資料-5　ソフトコンポーネント計画書

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ブータン国
廃棄物管理改善計画
準備調査

ソフトコンポーネント計画書

2020 年 1 月

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1. ソフトコンポーネントを計画する背景

（1）背景

ブータン国では、近年の経済成長に伴い、農村部から都市部への人口流入が進み、経済発展による人々の購買意欲が増進するとともに、輸入品が増加し、生活レベルの向上へ繋がっている。この都市人口の増加と輸入品の増加は廃棄物発生を促している。しかし、不適切な廃棄物管理は生活環境と公衆衛生の悪化を招き、廃棄物管理システムの整備・改善が急務となっている。

本プロジェクトの対象である 4 主要都市（ティンプー市、プンツォリン市、ゲレフ市、サムドゥプジョンカル市）では、廃棄物管理体制の強化に取り組んでいるものの、廃棄物収集機材の不足及び老朽化が大きな問題となっている状況である。上記の状況を踏まえ、分別収集を前提とした適切な廃棄物収集・運搬システムの構築が最も重要な課題として位置づけられている。

（2）本体事業の概要

「ブータン国廃棄物管理改善計画」は機材案件であり、対象 4 市の廃棄物管理の改善に係る、①収集・運搬機材の調達（コンパクター及びコンテナーキャリア）、②最終処分場の運用機材の調達（ブルドーザ、エクスカベータ、バックホーローダ）、③調達機材の維持管理のための維持管理用ツール及びスペアパーツの調達、で構成されている。

（3）課題の認識とソフトコンポーネント

1）機材の維持管理

機材の整備に際し、故障などにより数年で使用できなくなることがないよう適切に運用していくためには、組織、人材、技術の観点から 4 市の車両維持管理システムを強化し安定させることが重要である。一方、4 市の収集車両台数及び運営・維持管理状況と計画は様々であり、次表のように整理される。本プロジェクトでは、既にサービスが実施されている 4 市での老朽化した収集車の更新、不足する機材の補充が主であり、各 4 市では機材の基本的な運営・維持管理は実施可能であるが、市直営で実施する定期点検や民間整備工場に委託する修理の監理・監督において、現在定まった方針やマニュアルがないので、故障時対応指導書の整備など改善・強化すべき面がある。

このような状況を踏まえ、ソフトコンポーネントでは、各 4 市の維持管理システムの確立に必要な技術的支援を行うものである。4 市ともマニュアル・標準指導書等が整備されていず、故障・不具合の程度により、なすべき対応が不明確であるので、実施方法としては、日本人専門家が準備する標準指導書（案）を各 4 市の担当者が各市の状況に合わせて改訂するための支援を行う。（成果①）

表 1　4 市の収集車両台数及び運営・維持管理状況と計画

市	2023 年の収集車台数（推計）	市職員数	車両基地	ワークショップ	車両整備の状況と計画
ティンプー市	既存：5 新：23	管理：2 運転手：6	有	無・ 民間委託	2020 年民間委託契約から、市所有の貸与収集車は､毎月市が定期点検・整備を行う。
プンツォリン市	既存：2 新：5	管理：10 運転手：8	有	無・ 民間委託	市と契約の民間整備工場が整備。
ゲレフ市	既存：2 新：4	管理：3 運転手：6	有	無・ 民間委託	市と契約の民間整備工場が整備。新車両基地の整備計画あり(用地確保済)。
サムドゥプジョンガル市	既存：2 新：2	管理：3 運転手：4	有	無・ 民間委託	市と契約の民間整備工場が整備。新車両基地の整備計画あり(用地確保済)。

2）収集・運搬及び埋立処分

同国では、2009 年に制定した「廃棄物の排出抑制、管理に関する法律」において、排出源における廃棄物の 2 分別（”WET　ウェット”と”DRY　ドライ”）を促進しており、各市の分別収集の人口カバ

一率は、それぞれ、ティンプー市：98%、プンツォリン市：44%、ゲレフ市：18%、サムドゥプジョンカル市：85%となっている。しかしながら、実際には、地域間格差はあるものの、排出源での 2 分別は徹底できていない状況である。一方、埋立処分については、ティンプー市では現在 JICA・草の根技術協力プロジェクトによって、限定的な機材の中、改善の試みが行われているものの、他 3 市は、オープンダンピングの状況であり、周辺環境への影響が懸念されている。また、ティンプー市、プンツォリン市、サムドゥプジョンカル市では、斜面の上部から下部への落とし込みによる処分を行っており、斜面崩壊等による人身事故の発生が懸念される。

このような状況に鑑み、ソフトコンポーネントでは、本プロジェクトで調達する収集機材及び埋立処分機材を活用した適切な収集サービスの提供及び安全な埋立処分の実施に係る技術指導を行う。実施方法としては、収集・処分について各市の関係者と課題の共有を図ると共に、市担当者が自ら収集計画と埋立処分方法の見直しを行うことを支援する。（成果②）

3）住民啓発

ティンプー市では、上述の草の根技術協力プロジェクトの実施により、ごみの分別に関する住民啓発活動が促進されているため、排出源における 2 分別の徹底は徐々に浸透しつつあるが、他の 3 市においては、一部地域で分別収集が実施されておらず、現状では顕著な改善の傾向は見られない。

本プロジェクトで調達する収集車の効率的な使用を促進するために、ソフトコンポーネントでは、住民に対し分別収集の導入を周知し、その意義や重要性の理解を促進するため、ティンプー市で行われているごみの分別に関する住民啓発活動を、他の 3 市にも拡大し、排出源分別の徹底を促進するための技術指導を行う。本活動においては、排出源分別及び分別収集計画の内容の住民への周知を徹底するよう指導を行う。本活動では、既に草の根技術協力プロジェクトで住民啓発活動を実施しているティンプー市を除く対象 3 市での講習会の開催を予定している。講習会の講師については、草の根技術協力プロジェクトに携わったブータン側の人材を予定している。（成果③）

4）労働安全衛生

現地調査の結果では、市街地での収集作業を行っている作業員や最終処分場で作業を行っている労働者の安全衛生に関する意識が低いことが確認された。具体的には、ごみ収集時に手袋や適正な靴を着用しない、処分場において裸足やサンダルで作業をする等の状況が日常的に散見された。本プロジェクトで調達する機材を使用して、死傷者や病人が発生することのないよう、労働安全衛生に対する意識の向上に努めることが肝要である。そのため、ソフトコンポーネントでは、対象 4 市における労働安全衛生意識を向上させるための技術指導を行う。実施方法としては、日本人専門家が準備する標準指導書（案）を現地の状況に合わせて改訂するための支援を行う。（成果④）

2. ソフトコンポーネントの目標

本プロジェクトは、地域住民へ廃棄物管理サービスが適切に提供されることを目標としている。ソフトコンポーネントは、本プロジェクトで整備する機材の円滑な導入及び長期間にわたり適正に運営・維持管理するための支援を通じ、対象 4 市における廃棄物管理能力を向上させて、分別収集を踏まえた効率的な廃棄物収集サービス、安全な埋立処分の実施を実現し、協力成果の持続性を確保することを目的とする。なお、持続性の確保のためにはブータン側の主導で実施することが重要であることから、それぞれの成果について、ブータン側が主体的に関与することに留意する。

3. ソフトコンポーネントの成果

本プロジェクトは、ソフトコンポーネントの成果として、下記の 4 つ項目とする。

成果①　整備機材の維持管理能力（予防保全、車両故障時対応、スペアパーツ・消耗品の保管・管理）が向上する。
成果②　対象地域の廃棄物の収集・運搬、処分方法が改善する。
成果③　住民の排出源分別に対する意識が高まる。
成果④　廃棄物管理に携わる市職員の労働安全衛生に対する意識が高まる。

4. 成果達成度の確認方法

成果達成度を確認するための成果・指標とその測定方法は表 2 のとおりである。

表２　成果達成度の確認方法

成果	活動	項目	成果	指標	測定方法
成果①	活動①-1	予防保全技術改善	日常及び定期点検が改善される。	・ 予防保全指導書が作成される。[対象 4 市] ・ セミナーが実施される。	・ 予防保全指導書[対象 4 市] ・ セミナー記録
	活動①-2	車両故障時対応指導	市の規模、能力、民間工場の能力、故障・不具合の程度によって車両修理が適正に実施される。	・ 車両の故障時対応指導書が作成される。[対象 4 市] ・ セミナーが実施される。	・ 故障時対応指導書[対象 4 市] ・ セミナー記録
	活動①-3	スペアパーツ・消耗品の保管、管理改善	スペアパーツ・消耗品の保管、管理が改善される。	・ スペアパーツ・消耗品の保管・管理台帳（指導書）が作成される。[対象 4 市] ・ セミナーが実施される。	・ スペアパーツ・消耗品の保管・管理台帳（指導書）[対象 4 市] ・ セミナー記録
成果②	活動②	収集・運搬及び埋立処分の改善	分別収集を前提とした収集サービスが改善される。 埋立処分方法が改善される。	・ 分別収集の収集計画が改訂される。*1) ・ 埋立処分作業の方法書が策定される。	・ 収集計画（改訂版） ・ 埋立処分作業の方法書
成果③	活動③	住民啓発の実施	住民の廃棄物の排出源分別に対する意識が向上する。また、継続的な住民啓発活動実施のため、指導者を育成する。	・ 市職員を対象に、住民啓発活動の実施手法に関する講習会が開催される。 ・ 住民啓発活動計画が策定される。 ・ 地域コミュニティ等の住民組織を対象に、排出源分別に関する講習会が開催される。 ・ 講習会参加者の排出源分別に対する理解が改善する。	・ 住民啓発活動計画 ・ 講習会記録 ・ 講習会参加者への理解度確認アンケートの結果
成果④	活動④	労働安全衛生の徹底指導	収集運搬に係る運転手及び作業員への労働安全衛生教育や作業指導により適切な収集作業が行われる。	・ 労働安全衛生指導書が作成される。[4 市共通] ・ 講習会が実施される。	・ 労働安全衛生指導書 4 市共通] ・ 講習会記録

備考）*1) 分別収集の収集計画は各市で作成・適用済みであり、ソフトコンポーネントでは、整備機材の有効活用の目的で既存の計画を改訂するものである。

5. ソフトコンポーネントの活動（投入計画）

（１）成果と活動

各成果に対し、下表に示す活動を本ソフトコンポーネントにて実施する。なお、成果①②③については、現地活動を２回に分けて実施することから、それぞれの活動内容を併せて記載する。

表３　ソフトコンポーネントの活動内容

成果	活動概要	1回目と2回目の活動内容
成果①	**活動①-1**:予防保全技術改善 車両が不具合を起こす前に整備する「予防保全」の意識付け、ルール作り、運転手による日常点検の徹底実施の支援を行う。 **活動①-2**:車両故障時対応指導 車両修理の必要性・内容の判断支援、修理実施・確認	１回目で各標準指導書（案）について、各市の状況に適用できる内容にするための検討を市担当者と行い、指導書改訂の依頼を各市担当者に行うと共に、機材の維持管理に係る実施組織・体制整備の指導を行う。 （中間）各市担当者が各標準指導書（案）に従って試行する。 ２回目では、改訂版の内容の確認・協議・最終化と維持

	システム改善の指導を行う。 **活動①-3**:スペアパーツ・消耗品の保管、管理改善 スペアパーツ・消耗品の保管、管理改善の指導を行う。	管理の実施体制の確認・指導を行う。
成果②	**活動②**:収集・運搬及び埋立処分の改善 分別収集を前提とした収集計画（各戸収集、定時・定点収集、曜日収集等）の改訂・実施の指導を行う。整備機材を活用しての安全な埋立処分方法の指導を行う。	１回目で各市の状況を踏まえた収集･運搬及び埋立作業の課題の共有を行い､収集計画の改定及び埋立作業方法の改善に係る資料の作成指導を各市担当者に行う。 （中間）各市担当者が資料（計画案）の作成を行う。 2 回目では各 4 市で策定された資料の内容の確認・協議・最終化と実施指導を行う。
成果③	**活動③**:住民啓発の実施 排出源分別に係る住民意識の向上を目的に、市職員に対する住民啓発のための指導者の育成（Trainer's Training）を行う。具体的には、ティンプー市でのJICA・草の根技術協力プロジェクトの成果を他の 3 市に普及させる。	1 回目では､草の根技術協力プロジェクトで作成された住民啓発の教材に基づいて､各市の職員をティンプー市に招へいし､住民啓発手法を理解するための講習会を開催(講師は草の根技術協力プロジェクトに参画したブータン側の人材を登用予定）し､住民啓発手法の市職員への普及を図る。 （中間）講習会に参加した市職員は､2 回目の専門家の渡航までに､関係者と十分な協議を行い､2 回目の専門家渡航時に開催する講習会を含む住民啓発の計画（案）を作成する。また同時に､各市の住民組織等において事前アンケートを実施し､ごみ分別等に対する現状の意識の度合いを測定する。 2 回目では､各市の担当者と専門家との間で､住民啓発の計画（案）について協議を行い､計画を最終化する。また､最終化した計画に従い､1 回目の講習会に参加した各市の担当者を講師として､各市の住民組織等で講習会を開催し､ごみ分別の徹底等に対する住民の意識啓発を図る。また併せて､事後アンケートを実施して､講習を受講した住民の講習受講前後における意識の変化を確認する。
成果④	**活動④**:労働安全衛生の徹底指導 作業員の巻き込み事故、大型コンテナ使用の作業など重大事故につながる要因が多数存在するため、今回の機材整備にて運転手・作業員への安全指導を行う。また、労働環境（安全・衛生）改善に関する指導を行う。	標準指導書（安全衛生管理）について、現地状況に適用できる内容にするための検討を実施し､担当者に対し最終化の指導を行う。また、最終化した標準指導書の内容を各市で普及するための講習会を開催する｡各講習会の最後には、アンケートを配布し、市職員の安全衛生管理に対する意識の変化を確認する。 （活動④は１回の投入で実施）

（２）活動計画と投入

活動計画と投入（日本側及びブータン側）を下表に示す。

表４　活動計画と投入

活動	投入	
	日本側	ブータン側
活動①	日本人専門家「機材運用・維持管理」、現地傭人	車両維持管理担当者（各市）
活動②	日本人専門家「機材運用・維持管理」、現地傭人	収集運搬担当者/埋立処分担当者（各市）
活動③	日本人専門家「住民意識改革・労働安全衛生管理」、現地傭人	住民啓発担当者（各市）
活動④	日本人専門家「住民意識改革・労働安全衛生管理」、現地傭人	労働安全衛生担当者（各市）

各活動の詳細計画と日本人専門家の投入は下表に示すとおりである。

表 5-1　活動①、②の詳細計画

No.	活動内容		必要な投入 日本人専門家
国内作業（1 回目）			
1.	国内準備	1 日目：既存データの検討、活動計画の作成 2 日目：予備保全技術改善の標準指導書、故障時対応、スペアパーツ・消耗品保管・管理改善の標準指導書案の作成 3 日目：各 4 市の収集・運搬改善、埋立処分改善の検討	3 日 (0.15M/M)
現地作業（1 回目）			
	移動（往路）		2 日
2.	現地作業準備 ・国民総幸福委員会（Gross National Happiness Commission: 以下 GNHC）とのソフコン実施内容の説明・協議（1 回目）（活動①～④に共通）：ソフコン実施内容・日程の説明・協議、関連機関の協力・調整及び手続の依頼 ・場所：ティンプー市		1 日
3.	ソフコン実施内容に係るワークショップの準備・開催 ・対象：GNHC、公共事業省（Ministry of Works and Human Settlement: 以下 MoWHS）、対象 4 市招聘 ・場所：テインプー市		1 日
4.	ティンプー市の市長及び関係者への説明、及びティンプー市担当者との各標準指導書（①予備保全技術改善、②故障時対応、③スペアパーツ・消耗品保管・管理改善の 3 種類）の説明、協議（1 日） 標準指導書（3 種類）をベースにティンプー市の状況に応じた指導書の検討（1 日） ティンプー市の収集・運搬の課題の共有と分別収集を踏まえた収集サービスの指導と収集計画改定の市担当者への依頼、及び埋立処分方法の課題の共有と安全な埋立処分方法の指導と埋立処分作業の方法書の市担当者への作成依頼（1 日）		3 日
	ビザ切替手続き、労働許可証取得（健康診断含む）、国内移動許可証取得		（5 日）
	都市間移動 *1) ティンプー市→プンツォリン市（陸路 1 日） プンツォリン市→ゲレフ市（陸路：インド経由 1 日） ゲレフ市→プンツォリン市（陸路：インド経由 1 日） プンツォリン市→ティンプー市（陸路 1 日） （なお、サムドゥプジョンカル市については、ゲレフ市に来てもらっての実施とする。従って、訪問都市数は 3 か所。）		4 日
5.	ティンプー市以外の 3 市の市長及び関係者への説明（各 1 日）		2 日
6.	ティンプー市以外の 3 市との各標準指導書（3 種類）の説明、協議（各 1 日）		2 日
7.	ティンプー市以外の 3 市との標準指導書（3 種類）をベースに、各 3 市の状況に応じた指導書の検討（3 種類×3 市で、全 9 種類。各 3 市につき 1 日間） （サムドゥプジョンカル市には、ゲレフ市にて実施）		3 日
8.	ティンプー市以外の 3 市の収集・運搬の課題の共有と分別収集を踏まえた収集サービスの指導と収集計画改定の市担当者への依頼 ティンプー市以外の 3 市の埋立処分方法の課題の共有と安全な埋立処分方法の指導と埋立処分作業の方法書の市担当者への作成依頼 （各 1 日）		2 日
9.	活動内容の GNHC・JICA への報告（ティンプー市）		1 日
	移動（帰路）		2 日
		現地作業（1 回目）　合計	23 日 (0.77M/M)
国内作業（2 回目）			
1.	国内準備	1 日目：第 1 回目現地活動の結果を踏まえて、標準指導書（3 種類）の最適化の準備、対象 4 市の収集計画の検討	2 日 (0.1M/M)

No.	活動内容		必要な投入 日本人専門家
		2 日目：第 1 回現地活動の結果を踏まえて、対象 4 市の埋立処分作業の方法書の検討	
現地作業（2 回目）			
	移動（往路）		2 日
2.	現地作業準備 ・GNHC とのソフコン実施内容の説明・協議（2 回目）：第 1 回目の活動内容及び依頼したその後のブータン側の作業の説明・協議、さらにそれらを踏まえた第 2 回目のソフコン実施内容・日程の説明・協議、関連機関の協力・調整及び手続の依頼 ・場所：ティンプー市		1 日
	都市間移動 *2) ティンプー市→プンツォリン市（陸路 1 日） プンツォリン市→ゲレフ市（陸路：インド経由 1 日） ゲレフ市→プンツォリン市（陸路：インド経由 1 日） プンツォリン市→ティンプー市（陸路 1 日） （なお、サムドゥプジョンカル市については、ゲレフ市に来てもらっての実施とする。従って、訪問都市数は 3 か所。）		4 日
3.	標準指導書（3 種類）について、各 4 市の状況に応じた指導書の作成（3 種類×4 市で、全 12 種類。各 4 市につき 1 日間）		4 日
4.	対象 4 市が作成した分別収集を踏まえた収集計画の確認・修正指導・最終化の支援と実施指導（各 1 日）		4 日
5.	対象 4 市が作成した安全な埋立処分作業の方法書の確認・修正指導・最終化の支援と実施指導（各 1 日）		4 日
6.	ソフトコンポーネントのまとめ（報告書作成、GNHC・JICA への報告）		1 日
7.	ティンプー市における総括ワークショップの準備・開催（4 市招聘、GNHC、国家環境委員会 National Environment Commission: 以下 NEC、MoWHS）（活動①～④に共通）		4 日
	移動（帰路）		2 日
	現地作業（2 回目）　合計		26 日 (0.87M/M)
合計			1.89M/M

表 5-2　活動③、④の詳細計画

No.	活動内容		必要な投入 日本人専門家
国内作業（1 回目）：活動③のみ			
1.	国内準備	1 日目：既存データの検討、活動計画の作成	1 日 (0.05M/M)
現地作業（1 回目）：活動③のみ			
	移動（往路）		2 日
2.	現地作業準備 ・GNHC 及び関係機関とのソフコン実施内容の説明・協議 ・場所：ティンプー市		1 日
3.	ティンプー市を除く対象 3 市に対する住民啓発手法に関する講習会開催のための事前協議		1 日
4.	ティンプー市を除く対象 3 市に対する住民啓発手法に関する講習会、理解度確認アンケート実施指導		1 日
5.	住民啓発活動計画作成指導、住民組織への事前アンケート配布・回収指導		1 日
6.	ソフトコンポーネントのまとめ（GNHC・JICA への報告）		1 日

No.	活動内容		必要な投入 日本人専門家
	ビザ切替手続き、労働許可証取得（健康診断含む）、国内移動許可証取得		（5 日）
	移動（帰路）		2 日
	現地作業（1 回目）　合計		9 日 (0.3M/M)
国内作業（2 回目）：活動③、④			
1.	国内準備	1 日目：第 1 回目現地活動の結果を踏まえて、活動計画の作成	4 日 (0.2M/M)
		2-3 日目：各 3 市の理解度確認アンケートの集計、結果分析	
		4 日目：労働安全衛生指導書（案）の作成	
現地作業（2 回目）：活動③、④			
	移動（往路）		2 日
2.	労働安全衛生指導書（案）に対する関係機関協議（NEC, MoWHS, ティンプー市）		1 日
	都市間移動 *4) ティンプー市→プンツォリン市（陸路 1 日） プンツォリン市→ゲレフ市（陸路：インド経由 1 日） ゲレフ市→サムドゥプジョンカル市（陸路：インド経由 1 日） サムドゥプジョンカル市→プンツォリン市（陸路：インド経由 1 日） プンツォリン市→ティンプー市（陸路：国内移動 1 日）		5 日
3.	対象 4 市での講習会開催のための事前協議（各 1 日）		4 日
4.	対象 4 市での労働安全衛生指導書の講習会、事後アンケートの実施（各 1 日）		4 日
5.	対象 3 市での住民啓発活動計画最終化のための協議、住民組織に対する住民啓発講習会開催のための事前協議（各 1 日）		3 日
6.	対象 3 市の住民組織に対する住民啓発講習会、事後アンケート実施（各 1 日）		3 日
7.	ソフトコンポーネントのまとめ（報告書作成、GNHC・JICA への報告）		1 日
8.	ティンプー市における総括ワークショップの準備、開催（4 市招聘、GNHC、NEC、MoWHS）（活動①～④に共通）		2 日
	移動（帰路）		2 日
	現地作業（2 回目）　合計		27 日 (0.9M/M)
合計			1.45M/M

備考）*1), *2), *3), *4) 都市間移動は陸路移動を想定しているが、ソフコンの実施時期は冬季を想定しており、降雪や路面凍結等で通行が困難であることが想定されるため、ゲレフ市、サムドゥプジョンカル市への移動はインド経由のルートとする。

（3）　実施リソース

派遣する人材：「機材運用・維持管理」の日本人専門家（1 名）、「住民意識改善・労働安全衛生管理」の日本人専門家（1 名）

従事期間：計 3.34 人月（国内準備 0.50 人月、現地作業 2.84 人月）

派遣時期：機材引き渡し後

現地傭人：日本人専門家の補佐（2 名）　計 2.3 人月

6. ソフトコンポーネント実施リソースの調達方法

（活動①、②）本活動は、プロジェクトで整備される機材導入を支援するものである。本ソフトコンポーネントを担当する日本人専門家は、同無償資金協力プロジェクトの関係者及び収集・運搬及び埋立機材の運用・維持管理に関与した経験のある日本人コンサルタントが望ましい。また、現地傭人は日本人専門家と共同作業を行い、通訳も兼任する。

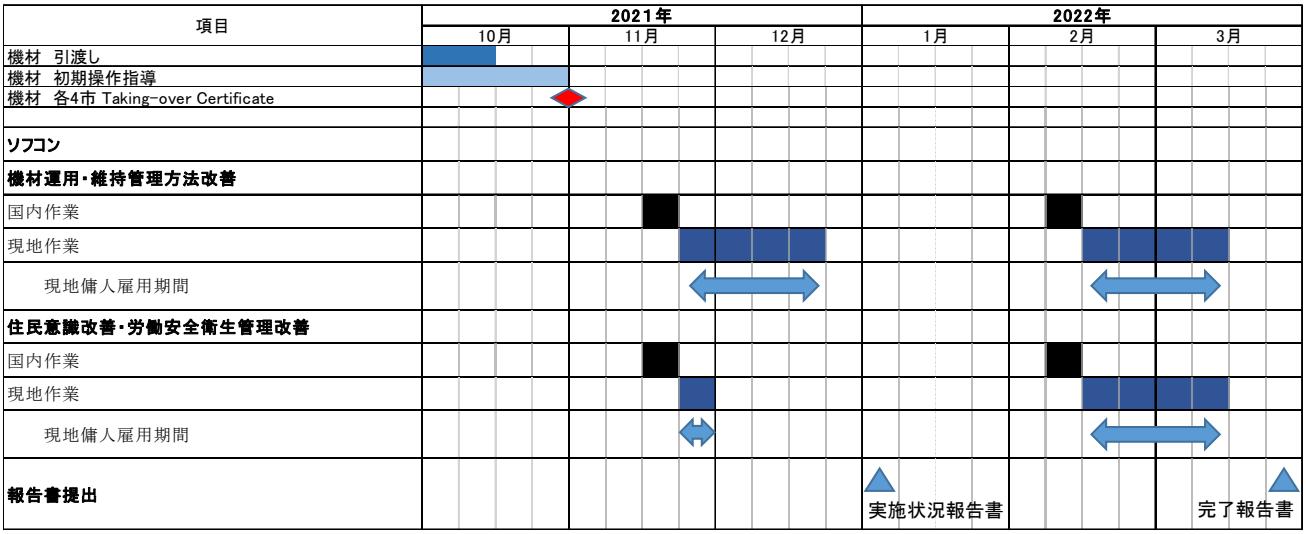
（活動③、④）本活動は、廃棄物の排出源分別、労働者の安全衛生に対する市職員及び住民の意識・行動を支援するものである。本ソフトコンポーネントを担当する日本人専門家は、同無償資金協力プロジェ

クトの関係者及び廃棄物管理、労働安全衛生に関する知識を有する日本人コンサルタントが望ましい。また、現地傭人は日本人専門家と共同作業を行い、通訳も兼任する。

7. ソフトコンポーネントの実施工程

ソフトコンポーネントの実施工程を下表に示す。

表 6　ソフトコンポーネントの実施工程



8. ソフトコンポーネントの成果品

次の成果品を実施機関側及び JICA に提出する。

表 7　成果品一覧表

活動	項目	成果品
活動①-1	予防保全改善	予防保全指導書
活動①-2	故障時対応指導	故障時対応指導書
活動①-3	スペアパーツ・消耗品の保管、管理改善	スペアパーツ・消耗品管理台帳（指導書）
活動②	収集・運搬、埋立方法の改善	収集計画（改訂版）、埋立処分作業の方法書
活動③	住民啓発	住民啓発教材、住民啓発活動計画
活動④	労働安全衛生指導	労働安全衛生指導書
全体	進捗報告 完了報告	ソフトコンポーネント実施状況報告書（英文） ソフトコンポーネント完了報告書（和文）

9. ソフトコンポーネントの概略事業費

ソフトコンポーネントの概略事業費は、14,211 千円と積算され、内訳は次表のとおりである。（詳細は別添の経費積算内訳書を参照。）

表 8　概略ソフトコンポーネント費

項目	金額（千円）
直接人件費	3,173
直接経費	4,439
間接経費	6,599
合計	14,211

10. 相手国側の責務

責任機関となる GNHC は、担当（Director または Senior Programme Coordinator）を 1 名任命し 、ソフトコンポーネント全体を管理する必要がある。実施機関となる各 4 市は、それぞれ表４に示す担当を任命し、日本人専門家と協力して活動を行う。

また、各ワークショップ及び講習会では、各機関から以下の参加を求める。

表９　ワークショップ及び講習会の実施機関参加リスト

活動	講習会名称	所属	役職	人数
活動①	機材維持管理ワークショップ（ティンプー市）	GNHC	Senior Programme Coordinator	1
			担当職員	1
		ティンプー市	環境部長	1
			車両管理担当技術者	1
		プンツォリン市	環境部長	1
			車両管理担当技術者	1
		ゲレフ市	環境部長	1
			車両管理担当技術者	1
		サムドゥプジョンカル市	環境部長	1
			車両管理担当技術者	1
小計				10
活動②	収集・運搬、埋立処分ワークショップ（ティンプー市）	GNHC	Senior Programme Coordinator	1
			担当職員	1
		MoWHS	水道・衛生部長	1
			担当者	1
		NEC	担当者	1
		ティンプー市	環境部長	1
			収集・運搬担当技術者	1
			埋立処分担当技術者	1
		プンツォリン市	環境部長	1
			収集・運搬担当技術者	1
			埋立処分担当技術者	1
		ゲレフ市	環境部長	1
			収集・運搬担当技術者	1
			埋立処分担当技術者	1
		サムドゥプジョンカル市	環境部長	1
			収集・運搬担当技術者	1
			埋立処分担当技術者	1
小計				17
活動③	住民啓発の手法に関する講習会（ティンプー市を除く 3 市）	各市	環境部長	各 1
			廃棄物管理担当者	各 3
小計				12(各 4)
活動③	住民啓発講習会（住民組織等）（ティンプー市を除く 3 市）	各市	廃棄物管理担当者	各 1
		住民組織等	責任者	各 1
			住民	多数

活動	講習会名称	所属	役職	人数
小計				6(各 2) +住民多数
活動④	労働安全衛生講習会 （ティンプー市）	GNHC	Senior Programme Coordinator	1
		NEC	担当者	1
		MoWHS	担当者	1
		ティンプー市	環境部長	1
			車両管理担当者	1
			廃棄物管理担当者	3
小計				8
活動④	労働安全衛生講習会 （他 3 市）	各市	環境部長	各 1
			車両管理担当者	各 1
			廃棄物管理担当者	各 3
小計				15(各 5)

（1） 実現可能性

本ソフトコンポーネントの目標に掲げた「本プロジェクトで整備する機材が円滑に導入され、長期間にわたり適正に運営・維持管理される」ことで、廃棄物収集・運搬・処分サービスが効率的に実施されること」に対する GNHC からの要望は高い。

各機関、各市については、ソフトコンポーネントについて担当者が任命されることに問題はない。

（2） 阻害要因及び必要な措置

阻害要因については特に想定されない。日本人専門家は、GNHC と緊密に連携して進捗状況を確認し、遅延の恐れがある場合は各 4 市に対して指導を行うよう要請する。

（3） ソフトコンポーネントの目標を達成するための継続的取組み

本プロジェクト完了後、支援活動での指導・支援に従って、維持管理を実施し、組織・体制改善を行っていく継続的な取組みが自立発展性の確保のために必要である。

資料-6　参考資料

（資料-6-1　再委託調査結果）

（資料-6-2　計画機材台数根拠）

（資料-6-3　運営維持管理費計算書）

資料-6-1　再委託調査結果

SURVEY ON SOLID WASTE MANAGEMENT IN FOUR THROMDES IN BHUTAN

A Report prepared for Yachiyo Engineering Company Limited, Japan
By NYCOM Consultants, Thimphu, Bhutan

October 2019

TABLE OF CONTENTS

1. COUNTRY CONTEXT 4
2. URBANIZATION AND SOLID WASTE MANAGEMENT 5
3. JICA PROJECT ON SOLID WASTE MANAGEMENT IN BHUTAN 6
4. OBJECTIVES AND SCOPE OF THE SURVEY 7
5. SURVEY METHODS AND TOOLS 8
6. DATA COLLECTION, DATA PROCESSING AND ANALYSIS 9
7. LIMITATIONS OF THE SURVEY 9
8. FINDINGS 10
8.1 General Findings on Acts and By-laws related to Solid Waste management 10
8.2 Responsibility demarcations of some organizations for Solid Waste Management 16
8.3 Specific Findings on Thromdes/Municipal Cities 17
8.3.1 Gelephu Thromde 17
8.3.2 Phuentsholing Thromde 25
8.3.3 Samdrup Jongkhar Thromde 35
8.3.4 List of Waste Collection Vehicles 44
8.3.5 Landfill Site Conditions 44
8.4 Findings on Component 2: Wastes amount disposed at Landfill sites 46
8.4.1 Summary - Thimphu Thromde 46
8.4.2 Summary - Phuentsholing Thromde 49
8.4.3 Summary - Gelephu Thromde 52
8.4.4 Summary - Samdrup Jongkhar Thromde 55
8.5 Comparative Analysis of Waste disposals in Gelephu, Phuentsholing and Samdrup Jongkhar Thromdes 57
REFERENCES 59
LIST OF KEY INFORMANTS MET/INTERVIEWED DURING THE SWM SURVEY 61
ANNEX A: COMPONENT 1: QUESTIONNAIRE 62
ANNEX B: COMPONENT 2 RECORDING SHEET 75
ANNEX-C: DATA OF INCOMING VEHICLES TO LANDFILL SITES 77

A6-1-2

Acronyms and Glossary

BNUS	Bhutan National Urbanization Strategy
CCTV	Closed Circuit Television
CSO	Civil Society Organization
DOI	Department of Industry
DOT	Department of Trade
DRA	Drug Regulatory Authority
DRC	Department of Revenue and Customs
DUDES	Department of Urban Development and Engineering Services
FYP	Five-Year Plan
GIS	Geographic Information System
GPS	Global Positioning System
GNH	Gross National Happiness
GNHC	Gross National Happiness Commission
GDP	Gross Domestic Product
HDI	Human Development Index
HH	Household
ISWM	Integrated Solid Waste Management
JICA	Japan International Co-operation Agency
KPI	Key Performance Indicators
LAP	Local Area Plan
MOE	Ministry of Education
MOF	Ministry of Finance
MOAF	Ministry of Agriculture and Forests
MOEA	Ministry of Economic Affairs
MOH	Ministry of Health
MOIC	Ministry of Information and Communications
MOWHS	Ministry of Works and Human Settlements
MRTS	Material Recovery and Transfer Station
NA	Not Available
NCHM	National Centre for Hydrology and Meteorology

NEC	National Environment Commission
NKRA	National Key Results Area
Nu	Ngultrum (Bhutanese monetary unit)
PWD	Public Works Department
RBP	Royal Bhutan Police
RSTA	Road Safety and Transport Authority
SDP	Small Development Programme
SJI	The Samdrup Jongkhar Initiative
STATA	Statistics and Data software (syllabic abbreviation)
SWM	Solid Waste Management
TCB	Tourism Council of Bhutan
TOR	Terms of Reference
UNDP	United Nations Development Programme
WASH	Water, Sanitation and Hygiene
YEC	Yachiyo Engineering Company Limited

Demkhong	Class A Thromde boundaries by delimitation
Deesung	Guardians of Peace
Dratshang Lhentshog	Council for Religious Affairs
Thromdes	Large urban Municipal areas with minimum of 5000 people
Thromde Tshogde	City/Town Urban Development Council
Yenlag Thromde	Branch or subsidiary satellite town
Dzongkhag	District
Dzongkhag Tshogdu	Highest decision making body for District
Dzongkhag Tshodge	District Development Council

A6-1-3

1. Country Context

Bhutan is a landlocked mountainous Himalayan kingdom situated in the Eastern Himalayas, wedged between the two giants of China (Xizang Autonomous Region of Tibet) in the North and India to the East, South and West. The country has a total land area of 38,394 square kilometers.[1] The terrain is among the most rugged and mountainous in the world. The topography varies from an elevation of about 100 meters above sea level in the south to more than 7,500 meters above sea level in the north. Bhutan can also be divided longitudinally into six major agro-climatic zones, with substantial variations in agro-ecological conditions and development features.

