehicles procured and distributed to the LGs	This indicator measures the total number of Biomedical waste collection vehicles procured and distributed to LGs	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly

KPI	KPI Description	Unit	Means of Verification	Data Source	Frequency
5.5 Number of Hazardous wastes collection vehicles procured and distributed to the LGs	This indicator measures the total number of Hazardous waste collection vehicles procured and distributed to LGs	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
5.6 Number of Dzongkhags with route optimization conducted	This indicator measures the number of Dzongkhags with route optimization conducted	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
6.1 Percentage of HHs covered by door-to-door campaigns	This indicator measures the percentage of households covered by door-to-door campaigns.	Percent	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
6.2 Number of panel discussions held on the national television/radio	This indicator measures the number of panel discussions held on the national television/radio	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
6.3 Timeline by which teachers/monks trained on Ecology note and other waste minimization program (ToT)	This indicator measures the timeline by which teachers/monks trained on Ecology note and other waste minimization program (ToT)	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
6.4 Timeline by which awareness materials are produced and distributed (documentaries, music videos, brochures, flyers)	This indicator measures the timeline by which awareness materials like documentaries, music videos, brochures, flyers are produced	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
6.5 Percentage of local TV operators involved in disseminating waste management awareness materials	This indicator measures the percentage of local TV operators involved in disseminating the IEC materials related to waste	Percent	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly

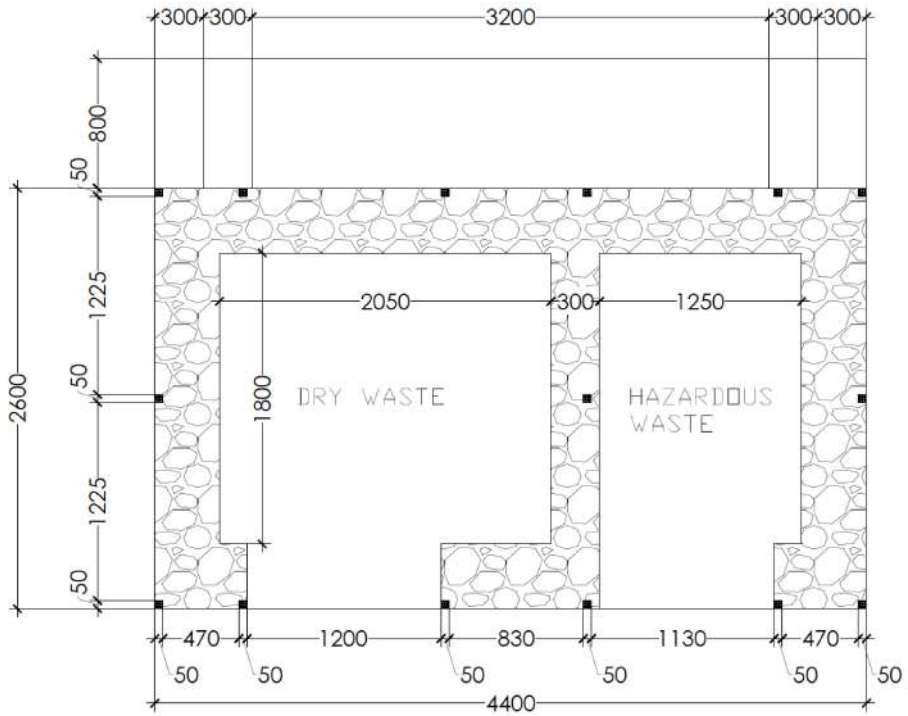
KPI	KPI Description	Unit	Means of Verification	Data Source	Frequency
6.6 Number of updates on social media pages/ websites	This indicator measures the number of times the social media/websites are updated	Number	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
7.1 Timeline by which the financing modality for sustainable waste management is developed and operationalised	This indicator measures the timeline by which the sustainable financial modality is developed and operationalized.	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
8.1 Timeline by which a website for waste management is launched	This indicator measures the timeline by which a website is launched for waste management	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
8.2 Timeline by which an information management system is established	This indicator measures the timeline by which an information management system is established to collect waste and environment data from local to national level	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
8.3 Timeline by which an integrated app is developed	This indicator measures the timeline by which an integrated app is developed	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly
8.4 Timeline by which a laboratory for waste management is established	This indicator measures the timeline by which a laboratory for waste management is established	Timeline	1. Field visits 2. Administrative data (official correspondence to and from relevant stakeholders) 3. Progress review Meetings	1. BTOR 2. Progress Reports 3. Minutes of the Review Meetings	1. Quarterly 2. Quarterly 2. Monthly