According to the 2017 Population and Housing Census of Bhutan, the total population of Bhutan was 681,720 in 2017[2]. The population is projected to be at 763,249 in 2022 and 815,755 by the year 2030.[3] From a population growth rate of 3.1 percent during the mid-1990s, it rapidly fell to 2.5 percent in around the year 2000 and to an even lower rate of 1.3 percent as per the National Health Survey of 2012. This trend was attributable to many factors which include the declining fertility rate (2.5) and infant mortality rate (30 per 1000 live births), as a result of successes in public health programmes supported by an aggressive public health promotion.

The proportion of population living under poverty in 2017 was estimated at 8.2 percent while that of subsistence poverty was 1.5 percent.[4] Therefore, it can be surmised that poverty is reduced but is persistent. Poverty though continues to be a rural phenomenon in Bhutan. While 11.9 percent of the rural population lived under the poverty line in 2017, the proportion of urban population living under poverty is only 0.8 percent in the same period. The extremely poor population in rural areas accounted to 2.3 percent in 2017.[5] Poverty is caused by remoteness, isolation, dearth of employment opportunities outside of subsistence farming, small and fragmented land holdings, low levels of education/literacy, vulnerability to climatic shocks and natural predators, lean-seasonal hunger and indebtedness to money borrowings.

1 Statistical Yearbook of Bhutan-2018, National Statistics Bureau, October, 2018
2 2017 Population & Housing Census of Bhutan, National Statistics Bureau, 2018.
3 Population projections Bhutan 2017-2047, National Statistics Bureau, 2019
4 Bhutan Poverty Analysis Report 2017, National Statistics Bureau, 2017
5 Ibid

According to the UNDP, the 2017 HDI for Bhutan is 0.612, which gives the country a rank of 134 out of 189 countries.[6] Gross Domestic Product (GDP) growth rate averaged about 15 percent per annum since the early eighties. The economy drew heavily upon the hydropower sector followed by agricultural sector as the top contributor to the Gross Domestic Product until mid-2000s, but its share came down from about 28 percent in 2000 to about 17 percent by 2017, and was contrastingly replaced by electricity whose contribution to GDP in 2017 was over 26 percent, particularly by the commissioning of major hydro-electric power projects.

Due to the mountainous topography, human settlements are highly scattered, concentrated mainly in the valleys and gentle slopes where agricultural farming is feasible. Bhutan is sparsely populated with only 19 persons per square kilometer[7], one of the lowest population densities in South Asia. The Bhutanese population presents a young age structure with 45.8 percent falling below the age of 25 years. With urbanization, an increasing proportion of the rural populations are now residing in urban centres, further fueling the rural-urban exodus. This scenario inevitably lends greater urgency to find solutions for a number of issues related to basic urban services such as solid waste management, water supply, sanitation, sewerage system etc. and the rising youth unemployment.

2. Urbanization and Solid Waste Management

Urbanization has been a rapidly growing phenomenon in Bhutan. Starting with the 5th Five-Year Plan in 1981, urban development featured as a consistent special development priority with a dedicated financial plan outlay. The process of urbanization in Bhutan is therefore just three decades old. Whereas the establishment and growth of towns and cities have been influenced by economic potential in most cases, the initial development of towns in Bhutan is said to have resulted from the need for establishing administrative centers. The urban population comprises of about 37.8 percent of the total population in 2017, and by 2022 it is projected that about 41 percent of the population will be living in the urban centers and by 2032, it is estimated that 50.4 percent will live in urban centers.[8] With this rapidly growing urban population with a growth rate of about 7 percent, the major urban city centers like Thimphu, Phuentsholing, Samdrup Jongkhar and Gelephu have reportedly started experiencing the adverse effects of urbanization such as waste disposal problems, water shortages, housing scarcity,

6 http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/BTN.pdf
7 2017 Population and Housing Census of Bhutan, National Statistics Bureau, 2018
8 Population projections Bhutan 2017-2047, National Statistics Bureau, 2019

sanitation, traffic congestion, deterioration of air quality through pollution and proliferation of informal settlements in environmentally sensitive non settlement areas.

Currently, there are four autonomous Thromdes of Thimphu, Phuentsholing, Gelephu and Samdrup Jongkhar; 15 Dzongkhag Thromdes and 18 Yenlag Thromdes that have been approved in early 2015. As per the qualification standards of size and density specifications as prescribed by the Bhutan National Urbanization Strategy (BNUS)-2008, there are about 62 designated urban centers. With regard to Acts, Byelaws and regulations for urban governance, an impressive array of legal arrangements are in place. Some of the key instruments include the Constitution of the Kingdom of Bhutan, The Penal Code of Bhutan-2004, Waste Prevention and Management Act of Bhutan- 2009, Bhutan Municipal Act-1999, Environment Assessment Act-2000, Water Act-2011, Thromde Act-2007, Waste Prevention and Management Act-2009, National Environment Protection Act-2007, The Local Government Act of Bhutan-2009, Water and Sanitation Rules-1995, Bhutan Building Rules-2002, Environmental Code of Practice for Stormwater-2004, Environmental Discharge Standard-2010, and National Health Policy-2011, Waste Prevention and Management Regulation-2012. A more detailed overview is presented under General findings section.

A6-1-4

As of now, there are no comprehensive human settlement plans, except for the structural plans and Local Area Plans (LAPs) for the Class A and Class B Thromdes and some Yenlag Thromdes. According to the Results of the first ever National Solid Waste Survey in the urban areas of Bhutan of 2008, the mean domestic household waste ranged from 0.6 to 1.2 kg. per day per household and the mean non household wastes from commercial sources was recorded at 2.401 kg per day per commercial establishment.[9] Although solid waste disposal and management system have been developed in all the autonomous Thromdes/cities including even in many other smaller towns, the need for improvements in solid waste management still persists.

3. JICA Project on Solid Waste Management in Bhutan

The project for Improvement of Solid Waste Management Equipment in Bhutan is primarily premised on 'Environmental Conservation', one of four pillars of Gross National Happiness (GNH). The improvement of living environment and public health through an appropriate waste management system is expected to increase the outcomes related to the National Key Result Areas (NKRAs) of maintaining a

9 Results of the first National Solid Waste Survey in the urban areas of Bhutan, Phuntsho,S.,Herat,S.,Yangden,D.,DUDES, MOWHS, 2008

healthy eco-system, improving public service delivery, enhancement of healthy and caring society, improve livability, safety and sustainability of human settlements and thereby the happiness level of the people.

National Integrated Solid Waste Management Strategy (ISWM)-2014 has important policies in which efforts to promote the 4 Rs (Reduce, Reuse, Recycle and Responsibility) along with a proper system of collection and transportation of the solid waste to the landfills forms part of the overall improvement goals.

The realization of an appropriate system of collection and disposal of solid waste in the four major target cities of this project (Thimphu, Phuentsholing, Samdrup Jongkhar and Gelephu) is regarded as the most important project intervention to address the above situation. Generally, the four cities are suffering from the problems of not having a systematic collection and transportation of solid waste, due to shortage of the equipment and vehicles.

In this regard, the Gross National Happiness Commission (GNHC), Royal Government of Bhutan requested the Government of Japan for a Grant Aid to procure waste collection vehicles for the four cities. As part of the project preparation, Japan International Cooperation Agency (JICA) decided to conduct a preparatory survey for the Grant Aid project. The goal of the survey is to confirm the necessity and relevance of the Grant Aid project by conducting an evidence-based field situational survey in the four cities as well as study the procurement conditions, specifying the equipment requirement plan and an implementation schedule.

The 'Preparatory Survey on the Project for Improvement of Solid Waste Management (SWM) in Bhutan' was undertaken from 13th August 2019 by NYCOM Consultants, the National counterpart survey team contracted by Yachiyo Engineering Company Limited.

4. Objectives and Scope of the Survey[10]

The Objective of the survey on SWM in Bhutan is to clarify the current condition/situation of SWM in the four cities. The work covered the following two components.

10 TOR for Survey on SWM in Four Cities in Bhutan, Yachiyo Engineering Company Ltd., August 2019

4.1 Component 1: Data collection and analysis on SWM in Phuentsholing, Samdrup Jongkhar and Gelephu;

4.2 Component 2: Survey on waste amount to be disposed to landfill sites in Thimphu, Phuentsholing, Samdrup Jongkhar and Gelephu.

The scope of the work stipulated the Contractor to carry out the work under the supervision of Yachiyo Engineering Company Ltd. (YEC). As per the TOR, the work consisted of the following:

(1) Preparation work
(2) Component-1: Data collection and analysis on SWM (interview to the concerned agencies, analysis of collected report/ data/ information etc.)
(3) Component-2: Waste amount to be disposed to landfill sites (hearing and measure collection vehicles haled into landfill sites)
(4) Compilation and analysis of data for Component-1
(5) Data entry and calculation of data for Component-2
(6) Analysis of results for Component-2
(7) Reporting for Component-1 & 2

A6-1-5

5. Survey Methods and Tools

As required by the TOR, the 'Preparatory Survey on the Project for Improvement of Solid Waste Management in Bhutan' used both primary data collection methods and secondary sources (bibliographic) and primary sources (key informants interviews and observations of SWM facilities such as landfill sites, transfer stations and other related equipments). Therefore the survey procedures followed desk reviews, key informants interviews and observations.

The desk review made use of available existing documents/reports and related literatures on solid waste management in Bhutan. The Key informants interviews (KII) was held with knowledgeable persons in the respective city municipalities such as the Thrompon (elected leader of the Thromde Tshogde or Municipal local government), other responsible SWM officials. For Component-1, the Questionnaire for Component-1 was used with the key informants. Similarly, for Component-2, the Structured Recording Sheet for Component-2 was used to conduct the Observations/interview with drivers of wastes disposal vehicles at the landfill sites in all four cities. For recording the landfill activities, the data collection first obtained the waste collection schedule from the respective agencies (Thromdes/Private waste collection

companies) and a data collector under close supervision of an Engineer monitored the collection and disposals for an entire week. Additionally, a recording Sheet was used to prepare an inventory of all waste collection vehicles in Phuentsholing, Samdrup Jongkhar and Gelephu cities.

6. Data Collection, Data Processing and Analysis

Data collection was undertaken by the consultants comprising of a Lead Consultant, supported by a Statistician, WASH Engineer and a GIS Expert. While the data for Component-1 Questionnaire was administered by the Team Leader and WASH Engineer in all the four Thromdes/cities, one data recorder was also hired to monitor and record the waste flow in all the four Thromdes/Cities closely supervised by the WASH Engineer. The GIS Expert mapped the key waste collection locations/points and the landfill sites.

After completion of the data collection work in about 28 days, data for Component-1 Questionnaire was processed through transcription of responses to each and every questions and summarizing the findings under relevant interest areas of the SWM survey. For Component 2 Recording Sheet of waste amount disposed at the landfill sites, the Statistician used Excel and STATA to process and analyse the data. As anticipated, about 6 days was required to complete the data cleaning/processing/analysis and another 6 days for writing the first draft report.

7. Limitations of the Survey

The following factors contributed as limitations to the survey work.

- The data collection for Component 2- amount of wastes disposed at landfill sites for one week may have presented some limitations to the degree of accuracy;
- The wastes generation data received from the Ministry of Works and Human Settlements (MOWHS) that was agreed to be used by YEC for deriving the conversion factor was based on verbal communication. The consultants were unable to access any published reports or documents related to the figures.
- Since there is no reliable data collection systems in all the concerned Thromdes/Cities, the wastes flow data received from some Thromdes under Component-1 Questionnaire could be erroneous to some extent.

8. Findings

8.1 General Findings on Acts and By-laws related to Solid Waste management

1) The Constitution of the Kingdom of Bhutan

The Constitution of the Kingdom of Bhutan 2008, the supreme law of the nation, in Article 5 mandate every citizen to contribute to the prevention of noise, visual and physical pollution and mandates the Royal Government to "Prevent pollution and ecological degradation" and "Ensure a safe and healthy environment" which can be achieved through proper management of solid wastes.

2) The Penal Code of Bhutan, 2004

The Penal Code of Bhutan also contains an Article (408) dealing with the offence of environmental pollution which can include the inappropriate disposal of solid wastes and the fines and penalties thereto to perpetrators.

3) Waste Prevention and Management Act of Bhutan, 2009

The Act is intended to help reduce generation of waste at the source; promote segregation, reuse, and recycling of waste; disposal of waste in an environmentally sound manner; and ensure functioning and coordination among implementing agencies.

National Environment Commission (NEC) is the apex regulatory authority for all matters concerning environment and its management which includes management of solid wastes among others. It can develop policies, plans, and programs for effective waste management and can levy fines and penalties for non-compliance. It can also issue and revoke environmental clearances issued for projects for noncompliance of environmental standards. NEC also has the authority to designate implementing agencies for the implementation of Waste Prevention and Management Act. A designated waste prevention and management implementing agency can frame rules and regulations and devise administrative and financial mechanisms for prevention and management of wastes. Currently the lead implementing agencies are 1) Ministry of Works and Human Settlement (MoWHS) and Thromdes for prevention and management of wastes in Thromdes, and 2) Dzongkhag Tshogdu and Gewog Tshogde in other areas. The collaborating agencies in waste prevention and management are:

a) Department of Trade (DoT) under Ministry of Economic Affairs (MoEA) in ensuring waste prevention and management of waste originating from transboundary trade;
b) Department of Industry (DoI) under MoEA for management of industrial wastes;

c) Tourism Council of Bhutan (TCB) for managing waste originating from hotels, restaurants, camp sites and trekking routes;
d) Ministry of Health (MoH) for prevention and management of medical waste;
e) Ministry of Education (MoE) for education and awareness programmes on waste;
f) Ministry of Agriculture and Forests (MoAF) for waste prevention and management with respect to agriculture, livestock and forestry;
g) Civil Society Organisations (CSO) and Media for education and public awareness on waste;
h) Ministry of Information and Communications (MoIC) for prevention and management of e-waste;
i) Department of Revenue and Customs (DRC) under the Ministry of Finance (MoF) for restricting entry of products that generates large volumes of wastes (through levying appropriate taxes and duties);
j) Road Safety and Transport Authority (RSTA) under MoIC for prevention and management of wastes related to transportation;
k) Drug Regulatory Authority (DRA) for prevention and management of wastes in pharmaceutical firms and pharmacies;
l) Dratshang Lhentshog (Council for Religious Affairs) for prevention and management of wastes in monastic institutions and religious sites; and
m) Armed forces for prevention and management of wastes at their respective areas.

The Royal Bhutan Police (RBP) is also designated as collaborating agency to assist implementing agencies in enforcement of this Act.

4) Bhutan Municipal Act, 1999

The Bhutan Municipal Act, 1999 mandates the Thromdes (Municipal Corporations) to carry out, among others, waste collection, disposal, establishment and operation of waste disposal facilities. The Act also empowered Thromdes to frame and adopt appropriate rules and regulations to discharge their functions.

5) Environmental Assessment Act , 2000

The Environmental Assessment Act, 2000 requires all waste management activities to apply for environmental clearance. Although not specifically related to the urban solid waste management, this Act requires all projects to be managed in an environmentally sound way which can include proper management of solid wastes.

6) Water Act, 2011

The Water Act, 2011 too governs that dumping of waste in to the streams, rivers, drainage system or other water bodies as an offence. Unsafe waste disposal can therefore be damaging to the environment (land, water and air) requiring high standards of management for environmental and public safety.

A. Policies/Strategies/Plans/Programmes related to Solid Waste Management

1) National Strategy and Action Plan – Integrated Solid Waste Management, 2007

2) National Integrated Solid Waste Management Strategy, 2014

The initial National Strategy & Action Plan-Integrated Solid Waste Management Strategy, 2007 came into force in 2007. The Strategy provided guidance for the effective removal of waste to address the negative impact on public health and the environment. This Strategy was revised as the National Integrated Solid Waste Management Strategy in 2014 to address existing problems of increased generation and improper disposal of solid wastes. The Strategy includes all forms of wastes and aims to prevent waste generation at the source and minimize the amount going to the landfill with a focus on refusing, reusing, recovering and recycling.

The Strategy advocates a seven-step process of planning through data collection, defining the main problems followed by establishing the strategic planning frameworks as well as identifying the options to develop the best strategy. Following this, action plans are to be prepared and implemented. Although entities at all level concerned with waste management are to follow this, capacity is an issue for which the Strategy recommends capacity building to institute knowledge and skills to take up the steps. In the long-term, the Strategy envisions a “zero waste” scenario and to achieve this it would promote and practice the 4 Rs (reduction at sources, re-use, recycle and responsibility). The objectives of the Strategy are to move to a “zero waste Bhutan” in partnership with a range of public, private and civil society players at all levels in segregation, resource conservation. The Strategy ensures environmental accountability and social responsibility of waste generators, managers and service providers and will institute extended producers responsibility for non-recyclable products, public-private partnership, create and protect livelihoods of a segment of society involved in waste recycling sector and take up awareness and communication activities on waste. The Strategy describes all activities to be undertaken with regard to waste storage, segregation, collection, transportation, processing and disposal of waste. The Strategy also deliberates on economy and financing of Integrated Solid Waste Management through

enabling policy instruments, ensuring financial security and indicates possible sources of revenue besides strategies to create awareness on Integrated Solid Waste Management.

3) National Waste Management Strategy 2019

This strategy “provides guidance on how waste which may have a negative impact on public health and the environment can be removed regularly and in an affordable way”. The main focus of the Strategy was to ensure waste producers are made accountable, address root cause of waste generation, and control waste pollution through a well trained workforce to combat mounting issue of waste. The strategy aims to prevent waste generation at the source and minimize the amount of waste going to landfill with focus on refusing, re-using, re-covering and recycling wastes.

4) Action Plan for Thimphu, 1992

The Action Plan prepared by NEC and Thimphu Thromde (then Thimphu City Corporation) recommended administrative and financial autonomy for Thimphu Thromde to plan and implement its plans related to solid waste management, develop necessary legislation, and a mobile inspection team to keep city clean. However, it is reported that none of the three recommendations were implemented.

5) Five Year Plans (FYP)

The Ninth Five Year Plan (FYP) from 2002-2007 identified solid waste management as one of the priority areas and stated that source reduction, community sensitization, and refinement of solid waste management rules need to be addressed. Similarly, the 12th FYP (2018-2023) included two Key Performance Indicators (KPI) related to Solid Waste Management (SWM). In order to safely manage solid wastes, the plan targets 'Reduction in waste going to landfill site from 75 percent in 2017 to 50 percent in 2023' and 'Increase in households segregating waste at source from 37 percent in 2017 to 70 percent in 2023'.

6) Waste Management Flagship Programme

The Prime Minister’s Office recently launched the Waste Management Flagship Programme. It is reported that the Programme targets to reduce waste at every point and put in place a strong management set-up and conscientious monitoring system.

7) Zero Waste Hour Initiative

Zero Waste Hour Initiative, which was launched recently by the NEC, is an awareness and action programme geared towards achieving the goal of "Zero Waste Bhutan" by 2030. The initiative requires all Bhutanese officials working for different offices and institutions to dedicate an hour for cleaning their surroundings on the second day of each month.

Other initiatives taken by Thromdes to effectively manage solid wastes includes 1) off-hour waste collection services such as during evenings for office goers who do not have anybody to dispose wastes during normal collection hours, 2) CCTV surveillance to monitor illegal dumping of solid wastes in selected areas, and 3) increased frequency of collection and coverage of collection services.

B. Rules/Regulations related to Solid Waste Management

1) Waste Prevention and Management Regulation, 2012

These regulations have been formulated to implement the Waste Prevention & Management Act 2009 and outline the different types of solid waste prevalent in the country, then goes in more detail with medical waste, municipal waste, industrial waste, waste in government reserved forests and protected areas and communities and e-waste. For each categories of these waste, the regulations discuss the scope, responsibilities of various stakeholders, collection, transfer and segregation. Offences and penalties, financial mechanism and amendments are discussed in latter sections. For municipal waste management, the regulations prescribe the responsibilities of the Thromdes and Dzongkhags as well as Thromde Inspectors, traders, scrap dealers, individual citizens and house owners. Responsibilities of constriction sector, business and industrial sector in waste management are also described. The regulations have specific rules for waste collection, transfer, segregation, transport and for waste recycling and composting. With regard to waste recycling and composting, the Thromde can operate activities and facilities for such activities by itself or outsource to a third party. The Thromde is to create an enabling environment to ensure waste recycling can succeed as a viable business. Composting facilities on commercial or community scale will be initiated by the Thromde or through the private sector.

2) Waste Prevention and Management (Amendment) Regulation, 2016

These regulations were established to implement the Waste Prevention and Management Act, 2009. The MoWHS, Thromdes, Dzongkhags and Gewogs take the responsibility of implementing it.

3) Thromde Rules, 2011

The Thromde Rules 2011 stipulates that one of the functions of the Thromde include "establishing and operating waste collection and disposal including landfill sites and recycling plants and litter control".

4) Thimphu Municipal Solid Waste Management Rules and Regulations, 2007

This rules and regulations were formulated as empowered by the Bhutan Municipal Act 1999 to discharge the functions of the Thromdes stipulated by the Act. The rule mandates compulsory segregation of solid wastes, specifies minimum standards and requirements for segregation and storage of solid waste, and safety of personnel directly handling solid wastes.

5) Water and Sanitation Rules, 1995

Prepared by the Public Works Division of the then Ministry of Communications, it aimed at safeguarding public health, maintaining good aesthetics of the community, and minimizing the quantity of solid waste disposed off. The rules contained provisions such as having to dispose of solid wastes in receptacles provided or approved by the Thromde, protection and care of public solid waste collection facilities such as 'Use Me' bins, prohibiting burning of solid wastes within Thromde boundaries, allowing only licensed scrap dealers operating from a Thromde approved designated area, etc. Business establishments like shops and hotels are required to provide Thromde approved waste containers while institutions like hospitals and schools are required to provide appropriate and sufficient waste receptacles. This rules also empowered Thromde to levy fines or demand labour contributions from defaulter to clean up the solid wastes in the cities.

6) Ban of use and sale of plastic bags and wrappers

The Ministry of Trade and Industry later renamed as Ministry of Economic Affairs (MOEA) issued public notification in 1999 officially banning the use and sale of plastic carry bags, package wrappers and pouches in Bhutan. The notification was reaffirmed in 2005 and again recently in January 2019 by National Environment Commission (NEC).

C. Guidelines related to Solid Waste Management

1) Environmental Audit Guidelines 2011

This guideline was developed to assist auditors in conducting performance audit, compliance audit, and financial audit with environmental perspectives which includes solid waste management. The Guideline

can help auditors to audit performance of different waste management programs and systems initiated by relevant institutions.

8.2 Responsibility demarcations of some organizations for Solid Waste Management

Table 1: Responsibility demarcations for SWM

Organizations		Responsibility Demarcation
Central Government	Prime Minister's Office	1. Launch flagship programme for waste management. Color coded garbage bins will be distributed to every household and institution across the country for waste management.
	GNHC	1. Mobilise and allocate resources for solid waste management 2. Establish baseline and set plan targets for SWM in consultation with implementing agencies 3. Evaluate plan activities and assess performances of implementing agencies against plan targets
	NEC	1. Develop, review and revise policies, plans, and programmes for effective SWM 2. Formulate, review and revise laws and acts related to SWM 3. Act as an apex regulatory authority for all matters concerning environment and its management which includes management of solid wastes 4. Levy fines and penalties for non-compliance and revoke environmental clearances issued for projects 5. Designate implementing agencies for implementation of SWM systems and programmes. 6. Initiate different programmes to prevent and manage SWM
	MoWHS	1. Frame rules and regulations for implementing waste prevention and management plans and programmes 2. Devise administrative and financial mechanisms for prevention and management of wastes 3. Initiate different programmes to prevent and manage SWM 4. Support fund mobilization for initiatives related to SWM
Local Government	Thromde Administration	1. Frame and adopt appropriate rules and regulations to discharge its functions related to SWM 2. Devise administrative and financial mechanisms for prevention and management of wastes 3. Initiate collection of fees and charges for SWM services 4. Initiate different programmes to prevent and manage solid waste 5. Establish and operate waste collection and disposal including landfill sites and recycling plants and litter control 6. Approve and enforce standards related to solid waste segregation, storage and handling

8.3 Specific Findings on Thromdes/Municipal Cities

8.3.1 Gelephu Thromde

8.3.1.1 Population and Area

As per the Population and Housing Census of Bhutan, 2017, the population of Gelephu Thromde is 9,858. For 2018 to 2027, the Thromde population figures are derived based on the proportion of population residing in the Thromde in 2017, and the projected figures based on the Dzongkhag Population Projection 2017-2027.

Table 2: Population of Gelephu Thromde

Year	Population (Number)
2017	9,858[11]
2018	10,005

11 Population and Housing Census of Bhutan, 2017, National Statistics Bureau.

A6-1-9

Year	Population (Number)
2019	10,154
2020	10,303
2021	10,452
2022	10,601
2023	10,762
2024	10,922
2025	11,082
2026	11,240
2027	11,398

The land area of Gelephu Thromde is 11.50 (km^2).[12]

8.3.1.2 Land and Natural Conditions- Map of Gelephu

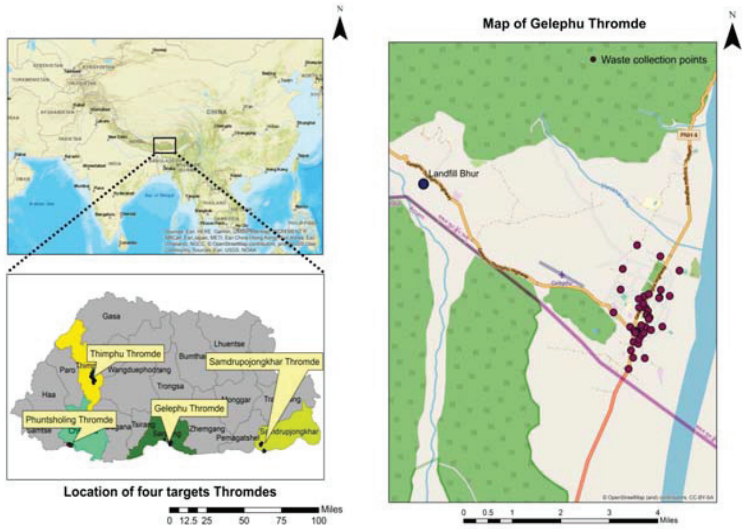


Figure 1: Map of Gelephu Thromde

12 Ibid

8.3.1.3 Meteorological data in the past five years

The yearly total rainfall in Gelephu was lowest in 2014 with 3,910 mm and the highest was recorded in 2017 with 5,930 mm. So the annual mean rainfall in Gelephu during the past five years ranged from 325.85 mm to 494.2 mm. The annual mean temperature ranged from a minimum of 23.45°C to a maximum of 24.60 during the period of 2014 to 2018. Although the questionnaire required monthly rainfall evaporation data, humidity data was collected instead of evaporation. So the annual mean humidity recorded ranged from 72.48 percent to 84.44 percent.

Table 3: Meteorological data of Gelephu

Meteorological data	2014	2015	2016	2017	2018
Annual Total Rainfall (mm)	3,910.20	5,260.44	5,374.08	5,930.40	4,471.68
Average Monthly Rainfall (mm)	325.85	438.37	447.84	494.2	372.64
Average Monthly Temperature (°C)	23.45	23.83	24.60	24.11	23.88
Average Monthly Humidity (percent)	72.48	76.07	84.44	78.87	78.84

The weather station for Gelephu is located at Bhur, 11 km from main city centre.

8.3.1.4 Big scale dischargers and system of SWM data collection

In terms of big-scale dischargers of wastes in Gelephu Thromde /City, there are just about 3 big scale dischargers: 2 vegetable markets- one located in Namkaling Demkhong (constituency) and another in Sonamgatshel Demkhong. The main city centre where most of the shops and business services are located is also considered as another big-scale discharger.

The current system of solid waste data collection is not well established focusing on collection of data for administrative purposes only. Although waste collection is segregated by dry and wet wastes types at the household level, regular data collection and recording of waste disposal in terms of the type of disposal vehicles, capacity and quantity is not an established routine procedure.

8.3.1.5 Waste Flow

Based on information gathered from key informant interviews in the Thromde administration, a total of 7.61 tons per day of wastes is being generated in Gelephu Thromde, of which 2.71 tons per day is being

segregated at source for recycling (includes 370 kg of pet bottles, 11- kg of assorted plastics, 390 kg of metals or aluminum, 1385 kg of glass/bottles, 455 kg of paper/carton boxes). The collection coverage rate is reportedly 100 percent with 4.9 tons per day of wastes being finally disposed off to the landfill site. The average per capita waste generation is 0.77 kg per person per day in Gelephu[13]. It must be noted here though that the figures of waste flow obtained from recording of the week-long survey of waste amount disposed at the landfill may not necessarily match with this data due to differences in the method of data collection and the source of the data itself.

8.3.1.6 Storage and Discharge containers

The storage and discharge of wastes are typically done at three different places in the Thromde: at the households, vegetable markets/shops and institutions. In terms of discharge containers at the households, plastic bins (5 litre), buckets (10-15 litres) and carton boxes (3-5 litres) are being used. The discharge place or collection points are usually in front of the house and at the curbside.

At the vegetable markets, big wheel bins (360 litres) are provided. The discharge place or collection point is fixed in front of the market/shops.

For institutions such as schools, offices and hospital, the storage and discharge containers are mainly big wheel bins (360-660 litres) and buckets (20 litres), which are either discharged/collected from within the premises or from in front of the institutions concerned.

8.3.1.7 Waste Collection services

Door to door waste collection services is extended to the resident population from 7:30 AM to 4:00 PM, for six days a week, except on Sundays. While the collection is undertaken on a daily basis for both dry and wet wastes in the main Core city area, wastes collection services is undertaken three times a week for both dry and wet wastes in the other Demkhongs/constituencies.

Privatization of waste collection has not been introduced as yet, possibly due to smallness of the waste generation. However, the Thromde administration has been contemplating to involve a private party to take care of the bio-degradable wet waste in the near future. The waste collection points in the city have been mapped using GPS. Refer maps below.

13 Gelephu Thromde Administration

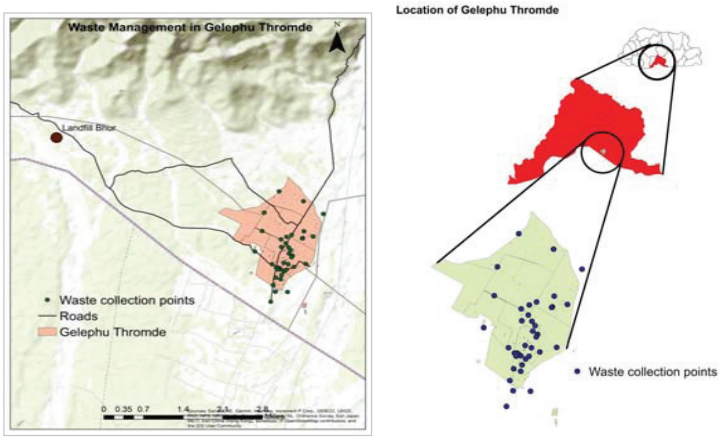


Figure 2: Waste Collection Map of Gelephu Thromde

8.3.1.8 Present Situation and Future plan for Recycling

Currently, the Thromde has no wastes recycling activities or facilities. However, there are five licensed private individual scrap dealers who collect recyclable wastes. As mention in a foregoing section of this report, these scrap dealers segregate about 2.71 tons per day of dry waste. They are allowed to recover various types of recyclable wastes such as pet bottles, plastics, metals, glass, beer bottles, paper/carton boxes etc.

8.3.1.9 Situation and Future plan for Mechanical workshops

The Thromde administration has no mechanical workshops to cater to the needs of their waste collection/disposal vehicle maintenance. At present, all repairs and maintenance services for the waste collection/disposal vehicles is being provided by private automobile workshops on a case by case basis. For example, if a vehicle requires a certain repair and maintenance service, the Thromde administration calls for expression of interest from service providers in accordance with the procurement rules in place. Usually, the service order is offered to the party with the lowest evaluated bid.

8.3.1.10 Present Situation and Future plan for Landfill site

The landfill of Gelephu Thromde is located at Bhur, about 11 km from the main city centre. The landfill is a 'controlled sanitary' one. With a predicted lifespan of 30 years and with a capacity of 3 tons per day,

it has been in operation for 11 years already. Therefore, the landfill is still expected to be in operation for the 19 more years but it could get filled up more quickly because the current waste flow rate is 4.9 tons per day.

The landfill has two huge ponds for collection and safe transport of leachate but observations revealed that no leachate has ever flown down to the ponds from the dumpsite. So, there is a need to carryout remedial work to make the leachate flow through the compaction area in to the ponds below. At present, the landfill is manned by one staff who works 6 days a week from 9:00 AM to 5:00 PM. The landfill facility is devoid of a number of essential facilities such as truck scale/weighbridge, control building, leachate treatment facility and vehicle washing station. Environmental monitoring systems and processes are also not in place. The landfill does not see any informal waste pickers. Although the landfill is located within the outskirts of inhabited communities, there are no issues that concerns issues with residents in an around the landfill. Given the above present situation, plans are underway to improve the landfill and facilities in the near future. The landfill has one dedicated JCB Backhoe (92 hp) purchased in 2010 with an Odometer reading of 68,817 KM. The Thromde plans to procure one additional Excavator.

8.3.1.11 Other 'soft' activities related to SWM

SWM activities involving community members have become a regular feature for the Thromde. Organizing voluntary cleaning campaigns with participation from the people of the Thromde is gaining momentum. Coinciding with national and international days such as the World Environment Day, the Thromde administration work closely with corporate offices, school children, police and Dessung (Guardians of Peace) for promoting civic and environment awareness programmes. The school Nature and Environment Clubs are also being used as a platform for raising awareness on cleanliness and waste management. The 'Zero Waste Hour'- an initiative launched by Her Majesty the Queen of Bhutan to instill positive behaviour change towards proper waste management and practice sustainable lifestyle for healthy and clean living is being observed on every 2nd day of the month.

8.3.1.12 Existing bylaws, regulations and policy on SWM in the Thromde

The Waste Prevention and Management Regulation of 2012 guides the Thromde in solid waste management. The regulation categorizes wastes, and discusses the scope, responsibilities of various stakeholders for waste collection, transfer and segregation. Offences and penalties, financial mechanism

and amendments are also clearly outlined for implementation. For municipal waste management, the regulation prescribes various responsibilities to not only the Thromde but also to the Dzongkhags, Thromdes and individual people. Responsibilities of construction sector, business and industrial sector in waste management are also covered by this regulation, including specific rules for waste collection, transfer, segregation, transport and for waste recycling and composting.

8.3.1.13 Organization chart and number of the staff

Solid waste management in the Thromde/Municipal city of Gelephu is a responsibility the Environment Division which is manned by a total of 36 staff. (Figure 3)

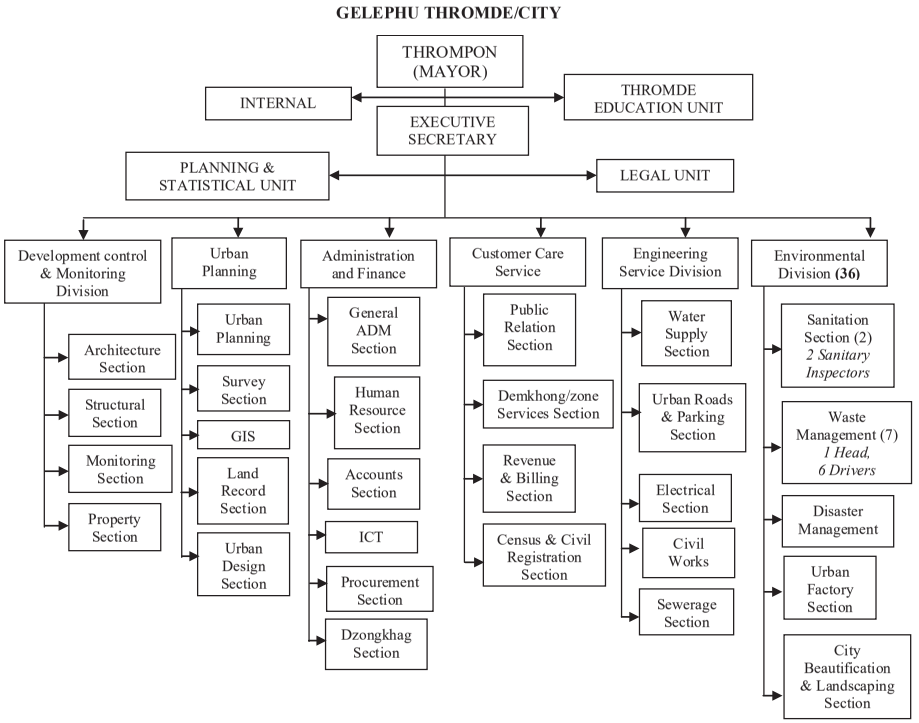


Figure 3: Organization Structure of Gelephu Thromde

8.3.1.14 SWM Revenue and Actual Expenditure in the past three years

Information gathered from key informants indicated that some subsidy is received from the government on an annual basis but the budget for the entire Thromde administration is maintained under one general budget head and no specific allocations figure for Environment Division was available at the time of the survey. A start has been made to implement the Taxation Policy 2012 for the 2018-2019 financial year and sum of Nu 359,540 has been collected as revenues from solid waste collection fee. On the other hand, huge expenditure has been incurred to the tune of Nu 2,640,000 for salary, fuel and maintenance cost for SWM vehicles.

Table 4: Revenue and Expenditure of Gelephu Thromde SWM

Item	2016-2018	2017-2018	2018-2019
Revenue Heads (Actual) e.g. Subsidy from the central government, waste fee etc			
Govt. subsidy (capital)	-	-	-
SW collection fee	-	-	Nu 359,540
Total Revenue			Nu 359,540
Expenditure Heads (Actual) e.g. Salary for staff			
Salary (Env. Div.staff)	Nu 1,920,000	Nu 1,980,000	Nu 2,232,000
Fuel (4 SWM vehicles, one Backhoe excavator)	Nu 1,440,000	Nu 1,584,000	Nu1,680,000
Vehicle maintenance	Nu 624,000	Nu720,000	Nu 960,000
Total Expenditure	Nu 2,064,000	Nu 2,304,000	Nu 2,640,000

8.3.1.15 Tariff/fees for waste collection

The tariff/fee for waste collection has been implemented for the financial year 2018-2019. Levied as per Taxation Policy 2012 by categories of buildings:

Category I- Nu10 per unit

Category II- Nu 8 per unit

Category III-Nu 6 per unit

Category IV-Nu 4 per unit

8.3.1.16 General operation and maintenance for the cost for SWM

Table 5: Monthly Operation and maintenance cost

Item	Cost (Nu)
Average diesel cost (per liter)	Nu 59
Average engineer salary (per month)	Nu 30,000
Average technician salary (per month)	Nu 25,000
Average driver salary for collection / transportation vehicle (per month)	Nu13,600
Average heavy equipment operator salary (per month)	Nu13,500
Average labor cost (per month)	Nu7,000

8.3.2 Phuentsholing Thromde

8.3.2.1 Population and Area

As per the Population and Housing Census of Bhutan, 2017, the population of Phuentsholing Thromde is 27,658. For 2018 to 2027, the Thromde population figures are derived based on the proportion of population residing in the Thromde in 2017, and the projected figures based on the Dzongkhag Population Projection 2017-2027.

Table 6: Population of Phuentsholing Thromde

Year	Population (Number)
2017	27,658[14]
2018	27,734
2019	27,810
2020	27,880
2021	27,943
2022	28,001
2023	28,081
2024	28,155
2025	28,221
2026	28,279
2027	28,330

14 Population and Housing Census of Bhutan, 2017, National Statistics Bureau.

The land area of Phuentsholing Thromde as per the Structural Plan is 15.60 (km^2).[15]

8.3.2.2 Land and Natural Conditions- Map of Phuentsholing

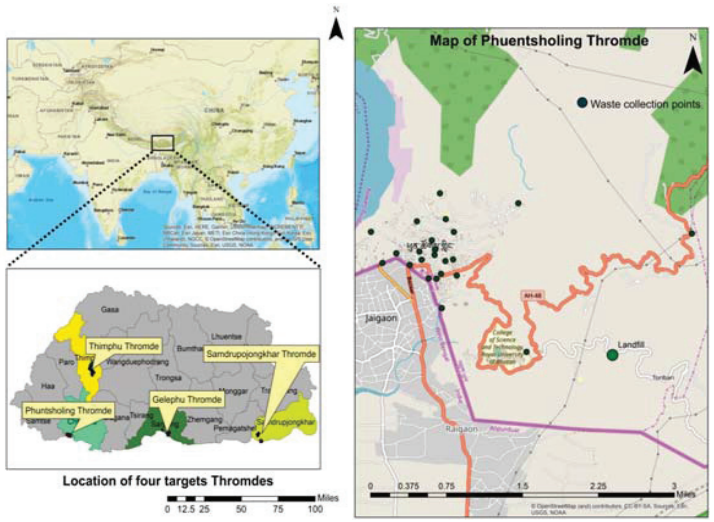


Figure 4: Map of Phuentsholing Thromde

8.3.2.3 Meteorological data in the past five years

The yearly total rainfall in Phuentsholing was recorded 3,227 mm in 2016, 4,979 mm in 2017, and 6146 in 2018. No other rainfall data were available for the year 2014 and 2015. Therefore, the annual mean rainfall in Phuentsholing for 2016, 2017 and 2018 was 268.88 mm, 414.95 mm, and 512.14 mm respectively. While the annual mean temperature for 2016 was recorded at 25.34°C, it was 24.14 °C in 2017 and 22.98°C in 2018. Although the questionnaire required monthly evaporation, humidity data was collected instead of evaporation. So the annual mean humidity recorded ranged from 63.11 percent in 2016, 74.35 percent in 2017 and 75.80 percent in 2018.

15 Ibid

Table 7: Meteorological data of Phuentsholing

Meteorological data	2014	2015	2016	2017	2018
Annual Total Rainfall (mm)	NA	NA	3,226.56	4,979.40	6,145.68
Average Monthly Rainfall (mm)	NA	NA	268.88	414.95	512.14
Average Monthly Temperature (°C)	NA	NA	25.34	24.14	22.98
Average Monthly Humidity (percent)	NA	NA	63.11	74.35	75.80

8.3.2.4 Big scale dischargers and system of SWM data collection

In Phuentsholing Thromde /City, there are just about 4 big scale dischargers: one vegetable market and one large commercial business centre (Upper Market and Lower Market) in the core area. There are also two automobile workshops (one located in core area near Sewerage treatment plant and another located at the Toorsa embankment reclamation area.

The current system of solid waste data collection is rudimentary despite some data recordings done manually on monthly basis. Only partial weighbridge data is maintained by using a private weighbridge located in the core area. Wastes from one farflung Pasakha area is not weighed due to logistical inconvenience. Although waste collection is segregated by dry and wet types at the household level, data collection and recording of waste disposal in terms of the type of disposal vehicles, capacity and quantity is not comprehensive enough.

8.3.2.5 Waste Flow

The current demarcations for solid waste management do not follow the LAP system in Phuentsholing. It is being divided under four major areas of Core area, PWD area, Beyond Om chu (Dhutikhola) and Pasakha, to suit to its present solid waste management operations. Based on key informant interviews, municipal solid wastes are generated at the households, vegetable markets, shops and institution levels. The wastes are mandatorily separated by dry and wet types and are stored in containers such as buckets, sacks and carry bags. In the core commercial business areas and institutions, large wheel-bins, wire mesh containers, and roadside communal containers are used.

A total of 8 metric tons of solid wastes are generated per day, of which about 1.5 metric tons (including 500 Kg. of green wastes per day) are separated by informal collectors. As of now, there are no established waste recoveries or transfer stations in Phuentsholing. Therefore, a total of 6.5 metric tons per day of both dry and wet wastes are disposed off to the landfill site located at a distance of 8 Km in Pekarzhing. The average per capita waste generation is 0.28 per person per day in Phuentsholing.[16]

It must be noted here though that the figures of waste flow obtained from recording of the week-long survey of waste amount disposed at the landfill may not necessarily match with this data due to differences in the data source and method of data collection.

8.3.2.6 Storage and Discharge containers

The storage and discharge of wastes are typically done at three different places in the Thromde: at the households, vegetable markets/shops and institutions. In terms of discharge containers at the households, plastic bins buckets (20 litres), carton boxes (3-5 litres) and sacks- (10-20 litres) are being used. The discharge place or collection points are usually in front of the house, curbside and communal container stations.

At the vegetable markets, big wheel bins (180 litres and 360 litres) are provided. The discharge place or collection point is fixed in front of the market/shops.

For institutions such as schools, offices and hospital, the storage and discharge containers are mainly big wheel bins (180 litres-360 litres) and communal containers (300 litres), which are either discharged/collected from within the premises or from in front of the institutions. A total of 48 communal containers (3.5 m3) are placed in various collection areas (23 in Pasakha area, 18 in Beyond Omchu (dhutikhola) area and 7 in core area).

8.3.2.7 Waste Collection services

Door to door waste collection services is extended to the resident population from 6:00 AM to 4:00 PM, for seven days a week. The collection services are carried out on a daily basis for both dry and wet wastes in all the four designated collection areas.

16 Phuentsholing Thromde Administration

The drive to privatize the municipal waste collection is under active consideration. The survey team found that expression of interest from private parties to render waste collection services have been already called for and the tender/proposals are due to be opened on 23rd August 2019 for further scrutiny and decision making. The waste collection points in the city have been mapped using GPS. Refer Figure 5 below.

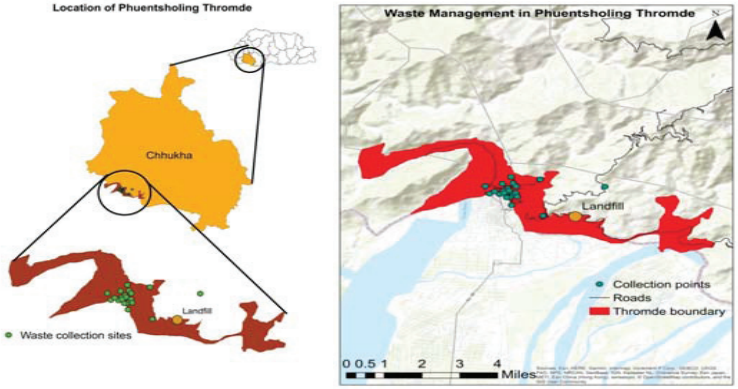


Figure 5: Waste Collection Map of Phuentsholing Thromde

8.3.2.8 Present Situation and Future plan for Recycling

Although segregation of waste is done by dry and wet types, presently there is no established recycling activity/facility in the city. However, segregation by informal scrap collectors for recyclable dry wastes such as pet bottles, plastics, metals, glass, beer bottles, paper/carton boxes etc. is widely practiced. However, the survey found that only 0.5 tons of wastes per day are being recycled presently. Apparently, the need for the establishment of a Recycling Plant was felt for many years. A proposal was submitted to establish a recycling plant by the Thromde administration during the 2019-2020 fiscal year but was not approved by the GNH Commission.

8.3.2.9 Present Situation and Future plan for Mechanical workshops

There are 8 waste collection/disposal vehicles in Phuentsholing Thromde. But there is no mechanical workshop of its own to cater to the repairs and maintenance needs of these vehicles. Under this circumstance, the Thromde administration makes use of a number of private automobile workshops to

meet the needs of vehicle maintenance services. It prepares an annual maintenance plan developed by calling quotation of price/rates for various maintenance services for its vehicle fleet. The system of offering the service contract to the lowest evaluated bid is being followed, which is sometimes detrimental to the desired level of quality maintenance service. There is no plan for establishment of any vehicle maintenance workshop of its own. As per information gathered from Key informants interviewed, a binding terms and condition to the concerned private agency selected for provision of SWM services in the near future will be the requirement to provide timely and reliable repairs and maintenance services for its vehicles.

8.3.2.10 Present Situation and Future plan for Landfill site

The landfill of Phuentsholing Thromde is located at Pekarzhing, about 8 Km from the main city centre. The landfill is said to be a 'controlled' type with a designated land area of 7.25 acres. At present only 1.35 acres is being used as the actual dumping area. It was constructed in 2005 with a predicted lifespan of 10 years, and it has been in operation for 14 years already exceeding well above its planned use period. However, since the landfill has adequate space for development, there is a need to expand and develop its dumping area. Therefore, the Thromde is creating space in the landfill through land reclamation by removing the old compacted wastes and transporting it to another section of the landfill for mitigation by soil cover and compaction. Otherwise, with the current waste flow rate of 6.5 tons per day, the landfill could get filled up very soon.

The landfill receives all three types of dry, wet and mixed wastes and has one small pond for leachate collection but observations revealed that no leachate has ever flown down to the pond from the dumpsite. At present, the landfill is manned by five staff who work 8 hours a day (7 days a week) from 9:00 AM to 5:00 PM. The landfill facility lacks a number of essential facilities such as truck scale/weighbridge, control building and vehicle washing station. Environmental monitoring systems and processes are also not in place. The landfill does not see any informal waste pickers. Since the landfill is located far away from the main city centre, there are no issues that concerns with residents living in an around the landfill. Given the above present situation, it is being speculated to convert the present landfill into a semi-aerobic one with natural ventilation and proper leachate collection facility. The landfill has one dedicated JCB Backhoe Loader (92Hp) purchased in 2004. The Odometer is non functional. The requirement of one Chain Excavator for the landfill site was felt for quite sometime but could not be procured due to financial constraints.

8.3.2.11 Other 'soft' activities related to SWM

With regard to SWM activities involving the community members, it has become a regular feature for the Thromde to organize cleanliness campaigns with voluntary participation of city dwellers. The Environment Division together with the Thromde Education Division work with the schools and school children to promote civic and environment awareness amongst both students and parents alike. The school Nature and Environment Clubs are being used as a platform for raising awareness on cleanliness and waste management. More recently, 'Zero Waste Hour'- an initiative launched by Her Majesty the Queen of Bhutan to instill positive behavior change towards proper waste management and practice sustainable consumption lifestyle for healthy and clean living environment is being observed on every 2nd day of the month.

8.3.2.12 Existing bylaws, regulations and policy on SWM in the Thromde

The Thromde Tshogde as being part of the Local Government is governed by the Local Government Act of 2009 and its enforcing Local Government Rules and regulations of 2012. It is therefore empowered with regulatory powers to improve the city's environment. However, the Waste Prevention and Management Regulation of 2012 mainly guides the Thromde in its solid waste management. It identifies various categories of wastes, and the regulation discusses the scope, responsibilities of various stakeholders, collection, transfer and segregation. Offences and penalties, financial mechanism and amendments are also clearly discussed. For municipal waste management, the regulation prescribes the responsibilities of the Thromdes, Dzongkhags as well as of Thromde inspectors, traders, scrap dealers, individual citizens and house owners. Responsibilities of construction sector, business and industrial sector in waste management are also covered. The regulation has specific rules for waste collection, transfer, segregation, transport and for waste recycling and composting.

8.3.2.13 Organization chart and number of the staff

Solid waste management in the Thromde/Municipal city of Phuentsholing is a responsibility the Environment Division which is manned by a total of 98 staff.

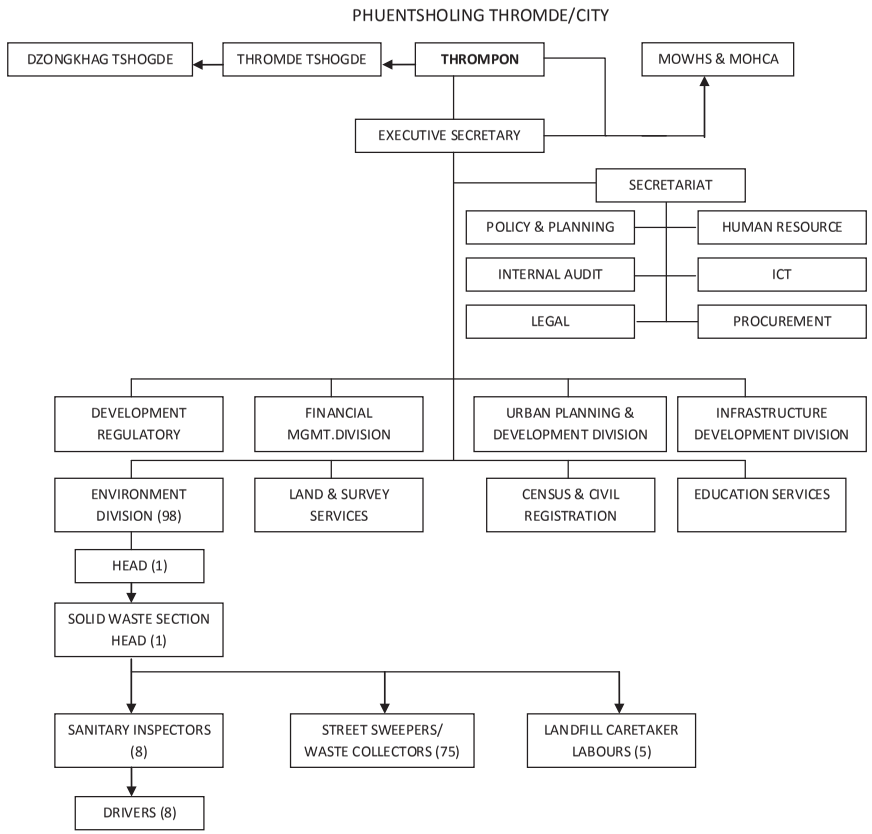


Figure 6: Organization Structure of Phuentsholing Thromde

The Environment Division is in-charge of the Solid Waste Management. The Division is entrusted with the following responsibilities:

- Issuing Environment Clearance as per 'Environment Assessment Act 2000';
- Beautification and Landscaping of the city;

- Management of urban waste in accordance with the 'Waste Management Act 2009' and its subsequent 'Waste Prevention and Management Regulation 2012' and management of urban forestry;
- Management of Waste Water and Sewerage services;
- Advocacy, social mobilization and public awareness creation on waste management, disasters and other environment issues.

The Division is currently headed by an Environment Officer, supported by one Solid Waste Section Head, 8 Sanitary Inspectors and 8 permanent drivers. A total of 80 Bhutanese and Non Bhutanese blue collared staff (75 street sweepers/waste collectors and 5 landfill caretaker labourers) also work in the Division.

8.3.2.14 SWM Revenue and Actual Expenditure in the past three years

Information gathered from key informants indicated that the Thromde administration has been receiving a subsidy grant of Nu 2 million for every financial year (see Table 8). However, the budget for the entire Thromde administration is maintained under one general budget head and no specific allocations has been made for Environment Division at the time of the survey. The Taxation Policy 2012 has not been implemented since there is no system of tariff/fee for waste collection at present. A small amount is said to have been included as part of the property tax in the past. However, the Taxation Policy is being considered to be implemented soon with an estimated revenue generation of about Nu 900,000 per month.

On the other hand, huge expenditure has been incurred to the tune of Nu14,801,920 every year for salary, fuel and maintenance cost for SWM vehicles.

Table 8: Revenue and Expenditure for WSM

Item	2016-2017	2017-2018	2018-2019
Revenue Heads (Actual) e.g. Subsidy from the central government, waste fee etc			
Subsidy	2 million	2 million	2 million
Total Revenue	2 million	2 million	2 million
Expenditure Heads (Actual) e.g. Salary for staff			
Salary	6,228,000	6,228,000	6,228,000
Fuel (8 vehicles)	5,213,920	5,213,920	5,213,920
Vehicle maintenance	3,360,000	3,360,000	3,360,000
Total Expenditure	**14,801,920**	**14,801,920**	**14,801,920**

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8.3.2.15 Tariff/fees for waste collection

There is no tariff/fee for waste collection. In order for the solid waste collection tariff/fee to be put in place, there is a need to carry out a classification of buildings by location/area and type of building in the near future.

8.3.2.16 General operation and maintenance for the cost for SWM

The items of cost for general operation and maintenance of SWM is presented in Table 9 below.

Table 9: General operation and maintenance for the cost for SWM

Items	Cost (Nu)
Average diesel cost (per litre)	64
Average engineer salary (per month)	23,000
Average technician salary (per month)	17,000
Average driver salary for collection / transportation vehicle (per month)	11,000
Average heavy equipment operator salary (per month)	17,000
Average labor cost (per month)	7,000

8.3.2.17 Any Other Donors/Partners supporting Waste Management

As shown in the Table below, the Eurpean Union assisted Phuentsholing Thromde from 2011-2014 through a project called SUNYA-Towards Zero Waste for waste management in the city.

Table10: Past Projects supported by donors/partners

Names of Donors/Partners	Project Period (yyyy/mm-yyyy/mm)	Category of Assistance Type (TC, Grant Aid, Loan)	Support summary
European Union	2011-2014 SUNYA-Towards Zero Waste	Grant Aid	Waste Management (collection, segregation, Recycling and disposal

8.3.3 Samdrup Jongkhar Thromde

8.3.3.1 Population and Area

As per the Population and Housing Census of Bhutan, 2017, the population of Samdrup JongkharThromde is 9,235. For 2018 to 2027, the Thromde population figures are derived based on the proportion of population residing in the Thromde in 2017, and the projected figures based on the Dzongkhag Population Projection 2017-2027.

Table 11: Population of Samdrup Jongkhar Thromde

Year	Population (Number)
2017	9,235[17]
2018	9,320
2019	9,314
2020	9,305
2021	9,294
2022	9,280
2023	9,272
2024	9,263
2025	9,250
2026	9,234
2027	9,214

The land area of Samdrup Jongkhar Thromde is 4.47 (km^2).[18]

17 Population and Housing Census of Bhutan, 2017, National Statistics Bureau.
18 Ibid

8.3.3.2 Land and Natural Conditions- Map of Samdrup Jongkhar

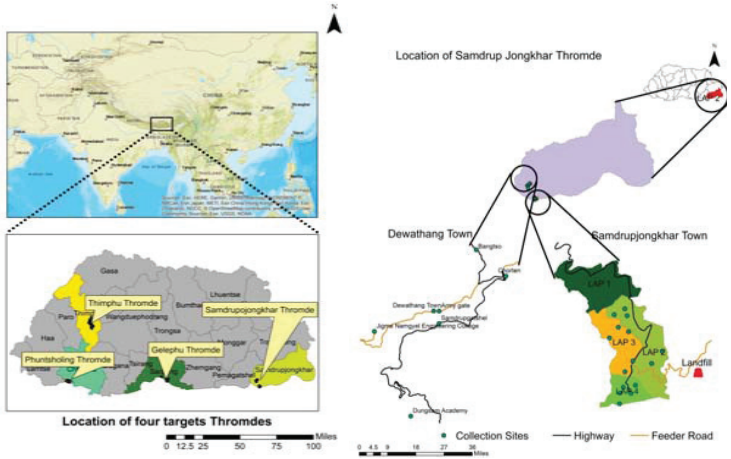

Figure 7: Map of Samdrup Jongkhar Thromde

8.3.3.3 Meteorological data in the past five years

The yearly total rainfall in Samdrup Jongkhar was lowest in 2018 with 3,277 mm and the highest was recorded in 2015 with 3,840 mm. So the Meteorological data available for Samdrup Jongkhar Thromde indicate that the annual mean rainfall for 2014 to 2018 ranged with the lowest of 273.12 mm in 2018 to the highest of 319.99 mm in 2015. While the lowest annual mean temperature was recorded at 19.45°C in 2015, the highest was recorded at 21.33°C in 2017. Although the questionnaire required monthly rainfall, temperature and evaporation data, humidity data was collected instead of evaporation. So the annual mean humidity recorded ranged from the lowest of 71.80 percent in 2014 to the highest of 74.38 percent in 2018.