10.3. Designs and Drawings

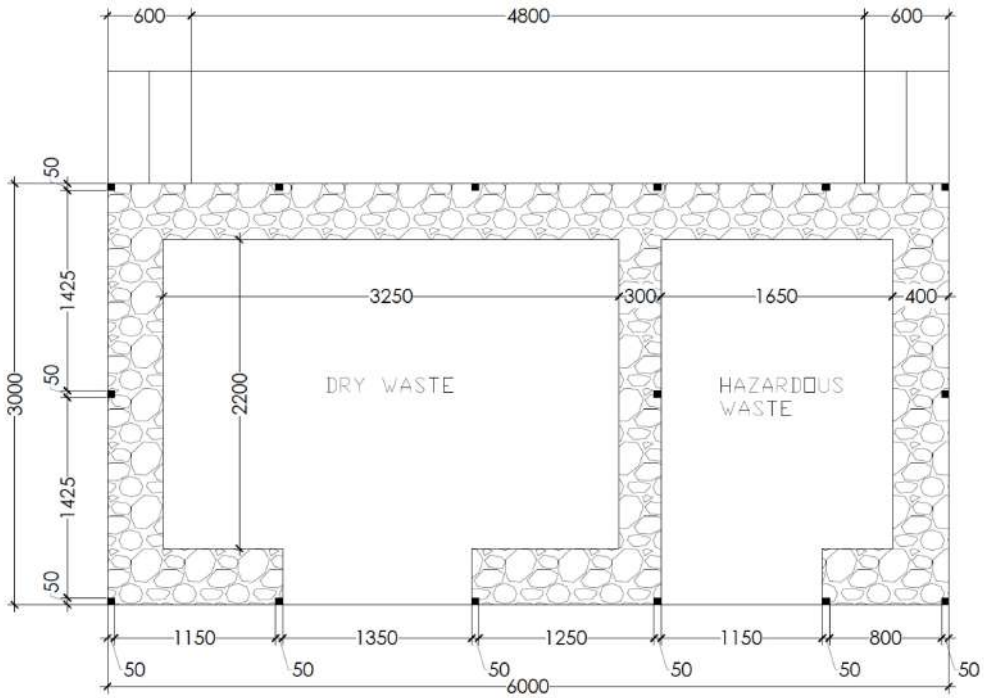
- *WCF I and II*

- *3D View*

- *Floor Plan of WCF I (Unit in mm)*

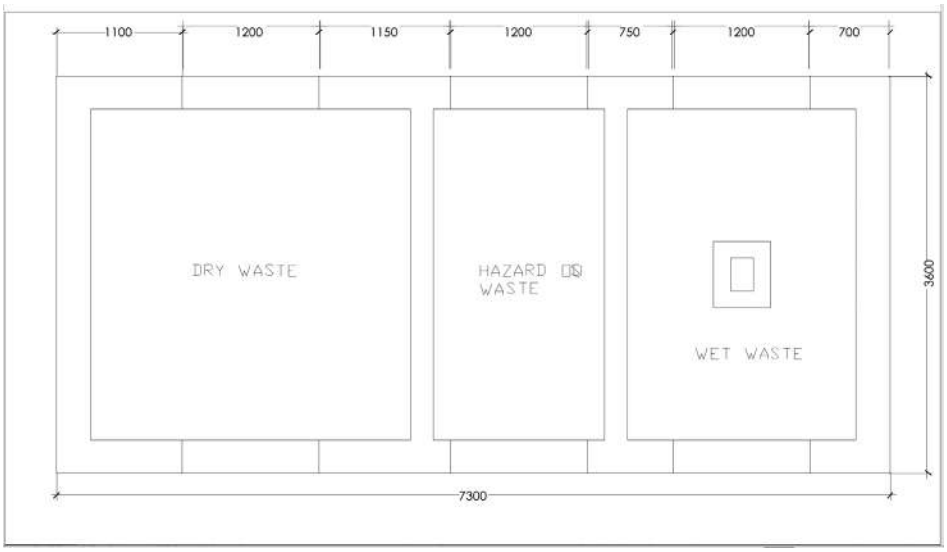


- *Floor Plan of WCF II (Unit in mm)*



- ***WCF III***
- ***3D View***

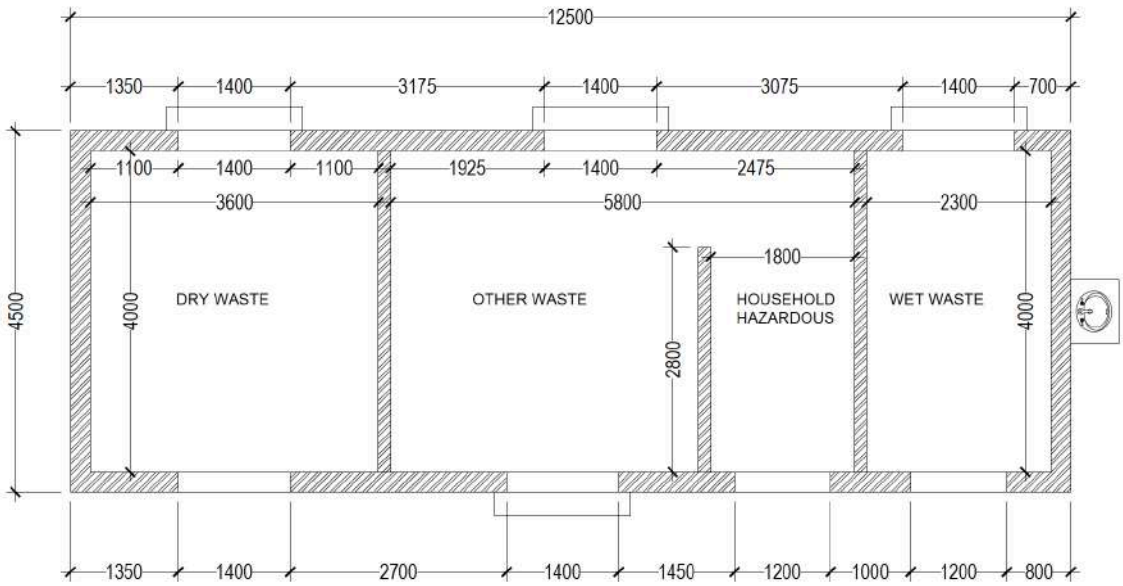
- *Floor Plan of WCF III (Unit in mm)*



◈ *Drop-off Centres*

- *3D View*

- *Floor Plan of Drop-off Centres (Unit in mm)*



10.4. Stakeholder Analysis

Relevant Partner/ Stakeholders	Role	Influence on the Program
Prime Minister's Office	Strategic guidance and monitoring	High
Gross National Happiness Commission Secretariat	Strategic planning and resources mobilization	High
National Environment Commission Secretariat	Regulatory, enforcement, implementation and monitoring	High
Ministry of Finance	Financial resources	High
Ministry of Education	Enforcement and Advocacy	High
Schools/institutes/colleges	Educate students, education and awareness, behavioural change, inculcating civic sense in young minds	High
Ministry of Health	Management of Biomedical waste (MoH through the Public Health Engineering Division is responsible for the rural and School sanitation and hygiene program and environmental Health Program)	High
Health Facilities (Hospital included)	Management of biomedical wastes	High
Local Governments (Dzongkhags/Thromdes/Gewogs)	Right policy and legal instruments/governance structures/ monitoring and evaluation/partnership and coordination/enforcement	High