Table 12: Meteorological data of Samdrup Jongkhar Thromde

Meteorological data	2014	2015	2016	2017	2018
Annual Total Rainfall (mm)	3,374.64	3,839.88	3,639.84	3,581.76	3,277.44
Average Monthly Rainfall (mm)	281.22	319.99	303.32	298.48	273.12
Average Monthly Temperature (°C)	20.95	19.45	21.19	21.33	20.74
Average Monthly Humidity (percent)	71.80	73.88	74.12	74.01	74.38

The weather station for Samdrup Jongkhar is located at Dewathang, which is about 18 km from main city centre.

8.3.3.4 Big scale dischargers and system of SWM data collection

In Samdrup Jongkhar Thromde /City, there are about 5 big scale dischargers: one vegetable market and one main town business centre in the core area. There is also one industrial area located under LAP 2 and a hospital in LAP 3. The Jigme Namgyel Engineering College and Army camp located 18 Kms away in Dewathang under Kibsey LAP are also considered as big scale dischargers by the Thromde.

The current system of solid waste data collection is rudimentary despite some data recordings done manually from time to time. Only partial weighbridge data is maintained by using a private weighbridge located in the core area due to long waiting time inconvenience. Although waste collection is segregated by dry and wet types at the household level, data collection and recording of waste disposal in terms of the type of disposal vehicles, capacity and quantity is not maintained.

8.3.3.5 Waste Flow

The current demarcations for solid waste management follow the LAP system in Samdrup Jongkhar. Based on key informant interviews, the municipal solid wastes are generated at the households, vegetable market, shops and institution levels. The wastes are being separated by dry and wet types and are stored in containers such as buckets, bins and carton boxes. In the commercial business areas and institutions, large wheel-bins, plastic trays, bamboo baskets, wire mesh containers, reused rice bags and large buckets are used.

Based on information gathered from Key informants at the Thromde Office, a total of 4 metric tons of solid wastes are generated per day, of which about 1.7 metric tons (includes 1 metric ton of paper/cardboards, 64 kg of plastics and 642 kg of glass/bottles) are separated by informal waste collectors. There are no established waste recoveries or transfer stations in Samdrup Jongkhar. Finally, a total of 2.3 metric tons of both dry and wet wastes are disposed off at the landfill site located 4 km away

at Tashipokto. The average per capita waste generation is 0.43 per person per day [19] in Samdrup Jongkhar.

It must be noted here though that the figures of waste flow obtained from recording of the week-long survey of waste amount disposed at the landfill may not necessarily match with this data due to differences in the source of the data and the method of data collection.

8.3.3.6 Storage and Discharge containers

The storage and discharge of wastes are typically done at three different places in the Thromde: at the households, vegetable markets/shops and institutions. In terms of discharge containers at the households, plastic bags (4-5 litres), buckets (5-10 litres) and carton boxes (5-10 litres) are being used. The discharge place or collection points are usually in front of the house and curbside.

At the vegetable markets, big wheel bins (100 litres) are provided. Other containers such as plastic bags (10 litres), buckets (20 litres), plastic trays (20 litres) and bamboo baskets (15-20 litres) are used. The discharge place or collection point is fixed in front of the market place/shops.

For institutions such as schools, offices and hospital, the storage and discharge containers are mainly big wheel bins (20 litres) and wire mesh containers (200-300 litres), plastic bag/bora (50 litres) and buckets (20 litres) are used. They are either discharged/collected from within the premises or from in front of the institutions.

8.3.3.7 Waste Collection services

Door to door and curbside waste collection services is extended to the resident population from 7:00 AM to 4:00 PM, for six days a week. The collection services are carried out on a fixed daily basis for both dry and wet wastes in all the four designated collection areas. The waste collection points in the city have been mapped using GPS. See Figure 8 below.

19 Samdrup Jongkhar Thromde.

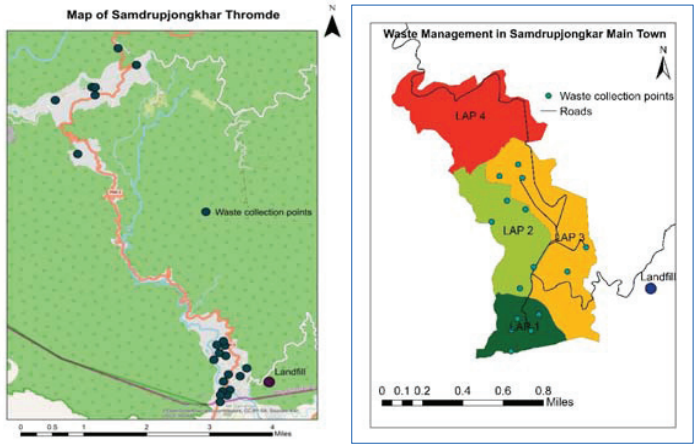

Figure 8: Waste Collection Map of Samdrup JongkharThromde

Although there are about 5 informal dry waste collectors, due to the small quantity of wastes generated, there is no plan for privatization of waste collection. Installation of incinerator in future is seen as one option to reduce solid waste.

8.3.3.8 Present Situation and Future plan for Recycling

Although segregation of waste is done by dry and wet types, presently there is no recycling activity/facility in the city. The Samdrup Jongkhar Initiative (SJI), a non-profit civil society organization collects and uses plastic wastes, to produce some products such as floor mats and bags among other activities.

Another private entrepreneur, (Egg Tray Factory) collects recyclable papers and cardboards/cartons to produce egg trays. Other scrap collectors also sells scrap papers/cartons to this factory in addition to the segregation of recyclable dry wastes such as pet bottles, plastics, metals, glass, beer bottles, paper/carton boxes etc. The survey found that only 1.7 tons of wastes per day are being recycled presently. Although there is no plan for establishing any recycling plant now, the Thromde administration sees the installation of an incinerator as a viable option to reduce solid waste in the near future.

8.3.3.9 Present Situation and Future plan for Mechanical workshops

There are 4 waste collection/disposal vehicles in Samdrup Jongkhar Thromde and there is also no mechanical workshop of its own to cater to the repairs and maintenance needs of these vehicles. Presently, the Thromde administration makes use of private automobile workshops to meet their needs for vehicle maintenance services. The Thromde administration makes use of an annual maintenance plan by calling quotation of price/rates for various maintenance services for its vehicles. The system of offering the service contract to the lowest evaluated bid is being followed, which is sometimes detrimental to the desired level of quality service. As such, there is no plan for establishing vehicle maintenance workshop of its own.

8.3.3.10 Present Situation and Future plan for Landfill site

The landfill of Samdrup Jongkhar Thromde is located at Tashi Pokto, about 4 Km from the main city centre. The landfill is said to be a 'controlled' type with a designated land area of 2.88 acres. The landfill was established around the year 2010, envisaged to be used for 20 years. Since it is in operation for about 10 years now, the landfill is expected to last for another 10 more years or so.

The landfill receives 2.3 tons/day of all three types of dry, wet and mixed wastes and has no leachate collection facility. At present, the landfill is manned by two staff who work 8 hours a day for 6 days a week from 9:00 AM to 5:00 PM. The landfill facility lacks a number of essential facilities such as truck scale/weighbridge, gate/fencing, control building, vehicle washing station and leachate collection and treatment. Environmental monitoring systems and processes are also not in place. The landfill does not see any informal waste pickers. Since the landfill is located at about 4 Km from the main city centre, there are no issues that concerns with residents living in an around the landfill. The landfill has one Excavator JCB JS 205 (148 hp) purchased in 2013with an Odometer reading of 2,457.407 hrs. and another small Robot Skid (56 hp) purchased in 2013 with an Odometer reading of 269.382 hrs. The Thromde administration is considering expanding the landfill site by increasing the dumping area, with improvement of the road leading to the landfill with proper drainage system. The parking area for the waste dumping vehicles also needs immediate improvement.

8.3.3.11 Other 'soft' activities related to SWM

Public information and education activities are being undertaken from time to time co-inciding with important national and international events. The ban on plastic use is being reinforced and the use of alternatives encouraged. School children are being used as agents of change to promote environment protection/cleanliness though mass cleaning activities/campaigns. In the recent times, the 'zero waste hour' initiative is being observed on the 2nd day of every month to reduce waste generation and management.

8.3.3.12 Existing bylaws, regulations and policy on SWM in the Thromde

The Waste Prevention and Management Regulation of 2012 is being used as the main guideline by the Thromde for solid waste management. It identifies various categories of wastes, and the regulation discusses the scope, responsibilities of various stakeholders, collection, transfer and segregation. Offences and penalties, financial mechanism and amendments are also clearly discussed. For municipal waste management, the regulation prescribes the responsibilities of the Thromdes, Dzongkhags/Districts as well as of Thromde inspectors, traders, scrap dealers, individual citizens and house owners. Responsibilities of construction sector, businesses and industrial sector in waste management are also clearly covered. The regulation has specific rules for waste collection, transfer, segregation, transport and for waste recycling and composting.

8.3.3.13 Organization chart and number of the staff

Solid waste management in the Thromde/Municipal city of Samdrup Jongkhar is a responsibility the Environment Division which is manned by a total of 36 staff.

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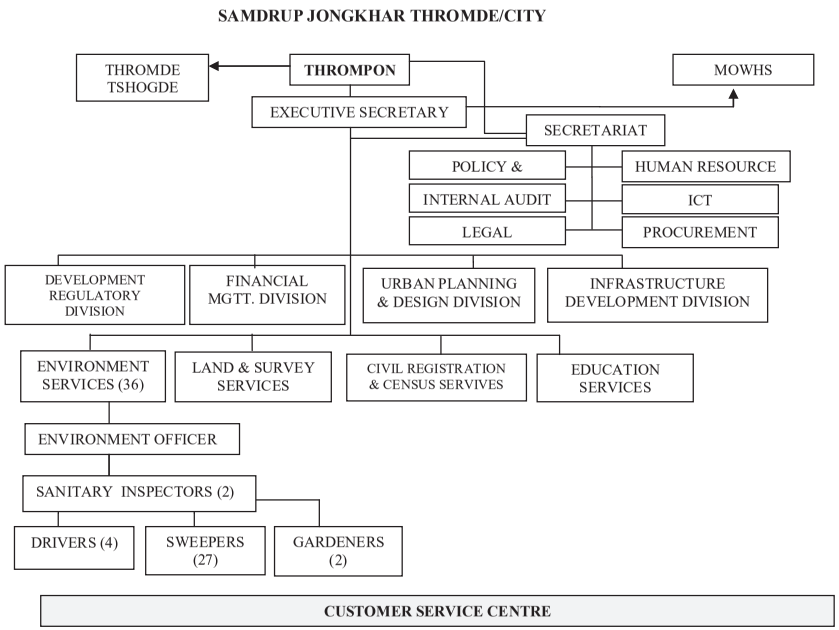

Figure 9: Organization Structure of Samdrup Jongkhar Thromde

The Environment Division is in-charge of the Solid Waste Management. The Division is entrusted with the following responsibilities:

- Issuing Environment Clearance as per 'Environment Assessment Act 2000';
- Beautification and Landscaping of the city;
- Management of urban waste in accordance with the 'Waste Management Act 2009' and its subsequent 'Waste Prevention and Management Regulation 2012' and management of urban forestry;
- Management of Waste Water and Sewerage services;
- Advocacy, social mobilization and public awareness creation on waste management, disasters and other environment issues.

The Division is currently headed by an Environment Officer, supported by two Sanitation Inspectors. The Division also employs 4 permanent drivers, 27 blue collared street sweepers (21 temporary and 6 permanent) and 2 gardeners).

8.3.3.14 SWM Revenue and Actual Expenditure in the past three years

Information received from key informants indicated that although some subsidy is received from the government, details of specific allocations made for Environment Division was not available at the time of the survey. However, the Thromde administration received a subsidy grant of Nu 7.8 million for the current 2019-2020 financial years (see Table 13). The Taxation Policy 2012 has not been implemented since there is no system of tariff/fee for waste collection at present. A small amount of Nu5 per unit is being levied uniformly as part of the property tax in the past. So the Taxation Policy is being considered for implementation in the near future.

On the other hand, expenditure has been incurred to the tune of over Nu 1.2 million every year for salary of staff. For fuel and maintenance cost of SWM vehicles, a total of over Nu4.1 million has been incurred from 2012-2019.

Table 13: Revenue and Expenditure of Gelephu Thromde for SWM

Item	2017-2018	2018-2019	2019-2020
Revenue Heads (Actual) e.g. Subsidy from the central government, waste fee etc			
Govt. subsidy (capital)	-	-	Nu 7.8 million
Total Revenue			Nu 7.8 million
Expenditure Heads (Actual) e.g. Salary for staff			
Salary (Env. Div. 36 staff)	Nu 1,236,810	Nu 1,275,450	
Fuel (4 SWM vehicles, one excavator and one Robot Skid) Vehicle maintenance	(2012-2019)	Nu 4,185,000	
Total Expenditure		Nu 5,460,450	

8.3.3.15 Tariff/fees for waste collection

There is no tariff/fee for waste collection. As per the Taxation Policy of 1992, a sum of Nu5 per unit per month is being levied irrespective of the type of buildings. Once the building types are classified, a uniform system of tariff/fee will be levied in the near future.

8.3.3.16 General operation and maintenance for the cost for SWM

Table 14: Monthly Operation and maintenance cost

Items	Cost (Nu)
Average diesel cost (per litre)	51-52
Average engineer salary (per month)	30,000
Average technician salary (per month)	15,000
Average driver salary for collection / transportation vehicle (per month)	12,000
Average heavy equipment operator salary (per month)	12,000
Average labor cost (per month)	7000

8.3.3.17 Any Other Donors/Partners supporting Waste Management

As shown in the Table 15 below, the SDP, Government of Indis assisted Samdrup Jongkhar Thromde from 2015-2016 through a project for provision of waste collection vehicles in the city.

Table 15: Past Projects supported by donors/partners

Names of Donors/Partners	**Project Period (yyyy/mm-yyyy/mm)**	**Category of Assistance Type** (TC, Grant Aid, Loan)	**Support summary** improvement
SDP, Govt. of India	2015-2016	Grant Aid	Provision of waste collection vehicles

A6-1-23

8.3.4 List of Waste Collection Vehicles

As stipulated by the Questionnaire under Component-1 survey, under 'Existing waste collection vehicles', an inventory of all waste collection/disposal vehicles was prepared in close consultation with Gelephu, Phuentsholing and Samdrup Jongkhar Thromdes/cities. The list and the details of vehicles are appended under the respective Thromdes at the concluding part of the Summary of Findings.

8.3.5 Landfill Site Conditions

As part of the Component 1 Questionnaire, the survey compiled a comparative snapshot details of the landfill conditions operated under the three Thromdes/cities of Gelephu, Phuentsholing and Samdrup Jongkhar as presented in Table 16. As mentioned under the Limitations of the study, it must be noted here that the quantity of waste (tons/day) received by the landfills may not be reliable.

Table 16: Comparative details of Landfills

Landfill details	Thromdes		
	Gelephu	**Phuentsholing**	**Samdrup Jongkhar**
Location (address)	Bhur, 11 km away from the main city centre.	Pekarzhing about 8 km from city	Tashipokto, situated at a distance of 4 km from the main city centre.
Area (hectare)	11 acres (4.4517 hectare)	7.25 acres (2.9340 hectare)	2.88 acres (1.1655 hectare)
Type of Landfill site (Open dump/ Controlled landfill/ Sanitary landfill)	Controlled sanitary landfill	Controlled	Controlled
Remaining Landfill capacity (m^3) and/or years	Design lifespan 30 years. Can be still used for another 19 years (3t/d).	Design capacity 10 t/d for 10 years. The landfill has long exceeded its operational period. Right now, the thromde is creating space in the landfill through land reclamation by removing old compacted wastes and transporting it to another section of the landfill. Actual dumping area only 1.35 acres.	The landfill was established around the year 2010, meant to be used for 20 years. As it is now in operation for about 10 years, the landfill is expected to last for another 10 more years or so.
Operation and Management of landfill site:			
Receiving waste quantity (t/d)	4.9	6.5	2.3
Receiving waste quality (wet, dry or mix)	Wet and dry waste only	All 3 types of wastes received	All three types of wastes received
Human resources (number of staffs)	1 caretaker	5 staff	2 staff
Working days and hours	9:00 AM to 5:00 PM (6 days per week).	8 hours/day (7 days per week)	9 AM to 5 PM (6 days per week)
Landfill facilities:			
Truck scale/ weigh bridge	None	None	None
Gate & fence	Yes	Small gate/ rudimentary fencing	Yes
Control building	No	None	None
Vehicle washing station	No	None	None
Leachate collection facility	There are two huge non functional leachate ponds.	Provision kept but not working.	None
Leachate treatment facility	No treatment facility. Only ponds.	There is a small non functional leachate collection facility.	None
Environmental Monitoring	None	None	None

(monitoring item, frequency, data collection etc.)			
Number and Situation of waste picker's activity at landfill site	None	None	No waste picker's activity. But the 2 staff may indulge in segregating recyclable wastes.
Relationship with residents around landfill site.	Good relations exist with surrounding residents.	The landfill existed since as long as 14 years ago, so any emerging environmental issue for nearby residents does not necessitate any responsibility to the Thromde authority.	No human habitation around the landfill.

Future plan /Requirements	Gelephu Thromde	Phuntsholing Thromde	Samdrup Jongkhar Thromde
Any construction plan and/or improvement of existing ones:	There is a need to carryout remedial work to make the leachate flow through the compaction area to the ponds below.	It is being speculated to convert the present landfill into a semi-aerobic one with natural ventilation and leachate collection facilities.	a. Considering to expanding the landfill site by increasing the dumping area, with improvement of the road leading to the landfill with proper drainage system. b. The parking area for the waste dumping vehicles also needs immediate improvement.
Procurement plan of heavy equipment	There is a plan to procure one excavator.	The need for one chain excavator for the landfill site was felt for quite sometime but this heavy equipment could not be procured due to financial/funding constraints.	None

A6-1-24

8.4 Findings on Component 2: Wastes amount disposed at Landfill sites

8.4.1 Summary - Thimphu Thromde

In order to estimate the amount of waste collected and reached at landfill sites, the information on wastes coming to Memelakha landfill site was recorded for a week (19 August-25 August 2019) using the record sheet (Annex 1). It recorded 152 vehicles during the week, ranging from 19 to 27 vehicles per day (Table 17).

Table 17: Number of vehicles that disposed wastes at Memelakha landfill site

Date	Number of vehicles	Percent
19/08/2019	20	13.2 %
20/08/2019	21	13.8 %
21/08/2019	23	15.1 %
22/08/2019	22	14.5 %
23/08/2019	19	12.5 %
24/08/2019	27	17.8 %
25/08/2019	20	13.2 %
Total	**152**	**100.0 %**

It is important to see the type of vehicles that were recorded during the week where the same vehicle was recorded that many times as it disposed the waste at the landfill site. Compactor truck (33.5 %) and container carrier (32.2 %) are most commonly used type of vehicles to dispose wastes at the landfill, followed by Tipper dump truck (15.8 %). Other types of vehicles such as Pick up, Tractor are also being used (See Figure 10)

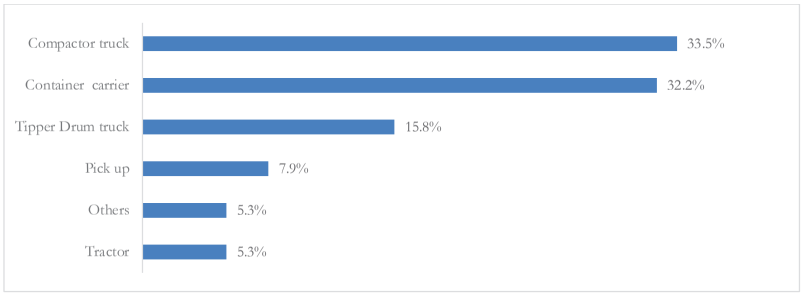

Figure 10: Type of waste disposal vehicle recorded at Memelakha landfill site

In order to estimate weight of the waste deposited at landfill sites, it is derived based on the following formula:

Weight (in tons) = Volume (m^3) x Conversion factor

Volume of waste in m^3 is calculated based on the capacity of the vehicle (m^3) and quantity of waste carried (expressed as %). The conversion factor used is 410 kg/m^3 which is the average of the dry and

wet waste conversion factors sourced from Ministry of Works and Human Settlement[20]. The same conversion factor is used to calculate for the other Thromdes as well. Summary of waste deposited at Memelakha landfill for one day is shown in Table 18. Today, the landfill is estimated to receive, on average 98 m^3 of waste per day which is equivalent to 40.2 tons per day.

Table 18: Solid waste disposed at the Memelakha landfill site in a day

Vehicle Type	M^3/day	Tons/day
Compactor Truck	35.0	14.4
Container Carrier	28.0	11.5
Tipper Dump Truck	22.2	9.1
Tractor	4.6	1.9
Pick-up	4.8	2.0
Others	3.4	1.4
Total	**98.0**	**40.2**

In Thimphu, based on the collection agents, during the one-week recording period, vehicles directly operated by Thimphu Thromde disposed 15 tons/day (37 %), followed by Clean City at 13.2 tons/day (33 %) and Greener Way at 10.7 tons/day (27 %). There were also other vehicles belonging to private or other organizations that disposed 1.3 tons/day (3 %).

Table 19: Type of Waste disposed at Memelakha landfill by different collection agents and type of waste

Wastes	Thimphu Thromde	Clean City	Greener Way	Others	Total
Dry	9.7	10.9	8.2	0.9	29.6
Mix	0.8	0.4	0.2	0.0	1.4
Wet	4.5	1.9	2.3	0.5	9.1
Total	**15.0**	**13.2**	**10.7**	**1.3**	**40.2**

From the total of 40.2 tons of waste per day, Figure 11 shows that about 73 percent of the waste disposed at the landfill site consists of dry waste, 23 percent wet, and the remaining less than four percent mix.

20 Dry waste-270 kg/m3, Wet waste-550 kg/m3

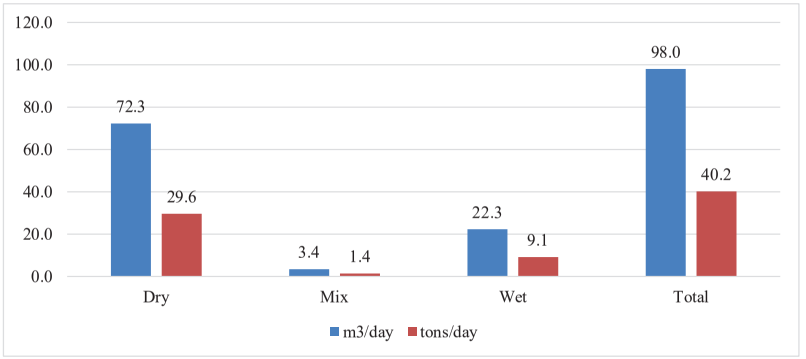

Figure 11: Types of wastes disposed at Memelakha landfill

Based on the Figure 11, we can also derive the ratio of source separation (SS) which is basically the total amount of dry and wet separated at source as percentage of the total waste. As shown in Table 20, the SS ratio for Thimphu is 96.5 percent indicating that 96.5 percent of the solid wastes is being separated at source.

Table 20: Ratio of Source separation in Thimphu Throme

Waste amount disposed (m^3/day)	Total amount Dry and Wet (m^3/day)	SS ratio (percent)
98.0	94.6	96.5

8.4.2 Summary - Phuentsholing Thromde

In order to estimate the amount of waste collected and reached at landfill sites, the information on wastes coming to Pekarzhing landfill site was recorded for a week (19 August-25 August 2019) using the record sheet (Annex 1). It recorded 51 vehicles during the week, ranging from 5 to 10 vehicles per day. The number of vehicles per day is shown in Table 21.

A6-1-25

A6-1-26

Table 21: Number of vehicles that disposed wastes at Pekarzhing landfill site

Date	Number of vehicles	Percent
19/08/2019	8	15.7 %
20/08/2019	10	19.6 %
21/08/2019	8	15.7 %
22/08/2019	5	9.8 %
23/08/2019	7	13.7 %
24/08/2019	7	13.7 %
25/08/2019	6	11.8 %
Total	**51**	**100.0 %**

In terms of the frequency of vehicle by type, an equal proportion of Compactor truck (62.7 %) and Container carriers (25.5 %) are commonly found used for disposing wastes at the landfill, followed by Tipper dump truck (11.8 %). Other types of vehicles such as Pick up, Tractor are also being used (See Figure 12).

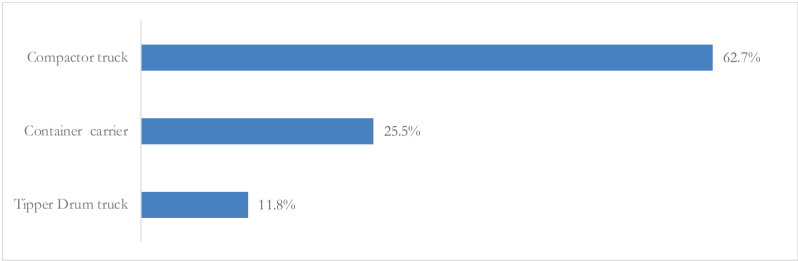

Figure 12: Type of waste disposal vehicle at Pekarzhing landfill site

Summary of waste deposited at Pekarzhing landfill for one day is shown in Table 22. Today, the landfill is estimated to receive, on average 35.3 m^3 of waste per day which is equivalent to 14.5 tons per day.

Table 22: Solid waste deposited at Pekarzhing landfill site in a day

Vehicle Type	M^3/day	Tons/day
Compactor Truck	26.0	10.6
Container Carrier	7.1	2.9
Tipper Dump Truck	2.3	0.9
Total	**35.3**	**14.5**

From the total of 14.5 tons of waste per day, Figure 13 below shows that more than half (57 %) of the waste disposed at the landfill site consists of mix waste, 25 percent dry, and the remaining 18 percent are wet waste. This indicates that source separation is an issue in Phuentsholing Thromde.

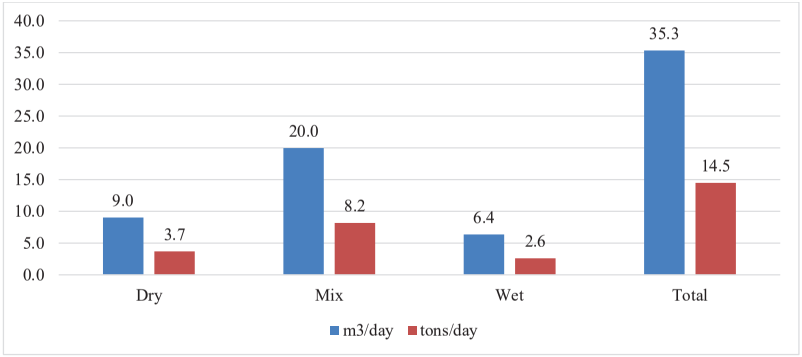

Figure 13: Types of wastes disposed at Pekarzhing landfill

Based on the Figure 13 above, the ratio of source separation (SS) which is 43.5 percent indicating that only 43.5 of the wastes taken to landfill is being separated at source.

Table 23: Ratio of Source separation in Phuentsholing Thromde

Waste amount disposed (m^3/day)	Total amount Dry and Wet (m^3/day)	SS ratio (percent)
35.3	15.4	43.5

Table 24: Inventory of Waste collection/disposal vehicles (Phuentsholing)

Vehicle Type	Plate No.	Manufacturer	Production Year	Mileage (km)	Volume (m3)	Volume recorded at landfill	Trips/day (Dry waste)	Trips/day (Wet waste)	Operation status	Odometer Reading KM
Refuse compactor	BG-2A-0725	Eicher	2011	2.1 Km/hr	7 M3	NA		1 trip	poor	41024
Refuse compactor	BG-2A-0782	TATA	2012	2.0 Km/hr	7 M3	8 M3	2 trip		poor	56789
Refuse compactor	BG-2A-0741	TATA	2011	2.0 Km/hr	7 M3	8 M3	2 trip		poor	46579
Refuse compactor	BG-2A-0927	TATA	2017	2.0 Km/hr	7 M3	8 M3	1 trip	1 trip	good	69980
Refuse compactor	BG-1-A-0807	TATA	20115	2.0Km /hr	7 M3	8 M3	2 Trip		good	45371
Tata Tripper	BG-2A-0472	TATA	2005	2.5Km /hr	5 M3	8 M3		2 trip	poor	54978
Dumper Placer	BG-2A-0784	TATA	2012	1.9 Km/hr	4M3	4 M3	5 trips		poor	76070
Dumper Placer	BG-2A-0857	TATA	2011	1.9 Km/hr	4M3	NA	5 Trips		under repair	48760

Note:

1. The Volume (m3) of the waste collection/disposal vehicles is provided by the Thromde and confirmed by YEC.

2. The volume recorded at landfill site is as per the Recording Sheet.

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8.4.3 Summary - Gelephu Thromde

In order to estimate the amount of waste collected and reached at landfill sites, the information on wastes coming to Bhur landfill site was recorded for a week (27th August–2nd September) using the record sheet (Annex 1). It recorded 17 vehicles during the week, ranging from 2 to 4 vehicles per day. The number of vehicles per day is shown in Table 25.

Table 25: Number of vehicles that disposed wastes at the Bhur landfill site

Date	Number of vehicles	Percent
27/08/2019	3	17.6 %
28/08/2019	3	17.6 %
29/08/2019	1	5.9 %
30/08/2019	4	23.5 %
31/08/2019	2	11.8 %
02/09/2019	4	23.5 %
Total	**17**	**100.0 %**

In terms of the frequency of vehicle by type, a high proportion of Compactor truck (76.5 %) followed by Tipper Dump Truck (23.5 %) are commonly found used vehicles for disposing wastes at the landfill (see Figure 14).

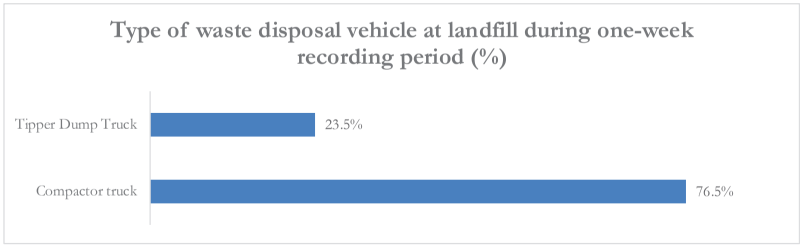

Figure 14: Type of waste disposal vehicle at Bhur landfill site

Summary of waste deposited at Bhur landfill for one day is shown in Table 26. Today, the Bhur landfill is estimated to receive, on average 12.5 m^3 of waste per day which is equivalent to 5.1 tons per day.

Table 26: Solid waste deposited at Bhur landfill site in a day

Vehicle Type	M^3/day	Tons/day
Compactor Truck	9.8	4.0
Tipper Dump Truck	2.7	1.1
Total	12.5	5.1

From the total of 5.1 tons of waste per day, Figure 15 shows that more than half (79 %) of the waste disposed at the landfill site consists of mix waste, 13 percent dry, and the remaining 8 percent are wet waste. This indicates that source separation is an issue in Gelephu Thromde.

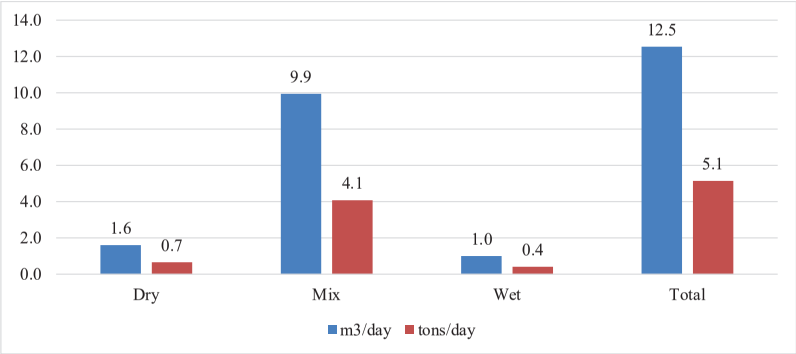

Figure 15: Types of wastes disposed at Bhur landfill

Based on Figure 15 above, the ratio of source separation (SS) in Gelephu is 20.7 percent indicating that only one-fifth of the wastes taken to landfill is being separated at source.

Table 27: Ratio of Source separation in Gelephu Thromde

Waste amount disposed (m^3/day)	Total amount Dry and Wet (m^3/day)	SS ratio (percent)
12.5	2.6	20.7

Table 28: Inventory of Waste collection/disposal vehicles (Gelephu)

Waste collection/ Disposal Vehicles	Registration number	Manufacturer	Production year	Mileage KM	Volume (m^3)	Volume recorded at landfill	Trip/ day (Dry)	Trip/ day (Wet)	Operation status	Odometer reading (km)
Compactor Truck	BG-3A-0090	TMC Toyota	2008	3.5 KM/ltr.	6 m^3	8 m^3	1 trip on alternate day	1 trip on alternate day	Under repair	98,351
Dump Truck	BG-3A-0165	TATA	2012	2.5 KM/ltr.	8 m^3	8 m^3	1 trip on alternate day	1 trip on alternate day	good	54,000
Compactor Truck	BG-3A-0173	Pro 1110	2016	2.5 KM/hr.	7 m^3	8 m^3	1 trip on alternate day	1 trip on alternate day	good	31,660
Compactor Truck	BG-3A-0175	TATA LPT 1109	2017	2.5 KM/hr.	7 m^3	8 m^3	1 trip on alternate day	1 trip on alternate day	good	24,960

Note:

1. The Volume (m^3) of the waste collection/disposal vehicles is provided by the Thromde and confirmed by YEC

2. The volume recorded at landfill site is as per the Recording Sheet.

8.4.4 Summary - Samdrup Jongkhar Thromde

In order to estimate the amount of waste collected and reached at landfill sites, the information on wastes coming to Tashipokto landfill site was recorded for a week (26th August–31st August) using the record sheet (Annex 1). It recorded 19 vehicles during the week, ranging from 3 to 4 vehicles per day. The number of vehicles per day is shown in Table 29.

Table 29: Number of vehicles that disposed wastes at the Tashipokto landfill site

Date	Number of vehicles	Percent
26/08/2019	3	15.8 %
27/08/2019	3	15.8 %
28/08/2019	3	15.8 %
29/08/2019	4	21.1 %
30/08/2019	3	15.8 %
31/08/2019	3	15.8 %
Total	**19**	**100.0 %**

In terms of the frequency of vehicle by type, a high proportion of Compactor truck (63.3 %) followed by Tipper Dump Truck (36.8 %) are commonly found used vehicles for disposing wastes at the landfill (see Figure 16).

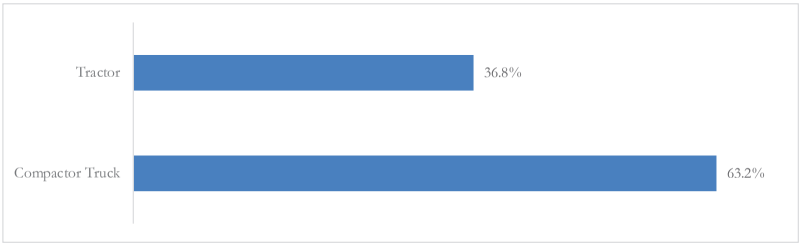

Figure 16: Type of waste disposal vehicle at Tashipokto landfill site

Summary of waste deposited at Tashipokto landfill for one day is shown in Table 30. Today, the Tashipokto landfill is estimated to receive, on average 11.8 m^3 of waste per day which is equivalent to 4.8 tons per day.

Table 30: Solid waste deposited at Tashipokto landfill site in a day

Vehicle Type	M^3/day	Tons/day
Compactor Truck	10.0	4.1
Tractor	1.8	0.7
Total	**11.8**	**4.8**

From the total of 4.8 tons of waste per day, Figure 17 shows that more than two-third (70 %) of the waste disposed at the landfill site consists of dry waste, 24 percent wet, and the remaining six percent are mix waste.

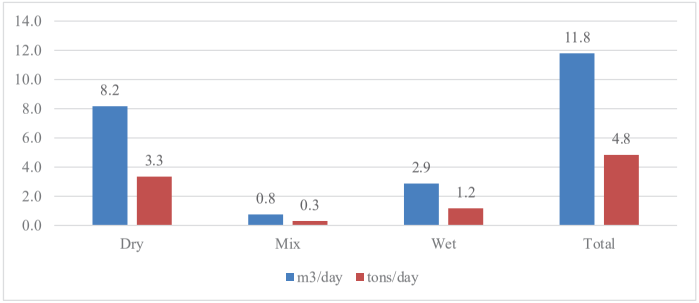

Figure 17: Types of wastes disposed at Tashipokto landfill

Based on Figure 17, the ratio of source separation (SS) in Gelephu is 93.6 percent indicating about 94 percent of the wastes taken to landfill is being separated at source. This indicates that source separation is an not really an issue in Samdrup Jongkhar Thromde.

Table 31: Ratio of Source separation in Samdrup Jongkhar Thromde

Waste amount disposed (m^3/day)	Total amount Dry and Wet (M^3/day)	SS ratio (Percent)
11.8	11.0	93.6

Table 32: Inventory of Waste collection/disposal vehicles (Samdrup Jongkhar)

Waste collection/ Disposal Vehicles	Registration number	Manufacturer	Production year	Mileage KM	Volume (m^3)	Volume recorded at landfill site	Trip/ day (Dry)	Trip/ day (Wet)	Operation status	Odometer reading (km)
Garbage Truck	BG-4A-0194	TATA	2014	1.5 KM/ltr.	13.8 m^3	NA	1 trip	1 trip	Under repair	28,000
Garbage Truck	BG-1A-0808	TATA	2016	2.5 KM/ltr.	7 m^3	8 m^3	1 trip	1 trip	good	17,180
Garbage Truck	BG-1A-0203	TATA	2016	2.0 KM/hr.	7 m^3	8 m^3	1 trip	1 trip	good	21,345
Hydraulic Tractor	BG-4A-0012	Sonalika	2016	Not known	3.3 m^3	4 m^3	2 trips	2 trips	good	782.8/hr.

Note:

1. The Volume (m^3) of the waste collection/disposal vehicles is provided by the Thromde and confirmed by YEC.
2. The volume recorded at landfill site is as per the Recording Sheet.

8.5 Comparative Analysis of Waste disposals in Gelephu, Phuentsholing and Samdrup Jongkhar Thromdes

It is important to see the type of vehicles that were recorded during the week. In terms of the frequency of vehicle by type, Compactor truck is more popular in all the three Thromdes: 77 percent in Gelephu, 63 percent in Phuentsholing and 63 percent in Samdrup Jongkhar. However, the second most popular vehicle varies across the Thromdes: Tipper Dump Truck in Gelephu (with 24 percent), Container Carrier in Phuentsholing at 26 percent, and Tractor in Samdrup Jongkhar at 37 percent (Figure 18).

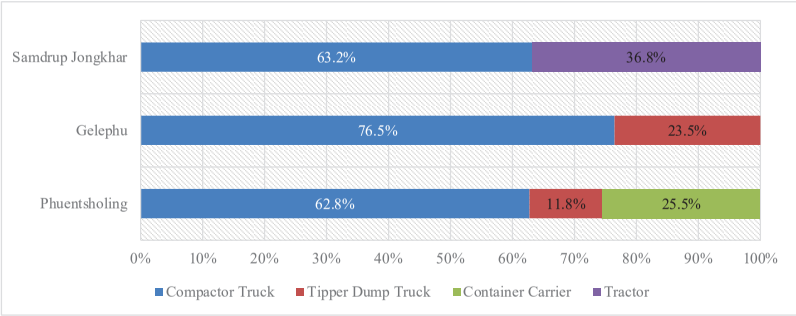

Figure 18: Type of waste disposal vehicle at landfill during one week recording period

In terms of the vehicle type, in all three Thromdes of Phuentsholing, Gelephu and Samdrup Jongkhar, Compactor Truck is the most popular transport used to deposit the solid waste: 85 percent of the solid wastes is being deposited at Gelephu landfill site, 74 percent in Phuentsholing and over 78 percent in Samdrup Jongkhar. Tipper Dump Truck is used in Phuentsholing which disposed 7 percent of the wastes while in Samdrup Jongkhar, it disposed 22 percent. Container carrier has disposed at least one-fourth of the solid waste in Phuentsholing, whereas no container carrier is being used in Gelephu and Samdrup Jongkhar. Tractor has disposed about one-sixth of the solid waste in Gelephu where no tractor is used in other two Thromdes (Table 33).

Table 33: Quantity and Proportion of wastes by different types of vehicles in a day

Type of Vehicle	Gelephu		Phuentsholing		Samdrup Jongkhar	
	Quantity of waste (m^3)	Proportion	Quantity of waste (m^3)	Proportion	Quantity of waste (m^3)	Proportion
Compactor Truck	10.0	84.8%	26.0	73.5%	9.8	78.1%
Tipper Dump Truck	0.0	0.0%	2.3	6.5%	2.7	21.9%
Container Carrier	0.0	0.0%	7.1	20.0%	0.0	0.0%
Tractor	1.8	15.2%	0.0	0.0%	0.0	0.0%
Total	**11.8**	**100.0%**	**35.3**	**100.0%**	**12.5**	**100.0%**

A6-1-30

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A6-1-31

List of Key Informants met/interviewed during the SWM Survey

Thimphu Thromde

1. Mr. Kinley Dorjee, Thrompon
2. Ms.Tshering Yangzome, Environment Officer
3. Mr. Karma Dorji, Planning Officer

Gelephu Thromde

1. Ms. Tashi Wangmo, Executive Secretary
2. Mr. Karma Gyeltshen, Senior Sanitary Inspector
3. Mr.Ugyen Dorji, Chief Engineer

Phuentsholing Thromde

1. Mr. Uttar Man Rai, Thrompon
2. Mr.Lhendup, Senior Environment Officer
3. Mr.Jamtsho Dukpa, Head, Waste Management Division

Samdrup Jongkhar Thromde

1. Mr. Karma Sherab Thobgyal, Thrompon
2. Mr. Cheda Jamtsho, Planning Officer
3. Mr. Sonam, Sanitary Inspector
4. Mr.Dorji Gyalpo, Sanitary Inspector

Annex A: COMPONENT 1: QUESTIONNAIRE

Preparatory Survey on

The Project for Improvement of Solid Waste Management Equipment in Bhutan

Yachiyo Engineering Co., Ltd.

This Questionnaire is to understand the current situation and future plan of solid waste management (SWM) of the target Thromdes. As the answers are the bases of basic design of equipment requirements, please respond to the best of your knowledge

Name of Thromde:……

1. General Information of the Thromde

1.1 Population and Area

	Local Area Plan (LAP)						Thromde
Population (in 2017)*							
Area (km^2)							

**Include the projected population from 2018 to 2030 if available (2023 is must)*

1.2 Land and Natural Conditions

1.2.1 Is there any **topographic map** of the Thromde?

a) Yes (If Yes, request for a copy)

b) No

1.2.2 Is there any **land use map** of the Thromde?

a) Yes (if Yes, request for a copy)

b) No

1.2.3 Natural Conditions of the Thromde: Meteorological data in the past five years

Meteorological data	2014	2015	2016	2017	2018
Monthly Rainfall (mm)					
Monthly temperature (°C)					
Monthly evaporation (mm)					

1.3 Big-scale discharger of waste, such as markets etc.

	Local Area Plan (LAP)						Thromde
Number of Market (vegetable market)							
Big-scale Dischargers (Institution building, hospital, hotel, industry facilities)							
Other							

2. General information on SWM

2.1 Data Collection

Agency/company	What is the current system of SWM data collection?	What are the standardized rules about the definition of data and data collection?
Environment Division (or concerned division) of Thromde		
Private company 1 name:		
Private company 2 name:		
Private company 3 name:		
Other (specify):		

2.2 Flow of SWM

Please present (or attach) the flowchart of the municipal wastes in each stage, i.e. generation, source separation if any, intermediate treatment, final disposal, with numerical data (ton/day or m^3/day)

Stages of waste flow	Value or Quantity	Tick the appropriate unit
Generation stage		□ **ton/day** □ **m^3/day**
Source separation (if any)		□ **ton/day** □ **m^3/day**

A6-1-32

Intermediate treatment		□ **ton/day** □ **m^3/day**
Final disposal		□ **ton/day** □ **m^3/day**

3. Present situation and Future plan of waste collection

3.1 Waste Generation amount and Waste Collection rate

	Collection Agent (collect for each agent including for Thromde)						**Total**
	Thromde						
1. Unit of Waste generated (kg/capita/day)							
2. Generated Amount (t/d)							
Household Waste							
Market Waste							
Others (specify)_____							
3. Collection Amount (t/d)							
Household Waste							
Market Waste							
Others (specify)_____							
4. Collection Coverage Rate (%)							
5. Recycling Amount (t/d)							
6. Disposal Amount (t/d)							

Please provide weighbridge data or incoming vehicle records on landfill sites. If the amount can be divided into dry, wet and mix waste, please list them separately

A6-1-33

3.2 Waste Discharge for Households

Storage and Discharge Container and its average volume (litre)	□Drum (…..litre) □Wheel bin (…..litre) □Wire mesh container (…… litre) □Plastic bag (….. litre) □Curb board (…… litre) □Buckets (…… litre) □Others（ ）
Discharge Place	□In front of house □Curbside □Communal container □Station □Others（ ）

3.3 Waste Discharge for vegetable Market

Storage and Discharge Container and its average volume (litre)	□Drum (…..litre) □Wheel bin (…..litre) □Wire mesh container (…… litre) □Plastic bag (….. litre) □Curb board (…… litre) □Buckets (…… litre) □Others（ ）
Discharge Place	□In front of house □Curbside □Communal container □Station □Others（ ）

3.4 Waste Discharge for Institutions and others

Storage and Discharge Container and its average volume (litre)	□Drum (…..litre) □Wheel bin (…..litre) □Wire mesh container (…… litre) □Plastic bag (….. litre) □Curb board (…… litter) □Buckets (…… litre) □Others（ ）
Discharge Place	□In front of house □Curbside □Communal container □Station □Others（ ）

3.5 Waste Collection Service by the Thromde

Working days	**days/week**
Working hour and shifts	Hours (: - :) Shifts
Collection method	□ Door to door collection □ Curbside collection □ Station collection □ Others ( )
Collection Frequency	( ) times/week
Collection time	□ Fixed □ Unfixed

Please attach the map showing the coverage area of waste collection service

3.6 Waste collection by the Private Company (Name of company:_____)

Working day	**…….. days/week**
Working hour and shift	Hours (: - :) Shifts
Collection method	□ Door to door collection □ Curbside collection □ Station collection □ Others ( )
Collection Frequency	( ) times/week
Collection time	□ Fixed □ Unfixed

Please attach the map showing the coverage area of waste collection service

3.7 Waste collection by the Private Company (Name of company:_____)

Working day	**…….. days/week**
Working hour and shift	Hours (: - :) Shifts
Collection method	□ Door to door collection □ Curbside collection □ Station collection □ Others ( )
Collection Frequency	( ) times/week
Collection time	□ Fixed □ Unfixed

Please attach the map showing the coverage area of waste collection service

4. Existing Waste Collection Vehicles

Refer and use the attached Excel sheet "Inventory of Collection Vehicles of Thromde"

4.1 Existing Containers for container carrier collection

Local Are Plan (LAP)	Number	Capacity (m^3)

4.2 Privatization of waste collection

Please explain present situation and future plan on privatization of waste collection:

Please attach the contract document with private company, if any.

5. Present situation and future plan of Recycling activity and Recycling facility

5.1 Present situation on existing recycling activities and facilities

Please explain the recycling activities by the local government and private sector. 1) By Thromde 2) By private company (name_____) 3) By private company (name_____) 4) Others
Please explain the current status of the recycling facilities 1) By Thromde Administration 2) By private company (name_____)

3) By private company (name_____)
4) Others

5.2 Future plan of recycling activities and facilities

Please explain future plans for recycling activities
1) By Thromde Administration
2) By private company (name_____)
3) By private company (name_____)
4) Others
Please explain construction plan of the recycling facilities
1) By Thromde Administration
2) By private company (name_____)
3) By private company (name_____)
4) Others

6. Present situation and future plan of Transfer Stations

6.1 Present situation of existing transfer stations

Item	Transfer station-1	Transfer station-2
Location		
Capacity		
Facilities		
Operation equipment		
Operation hours		
Staff numbers		

6.2 Existing waste transportation vehicles from transfer station to landfill site (if any)

Item (eg. Trailer)	Registration no.	Manufacturer	Purchase year	Odometer reading (km)	Operation status	Capacity ton or m^3	Trip/week

6.3 Future plan of transfer station

Please explain construction plans on new transfer stations and/or improvement of existing ones:

7. Present situation and future plan of mechanical workshop for vehicle maintenance

7.1 Present situation on the existing workshop

Please explain maintenance system, such as workshop location, number of bays, condition of garage, main maintenance equipment, number of the staffs, inspection and maintenance method, spare parts management:
a) Thromde administration owned workshop
b) Private workshop

7.2 Future plan of mechanical workshop

Please explain construction plans on new mechanical workshop and/or improvement of existing ones:

8. Present situation and future plan of landfill sites

8.1 Present situation on the existing landfill sites

Item	Landfill site-1	Landfill site-2	……
Location (address)			
Area (hectare)			
Type of Landfill site (Open dump/ Controlled landfill/ Sanitary landfill)			
Remaining Landfill capacity (m^3) and/or years			
Operation and Management of landfill site			
Receiving waste quantity (t/d)			
Receiving waste quality (wet, dry or mix)			
Human resources (number of staffs)			
Working days and hours			
Landfill facilities;			
Truck scale/ weigh bridge			
Gate & fence			
Control building			
Vehicle washing station			
Leachate collection facility			
Leachate treatment facility			
Others			
Environmental Monitoring (monitoring item, frequency, data collection etc.)			
Number and Situation of waste picker's activity at landfill site			
Relationship with residents around landfill			

A6-1-36

Item	Landfill site-1	Landfill site-2	……
site			

Please provide the topographic map and/or GIS map of the landfill site

8.2 Existing Heavy Equipment for landfill operation

Item (eg. Bull dozer)	Capacity (Hp)	Purchase year	Odometer reading (Km)	Name of landfill site (LFS)

8.3 Future plan on Landfill Site

a) Please explain candidate sites, construction plans and/or improvement of existing ones: b) Procurement plan of heavy equipment

9. Other facilities and activities related to SWM

Please explain other SWM activities, such as community activities, clean campaign, environmental education etc.:

10. Legislation, organizational and financial situation of the Thromde

10.1 Existing bylaws, regulations and strategies on SWM in Bhutan

Please explain existing bylaw, regulations, strategies on SWM in Bhutan:

10.2 Existing bylaws, regulations and policy on SWM in the Thromde

Please explain existing bylaw, regulations, policy on SWM in the Thromde:

10.3 Future plan on SWM in the Thromde

Please explain the future plan on SWM (SWM master plan):

Please attach the future plan on SWM

10.4 Organization chart and number of the staffs

Please explain the organization structure of the Thromde and SWM in-charge division, responsibility and number of staffs (permanent/temporary).

***Please attach the organization chart including No. of staff**

10.5 Responsibility demarcation for SWM

Organization		● **Responsibility Demarcation (eg:** *To develop law and regulations on SWM, To supervise the operation of waste collection and transportation, workshop, landfill and other activities related to SWM done by city)*
Central Government	Prime Minister's Office	
	GNHC	
	NEC	
	MoWHS	
Local Government	Thromde Administration	

10.6 SWM Revenue and Actual Expenditure in the past three years

Item	**2016**	**2017**	**2018**
1) Revenue Heads (Actual) *Eg. Subsidy from the central government, waste fee etc*			
Total Revenue			

2) Expenditure Heads (Actual) Eg. *Salary for staff*			
Total Expenditure			

***Please attach Annual Budget Book/Financial Reports for the past three years**

10.7 Tariff/fees for waste collection

Present situation: Future plan:

10.8 Waste fee collection rate in the past three years

Item	**2016**	**2017**	**2018**
SWM fee collection ratio (%)			

10.9 General operation and maintenance for the cost for SWM

Item	**Cost (Nu)**
Average diesel cost (per liter)	
Average engineer salary (per month)	
Average technician salary (per month)	
Average driver salary for collection / transportation vehicle (per month)	
Average heavy equipment operator salary (per month)	
Average labor cost (per month)	

11. Any Other Donors/Partners supporting Waste Management

Names of Donors/Partners	**Project Period (yyyy/mm-yyyy/mm)**	**Category of Assistance Type** (TC, Grant Aid, Loan)	**Support summary (eg.** 1.Waste collection improvement

			2.Landfill improvement

12. Other relevant information

A6-1-38

Annex B: COMPONENT 2 RECORDING SHEET

(WASTE AMOUNT TO BE DISPOSED AT LANDFILL SITES)

To be completed at each Landfill site for all types of vehicles with Dry and Wet waste disposals in all four Thromdes.

Thromde name:……**Date**:……

A1	Interviewer	
A2	Interviewee	
A3	Company Name (if private)	

1. Basic Information

1.1	Time of Arrival	____:_____ AM/PM	Time of Departure	____:_____ AM/PM
1.2	Vehicle Number			
1.3	Driver's Name			
1.4	Number of crewmen/Helper			

2. Collection Areas

2.1	Name of LAP/Area/Zone		
2.2	Name of Housing estate/market/institution		
2.3	Name of Road		
2.4	Type of Wastes: □ Wet □ Dry **(Use √ mark)**	□Residential	□Housing estate
		□Market	□Hospital
		□Institution	□Commercial business
		□Construction Company	□Road wastes
		□ Informal sector RORO points	□Mixed (HH/Commercial/roads)

3. Carrying Capacity of vehicles and tonnage using visual inspection/question to Driver (Use √ mark)

	Vehicle Type	Capacity	Estimated waste Quantity					
3.1	□Compactor truck	□4m^3	□100 %	□80 %	□60 %	□40 %	□20 %	□0
		□6m^3	□100 %	□80 %	□60 %	□40 %	□20 %	□0
	(Record if capacity is more than 10m^3) →	□8m^3	□100 %	□80 %	□60 %	□40 %	□20 %	□0
		□10m^3	□100 %	□80 %	□60 %	□40 %	□20 %	□0
3.2	□Tipper Dump truck	□5m^3	□100 %	□80 %	□60 %	□40 %	□20 %	□0
		□6m^3	□100 %	□80 %	□60 %	□40 %	□20 %	□0
		□8m^3	□100 %	□80 %	□60 %	□40 %	□20 %	□0
		Capacity						
3.3	□Container carrier	□2m^3	□4m^3	□6m^3				
3.4	□Tractor	□2m^3	□4m^3					
3.5	□Pick-up	□2m^3	□4m^3					
3.6	□ Others	□2m^3	□4m^3					