Development Partners	Knowledge; technical expertise; resources mobilisation	High
Non-Government Organisation(s)/Civil Society Organisation(s)	Advocacy and awareness	High
Waste handlers	Segregation and management at source; operation and management of waste facilities and infrastructure	High
Households	Segregation and management at household/community level, fee payment	High
Commercial Units	Segregation at source and fee payment	High
Ministry of Information and Communication	Management of e-waste	Medium
Department of Roads (MoWHS)	Enforcement	Medium
Ministry of Works and Human Settlement	Enforcement	Medium
Department of National Properties	Collector of e-wastes	Medium
Department of Agriculture (MoAF)	Enforcement	Medium
Department of Forest and Park Services (MoAF)	Enforcement	Medium
Department of Livestock (MoAF)	Enforcement	Medium
Department of Industry (MoEA)	Prevention and management of industrial wastes	Medium
Monasteries and Nunneries	Expected to segregate and store waste at secured place, Enforcement	Medium

Relevant Partner/ Stakeholders	Role	Influence on the Program
Tourism Council of Bhutan	**Enforcement**	**Medium**
Bhutan Chamber for Commerce and Industry	**Advocacy; private sector involvement**	**Medium**
Drug Regulatory Authority	**Enforcement**	**Medium**
Bhutan Narcotics Control Agency	**Enforcement**	**Medium**

◈ *Common Residential Bins*


DRY WASTE
HOUSEHOLD HAZARDOUS WASTE
WET WASTE


DRY WASTE
HOUSEHOLD HAZARDOUS WASTE
WET WASTE
ZERO WASTE BHUTAN
ZERO WASTE BHUTAN
ZERO WASTE BHUTAN