4. Remarks:

A6-1-39

Annex-C: DATA OF INCOMING VEHICLES TO LANDFILL SITES

SL.N	Landfill	Date	Interviewer	Interviewee	Company name (if private)	Time of arrival	time of Departure	Vehicle Number	Driver's name	Number of crewmembers	Name of LAP/Area/Zone	Name of Housing estate/market/institution	Name of Road	Type of Wastes	Area	Vehicle Type	Capacity	Estimated waste Quantity
1	Gelephu Thromde	27-Aug-19	Dorji Wangdi	Kamla Rai	Thromde	8.00 AM	8.30 AM	BG-3-A0930	Kamal Rai			Tali Dratshang, Kuendrup HSS, Hospital area		Mix	Residential, market, institution, housing estate, hospital	Compactor Truck	6	80
2	Gelephu Thromde	27-Aug-19	Dorji Wangdi	Phub Dorji Tamang	Thromde	3.09 PM	3.15 PM	BG-3-A0175	Phub Dorji Tamang	2		Core town, BOD, RBP, Fishery Area		Wet	Residential, market, institution	Compactor Truck	7	100
3	Gelephu Thromde	27-Aug-19	Dorji Wangdi	Karma Tenzin	Thromde	3.40 PM	3.50 PM	BG-3-A0175	Karma Tenzin	2		Forest colony Town, Housing, LSS, main gate		Mix	Mixed	Compactor Truck	7	60
4	Gelephu Thromde	28-Aug-19	Dorji Wangdi	Kamla Rai	Thromde	3.55 PM	4.10 PM	BG-3-A0930	Kamal Rai	2		Fishery, Hospital, Kuendrup HSS, Tali Dratshang, BFF, Tali Dratshang		Mix	Residential, Institution, housing estate, hospital, commercial	Compactor Truck	8	80
5	Gelephu Thromde	28-Aug-19	Dorji Wangdi	Karma Gyeltshen	Thromde	11.00 PM	11.10 PM	BG-3-A0185	Karma Gyeltshen	2		HSS, Customs office, sawmills, AWP, YDF, Thromde office		Dry	Residential, Market, Institution, Housing estate	Tipper Dump Truck	8	60
6	Gelephu Thromde	28-Aug-19	Dorji Wangdi	Phub Dorji Tamang	Thromde	3.50 PM	4.00 PM	BG-3-A0175	Phub Dorji Tamang	2		RSTA office, truck parking, veg market, BOB		Mix	Residential, market, institution, housing estate, hospital	Compactor Truck	7	100
7	Gelephu Thromde	29-Aug-19	Dorji Wangdi	Phub Dorji	Thromde	1.10 PM	1.23 PM	BG-3-A0175	Phub Dorji Tamang	1		Bank, RSTA, malaria office, veg market		Mix	Residential, market, institution	Compactor Truck	7	60
8	Gelephu Thromde	30-Aug-19	Dorji Wangdi	Phub Dorji Tamng	Thromde	4.25 PM	4.30 PM	BG-3-A0175	Phub Dorji Tamang	2		RICB, RSTA, veg market, truck parking		Mix	Mixed	Compactor Truck	7	100
9	Gelephu Thromde	30-Aug-19	Dorji Wangdi	Karma Gyeltshen	Thromde	3.50 PM	4.00 PM	BG-3-A0185	Karma Gyeltshen	2		HSS, MSS, customs office, sawmill		Dry	Residential, market, institution, housing estate	Tipper Dump Truck	8	80
10	Gelephu Thromde	30-Aug-19	Dorji Wangdi	Karma Tenzin	Thromde	4.50 PM	5.00 PM	BG-3-A0175	Karma Tenzin	2		Hospital, main gate, LSS, Auction Yard		Mix	Residential, institution, market	Compactor Truck	7	80
11	Gelephu Thromde	30-Aug-19	Dorji Wangdi	Kamal Rai	Thromde	3.39 PM	3.45 PM	BG-3-A0930	Kamal Rai	2		Fishery area, hospital, Kuendrup, BFF, Tali Dratshang		Mix	Mixed	Compactor Truck	8	60
12	Gelephu Thromde	31-Aug-19	Dorji Wangdi	Phub Dorji	Thromde	3.15 PM	3.20 PM	BG-3-A0175	Phub Dorji Tamang	2		RSTA office, malaria office, truck parking, veg market		Mix	Residential, market, institution	Compactor Truck	7	80
13	Gelephu Thromde	31-Aug-19	Dorji Wangdi	Karma Gyeltshen	Thromde	3.30 PM	3.40 PM	BG-3-A0185	Karma Gyeltshen	2		Customs office, sawmill, AWP, Industrial area		Mix	Residential, Institution, Housing estate, mixed	Tipper Dump Truck	8	80
14	Gelephu Thromde	2-Sep-19	Dorji Wangdi	Karma Tenzin	Thromde	4.30 PM	4.35 PM	BG-3-A0175	Karma Tenzin	2		Hospital, main gate, LSI, RBP, Workshop, BOD		Mix	Residential, market, institution, hospital	Compactor Truck	7	80
15	Gelephu Thromde	2-Sep-19	Dorji Wangdi	Phub Dorji	Thromde	4.45 PM	4.50 PM	BG-3-A0175	Phub Dorji Tamang	2		TCC office, Clock Tower, Veg market, RICB, Public ground		Mix	Mixed	Compactor Truck	7	80
16	Gelephu Thromde	2-Sep-19	Dorji Wangdi	Karma Gyeltshen	Thromde	3.00 PM	3.05 PM	BG-3-A0185	Karma Gyeltshen	2		BOD, AWP, Traffic office, Labor office		Mix	Residential, market, Housing estate, commercial business	Tipper Dump Truck	8	80
17	Gelephu Thromde	2-Sep-19	Dorji Wangdi	Kamal Rai	Thromde	4.00 PM	4.05 PM	BG-3-A0930	Kamal Rai	2		Fishery, hospital, BFF, Kuendrup, Tali Dratshang		Mix	Residential, market, institution	Compactor Truck	6	60
1	Pauntsholing Thromde	23/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	11.00 AM	11.15 AM	BG-2-A0784	Tshering Wangdi	1	9	Pasakha		Mix		Container Carrier	4	100
2	Pauntsholing Thromde	24/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	7.00 AM	7.10 AM	BG-2-A0784	Tshering Wangdi	1		Ramety Reldi, CST, Pasakha		Mix	Residential, Market, Institution, Commercial business and Mixed	Container Carrier	4	100
3	Pauntsholing Thromde	22/08/2019	Dorji Wangdi	D.B Pradhan	Thromde	9.55 AM	10.20 AM	BG-3-A0472	D.B.Pradhan	2		Veg. Market, Main Town, Toorsa Khola, Druk Hotel		Wet	Market	Tipper Dump Truck	5	40
4	Pauntsholing Thromde	19/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	6.00 PM	6.15 PM	BG-2-A0927	Tshering Dorji	1	PWD Area, Dungkhag	Bank, Colony		Dry	Residential,Market, Institution,Housing estate, Road	Compactor Truck	7	40
5	Pauntsholing Thromde	25/08/2019	Dorji Wangdi	D.B Pradhan	Thromde	10.30 AM	10.40 AM	BG-2-A0472	D.B.Pradhan	2		Cerima Hall, Hotel Paradise, veg market	Lower Ma	Wet	Residential	Tipper Dump Truck	5	80
6	Pauntsholing Thromde	21/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	3.30 PM	3.35 PM	BG-2-A0927	Tshering Dorji	1		PWD Area, Dungkhag Office, Bank, RBP, RBA		Mix	Residential, Market, Commercial business and Mixed	Compactor Truck	7	80
1	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	11.25 AM	11.50 AM	BG-2-A0927	Tshering Dorji	1	Town Area	RBP, RBA, Dungkhag Offices Area		Wet	Residential, Market, Institution, Housing estate, Hospital,	Compactor Truck	7	100
2	Pauntsholing Thromde	19/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	10.10 AM	10.25 AM	BG-2-A0784	Tshering Wangdi	1	Market Area/commer	Pasakha, Main Town, Housing Colony		Dry	Residential,Market, Institution, Commercial business and Mixed	Container Carrier	4	100
3	Pauntsholing Thromde	22/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	11.30 AM	11.35 AM	BG-2-A0927	Tshering Dorji			PWD Area, Dungkhag Office, Bank Colony, RBP, RBA		Dry	Residential, Market, Institution and Mixed	Compactor Truck	7	80
4	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	Phurba	Thromde	12.05 PM	12.15 PM	BG-3-A0741	Phurba	2	Pasakha	CST, Kharbandi, Ramey ley		Mix	Residential, Market, Informal sector RORO points, Commercial business	Compactor Truck	7	60
5	Pauntsholing Thromde	23/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	9.30 AM	9.40 AM	BG-2-A0784	Tshering Wangdi	1		Post office, Damdara, Pepal Dara		Mix		Container Carrier	4	100
6	Pauntsholing Thromde	21/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	10.00 AM	10.15 AM	BG-2-A0927	Tshering Dorji			PWD Area, housing Colony, RICBL		Mix	Residential, Market, Housing estate, Hospital and Mixed	Compactor Truck	7	100
7	Pauntsholing Thromde	24/08/2019	Dorji Wangdi	Phurba	Thromde	10.30 AM	10.35 AM	BG-2-A0741	Phurba			Taxi Parking, PCB Building, NPPF, BPC		Mix	Residential, Market, Housing estate and Mixed	Compactor Truck	7	100
8	Pauntsholing Thromde	25/08/2019	Dorji Wangdi	M.B Pradhan	Thromde	11.30 AM	11.45 AM	BG-2-A0782	M.B Pradhan			Housing estate, Damdara, Kabreylar, Reldi		Mix	Residential, Market, Institution, Hospital and Mixed	Compactor Truck	7	80
9	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	M.B Pradhan	Thromde	10.45 AM	11.00 AM	BG-2-A0782	M.B Pradhan			RICBL, Hospital, Kabrey lar, CHPC area		Dry	Market, Hospital, Commercial business and Mixed	Compactor Truck	7	80
10	Pauntsholing Thromde	23/08/2019	Dorji Wangdi	M.B Pradhan	Thromde	10.45 AM	10.50 AM	BG-2-A0782	M.B Pradhan			RICBL, Hospital, Kabrey lar, Damdara		Wet	Market, Hospital, Commercial	Compactor Truck	7	80
11	Pauntsholing Thromde	25/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde			BG-2-A0784	Tshering Wangdi	1		CST, Ramety, Reldi		Mix	Residential, Market, Institution and Mixed	Container Carrier	4	100
12	Pauntsholing Thromde	21/08/2019	Dorji Wangdi	Phurba	Thromde	1.15 PM	1.35 PM	BG-2-A0741	Phurba	3	Town Area	CST, Kharbandi, Reldi, Kabrey lar, Damdara		Dry	Residential, Market, Institution, Informal sector RORO points,	Compactor Truck	7	80
13	Pauntsholing Thromde	24/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	10.45 AM	10.55 AM	BG-2-A0927	Tshering Dorji			Bongopa Line, Lama Building, Hotel paradise		Mix	Residential, Market, Commercial business and Mixed.	Compactor Truck	7	80
14	Pauntsholing Thromde	19/08/2019	Dorji Wangdi	D.B Pradhan	Thromde	10.00 AM	10.20 AM	BG-2-A0472	D.B.Pradhan	2	Town	Toorsa Khola, Druk Hotel, Veg. Market,		Wet	Residential and Market	Tipper Dump Truck	5	60
15	Pauntsholing Thromde	22/08/2019	Dorji Wangdi	Yeshi Wangchuk	Thromde	11.50 AM	12.00 PM	BG-1-A0807	Yeshi Wangdi	1		Main Town, Hotels, Offices, Institutions		Mix	Residential, Market, Institution, Road wastes and Mixed	Compactor Truck	7	60
16	Pauntsholing Thromde	22/08/2019	Dorji Wangdi	M.B Pradhan	Thromde	11.30 AM	11.40 AM	BG-1-A0782	M.B Pradhan			RICBL, Hospital, CHCPC, Industrial Area		Mix	Market, Institution , Hospital and Mixed	Compactor Truck	7	100
17	Pauntsholing Thromde	24/08/2019	Dorji Wangdi	M.B Pradhan	Thromde	10.15 AM	10.40 AM	BG-2-A0782	M.B Pradhan	2		Sensarp Auction, Veg Market, Tashi BOD		Wet	Residential, Market, Housing estate and Road wastes	Compactor Truck	7	60
18	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	Yeshi Wangdi	Thromde	2.00 PM	2.15 PM	BG-1-A0807	Yeshi Wangdi	10 Kilo, Main Town,				Mix	Mixed	Compactor Truck	7	80
19	Pauntsholing Thromde	19/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	9.30 AM	10.10 AM	BG-2-A0927	Tshering Dorji	Town Area/ 2Institution		CST, Reldi, Norbu Academy, Hospital		Mix	Institution, Housing estate, Hospital and Mixed	Compactor Truck	7	60
20	Pauntsholing Thromde	25/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	10.35 AM	10.40 AM	BG-2-A0927	Tshering Dorji					Mix	Residential, Market, Institution, Housing estate, Hospital and Mixed	Compactor Truck	7	100
21	Pauntsholing Thromde	21/08/2019	Dorji Wangdi	Yeshi Wangdi	Thromde	12.00 AM	12.11 AM	BG-1-A0807	Yeshi Wangdi	1		Main Town, Hotel, Offices, Residentials		Mix	Residential, Construction Company, informal sector RORO, housing	Compactor Truck	7	100
22	Pauntsholing Thromde	23/08/2019	Dorji Wangdi	Tshering wangdi	Thromde	7.00 AM	7.15 AM	BG-2-A0784	Tshering Wangdi	1		Kabreylar, Damdara		Dry	Residential, Market, Institution, Commercial business and Mixed	Container Carrier	4	100
23	Pauntsholing Thromde	25/08/2019	Dorji Wangdi	Phurba	Thromde	11.50 AM	12.00 AM	BG-3-A0741	Phurba					Mix	Residential, Market, Institution, housing estate, Commercial	Compactor Truck	7	100
24	Pauntsholing Thromde	23/08/2019	Dorji Wangdi	Phurba	Thromde	9.45 AM	10.00 AM	BG-3-A0741	Phurba	4		CST, Kharbandi Area, Norbu, Reldi Site		Mix		Compactor Truck	7	80
25	Pauntsholing Thromde	19/08/2019	Dorji Wangdi	Phurba	Thromde	11.25 AM	11.40 PM	BG-2-A0741	Phurba	3		CST, Kharbandi, Reldi, Norbu Academy, Ramelay 10 klo		Dry	Residential,Market, Institution,Housing estate and Mixed	Compactor Truck	7	100
26	Pauntsholing Thromde	22/08/2019	Dorji Wangdi	Phurba	Thromde	11.05 AM	11.15 AM	BG-2-A0741	Phurba	3		CST, Kharbandi, Reldi, Norbu Academy		Dry	Residential, Institution, Housing estate and Mixed	Compactor Truck	7	100
27	Pauntsholing Thromde	24/08/2019	Dorji Wangdi	Yeshi Wangdi	Thromde	10.10 AM	10.30 AM	BG-1-A0807	Yeshi Wangdi	1		Truck Parking, Rum Gudi, Zanghopelri		Mix	Residential, Market, Institution, Road wastes and Mixed	Compactor Truck	7	80
28	Pauntsholing Thromde	21/08/2019	Dorji Wangdi	M.B Pradhan	Thromde	11.05 AM	11.10 AM	BG-2-A0782	M.B Pradhan			RICBL, Hospital, Kabrey lar, Damdara		Wet	Residential, Market, Institution, Construction Company, Informal	Compactor Truck	7	100
29	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	4.00 PM	4.15 PM	BG-2-A0927	Tshering Dorji		Town Area	PWD area, RBA, RBP, Schools		Mix	Residential, Market, Institution and Mixed	Compactor Truck	7	80
30	Pauntsholing Thromde	25/08/2019	Dorji Wangdi	Yeshi Wangdi	Thromde			BG-2-A0807	Yeshi Wangdi					Mix	Residential, Market, Institution, housing estate and Mixed	Compactor Truck	7	100
31	Pauntsholing Thromde	24/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	9.00 AM	9.10 AM	BG-2-A0784	Tshering Wangdi	1		Gas Store, Hiring Company, Workshop Area		Mix	Residential, Market, Institution, Housing estate and Mixed	Container Carrier	4	100
32	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	Yeshi Wangdi	Thromde	2.00 PM	2.15 PM	BG-2-A0927	Yeshi Wangdi	1	10 Kilo	Town, Dungkhag Office Area		Dry	Residential, Construction Company, housing estate, Road wastes and	Compactor Truck	7	80
33	Pauntsholing Thromde	19/08/2019	Dorji Wangdi	Yeshi Wangdi	Thromde	12.00 AM	12.15 PM	BG-1-A0807	Yeshi Wangdi	1		Main Town, Hotel, Offices, Schools		Dry	Residential,Market,Institution,Road wastes and Mixed	Compactor Truck	7	100
34	Pauntsholing Thromde	23/08/2019	Dorji Wangdi	Tshering Dorji	Thromde	10.00 AM	10.09 AM	BG-2-A0927	Tshering Dorji			PWD Area, Dungkhag Office, RBP, RBA		Wet		Compactor Truck	7	80
35	Pauntsholing Thromde	21/08/2019	Dorji Wangdi	D.B Pradhan	Thromde	10.00 AM	10.20 AM	BG-3-A0472	D.B.Pradhan	3	Veg. Market Area	Main Town, Toorsa Khola, Druk Hotel,		Wet	Market, Commercial and Mixed	Tipper Dump Truck	5	40
36	Pauntsholing Thromde	21/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	8.30 AM	9.00 AM	BG-2-A0784	Tshering Wangdi	1	Town Area	Pasakha		Mix	Residential, Market, Institution, Housing, Commercial business,	Container Carrier	4	100
37	Pauntsholing Thromde	19/08/2019	Dorji Wangdi	M.B Pradhan	Thromde	11.00 PM	11.30 AM	BG-2-A0782	M.B Pradhan	2		Veg. Market, Main Town, Toorsa, Druk Hotel		Dry	Residential, Market, Housing estate, Hospital and Mixed	Compactor Truck	7	100
38	Pauntsholing Thromde	24/08/2019	Dorji Wangdi	D.B Pradhan	Thromde	9.50 AM	10.00 AM	BG-3-A0782	M.B Pradhan			Pepi Factory, Pepal Dara, Hospital and Schools		Mix	Residential, Market, Institution , Housing estate, Hospital and Mixed	Compactor Truck	7	80
39	Pauntsholing Thromde	23/08/2019	Dorji Wangdi	D.B Pradhan	Thromde	10.45 AM	11.00 AM	BG-2-A0472	D.B.Pradhan	2		Veg. Market, Town, Druk hotel Area		Wet	Market	Tipper Dump Truck	5	60
40	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	D.B Pradhan	Thromde	9.45 AM	10.10 AM	BG-2-A0472	D.B.Pradhan	2	Veg. Market Area			Wet	Market, Institution and Commercial business	Tipper Dump Truck	5	40
41	Pauntsholing Thromde	19/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	3.00 PM	3.20 PM	BG-2-A0784	Tshering Wangdi	1	Town Area	Pasakha, Main Town, Housing		Mix	Residential, Market, Institution, Construction Company, Informal	Container Carrier	4	100
42	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	9.00 AM	9.10 AM	BG-2-A0784	Tshering Wangdi	1	Town Area	Pasakha,Residential, Industrial area		Mix	Residential, Market, Institution and Mixed	Container Carrier	4	100
43	Pauntsholing Thromde	21/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	1.05 PM	1.09 PM	BG-2-A0784	Tshering Wangdi	1		Main Town, Post Office and Residential Area,		Mix	Residential, Market, Institution and Mixed	Container Carrier	4	100
44	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	11.00 AM	11.15 AM	BG-2-A0784	Tshering Wangdi	1	Pasakha Area			Mix	Residential, Institution, Commercial business and Mixed	Container Carrier	4	100
45	Pauntsholing Thromde	20/08/2019	Dorji Wangdi	Tshering Wangdi	Thromde	7.15 AM	7.30 AM	BG-2-A0784	Tshering Wangdi	1	Town Area			Dry	Residential, Market, Institution, Construction Company, Commercial	Container Carrier	4	100

1	Samdrup Jongkhar Thromde	26-Aug-19	Seki Choden	Pema Gyalpo	Thromde	11:30 AM	12:00 AM	BG-4-A0203	Pema Gyalpo	2	Lap-1	Forest, Police, gate, RSTA, Road		Dry	Residential, institution	Compactor Truck	7	100
2	Samdrup Jongkhar Thromde	26-Aug-19	Seki Choden	Pradhan	Thromde	11:30 AM	12:00 AM	BG-4-A0012	Pradhan	2	Lap-1	Market, town		Wet	Market, commercial business	Tractor	3.3	100
4	Samdrup Jongkhar Thromde	26-Aug-19	Seki Choden	Dorji Tshering	Thromde	1:00 PM	1:30 PM	BG-1-A0808	Dorji Tshering	.	Lap-3	Dzong, Dratshang, Jail, AWP, and hospital area		Dry	Residential, institution, hospital	Compactor Truck	7	100
5	Samdrup Jongkhar Thromde	29-Aug-19	Seki Choden	Pema Gyalpo	Thromde	12:00 AM	12:15 AM	BG-4-A0203	Pema Gyalpo	2	Lap-1	Town area		Wet	Market, commercial business	Compactor Truck	7	60
6	Samdrup Jongkhar Thromde	27-Aug-19	Seki Choden	Pradhan	Thromde	10:50 AM	11:15 AM	BG-4-A0012	Pradhan	2	Lap-4 /Lap-2	Primary school area or industrial area		Dry	Institution	Tractor	3.3	60
7	Samdrup Jongkhar Thromde	27-Aug-19	Seki Choden	Dorji Tshering	Thromde	3:40 PM	4:10 PM	BG-1-A0808	Dorji Tshering	.	Lap-3 /Lap-1	Town, hospital		Dry	Residential, market, institution,hospital, commercial	Compactor Truck	7	100
8	Samdrup Jongkhar Thromde	27-Aug-19	Seki Choden	Pradhan	Thromde	3:30 PM	4:00 PM	BG-4-A0012	Pradhan	2	Lap-4 /Lap-2	Primary school area or industrial area		Dry	Institution	Tractor	3.3	100
9	Samdrup Jongkhar Thromde	28-Aug-19	Seki Choden	Pema Gyalpo	Thromde	12:00 AM	12:30 AM	BG-4-A0203	Pema Gyalpo	2		Town		Dry	Market	Compactor Truck	7	100
10	Samdrup Jongkhar Thromde	28-Aug-19	Seki Choden	Pardhan	Thromde	10:30 AM	11:00 AM	BG-4-A0012	Pradhan	2		Town		Mix	Market and commercial	Tractor	3.3	60
11	Samdrup Jongkhar Thromde	28-Aug-19	Seki Choden	Dorji Tshering	Thromde	1:30 PM	2:00 PM	BG-1-A0808	Dorji Tshering	.		Workshop		Dry	Mixed	Compactor Truck	7	100
13	Samdrup Jongkhar Thromde	29-Aug-19	Seki Choden	Pema Gyalpo	Thromde	9:40 AM	10:10 AM	BG-4-A0203	Pema Gyalpo	2		Town		Wet	Market and commercial	Compactor Truck	7	60
14	Samdrup Jongkhar Thromde	29-Aug-19	Seki Choden	Pradhan	Thromde	9:40 AM	10:10 AM	BG-4-A0012	Pradhan	2		Town		Dry	Market and commercial	Tractor	3.3	40
15	Samdrup Jongkhar Thromde	29-Aug-19	Seki Choden	Dorji Tshering	Thromde	2:00 PM	2:30 PM	BG-1-A0808	Dorji Tshering	.		Workshop		Dry	Institution and commercial and Hosptial	Compactor Truck	7	80
16	Samdrup Jongkhar Thromde	30-Aug-19	Seki Choden	Pema Gyalpo	Thromde	10:00 AM	10:30 AM	BG-4-A0203	Pema Gyalpo	2		Dewathang		Dry	market, institution, hospital and commercial buiness	Compactor Truck	7	100
17	Samdrup Jongkhar Thromde	30-Aug-19	Seki Choden	Pardhan	Thromde	10:30 AM	11:00 AM	BG-4-A0012	Pradhan	2		Town		Mix	Market and commercial	Tractor	3.3	60
18	Samdrup Jongkhar Thromde	30-Aug-19	Seki Choden	Dorji Tshering	Thromde	10:00 AM	10:30 AM	BG-1-A0808	Dorji Tshering	.		Dewathang		Dry	market, institution, hospital and commercial buiness	Compactor Truck	7	100
19	Samdrup Jongkhar Thromde	31-Aug-19	Seki Choden	Pema Gyalpo	Thromde	10:50 AM	11:20 AM	BG-4-A0203	Pema Gyalpo	2		Town		Wet	Market and commercial	Compactor Truck	7	60
20	Samdrup Jongkhar Thromde	31-Aug-19	Seki Choden	Dorji Tshering	Thromde	10:00 AM	10:30 AM	BG-1-A0808	Dorji Tshering	.		Workshop		Wet	institution , hospital and commerical business	Compactor Truck	7	60
21	Samdrup Jongkhar Thromde	31-Aug-19	Seki Choden	Pardhan	Thromde	11:00 AM	11:30 AM	BG-4-A0012	Pradhan	2		Town		Mix	Market and commercial	Tractor	3.3	40
1	Thimphu Thromde	21/08/2019	puma	Tenzin	Thromde	9:35 AM	3:20 PM	BG-1-A0734	Tenzin Dorji	1	Hejo			Dry	Residential	Compactor Truck	3.7	80
1	Thimphu Thromde	22/08/2019	puma	C.B Gurung	Greener way	7:45 AM	7:50 AM	BG-1-A0384	Ash Man	1	Olakha			Dry	Residential	Compactor Truck	3.75	80
1	Thimphu Thromde	25/08/2019	puma	Deepak Chhetri	Clean City	8:50 AM	9:10 AM	BG-1-A0554	Passang Tshering	1	Langjuphakha			Dry	Residential	Container Carrier	4	100
1	Thimphu Thromde	20/08/2019	puma	Rinchen	Greener way	10:04 AM	10:25 AM	BP-1-1339	Rinchen	1	Workshop			Dry	Commerical Business	Tipper Dump Truck	4.5	100
1	Thimphu Thromde	19/08/2019	puma	Puma Bdr Gurung	Thromde	10:10 AM	3:30 PM	BG-1-A0734	Tenzin Dorji	1	north			Dry	Housing estate	Compactor Truck	3.7	100
1	Thimphu Thromde	24/08/2019	puma	Dhan Bdr	Clean City	8:50 AM	9:00 AM	BG-1-A0665	Bada Nadi	1	Hospital			Dry	Residential	Container Carrier	4	100
1	Thimphu Thromde	23/08/2019	puma	Dhan Bdr	Clean City	8:25 AM	8:35 PM	BG-1-A0665	Bada Nadi	1	Imtrat			Dry	Housing estate	Container Carrier	4	100
2	Thimphu Thromde	20/08/2019	puma	Ram Bdr Gurung	Thromde	10:05	3:45 PM	BG-1-A0734	Tenzin Dorji	1	Samtenling - Royal			Dry	Residential	Compactor Truck	3.7	80
2	Thimphu Thromde	22/08/2019	puma	Ram Bdr Gurung	Thromde	8:20 AM	8:30 AM	BG-1-A0737	Nado	1	Dechenling and taba			Dry	Residential	Compactor Truck	3.4	80
2	Thimphu Thromde	19/08/2019	puma	Mehebvoh Khan	Others	10:00 AM	10:30 AM	14 D 193479E	Madan Lal	1	Imtrat			Dry	Commerical Business	Others	2	100
2	Thimphu Thromde	21/08/2019	puma	Til Bdr Gurung	Thromde	10:30 AM	10:40 AM	BP-1-E1432	Till Bdr Gurung	1	Agro			Wet	Residential	Pick up	4	100
2	Thimphu Thromde	23/08/2019	puma	Tenzin	Thromde	10:04	3:25	BG-1-A0734	Tenzin Dorji	1	Palace			Dry	Residential	Compactor Truck	3.7	100
2	Thimphu Thromde	25/08/2019	puma	Rinchen	Greener way	10:00 AM	10:15 AM	BP-1-A0091	Rinchen	1	Grenner Way			Dry	Commerical Business	Tipper Dump Truck	4.5	100
2	Thimphu Thromde	24/08/2019	puma	Dorji Khandu	Thromde	9:45 AM	9:53 AM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Dry	Residential	Container Carrier	4	100
3	Thimphu Thromde	25/08/2019	puma	Pema	Clean City	11:15 AM	11:20 AM	BG-1-A0795	Krishna	1	Hejo			Dry	Residential	Compactor Truck	8.9	100
3	Thimphu Thromde	19/08/2019	puma	Rinchen	Greener way	10:25 AM	10:30 AM	BP-1-A0091	Rinchen Wangdi	1	South			Dry	Commerical Business	Tipper Dump Truck	4.5	100
3	Thimphu Thromde	23/08/2019	puma	Ajit Kumar Gurung	Thromde	10:10 AM	10:35 AM	BG-1-A0692	Ajit Kumar Gurung		Hongkhong Market			Dry	Road wastes	Tractor	4	100
3	Thimphu Thromde	21/08/2019	puma	Sangay Dorji	Others	10:40 AM	10:45 AM	BP-1-D7132	Sangay Dorji	1	Hotel Norkhil			Dry	Residential	Pick up	2	50
3	Thimphu Thromde	20/08/2019	puma	Tashi	Greener way	10:27 AM	10:35 AM	BP-1-A0091	Thinley	1	Babesa			Dry	Residential	Tipper Dump Truck	4.5	100
3	Thimphu Thromde	24/08/2019	puma	Bhim	Thromde	9:40 AM	9:55 AM	BG-1-A0013	Bhim Kumar	2	Changling			Dry	Road wastes	Tractor	4	100
3	Thimphu Thromde	22/08/2019	puma	Prita	Thromde	8:50 AM	9:00 AM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Dry	Residential	Container Carrier	4	100
4	Thimphu Thromde	24/08/2019	puma	Bada Nadi	Clean City	10:10 AM	10:20 AM	BG-1-A0665	Bada Nadi	1	Hospital			Dry	Hospital	Container Carrier	4	100
4	Thimphu Thromde	19/08/2019	puma	Dorji Khandu	Thromde	8:30 AM	8:50 AM	BG-1-A0664	Dorji Khandu	1	Kelki			Dry	Commerical Business	Container Carrier	4	100
4	Thimphu Thromde	21/08/2019	puma	Budhi Raj Subba	Thromde	10:40 AM	10:50 AM	BG-1-A0726	Budhi Raj Subba		CFM			Wet	Market	Tipper Dump Truck	14	100
4	Thimphu Thromde	23/08/2019	puma	Dhan Bdr	Clean City	10:35 AM	10:50 AM	BG-1-A0665	Bada Nadi	1	Police Camp			Dry	Housing estate	Container Carrier	4	100
4	Thimphu Thromde	22/08/2019	puma	Dhan Bdr	Clean City	9:05 AM	9:15 AM	BG-1-A0665	Bada Nadi	1	Motithang			Dry	Residential	Container Carrier	4	100
4	Thimphu Thromde	25/08/2019	puma	Rama	Thromde	11:15 AM	11:25 AM	BG-1-A0734	Tenzin Dorji	1	Changlimithang			Dry	Residential	Compactor Truck	3.7	100
4	Thimphu Thromde	20/08/2019	puma	Pema	Clean City	12:30 PM	12:40 PM	BG-1-A0795	Krishna	2	Dzong			Dry	Residential	Compactor Truck	8.9	100
5	Thimphu Thromde	25/08/2019	puma	Padan Kumar	Clean City	11:40 AM	11:50 AM	BG-1-A0650	Suk Raj Subba	1	Dechencholing			Mix	Residential	Compactor Truck	8.9	80
5	Thimphu Thromde	19/08/2019	puma	Ugyen Phuntsho	Greener way	10:54 AM	11:00 AM	BP-1-1339	Ugyen Phuntsho	1	Greener Way	Green House		Dry	Commerical Business	Tipper Dump Truck	4.5	100
5	Thimphu Thromde	20/08/2019	puma	Padan Kumar	Clean City	12:40 PM	12:50 PM	BG-1-A0650	Suk Raj Subba	2	Dechencholing			Dry	Residential	Compactor Truck	8.9	100
5	Thimphu Thromde	24/08/2019	puma	C.B Gurung	Thromde	10:15 AM	10:25 AM	BG-1-A0384	Ash Man	1	Main Town			Wet	Residential	Compactor Truck	3.75	100
5	Thimphu Thromde	21/08/2019	puma	C.B Gurung	Greener way	11:00 AM	11:10 AM	BG-1-A0384	Ash Man	1	Main Town			Wet	Residential	Compactor Truck	3.75	100
5	Thimphu Thromde	23/08/2019	puma	Rupes	Greener way	11:35 AM	11:44 AM	BP-1-C4176	Nima Tshering	1	Main Town			Wet	Residential	Pick up	4	80
5	Thimphu Thromde	22/08/2019	puma	prita	Thromde	9:50 AM	10:05 AM	BG-1-A0664	Dorji Khandu	1	Memelhakha			Dry	Residential	Container Carrier	4	100
6	Thimphu Thromde	24/08/2019	puma	Tarsam Lal	Others	10:20 AM	10:50 AM	4D 1933479E	Madan Lal	1	Imtrat			Dry	Residential	Others	2	100
6	Thimphu Thromde	22/08/2019	puma	Til Bdr Gurung	Thromde	10:00 AM	10:20 AM	BP-1-E1423	Till Bdr Gurung	1	Agro			Wet	Residential	Pick up	4	90
6	Thimphu Thromde	21/08/2019	puma	Ajit Kumar Gurung	Thromde	11:10 AM	11:30 AM	BG-1-A0692	Ajit Kumar Gurung	1	Sabji Bazar			Dry	Road wastes	Tractor	4	100
6	Thimphu Thromde	20/08/2019	puma	Perta	Thromde	12:50 PM	1:10 PM	BG-1-A0664	Dorji Khandu	1	Kelki			Dry	Residential	Container Carrier	4	100
6	Thimphu Thromde	25/08/2019	puma	Suk Raj Subba	Thromde	11:40 AM	11:55 AM	BG-1-A0726	Suk Raj Subba		CFM			Wet	Market	Tipper Dump Truck	14	100
6	Thimphu Thromde	23/08/2019	puma	Ran Bdr	Thromde	11:20 AM	11:30 AM	BG-1-A0737	Nado	2	Raguu Waste Collection			Dry	Residential	Compactor Truck	3.4	100
6	Thimphu Thromde	19/08/2019	puma	Ajit Kumar Gurung	Thromde	11:00 AM	11:20 AM	BG-1-A0692	Ajit Kumar Gurung	1	CFM			Dry	Market	Tractor	4	100
7	Thimphu Thromde	23/08/2019	puma	Perta	Thromde	12:00 PM	12:10 PM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Dry	Residential	Container Carrier	4	100
7	Thimphu Thromde	22/08/2019	puma	Suk Raj	Thromde	10:53 AM	10:59 AM	BG-1-A0726	Suk Raj Subba	1	CFM			Mix	Market	Tipper Dump Truck	14	100
7	Thimphu Thromde	25/08/2019	puma	Prita	Thromde	12:05 PM	12:15 PM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Dry	Residential	Container Carrier	4	100
7	Thimphu Thromde	21/08/2019	puma	Ram Bdr Gurung	Thromde	11:20 AM	11:35 AM	BG-1-A0737	Nado	2	Palace			Dry	Residential	Compactor Truck	3.4	80
7	Thimphu Thromde	24/08/2019	puma	Rinchen	Greener way	10:50 AM	10:55 AM	BP-1-A0091	Rinchen	0	Babesa Transfer			Dry	Residential	Tipper Dump Truck	4.5	100
7	Thimphu Thromde	19/08/2019	puma	Bhim Kumar	Thromde	11:25 AM	11:45 AM	BG-1-A0013	Bhim Kumar	2	north			Dry	Commerical Business	Tractor	4	100
7	Thimphu Thromde	20/08/2019	puma	Perta	Thromde	1:20 PM	1:30 PM	BG-1-A0664	Dorji Khandu	1	Landfill			Dry	Residential	Container Carrier	4	100

8	Thimphu Thromde	24/08/2019	purna	Rama	Thromde	10:55 AM	4:10 PM	BG-1-A0734	Tenzin Dorji	1	Changlimithang			Dry	Residential	Compactor Truck	3.7	60
8	Thimphu Thromde	20/08/2019	purna	Deepak Chhetri	Clean City	1:45 PM	1:50 PM	BG-1-A0554	Passang Tshering	1	Hejo			Dry	Residential	Container Carrier	4	100
8	Thimphu Thromde	23/08/2019	purna	Rinehen	Greener way	12:20 PM	12:30 PM	BP-1-A0091	Rinehen	1	Babesa Transfer			Dry	Residential	Tipper Dump Truck	4.5	100
8	Thimphu Thromde	25/08/2019	purna	Rinchen	Greener way	12:15 PM	12:30 PM	BP-1-A0091	Rinchen		Greener Way Transfer			Dry	Commerical Business	Tipper Dump Truck	4.5	100
8	Thimphu Thromde	19/08/2019	purna	Budhi Raj Subba	Thromde	11:30 AM	11:35 AM	BG-1-A0726	Budhi Raj Subba	0	CFM	Sunday Market		Wet	Market	Tipper Dump Truck	14	100
9	Thimphu Thromde	22/08/2019	purna	Lhakpa Tshering	Others	11:30 AM	11:35 AM	BP-1-D8056	Lhakpa Tshering		Taj			Wet	Residential	Others	4	100
9	Thimphu Thromde	25/08/2019	purna	Dhan Bdr	Clean City	12:40 PM	12:55 PM	BG-1-A0665	Bada Nadi	1	Upper Motithang			Wet		Container Carrier	4	100
9	Thimphu Thromde	24/08/2019	purna	Suk Raj Subba	Thromde	11:30 AM	11:35 PM	BG-1-A0726	Suk Raj Subba		CFM			Wet	Market	Tipper Dump Truck	14	100
9	Thimphu Thromde	19/08/2019	purna	Nima Tshering	Greener way	11:50 AM		BP-1-C4176	Nima Tshering	1	Main Town	Town		Dry	Commerical Business	Pick up	4	80
9	Thimphu Thromde	20/08/2019	purna	Raju Gurung	Clean City	1:50 PM	2:10 PM	BG-1-A0341	Padam Kumar	1	Taba			Dry	Residential	Compactor Truck	6.8	100
10	Thimphu Thromde	24/08/2019	purna	Tika Rai	Others	11:34 AM	11:39 AM	BP-1-C5097	Jit Man Mongar	1	Main Town			Dry	Residential	Pick up	4	100
10	Thimphu Thromde	21/08/2019	purna	Tek Bdr	Thromde	12:00 PM	12:40 PM	BG-1-A1822	Pema Dorji	1	Hospital			Dry	Hospital	Others	6	100
10	Thimphu Thromde	22/08/2019	purna	Dhan Bdr	Clean City	11:30 AM	11:40 AM	BG-1-A0665	Bada Nadi	1	Babesa Transfer			Wet	Residential	Container Carrier	4	100
10	Thimphu Thromde	23/08/2019	purna	Chabi Lal	Clean City	12:40 PM	12:50 PM	BG-1-A0341	Padam Kumar	1	Langjuphakha			Wet	Residential	Compactor Truck	6.8	100
10	Thimphu Thromde	19/08/2019	purna	Rama Bdr Subba	Thromde	11:55 AM	3:30 PM	BG-1-A0737	Nado	1	North	Kinga Choling		Dry	Housing estate	Compactor Truck	3.4	100
10	Thimphu Thromde	20/08/2019	purna		Thromde	2:00 PM	2:20 PM	BG-1-A0013	Bhim Kumar	2	Chamlimithang			Dry	Road wastes	Tractor	4	100
11	Thimphu Thromde	25/08/2019	purna	Dorji Khandu	Greener way	1:00 PM	1:15 PM	BG-1-A0664	Dorji Khandu		Road side			Dry	Road wastes	Container Carrier	4	100
11	Thimphu Thromde	22/08/2019	purna	Purna	Thromde	11:42 AM	11:54 AM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Wet	Residential	Container Carrier	4	100
11	Thimphu Thromde	20/08/2019	purna	Rupees	Greener way	2:35 PM	2:57 PM	BP-1-C4176	Nima Tshering	1	Upper Motithang	Amen Kora		Wet	Residential	Pick up	4	40
11	Thimphu Thromde	23/08/2019	purna	Kul Bdr	Greener way	2:08 PM	2:14 PM	BG-1-A0798	Dhoj Bir	2	Changangkha			Dry	Residential	Compactor Truck	3.75	100
11	Thimphu Thromde	19/08/2019	purna	Rinchen Wangdi	Greener way	12:05 PM	12:15 PM	BP-1-A0091	Rinchen Wangdi	1	South			Dry	Commerical Business	Tipper Dump Truck	4.5	100
11	Thimphu Thromde	21/08/2019	purna	Purna Raika	Greener way	12:20 PM	12:35 PM	BG-1-A4080	Dalay	2	Sarbithang			Dry	Residential	Compactor Truck	3.75	100
11	Thimphu Thromde	24/08/2019	purna	Ajit Kumar Gurung	Thromde	11:34 AM		BG-1-A0692	Ajit Kumar Gurung	1	Jojo			Dry	Road wastes	Tractor	4	100
12	Thimphu Thromde	20/08/2019	purna	Purna Raika	Greener way	2:53 PM	3:07 PM	BG-1-A4080	Dalay	2	Main town Police camp	Police Camp		Wet	Residential	Compactor Truck	3.75	100
12	Thimphu Thromde	19/08/2019	purna	Pema Dorji	Thromde	12:15 PM	12:25 PM	BG-1-A1822	Pema Dorji	1	Hospital			Wet	Hospital	Others	4	100
12	Thimphu Thromde	23/08/2019	purna	Dhan Bdr	Clean City	2:09 PM	2:15 PM	BG-1-A0665	Bada Nadi	1	Kala Bazar			Wet	Residential	Container Carrier	4	100
12	Thimphu Thromde	21/08/2019	purna	Prita	Thromde	12:42 PM	12:58 PM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Dry	Residential	Container Carrier	4	100
12	Thimphu Thromde	25/08/2019	purna	Dorji Khandu	Thromde	1:45 PM	1:45 PM	BG-1-A0664	Dorji Khandu	1	Road side			Dry	Road wastes	Container Carrier	4	100
12	Thimphu Thromde	24/08/2019	purna	Dhan Bdr	Clean City	11:40 AM	11:45 AM	BG-1-A0665	Bada Nadi		Buddha Point			Dry	Residential	Container Carrier	4	100
12	Thimphu Thromde	22/08/2019	purna	Jamyang	Others	11:58 PM	12:07 PM	BP-1-7644	Jamyang Dorji	1	Sarbithang			Dry	Residential	Others	2	100
13	Thimphu Thromde	23/08/2019	purna	Padan Kumar	Clean City	2:15 PM	2:25 PM	BG-1-A0650	Suk Raj Subba	1	Dechencholing and Taba			Dry	Residential	Compactor Truck	8.9	100
13	Thimphu Thromde	22/08/2019	purna	Dhan Bdr	Clean City	1:10 PM	1:20 PM	BG-1-A0665	Bada Nadi	1	Hospital			Dry	Hospital	Container Carrier	4	100
13	Thimphu Thromde	20/08/2019	purna	Karma Lekden	Others	3:10 PM	3:15 PM	BP-1-C9346	Karma Lekden	2	Main Town			Dry	Commerical Business	Others	2	100
13	Thimphu Thromde	21/08/2019	purna	Nima Tshering	Greener way	12:50 PM	1:02 PM	BP-1-C4176	Nima Tshering	1	Police Camp			Dry	Residential	Pick up	4	60
13	Thimphu Thromde	25/08/2019	purna	Chabi Lal	Clean City	2:05 PM	2:15 PM	BG-1-A0341	Padam Kumar	1	Taba			Dry	Residential	Compactor Truck	6.8	60
14	Thimphu Thromde	21/08/2019	purna	Dhoj Bir	Greener way	1:30 PM	1:35 PM	BG-1-A0798	Dhoj Bir	1	Sabji Bazar			Mix	Residential	Compactor Truck	3.75	80
14	Thimphu Thromde	24/08/2019	purna	Rinchen	Greener way	12:10 PM	12:20 PM	BP-1-A0091	Rinchen		Babesa			Dry	Residential	Tipper Dump Truck	4.5	100
14	Thimphu Thromde	22/08/2019	purna	Pema	Clean City	1:20 PM	1:32 PM	BG-1-A0795	Krishna	2	Hejo dzong			Dry	Residential	Compactor Truck	8.9	100
14	Thimphu Thromde	23/08/2019	purna	Deepak Chhetri	Clean City	3:40 PM	3:45 PM	BG-1-A0554	Passang Tshering	1	Hospital			Dry	Hospital	Container Carrier	4	100
14	Thimphu Thromde	25/08/2019	purna	Deepak Chhetri	Clean City	12:45 PM	12:50 PM	BG-1-A0554	Passang Tshering	1	Pamtsho			Dry	Residential	Container Carrier	4	100
14	Thimphu Thromde	20/08/2019	purna	Khandu	Thromde	4:30 PM	4:45 PM	BG-1-A0664	Dorji Khandu		Kelki			Dry	Residential	Container Carrier	4	100
15	Thimphu Thromde	19/08/2019	purna	Prithi Lal	Clean City	1:20 PM	1:30 PM	BG-1-A0554	Passang Tshering	1	north			Dry	Commerical Business	Container Carrier	4	100
15	Thimphu Thromde	25/08/2019	purna	Dhan Bdr	Clean City	1:25 PM	1:35 PM	BG-1-A0665	Bada Nadi	1	Kala Bazar			Wet	Residential	Container Carrier	4	100
15	Thimphu Thromde	23/08/2019	purna	Dhan Bdr	Clean City	4:00 PM	4:10 PM	BG-1-A0665	Bada Nadi	1	R.S.T.A Lungten			Dry	Residential	Container Carrier	4	100
15	Thimphu Thromde	20/08/2019	purna	Yeshi	Others	4:50 PM	5:00 PM	BP-1-D4609	Yeshi		Babesa			Dry	Residential	Others	2	100
15	Thimphu Thromde	21/08/2019	purna	C.B Gurung	Greener way	2:00 PM	2:15 PM	BG-1-A0384	Ash Man	1	Main Town			Wet	Residential	Compactor Truck	3.75	60
16	Thimphu Thromde	22/08/2019	purna	Deepak Chhetri	Clean City	1:34 PM	1:40 PM	BG-1-A0554	Passang Tshering	1	lanjophakha(NECS)			Dry	Residential	Container Carrier	4	100
16	Thimphu Thromde	19/08/2019	purna	preti	Thromde	2:15 PM	2:30 PM	BG-1-A0664	Dorji Khandu		Kelki			Dry	Commerical Business	Container Carrier	4	100
16	Thimphu Thromde	25/08/2019	purna	Prita	Thromde	2:30 PM	2:55 PM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Dry	Residential	Container Carrier	4	100
16	Thimphu Thromde	24/08/2019	purna	Perta	Thromde	12:25 PM	12:25 PM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Dry	Residential	Container Carrier	4	100
16	Thimphu Thromde	21/08/2019	purna	Kinga Norbu	Greener way	2:30 PM	2:45 PM	BP-1-A0091	Karma Younten	1	Station			Dry	Residential	Tipper Dump Truck	4.5	100
16	Thimphu Thromde	20/08/2019	purna	Rinchen	Greener way	5:55 PM	6:15 PM	BP-1-A0091	Rinchen	2	Greener Way			Dry	Commerical Business	Tipper Dump Truck	4.5	100
17	Thimphu Thromde	21/08/2019	purna	Kul Bdr	Greener way	2:40 PM	2:50 PM	BG-1-A0798	Dhoj Bir	1	Sabji Bazar			Dry	Residential	Compactor Truck	3.75	100
17	Thimphu Thromde	20/08/2019	purna	Rinchen	Greener way	8:00 AM	8:20 AM	BP-1-A0091	Rinchen	2	Greener Way			Dry	Commerical Business	Tipper Dump Truck	4.5	100
17	Thimphu Thromde	24/08/2019	purna	Padan Kumar	Clean City	12:40 PM	12:50 PM	BG-1-A0650	Suk Raj Subba	2	Jungzhina-Pamtsho			Dry	Residential	Compactor Truck	8.9	100
17	Thimphu Thromde	23/08/2019	purna	Raj Man	Others	4:45 PM	4:53 PM	BP-1-C3271	Raj Man		Youspang			Wet	Residential	Pick up	4	100
17	Thimphu Thromde	25/08/2019	purna	Prita	Thromde	2:40 PM	2:45 PM	BG-1-A0664	Dorji Khandu	1	Memelhakha			Dry	Residential	Container Carrier	4	100
17	Thimphu Thromde	19/08/2019	purna	Rinchen Wangdi	Greener way	2:30 PM	2:50 PM	BP-1-A0091	Rinchen Wangdi	1	South			Dry	Commerical Business	Tipper Dump Truck	4.5	100
18	Thimphu Thromde	20/08/2019	purna	Purna Raika	Greener way	8:25 AM	8:35 AM	BG-1-A4080	Dalay	1	Lower Motithang			Dry	Housing estate	Compactor Truck	3.75	60
18	Thimphu Thromde	21/08/2019	purna	Dorji Khandu	Thromde	5:40 PM	5:50 PM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Dry	Road wastes	Container Carrier	4	100
18	Thimphu Thromde	23/08/2019	purna	Purna Raika	Greener way	6:05 PM	6:15 PM	BG-1-A4080	Dalay	1	Upper Motithang-			Wet	Residential	Compactor Truck	3.75	80
18	Thimphu Thromde	22/08/2019	purna	Dorji Khandu	Thromde	3:25 PM	3:40 PM	BG-1-A0664	Dorji Khandu	1	Kelki (Transfer			Dry	Residential	Container Carrier	4	100
18	Thimphu Thromde	25/08/2019	purna	Rupes	Greener way	3:50 PM	4:10 PM	BP-1-1339	Ugyen Phuntsho	1	Olakha Workshop			Dry	Residential	Tipper Dump Truck	4.5	100
18	Thimphu Thromde	19/08/2019	purna	Prithi Lal	Clean City	3:30 PM	3:34 PM	BG-1-A0054	Passang Tshering	1	Road side			Dry	Commerical Business	Container Carrier	4	100
18	Thimphu Thromde	24/08/2019	purna	Kumar	Greener way	12:56 PM	1:05 PM	BG-1-A0798	Dhoj Bir	2	Changjiji			Wet	Residential	Compactor Truck	3.75	100
19	Thimphu Thromde	23/08/2019	purna	Padan	Clean City	7:15 PM	7:25 PM	BG-1-A0341	Padam Kumar	1	Taba			Dry	Residential	Compactor Truck	6.8	80
19	Thimphu Thromde	22/08/2019	purna	Deepak Chhetri	Clean City	3:40 PM	3:45 PM	BG-1-A0554	Passang Tshering	1	Lungtenzampa (RSTA)			Dry	Residential	Container Carrier	4	100
19	Thimphu Thromde	20/08/2019	purna	Dorji Khandu	Thromde	9:15 PM	9:30 PM	BG-1-A0664	Dorji Khandu	1	Kelki			Dry	Residential	Container Carrier	4	100
19	Thimphu Thromde	21/08/2019	purna	Dorji Khandu	Thromde	6:00 PM	6:10 PM	BG-1-A0664	Dorji Khandu	1	Road side			Dry	Road wastes	Container Carrier	4	100
19	Thimphu Thromde	25/08/2019	purna	Kul Bdr	Greener way	5:10 PM	5:15 PM	BG-1-A0798	Dhoj Bir	1	Motithang			Dry	Residential	Compactor Truck	3.75	100

20	Thimphu Thromde	21/08/2019	puma	C.B Gurung	Greener way	6:05 PM	6:15 PM	BG-1-A0384	Ash Man		1	Kela Bazar			Dry	Residential	Compactor Truck	3.75	80
20	Thimphu Thromde	22/08/2019	puma	Rinchen	Greener way	4:10 PM	4:20 PM	BP-1-A0091	Rinchen		1	Greener Way			Dry	Commercial Business	Tipper Dump Truck	4.5	100
20	Thimphu Thromde	24/08/2019	puma	C.B Gurung	Greener way	1:35 PM	1:43 PM	BG-1-A0384	Ash Man		1	Main Town			Wet	Residential	Compactor Truck	3.75	100
20	Thimphu Thromde	19/08/2019	puma	Dorji Khandu	Thromde	4:05 PM	4:25 PM	BG-1-A0994	Dorji Khandu		1	Kelki			Dry	Commercial Business	Container Carrier	4	100
20	Thimphu Thromde	20/08/2019	puma	C.B Gurung	Greener way	9:35 PM	9:50 PM	BG-1-A0384	Ash Man		2	Olakha			Wet	Residential	Compactor Truck	3.75	80
20	Thimphu Thromde	23/08/2019	puma	Rupes	Greener way	8:25 PM	8:30 PM	BP-1-G417	Nima Tshering		1	Main Town			Wet	Residential	Pick up	4	40
20	Thimphu Thromde	25/08/2019	puma	Pirta	Thromde	7:20 PM	7:35 PM	BG-1-A0994	Dorji Khandu		1	Kelki Transfer			Dry	Residential	Container Carrier	4	100
21	Thimphu Thromde	22/08/2019	puma	Passang	Gean City	4:10 PM	4:15 PM	BG-1-A0994	Passang Tshering		1	Dechenchol ing			Dry	Residential	Container Carrier	4	100
21	Thimphu Thromde	25/08/2019	puma	C.B Gurung	Greener way	8:10 PM	8:25 PM	BG-1-A0384	Ash Man		1	Olakha			Dry	Residential	Compactor Truck	3.75	100
21	Thimphu Thromde	20/08/2019	puma	Kuril Bir	Greener way	10:20 PM	10:35 PM	BG-1-A0798	Dhoj Bir		1	Changlangd ie and Chanji			Dry	Residential	Compactor Truck	3.75	100
21	Thimphu Thromde	24/08/2019	puma	Perma	Gean City	2:05 PM	2:10 PM	BG-1-A0795	Krishna		2	Olrukha and Babesa			Dry	Residential	Compactor Truck	8.9	100
21	Thimphu Thromde	19/08/2019	puma	Perma	Gean City	10:15 AM	10:30 AM	BG-1-A0795	Krishna		1	Babesa			Dry	Residential	Compactor Truck	8.9	100
21	Thimphu Thromde	21/08/2019	puma	Kenga Norbu	Greener way	6:05 PM	6:20 PM	BG-1-A0091	Karma Younten		1	Greener Way			Dry	Commercial Business	Tipper Dump Truck	4.5	100
21	Thimphu Thromde	23/08/2019	puma	Puma	Gean City	9:45 PM	10:00 PM	BG-1-A0795	Krishna		2	Haju and Jabulma			Wet	Residential	Compactor Truck	8.9	100
22	Thimphu Thromde	21/08/2019	puma	Deepak Chhetri	Gean City	6:10 PM	6:25 PM	BG-1-A0994	Passang Tshering		1	Changzamto			Dry	Residential	Container Carrier	4	100
22	Thimphu Thromde	22/08/2019	puma	Nima Tshering	Greener way	4:30 PM	4:35 PM	BP-1-G417	Nima Tshering		1	Quest-2			Dry	Residential	Pick up	4	80
22	Thimphu Thromde	19/08/2019	puma	Padan Kumar	Gean City	8:00 PM	8:10 PM	BG-1-A0990	Sukhraj Subba		2	Pamtsho and Jungshina			Dry	Residential	Compactor Truck	8.9	100
22	Thimphu Thromde	24/08/2019	puma	TI Bdr	Thromde	1:45	2:10	BP-1-E1423	Dorji		1	Bhutan Agro-Babesa			Wet		Pick up	4	40
23	Thimphu Thromde	24/08/2019	puma	Santa Bdr Tamang	Thromde	2:10 PM	2:20 PM	BG-1-A0020	Santa Bdr Tamang			Garden Project/Repa			Dry		Tractor	4	100
23	Thimphu Thromde	22/08/2019	puma	Dhan Bdr	Gean City	6:15 PM	6:30 PM	BG-1-A0995	Bada Nadi		1	Hospital			Dry	Hospital	Container Carrier	4	100
23	Thimphu Thromde	19/08/2019	puma	Raju Gurung	Gean City	9:30 PM	9:35 PM	BG-1-A0341	Padam Kumar		1	Langjaha kha			Dry	Residential	Compactor Truck	6.8	100
23	Thimphu Thromde	21/08/2019	puma	Puma Raika	Greener way	8:05 PM	8:20 PM	BG-1-A0080	Dalay		1	Sarbithang			Dry	Residential	Compactor Truck	3.75	100
24	Thimphu Thromde	22/08/2019	puma	Juma Raika	Greener way	8:20 PM	8:30 PM	BG-1-A0080	Dalay		1	Olakha			Wet	Residential	Compactor Truck	3.75	80
24	Thimphu Thromde	21/08/2019	puma	Kuril Bir	Greener way	8:30 PM	8:40 PM	BG-1-A0798	Dhoj Bir		1	Olakha			Dry	Residential	Compactor Truck	3.75	80
25	Thimphu Thromde	22/08/2019	puma	Dirty	Thromde	8:50 PM	9:10 PM	BG-1-A0994	Dorji Khandu		1	Kelki Transfer			Dry	Residential	Container Carrier	4	100
25	Thimphu Thromde	21/08/2019	puma	Perta	Thromde	8:50 PM	9:05 PM	BG-1-A0994	Dorji Khandu		1	Kelki Transfer			Dry	Residential	Container Carrier	4	100
26	Thimphu Thromde	24/08/2019	puma	Chebi Lal	Gean City	3:03 PM	3:08 PM	BG-1-A0341	Padam Kumar		1	Langjaha kha Lower			Dry	Residential	Compactor Truck	6.8	100
26	Thimphu Thromde	24/08/2019	puma	Puma Raika	Greener way	3:15 PM	3:25 PM	BG-1-A0080	Dalay		1	Motithang&P			Wet	Residential	Compactor Truck	3.75	100
27	Thimphu Thromde	24/08/2019	puma	Ugyen Phuntsho	Greener way	3:40 PM	4:10 PM	BP-1-1339	Ugyen Phuntsho			Workshop			Dry	Residential	Tipper Dump Truck	4.5	100
28	Thimphu Thromde	24/08/2019	puma	C.B Gurung	Greener way	3:05 PM	3:15 PM	BG-1-A0384	Ash Man		1	Changzamto			Dry	Residential	Compactor Truck	3.75	100
29	Thimphu Thromde	24/08/2019	puma	Kuril Bir	Greener way	4:40 PM	5:00 PM	BG-1-A0798	Dhoj Bir		1	Olakha			Wet	Residential	Compactor Truck	3.75	80
30	Thimphu Thromde	24/08/2019	puma	Rinchen	Greener way	6:50 PM	7:05 PM	BP-1-A0091	Rinchen		1	Babesa Transfer			Dry		Tipper Dump Truck	4.5	100
31	Thimphu Thromde	24/08/2019	puma	Pirta	Thromde	8:10 PM	8:20 PM	BG-1-A0994	Dorji Khandu		1	Kelki Transfer			Dry	Residential	Container Carrier	4	100

A6-1-41

資料-6-2　計画機材台数根拠

資料-6-2　計画機材台数根拠

A6-2-1　ティンプー市

A6-2-1-1 廃棄物収集運搬機材

Thimphu Thromde

Planned Collection Amount	Waste Aoumnt in2023 Year (Source: Thimphu)	Existing Vehicle Type	Operating Number in 2019 of Existing Vehicle	Operating Capacity in 2019 by Existing Vehice (t/d)	Operating Number in 2023 of Existing Vehicle	Operating Capacity in 2023 by Existing Vehice (t/d) (A)	Collection amount to be collected by newly procured compactor track by the project in 2023 (t/d)		Breakdown into Dry & Wet Area		New Number in 2023	New Capacity in 2023 (t/d) (B)	Total Capacity in 2023 (t/d) (C)=(A)+(B)
Dry waste	29.2	Compactor	23	41.5	5	7.1	Dry Waste	26.1	Dry Waste Thromde Area	2.8	1	3.0	3.0
Wet waste	37.7	Container Carrier Lift Type	0	0.0	0	0.0	Wet Waste	33.7	Wet Waste Thromde Area	2.1	1	3.0	3.0
Total	66.9	Tractor	5	5.2	0	0.0	Total	59.8	Dry Waste North Area	6.9	2	9.0	9.0
		Dump Truck	2	4.8	0	0.0			Wet Waste North Area	6.8	3	9.0	9.0
		Total	30	51.5	5	7.1			Dry Waste Central & South Area	16.4	4	18.0	18.0
									Dry Waste Central & South Area	24.8	6	27.0	27.0
									total	59.8	17	69.0	76.1

Existing vehicles

Vehicle Type			In year 2019													In target year							
Type1	Type2	Type3	Registration No.	Manufactur er	Purchase year	Total milage	Milage in yast year	Capacity (m^3)	trip/day	Vehicle age in 2019	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (t/m3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)	trip/day	Vehicle age in 2023	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (t/m3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)
1	Compactor	Thimphu Thromde	BG-1-A0734		2004		2.5kpl /142	4	2	15	50%	0.90	0.86	0.50	0.80	1.60	2.00	19	FALSE	0.90	0.86	0.50	0.00	0.00
2	Compactor	Thimphu Thromde	BG-1-A0815	TATA	2017		2.5kpl/987	8.9	2	2	100%	0.90	0.86	0.50	3.40	6.80	2.00	6	25%	0.90	0.86	0.50	0.90	1.80
3	Compactor	Thimphu Thromde	BG-1-A0737		2002		2.5kpl/230	4	2	17	0%	0.90	0.86	0.50	0.00	0.00	2.00	21	FALSE	0.90	0.86	0.50	0.00	0.00
4	Tractor	Thimphu Thromde	BG-1-A0013		2016		2.5l/hour /2	3	2	3	100%	0.90	0.86	0.30	0.70	1.40	2.00	7	0%	0.90	0.86	0.30	0.00	0.00
5	Tractor	Thimphu Thromde	BG-1-A0692		2012		2l/h / 7366	3	2	7	100%	0.90	0.86	0.30	0.70	1.40	2.00	11	FALSE	0.90	0.86	0.30	0.00	0.00
6	Tractor	Thimphu Thromde	BG-1-A0014		2016		2.5l/hour /2	3	2	3	100%	0.90	0.86	0.30	0.70	1.40	2.00	7	0%	0.90	0.86	0.30	0.00	0.00
7	Compactor	Clean City Co.	BG-1-0650	Tata	2011		74328	8.9	2	8	100%	0.90	0.86	0.50	3.40	6.80	2.00	12	FALSE	0.90	0.86	0.50	0.00	0.00
8	Compactor	Clean City Co.	BG-1-A0795	Tata	2016		44065	8.9	2	3	100%	0.90	0.86	0.50	3.40	6.80	2.00	7	25%	0.90	0.86	0.50	0.90	1.80
9	Compactor	Clean City Co.	BG-1-A0341	Toyota	2001		Not functio	6.8	2	18	0%	0.90	0.86	0.50	0.00	0.00	2.00	22	FALSE	0.90	0.86	0.50	0.00	0.00
10	Compactor	Clean City Co.	BG-1-A0667	Nissan	2002		Off - road	3.2	0	17	0%	0.90	0.86	0.50	0.00	0.00	0.00	21	FALSE	0.90	0.86	0.50	0.00	0.00
11	Compactor	Greener Way Co.	BG-1-0380				Surrendere	0	0	2019	FALSE	0.90	0.86	0.50	0.00	0.00	0.00	2023	FALSE	0.90	0.86	0.50	0.00	0.00
12	Compactor	Greener Way Co.	BG-1-A0797	TATA	2016		51750	3.75	2	3	100%	0.90	0.86	0.50	1.50	3.00	2.00	7	25%	0.90	0.86	0.50	0.40	0.80
13	Compactor	Greener Way Co.	BP-1-A4080	TATA	2016		41782.4	3.75	2	3	100%	0.90	0.86	0.50	1.50	3.00	2.00	7	0%	0.90	0.86	0.50	0.00	0.00
14	Compactor	Greener Way Co.	BP-1-A0798	TATA	2016		39667.9	3.75	2	3	100%	0.90	0.86	0.50	1.50	3.00	2.00	7	0%	0.90	0.86	0.50	0.00	0.00
15	Compactor	Greener Way Co.	BG-1-A0635				Surrendered			2019	FALSE	0.90	0.86	0.50	0.00	0.00	0.00	2023	FALSE	0.90	0.86	0.50	0.00	0.00
16	Compactor	Greener Way Co.	BG-1-0382	ISUZU	1994		247101	3.75	2	25	FALSE	0.90	0.86	0.50	0.00	0.00	2.00	29	FALSE	0.90	0.86	0.50	0.00	0.00
17	Compactor	Greener Way Co.	BG-1-0651				Surrendered			2019	FALSE	0.90	0.86	0.50	0.00	0.00	0.00	2023	FALSE	0.90	0.86	0.50	0.00	0.00
18	Compactor	Greener Way Co.	BG-1-0384	ISUZU	1994		138813.7	3.75	2	25	FALSE	0.90	0.86	0.50	0.00	0.00	2.00	29	FALSE	0.90	0.86	0.50	0.00	0.00
19	Compactor	Greener Way Co.	BG-1-A0669				Surrendered			2019	FALSE	0.90	0.86	0.50	0.00	0.00	0.00	2023	FALSE	0.90	0.86	0.50	0.00	0.00
20	Compactor	Greener Way Co.	BG-1-A0755				Surrendered			2019	FALSE	0.90	0.86	0.50	0.00	0.00	0.00	2023	FALSE	0.90	0.86	0.50	0.00	0.00
21	Compactor	Greener Way Co.	BG-1-A0736				Surrendered			2019	FALSE	0.90	0.86	0.50	0.00	0.00	0.00	2023	FALSE	0.90	0.86	0.50	0.00	0.00
22	Compactor	Greener Way Co.	BG-1-A0794	TATA	2016		42642	3.75	2	3	100%	0.90	0.86	0.50	1.50	3.00	2.00	7	25%	0.90	0.86	0.50	0.40	0.80
23	Compactor	Greener Way Co.	BG-1-A0555				Surrendered			2019	FALSE	0.90	0.86	0.50	0.00	0.00	0.00	2023	FALSE	0.90	0.86	0.50	0.00	0.00
24	Compactor	Greener Way Co.	BG-1-A0714				Surrendered			2019	FALSE	0.90	0.86	0.50	0.00	0.00	0.00	2023	FALSE	0.90	0.86	0.50	0.00	0.00
25	Compactor	Greener Way Co.	(BG-1-A0815)				Surrendered			2019	FALSE	0.90	0.86	0.50	0.00	0.00	0.00	2023	FALSE	0.90	0.86	0.50	0.00	0.00
26	Compactor	Greener Way Co.	BG-1-A0195	TATA	2014			19.5	1	5	100%	0.90	0.86	0.50	7.50	7.50	1.00	9	25%	0.90	0.86	0.50	1.90	1.90
27	Tractor	Greener Way Co.	BP-1-A0028	ACE Trac	2017	Off Road		2	0	2	100%	0.90	0.86	0.30	0.50	0.00	0.00	6	50%	0.90	0.86	0.30	0.20	0.00
28	Tractor	Greener Way Co.	BP-1-A0027	ACE Trac	2017		7155	2	2	2	100%	0.90	0.86	0.30	0.50	1.00	2.00	6	0%	0.90	0.86	0.30	0.00	0.00
29	Dump Truck	Greener Way Co.	BP-1-1339	Eicher	2003		146102	4.5	4	16	0%	0.90	0.86	0.35	0.00	0.00	4.00	20	FALSE	0.90	0.86	0.35	0.00	0.00
30	Dump Truck	Greener Way Co.	BP-1A-0091	TATA	2019		9988	4.5	4	0	100%	0.90	0.86	0.35	1.20	4.80	4.00	4	0%	0.90	0.86	0.35	0.00	0.00
																51.50								7.10

New vehicle (Dry Waste Aoumnt in2023 Year Thromde Area)

Vehicle Type			Capacity (m^3)	No. of vehicles	trip/day	Vehicle age	Effective R	Loading Ra	Operation R	Unit Loade	Average Co	Daily Work Capacity (t/day)
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
												3.00

New vehicle (Wet Waste Aoumnt in2023 Year Thromde Area)

Vehicle Type			Capacity (m^3)	No. of vehicles	trip/day	Vehicle age	Effective R	Loading Ra	Operation R	Unit Loade	Average Co	Daily Work Capacity (t/day)
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
												3.00

New vehicle (Dry Waste Aoumnt in2023 Year North Area)

Vehicle Type			Capacity (m^3)	No. of vehicles	trip/day	Vehicle age	Effective R	Loading Ra	Operation R	Unit Loade	Average Co	Daily Work Capacity (t/day)
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		8	1	2	1	100%	0.9	0.86	0.5	3.1	6
												9.00

New vehicle (Wet Waste Aoumnt in2023 Year North Area)

Vehicle Type			Capacity (m^3)	No. of vehicles	trip/day	Vehicle age	Effective R	Loading Ra	Operation R	Unit Loade	Average Co	Daily Work Capacity (t/day)
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
												9.00

New vehicle (Dry Waste Aoumnt in2023 Year Central & South Area)

Vehicle Type			Capacity (m^3)	No. of vehicles	trip/day	Vehicle age	Effective R	Loading Ra	Operation R	Unit Loade	Average Co	Daily Work Capacity (t/day)
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		8	1	2	1	100%	0.9	0.86	0.5	3.1	6
1	Compactor		8	1	2	1	100%	0.9	0.86	0.5	3.1	6
												18.00

New vehicle (Wet Waste Aoumnt in2023 Year Central & South Area)

Vehicle Type			Capacity (m^3)	No. of vehicles	trip/day	Vehicle age	Effective R	Loading Ra	Operation R	Unit Loade	Average Co	Daily Work Capacity (t/day)
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		4	1	2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		8	1	2	1	100%	0.9	0.86	0.5	3.1	6
1	Compactor		8	1	2	1	100%	0.9	0.86	0.5	3.1	6
1	Compactor		8	1	2	1	100%	0.9	0.86	0.5	3.1	6
												27.00

A6-2-1-2 ドロップインセンター用機材

Thimphu Thromde

Existing Vehicle Type	Operating Number in 2019 of Existing Vehicle	Operating Capacity in 2019 by Existing Vehicle (t/d)	Operating Number in 2023 of Existing Vehicle	Operating Capacity in 2023 by Existing Vehice (t/d)
Container Carrier Lift Type	2	4.3	0	0.0
Total	2	4.3	0	0.00

Existing vehicles

	Vehicle Type								In year 2019										In target year								
	Type1	Type2	Type3	Registration No.	Manufacturer	Purchase year	Total milage	Milage in yeat year	Capacity (m^3)	trips/day	Vehicle age in 2019	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (t/m^3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)	trip/day	Vehicle age in 2023	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (t/m^3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)
1	Container Carrier Lift Type		Thimphu Thromde	BG-1-A0664	Eicher	2011		4kph/3221Skms	4	2	8	100%	0.90	0.86	0.35	1.10	2.20	2.00	12	FALSE	0.90	0.86	0.35	0.00	0.00
2	Container Carrier Lift Type		Clean City Co.	BG-1-A0554	Eicher	2006		Not functional	4.8	3	13	50%	0.90	0.86	0.35	0.70	2.10	3.00	17	FALSE	0.90	0.86	0.35	0.00	0.00
3	Container Carrier Lift Type		Greener Way Co.	BG-1-A0665	Eicher	2011	Off Road	628814	4.5	0	8	100%	0.90	0.86	0.35	1.20	0.00	0.00	12	FALSE	0.90	0.86	0.35	0.00	0.00
																	4.30								0.00

A6-2-2　プンツォリン市

A6-2-2-1 廃棄物収集運搬機材

Phuntsholing Thromde

Planned collection amount	Waste Aoumnt in2023 Year (Source:Phuntsholing)	Existing vehicle type	Existing Number in 2019	Existing capacity in 2019 (t/d)	Existing Number in 2023	Existing capacity in 2023 (t/d) (A)	Collection amount to be collected by newly procured compactor truck by the project in 2023 (t/d)	New Number in 2023	New Capacity in 2023 (t/d) (B)	Toutl Capacity in 2023 (t/d) (C)=(A)+(B)	Remarks
Dry waste	7.5	Compactor	5	24	5	5.6	Dry Waste 5.0	2	6.0	8.8	Include Exist. Vehicle No.5 data in 2023
Wet waste	9.6	Container Carrier Lift Type	2	6	2	0	Wet Waste 6.5	3	9.0	11.8	Include Exist. Vehicle No.4 data in 2023
total	17.1	Tractor	0	0	0	0	Total 11.5	5	15.0	20.6	
		Dump Track	1	1	0	0					
		Total	8	31	7	5.6					

Existing vehicles

	Vehicle Type							In year 2019									In target year									
	Type1	Type2	Type3	Registration No.	Manufactur er	Purchase year	Total mileage	Milage in yast year	Capacity (m^3)	trip/day	Vehicle age in 2019	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (tm3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)	trip/day	Vehicle age in 2023	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (tm3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)
1	Compactor		BG-2A-0725	EICHER	2011			7	1	8	100%	0.90	0.86	0.50	2.70	2.70	1.00	12	FALSE	0.90	0.86	0.50	0.00	0.00
2	Compactor		BG-2A-0782	TATA	2012			7	2	7	100%	0.90	0.86	0.50	2.70	5.40	2.00	11	FALSE	0.90	0.86	0.50	0.00	0.00
3	Compactor		BG-2A-0741	TATA	2011			7	2	8	100%	0.90	0.86	0.50	2.70	5.40	2.00	12	FALSE	0.90	0.86	0.50	0.00	0.00
4	Compactor		BG-2A-0927	TATA	2017			7	2	2	100%	0.90	0.86	0.50	2.70	5.40	2.00	6	50%	0.90	0.86	0.50	1.40	2.80
5	Compactor		BG-1-A-0807	TATA	2015			7	2	4	100%	0.90	0.86	0.50	2.70	5.40	2.00	8	50%	0.90	0.86	0.50	1.40	2.80
6	Dump Truck		BG-2A-0472	TATA	2005			5	1	14	50%	0.90	0.86	0.35	0.70	0.70	1.00	18	FALSE	0.90	0.86	0.35	0.00	0.00
7	Container Carrier Lift Type		BG-2A-0784	TATA	2012			4	5	7	100%	0.90	0.86	0.35	1.10	5.50	5.00	11	FALSE	0.90	0.86	0.35	0.00	0.00
8	Container Carrier Lift Type		BG-2A-0857	TATA	2012			4	0	7	100%	0.90	0.86	0.35	1.10	0.00	0.00	11	FALSE	0.90	0.86	0.35	0.00	0.00
																30.50								5.60

New vehicle for collecting dry waste in 2023

Vehicle Type			Capacity (m^3)	No. of vehicles		trip/day	Vehicle age	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (tm3)	Average Collection Amount (t/trip)	Daily Work Capacity
1	Compactor		4	1		2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		4	1		2	1	100%	0.9	0.86	0.5	1.5	3
													6.00

New vehicle for collecting wet waste in 2023

Vehicle Type			Capacity (m^3)	No. of vehicles		trip/day	Vehicle age	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (tm3)	Average Collection Amount (t/trip)	Daily Work Capacity
1	Compactor		4	1		2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		4	1		2	1	100%	0.9	0.86	0.5	1.5	3
1	Compactor		4	1		2	1	100%	0.9	0.86	0.5	1.5	3
													9.00

A6-2-3 ゲレフ市

A6-2-3-1 廃棄物収集運搬機材

Gelephu Thromde

Planned collection amount	Waste Aoumnt in2023 Year (Source: Gelephu)	Existing vehicle type	Operating Number in 2019 of Existing Vehicle	Operating Capacity in 2019 by Existing Vehicee (t/d)	Operating Number in 2023 of Existing Vehicle	Operating Capacity in 2023 by Existing Vehicee (t/d)	Breakdown into Dry & Wet Area in 2023		New Number in 2023	New Capacity in 2023 (t/d) (B)	Total Capacity in 2023 (t/d) (C)=(A)+(B)
Dry waste	1.4	Compactor	3	5.4	2	2.8	Dry Waste in Core Town	0.7	0	1	1.5
Wet waste	1.8	Container Carrier Lift Type	0	0.0	0	0.0	Wet Waste in Core Town	0.9	0	1	1.5
Mix waste	2.6	Tractor	0	0.0	0	0.0	Mix Waste in LAP 1 & 3	1.2	1	1.4	0
Total	5.8	Dump Truck	1	2.2	0	0.0	Dry Waste in LAP 2 & 6	0.7	0	0	1.5
		Total	4	7.6	2	2.8	Wet Waste in LAP 2 & 6	0.9	0	1	1.5
							Mix Waste in LAP 4 & 5	1.4	1	1.4	0
							Total	5.8	2	2.8	4

Existing vehicles

	Vehicle Type							In year 2019					In target year							
	Type1	Type2	Type3	Registration No.	Manufacturer	Purchase year	Total milage	Milage in yast year	Capacity (m^3)	trip/day	Existing Number in 2023	Vehicle age in 2019	Effective Rate	New Number in 2023	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (t/m3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)	trip/day	Vehicle age in 2023	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (t/m3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)
1	Compactor	Gelephu Thromde	BG-3A-0090	Toyota	2008	98,351		6	0	11	50%	0.90	0.86	0.50	1.20	0.00	0	15	FALSE	0.90	0.86	0.50	0.00
2	Compactor	Gelephu Thromde	BG-3A-0173	Eicher	2016	31,660		7	1	3	100%	0.90	0.86	0.50	2.70	2.70	1	7	50%	0.90	0.86	0.50	1.40	1.40
3	Compactor	Gelephu Thromde	BG-3A-0175	TATA	2017	24,960		7	1	2	100%	0.90	0.86	0.50	2.70	2.70	1	6	50%	0.90	0.86	0.50	1.40	1.40
4	Dump Truck	Gelephu Thromde	BG-3A-0165	TATA	2012	54,000		8	1	7	100%	0.90	0.86	0.35	2.20	2.20	1	11	FALSE	0.90	0.86	0.35	0.00	0.00
																7.60										2.80

New vehicle for collecting dry waste in Core Town in 2023

Vehicle Type																										
			Capacity (m^3)	No. of vehicles																						
			4	1																						
1	Compactor																									

New vehicle for collecting wet waste in Core Town in 2023

Vehicle Type																										
			Capacity (m^3)	No. of vehicles																						
			4	1																						
1	Compactor																									

New vehicle for collecting dry waste in LAP 2 & 6 in 2023

Vehicle Type																										
			Capacity (m^3)	No. of vehicles																						
			4	1																						
1	Compactor																									

New vehicle for collecting wet waste in LAP 2 & 6 in 2023

Vehicle Type																										
			Capacity (m^3)	No. of vehicles																						
			4	1																						
1	Compactor																									

A6-2-4　サムドゥプジョンカル市

A6-2-4-1 廃棄物収集運搬機材

Samdrupjongkhar Thromde

Planned collection amount	Waste Aoumnt in 2023 Year (Source: Samdrupjongkhar)	Existing vehicle type	Operating Number in 2019 of Existing Vehicle	Operating Capacity in 2019 by Existing Vehice (t/d)	Operating Number in 2023 of Existing Vehicle	Operating Capacity in 2023 by Existing Vehice (t/d)	Breakdown into Dry & Wet Area in 2023		Existing Number in 2023	Existing Capacity in 2023 (t/d) (A)	New Number in 2023	New Capacity in 2023 (t/d) (B)	Total Capacity in 2023 (t/d) (C)=(A)+(B)
Dry waste	2.5	Compactor	2	5.4	2	4.2	Dry Waste in Samdrupjongkhar	1.5	1	2.8	0	0	2.8
Wet waste	3.2	Container Carrier Lift Type	0	0	0	0	Wet Waste in Samdrupjongkhar	1.9	0	0	1	3.0	3.0
total	5.7	Tractor	1	0.8	0	0	Dry Waste in Dewathang	1.0	1	1.4	0	0	1.4
		Dump Truck	0	0	0	0	Wet Waste in Dewathang	1.3	0	0	1	1.5	1.5
		Total	3	6.2	2	4.2	Total	5.7	0	0	2	4.5	8.7

Existing vehicles

Vehicle Type			In year 2019														In target year								
Type1	Type2	Type3	Registration No.	Manufacturer	Purchase year	Total milage	Milage in yast year	Capacity (m^3)	trip/day	Vehicle age in 2019	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (t/m3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)	trip/day	Vehicle age in 2023	Effective Rate	Loading Rate	Operation Rate	Unit Loaded Weight after Loading (t/m3)	Average Collection Amount (t/trip)	Daily Work Capacity (t/day)	Remarks
1	Compactor	Samdrupjongkhar Thromde	BG-4A-0194	TATA	2016	28000 km		7	1	3	100%	0.90	0.86	0.50	2.70	2.70	2	7	50%	0.90	0.86	0.50	1.40	2.80	Vehicle for Samdrupjongkhar
2	Compactor	Samdrupjongkhar Thromde	BG-1A-0808	TATA	2016	17180 km		7	1	3	100%	0.90	0.86	0.50	2.70	2.70	1	7	50%	0.90	0.86	0.50	1.40	1.40	Vehicle for Dewathang
3	Compactor	Samdrupjongkhar Thromde	BG-1A-0203	TATA	2014	21345 km		13.8	0	5	100%	0.90	0.86	0.50	5.30	0.00	0	9	50%	0.90	0.86	0.50	2.70	0.00	Totaled in 2023 due to reasons below:1)This vehicle is retired in 2024, 2)This vehicle is too huge to fit in narrow roads in the town, hence, this vehicle cannot cover the area with only this vehicle
4	Tractor	Samdrupjongkhar Thromde	BG-4A-0012	Sonalika	2016	782.8 hr		3.3	1	3	100%	0.90	0.86	0.30	0.80	0.80	0	7	50%	0.90	0.86	0.30	0.40	0.00	Low collection efficiency of this vehicle
																6.20								4.20	

New vehicle for collecting wet waste in Samdrupjongkhar in 2023

Vehicle Type			Capacity (m^3)	No. of vehicles	trip/day	Vehicle age	Effective R	Loading Ra	Operation R	Unit Loaded	Average Co	Daily Work Capacity (t/day)
1	Compactor		4	1	**2**	1	100%	0.9	0.86	0.5	1.5	3
												3.00

New vehicle for collecting wet waste in Dewathang in 2023

Vehicle Type			Capacity (m^3)	No. of vehicles	trip/day	Vehicle age	Effective R	Loading Ra	Operation R	Unit Loaded	Average Co	Daily Work Capacity (t/day)	Remarks
1	Compactor		4	1	**1**	1	100%	0.9	0.86	0.5	1.5	1.5	one trip per day due to the location of Dewathang
												1.50	

資料-6-3　運営維持管理費計算書

資料-6-3　運営維持管理費計算書

A6-3-1　ティンプー市における運営維持管理費概算

2023年度時点想定

項目	細目	単価	単位	計(BTN/年)	備考
収集車運転手給与		11,000	BTN/人/月	528,000	4名(1名予備)
収集車保険　他		4,500	BTN/台/年	112,500	25台分(5+17+3)
収集車燃料費	計		BTN/年	670,271	313日(週6日)
	DRY　A　新規4m3	831	BTN/日	260,015	5.9L/h, 22km
	WET　B　新規4m3	831	BTN/日	260,015	5.9L/h, 22km
	コンテナキャリア Ⅰ	480	BTN/週	150,240	4.0km/L, 10km, 52週/年
収集車維持管理費	計		BTN/年	475,000	
	DRY　A　既存4m3	170,000	BTN/年	170,000	※2
	WET　B　既存4m3	170,000	BTN/年	170,000	※2
	コンテナキャリア Ⅰ	135,000	BTN/年	135,000	※6
収集車維持管理費 (通常点検除く)	計	計	BTN/年	3,635,100	維持管理費の90%を計上
	DRY　C　新規8m3	166,500	BTN/年	166,500	※1
	DRY　D　新規4m3	153,000	BTN/年	153,000	※2
	WET　E, F, G　新規4m3	153,000	BTN/年/台	459,000	※2
	コンテナキャリア Ⅱ	121,500	BTN/年	121,500	※6
	DRY　H, I　既存8.9m3	166,500	BTN/年/台	333,000	※1
	DRY　J, K　新規8m3	166,500	BTN/年/台	333,000	※1
	DRY　L, M　新規4m3	153,000	BTN/年/台	306,000	※2
	WET　N　既存19.5m3	377,100	BTN/年/台	377,100	※8
	WET　O, P　既存3.75m3	153,000	BTN/年/台	306,000	※2
	WET　Q, R, S　新規8m3	166,500	BTN/年/台	499,500	※1
	WET　T, U, V　新規4m3	153,000	BTN/年/台	459,000	※2
	コンテナキャリア Ⅲ	121,500	BTN/週	121,500	※6
収集補助員給与		7,000	BTN/人/月	588,000	7名(1名予備)
最終処分場作業員給与		7,000	BTN/人/月	420,000	5名
重機燃料費	既存バックホウ	18,432	BTN/週	958,464	週18時間, 52週/年, 16L/h
	新規ブルドーザ	23,040	BTN/週	1,198,080	週12時間, 52週/年, 30L/h
重機運転手給与		13,500	BTN/人/月	324,000	2名
重機保険　他		30,000	BTN/年	60,000	2台分
重機維持管理費	既存バックホウ	345,000	BTN/年	345,000	※3
	新規ブルドーザ	944,000	BTN/年	944,000	※4
ダンプトラック運転手給与		13,500	BTN/人/月	81,000	環境部負担分、1/2
ダンプトラック燃料費		3,894	BTN/週	202,488	週6時間, 52週/年, 11L/h
委託費(北部)				5,020,720	
管理費				1,434,251	直接経費の40%以下
直接経費				3,586,469	
	収集車運転手給与	7,000	BTN/人/月	588,000	7名(1名予備)
	収集補助員給与	7,000	BTN/人/月	1,428,000	15名(3名予備)
	収集車燃料費	計	BTN/年	1,470,469	313日(週6日)
	DRY　C　新規8m3	1,295	BTN/日	405,448	9.2L/h, 22km
	DRY　D　新規4m3	831	BTN/日	260,015	5.9L/h, 22km
	WET　E, F, G　新規4m3	831	BTN/日/台	780,046	5.9L/h, 22km
	コンテナキャリア Ⅱ	480	BTN/週	24,960	4.0km/L, 10km, 52週/年
	収集車維持管理費(通常点検)	計	BTN/年	100,000	維持管理費の10%を計上
	DRY　C　新規8m3	18,500	BTN/年	18,500	※1
	DRY　D　新規4m3	17,000	BTN/年	17,000	※2
	WET　E, F, G　新規4m3	17,000	BTN/年/台	51,000	※2
	コンテナキャリア Ⅱ	13,500	BTN/年	13,500	※6
委託費(中部/南部)				14,171,000	
管理費				4,048,541	直接経費の40%以下
直接経費				10,122,459	
	収集車運転手給与	7,000	BTN/人/月	1,596,000	19名(3名予備)
	収集補助員給与	7,000	BTN/人/月	2,940,000	35名(3名予備)
	収集車燃料費	計	BTN/年	5,282,559	313日(週6日)
	DRY　H, I　既存8.9m3	1,126	BTN/日/台	705,126	2.5km/L, 22km
	DRY　J, K　新規8m3	1,295	BTN/日/台	810,895	9.2L/h, 22km
	DRY　L, M　新規4m3	831	BTN/日/台	520,031	5.9L/h, 22km
	WET　N　既存19.5m3	2,253	BTN/日/台	705,126	16L/h (※7), 22km
	WET　O, P　既存3.75m3	831	BTN/日/台	520,031	5.9L/h, 22km
	WET　Q, R, S　新規8m3	1,295	BTN/日	1,216,343	9.2L/h, 22km
	WET　T, U, V　新規4m3	831	BTN/日/台	780,046	5.9L/h, 22km
	コンテナキャリア Ⅲ	480	BTN/週	24,960	4.0km/L, 10km, 52週/年
	収集車維持管理費(通常点検)	計	BTN/年	303,900	維持管理費の10%を計上
	DRY　H, I　既存8.9m3	18,500	BTN/年/台	37,000	※1
	DRY　J, K　新規8m3	18,500	BTN/年/台	37,000	※1
	DRY　L, M　新規4m3	17,000	BTN/年/台	34,000	※2
	WET　N　既存19.5m3	41,900	BTN/年/台	41,900	※8
	WET　O, P　既存3.75m3	17,000	BTN/年/台	34,000	※2
	WET　Q, R, S　新規8m3	18,500	BTN/年/台	55,500	※1
	WET　T, U, V　新規4m3	17,000	BTN/年/台	51,000	※2
	コンテナキャリア Ⅲ	13,500	BTN/週	13,500	※6
合計				29,733,623	BTN/年

2019年時点(参考)　26,071,000　114%

※　職員給与、減価償却費、修理機材送料は本計算に含まない
※　物価変動は本計算では想定しない

【運転条件】

収集車	
シフト/トリップ数	
	1 shift, 2 trips
種別	
直営:DRY	新規4m3×1台
直営:WET	新規4m3×1台
北部:DRY	新規8m3×1台、4m3×1台
北部:WET	新規4m3×3台
中部・南部:DRY	既存8.9m3×2台, 新規8m3×2台、4m3×2台
中部・南部:WET	既存19.5m3×1台、3.75m3×2台
Drop-in Centre	新規コンテナキャリア3台
体制	民間委託
収集車1台につき、運転手1名、補助員2名	
稼働日	
収集車	週6日
コンテナキャリア	週3日
処分場重機(既存バックホウ、新規ブルドーザ)	
転圧	1日4時間、週3日
覆土	1日6時間、週3日

※　労働者給与、軽油燃料費は、調査時聴き取りによる　64BTN/L
※　新規収集車、重機、ダンプトラックの燃費は、「令和元年度版　建設機械等損料表」による
※1 (7,550,000/1.5)BTN×35%(維持管理費率) / 9.5年間(標準使用年数)
「建設機械等損料表」P20-17 "2072 パッカー車　積載容量8m3"参照
※2 (6,930,000/1.5)BTN×35%(維持管理費率) / 9.5年間(標準使用年数)
「建設機械等損料表」P20-17 "2072 パッカー車　積載容量4m3"参照
※3 (13,300,000/1.5)BTN×35%(維持管理費率) / 9年間(標準使用年数)
「建設機械等損料表」P02-9 "0202 バックホウ 112【標準型・排出ガス対策型(第1次基準値)】
060-001標準バケット容量(山積／平積)0.8/0.6m3"参照
※4 (36,200,000/1.5)BTN×45%(維持管理費率) / 11.5年間(標準使用年数)
「建設機械等損料表」P01-3 "0101 ブルドーザ 016【普通・排出ガス対策型(2014年規制)】 210-001 21t級

※5 「建設機械等損料表」P03-1 "0301 ダンプトラック 011【オンロード・ディーゼル】"

110-001 10t積級　供用1日当り損料13,000円を参考に算出

※6 (10,500,000/1.5)BTN×25%(維持管理費率) / 13.0年間(標準使用年数)
「建設機械等損料表」P04-7 "0402 トラッククレーン 022【トラッククレーン・油圧伸縮ジブ型】
007-1　7.0t吊"参照
※7 「建設機械等損料表」P20-18 "2072 パッカー車 積載容量8m3"より、燃料消費率0.063L/kW・h
「建設機械等損料表」P03-3 "0302 トラック 011【普通型】110-001 11t積" 257kWより 0.063×257=16L/h
※8 「建設機械等損料表」P03-3 "0302 トラック 011【普通型】"より4t積と11t積の基礎価格比は
4t積:11t積=4,070:10,000≒1:2.46
「建設機械等損料表」P20-17 "2072 パッカー車　積載容量8m3"を適用し
(6,930,000×2.46/1.5)BTN×35%(維持管理費率) / 9.5年間(標準使用年数)

A6-3-2　プンツォリン市における運営維持管理費概算

2023年度時点想定

項目	細目	単価	単位	計(BTN/年)	備考
収集車運転手給与		11,000	BTN/人/月	1,056,000	8名(1名予備)
収集車保険 他		4,500	BTN/台/年	31,500	7台分
収集車燃料費	計		BTN/年	2,974,752	313日(週6日)
	DRY A 既存7m3	1,920	BTN/日	600,960	2.0km/L, 30km
	WET B 既存7m3	1,920	BTN/日	600,960	2.0km/L, 30km
	DRY C 新規4m3	1,133	BTN/日	354,566	5.9L/h, 30km
	DRY D 新規4m3	1,133	BTN/日	354,566	5.9L/h, 30km
	WET E 新規4m3	1,133	BTN/日	354,566	5.9L/h, 30km
	WET F 新規4m3	1,133	BTN/日	354,566	5.9L/h, 30km
	WET G 新規4m3	1,133	BTN/日	354,566	5.9L/h, 30km
収集車維持管理費	計		BTN/年	1,220,000	
	DRY A 既存7m3	185,000	BTN/年	185,000	※1
	WET B 既存7m3	185,000	BTN/年	185,000	※1
	DRY C 新規4m3	170,000	BTN/年	170,000	※2
	DRY D 新規4m3	170,000	BTN/年	170,000	※2
	WET E 新規4m3	170,000	BTN/年	170,000	※2
	WET F 新規4m3	170,000	BTN/年	170,000	※2
	WET G 新規4m3	170,000	BTN/年	170,000	※2
重機燃料費	バックホウ	6,144	BTN/週	319,488	週6時間, 52週/年, 16L/h
重機運転手給与		13,500	BTN/人/月	162,000	1名
重機保険 他		15,000	BTN/年	15,000	1台分
重機維持管理費	バックホウ	412,000	BTN/年	412,000	※3
収集車貸出費用(運転手込)		-90,000	BTN/台/月	-1,080,000	
重機貸出費用(運転手込)		-20,000	BTN/台/月	-240,000	
委託費				5,697,000	道路清掃等の費用は含まない
	管理費			1,627,352	直接経費の40%以下
	直接経費			4,069,648	
	収集補助員給与	7,000	BTN/人/月	1,428,000	17名(3名予備)
	最終処分場作業員給与	7,000	BTN/人/月	420,000	5名
	収集車賃料	90,000	BTN/台/月	1,080,000	
	重機賃料	20,000	BTN/台/月	240,000	
	ダンプトラック賃料	10,000	BTN/台/日	520,000	52日間/年 ※4
	ダンプトラック運転手給与	13,500	BTN/人/月	162,000	
	ダンプトラック燃料費	4,224	BTN/週	219,648	週6時間, 52週/年, 11L/h
合計				10,567,740	BTN/年

道路清掃含む
2019年時点(参考)
17,983,892

※ 職員給与、減価償却費、修理機材送料は本計算に含まない
※ 物価変動は本計算では想定しない

※ 労働者給与、軽油燃料費は、調査時聴き取りによる 64BTN/L
※ 新規収集車、重機、ダンプトラックの燃費は、「令和元年度版 建設機械等損料表」による
※1 (7,550,000/1.5)BTN×35%(維持管理費率) / 9.5年間(標準使用年数)
「建設機械等損料表」P20-17 "2072 バッカー車 積載容量8m3"参照
※2 (6,930,000/1.5)BTN×35%(維持管理費率) / 9.5年間(標準使用年数)
「建設機械等損料表」P20-17 "2072 バッカー車 積載容量4m3"参照
※3 (15,900,000/1.5)BTN×35%(維持管理費率) / 9年間(標準使用年数)
「建設機械等損料表」P02-11 "0202 バックホウ 114【標準型・排出ガス対策型(第3次基準値)】
060-001標準バケット容量(山積/平積)0.8/0.6m3"参照
※4「建設機械等損料表」P03-1 "0301 ダンプトラック 011【オンロード・ディーゼル】"
110-001 10t積級 供用1日当り損料13,000円を参考に算出

【運転条件】

収集車	
シフト/トリップ数	1 shift, 2 trips
種別	
DRY	既存7m3×1台、新規4m3×2台
WET	既存7m3×1台、新規4m3×3台
体制	民間委託
収集車1台につき、運転手1名、補助員2名	
稼働日	週6日
処分場重機(バックホウ)	
転圧	1日2時間、週3日
覆土	1日6時間、週1日

2023年度時点想定

項目	細目	単価	単位	計(BTN/年)	備考
収集車運転手給与		13,600	BTN/人/月	816,000	5名（1名予備）
収集車保険　他		4,500	BTN/台/年	27,000	6台分
収集車燃料費	計		BTN/年	987,985	313日（週6日）
	MIX_A_既存7m3	708	BTN/日	221,604	2.5km/L, LAP1＆3, 30km
	MIX_B_既存7m3	708	BTN/日	221,604	2.5km/L, LAP4＆5, 30km
	DRY_C_新規4m3	348	BTN/日	108,955	5.9L/h, Core Town, 20km
	DRY_D_新規4m3	522	BTN/日	163,433	5.9L/h, LAP2＆6, 30km
	WET_E_新規4m3	348	BTN/日	108,955	5.9L/h, Core Town, 20km
	WET_F_新規4m3	522	BTN/日	163,433	5.9L/h, LAP2＆6, 30km
収集車維持管理費	計		BTN/年	1,050,000	
	MIX_A_既存7m3	185,000	BTN/年	185,000	※1
	MIX_B_既存7m3	185,000	BTN/年	185,000	※1
	DRY_C_新規4m3	170,000	BTN/年	170,000	※2
	DRY_D_新規4m3	170,000	BTN/年	170,000	※2
	WET_E_新規4m3	170,000	BTN/年	170,000	※2
	WET_F_新規4m3	170,000	BTN/年	170,000	※2
収集補助員給与		7,000	BTN/人/月	1,260,000	15名（3名予備）
最終処分場作業員給与		7,000	BTN/人/月	252,000	3名
重機燃料費	バックホウローダー	6,018	BTN/週	312,936	週6時間, 52週/年, 17L/h
重機運転手給与		13,500	BTN/人/月	162,000	1名
重機保険　他		15,000	BTN/年	15,000	1台分
重機維持管理費	バックホウローダー	381,000	BTN/年	381,000	※3
ダンプトラック運転手給与		2,250	BTN/人/月	27,000	環境部負担分　1/6のみ
ダンプトラック燃料費	10t	3,894	BTN/週	202,488	週6時間, 52週/年, 11L/h
合計				5,493,409	BTN/年

2019年時点（参考）
4,579,200　120%

※　職員給与、減価償却費、修理機材送料は本計算に含まない
※　物価変動は本計算では想定しない

【運転条件】

収集車	
シフト／トリップ数	
	1 shift, 1 trip
種別	
DRY	新規4m3×2台
WET	新規4m3×2台
混合	既存7m3×2台
体制	
収集車1台につき、運転手1名、補助員2名	
稼働日	
	週6日
処分場重機（バックホウローダー）	
転圧	1日2時間、週3日
覆土	1日6時間、週1日

※　労働者給与、軽油燃料費は、調査時聴き取りによる　59BTN/L
※　新規収集車、重機、ダンプトラックの燃費は、「令和元年度版　建設機械等損料表」による
※1 (7,550,000/1.5)BTN×35%（維持管理費率）/ 9.5年間（標準使用年数）
「建設機械等損料表」P20-17 "2072 パッカー車　積載容量8m3"参照
※2 (6,930,000/1.5)BTN×35%（維持管理費率）/ 9.5年間（標準使用年数）
「建設機械等損料表」P20-17 "2072 パッカー車　積載容量4m3"参照
※3 (14,300,000/1.5)BTN×50%（維持管理費率）/ 12.5年間（標準使用年数）
「建設機械等損料表」P02-23 "0206 クローラローダ（トラクタショベル）
190-001標準ﾊﾞｹｯﾄ容量（山積）1.8～1.9m3"参照

2023年度時点想定

項目	細目	単価	単位	計(BTN/年)	備考
収集車運転手給与		12,000	BTN/人/月	720,000	5名（1名予備）
収集車保険　他		4,500	BTN/台/年	18,000	4台分
収集車燃料費	計		BTN/年	1,500,973	313日（週6日）
	DRY_A 既存7m3	1,456	BTN/日	455,728	2.5km/L, 70km, デワタン地区
	DRY_B 既存7m3	1,560	BTN/日	488,280	2.0km/L, 30km, サムドゥプジョンカル地区
	WET_C 新規4m3	859	BTN/日	268,880	5.9L/h, 70km, デワタン地区
	WET_D 新規4m3	920	BTN/日	288,085	5.9L/h, 30km, サムドゥプジョンカル地区
収集車維持管理費	計		BTN/年	710,000	
	DRY_A 既存7m3	185,000	BTN/年	185,000	※1
	DRY_B 既存7m3	185,000	BTN/年	185,000	※1
	WET_C 新規4m3	170,000	BTN/年	170,000	※2
	WET_D 新規4m3	170,000	BTN/年	170,000	※2
収集補助員給与		7,000	BTN/人/月	840,000	10名（2名予備）
最終処分場作業員給与		7,000	BTN/人/月	252,000	3名
重機燃料費	バックホウローダー	5,304	BTN/週	275,808	週6時間, 52週/年, 17L/h
重機運転手給与		12,000	BTN/人/月	144,000	1名
重機保険　他		15,000	BTN/年	15,000	1台分
重機維持管理費	バックホウローダー	381,000	BTN/年	381,000	※3
ダンプトラック運転手給与		2,000	BTN/人/月	24,000	環境部負担分　1/6のみ
ダンプトラック燃料費	10t	3,432	BTN/週	178,464	週6時間, 52週/年, 11L/h
合計				5,059,245	BTN/年

2019年時点（参考）
5,713,000　89%

※　職員給与、減価償却費、修理機材送料は本計算に含まない
※　物価変動は本計算では想定しない
※　労働者給与、軽油燃料費は、調査時聴き取りによる　52BTN/L
※　新規収集車、重機、ダンプトラックの燃費は、「令和元年度版　建設機械等損料表」による

【運転条件】

収集車	
シフト／トリップ数	
サムドゥプジョンカル地区	1 shift, 2 trips
デワタン地区	1 shift, 1 trip
種別	
DRY	既存7m3×2台
WET	新規4m3×2台
体制	
収集車1台につき、運転手1名、補助員2名	
稼働日	
	週6日
処分場重機（バックホウローダー）	
転圧	1日2時間、週3日
覆土	1日6時間、週1日

※1 (7,550,000/1.5)BTN×35%（維持管理費率）/ 9.5年間（標準使用年数）
「建設機械等損料表」P20-17 "2072 パッカー車　積載容量8m3"参照
※2 (6,930,000/1.5)BTN×35%（維持管理費率）/ 9.5年間（標準使用年数）
「建設機械等損料表」P20-17 "2072 パッカー車　積載容量4m3"参照
※3 (14,300,000/1.5)BTN×50%（維持管理費率）/ 12.5年間（標準使用年数）
「建設機械等損料表」P02-23 "0206 クローラローダ（トラクタショベル）
190-001標準ﾊﾞｹｯﾄ容量（山積）1.8～1.9m3"参照