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Advice on Inter-municipal Cooperation on Waste Management in Adjara/ Georgia

Final Summary Report

Strasbourg, 21 November 2017

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ABBREVIATIONS

a	year (lat.: annum)
cap	person (lat.: capita)
CoE	Council of Europe
d	day
EU	European Union
€/ EUR	Euro
GEL	Georgian Lari
GPS	Global Positioning System
IMC	inter-municipal cooperation
IU	INFRASTRUKTUR & UMWELT
ISWM	integrated solid waste management
kg	kilogram
km	kilometre
l	litre
Ltd.	Limited company
m	meter
m^3	cubic meter
Mg	ton (mega gram)
MOENRP	Georgian Ministry of Environment and Natural Resource Protection
MoFE	Adjara Ministry of Finance and Economy
MRDI	Georgian Ministry of Regional Development and Infrastructure
n/a	not applicable
no	number
PET	Polyethylene terephthalate
SWM	solid waste management
SWMCG	Solid Waste Management Company of Georgia
USAID	United States Agency for International Development
w	week
WMTR	Waste Management Technologies in the Regions

0 Executive Summary

Background

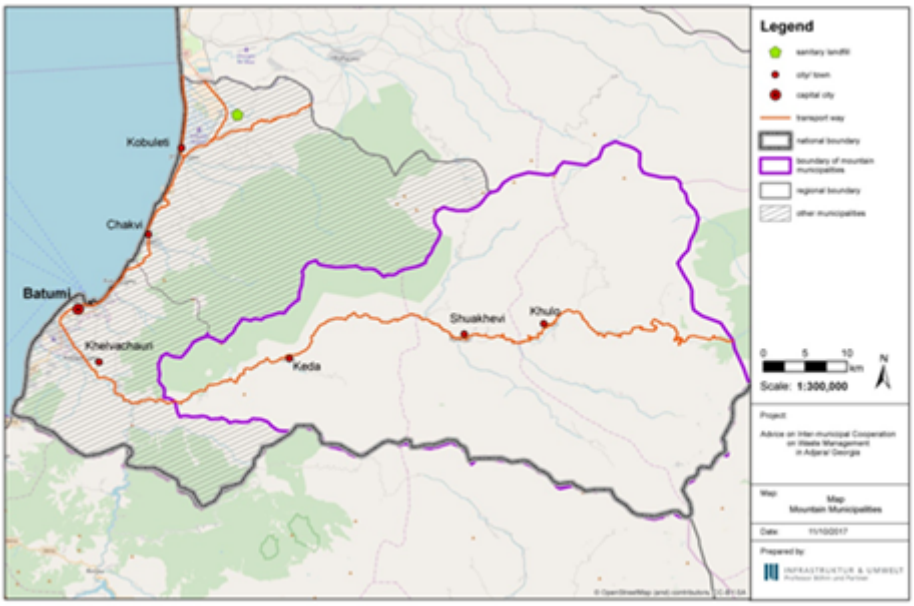
Within the project in inter-municipal cooperation in the Adjara Region, which is founded by the Council of Europe (CoE), the mountain municipalities of Keda, Shuakhevi and Khulo shall be supported in establishing inter-municipal cooperation in the waste management sector. The Municipal Service Development Centre has already been established in Keda Municipality and is to take over municipal services for the three mountain municipalities. This Summary Report sums up main findings and recommendations for technical objectives and options for solid waste management in general and for inter-municipal cooperation in particular.

Regulatory Framework

The relevant Georgian legal and policy framework as well as results of discussion with relevant stakeholders from the local, regional and national level have been used as basis for setting the objectives and for drafting the options for integrated solid waste management in the mountain municipalities.

Status-quo Analysis

The project area comprises the three mountain municipalities in Adjara: Keda, Shuakhevi and Khulo.



At present (2017), in total 55,900 inhabitants are living in the mountain municipalities. Of these overall 6 % are living in urban (administrative centres) and 94 % are living in rural areas.

For the project's 20 years planning horizon (2019 – 2038) a population forecast has been prepared: The population is forecasted to decrease from 56,516 in 2019 to 51,709 in 2038.

Regarding the further development of tourism it is assumed that in the mountain municipalities the number of overnight stays will increase from 607,477 in 2019 to 733,898 in 2038.

Currently, there is no reliable data on the quantity of municipal solid waste generated and collected in the mountain municipalities. Therefore, the waste amounts have been calculated based on statistical data and assumptions based on the experience of the Consultant. In the tables below, the calculated waste quantities for the status quo (2017) are shown.

Estimated waste generation in the mountain municipalities (2017)	Population	Mg/a	Mg/m	Mg/w	Mg/d
Keda Municipality	17,000	1,917	160	37	5
Shuakhevi Municipality	15,200	1,694	141	33	5
Khulo Municipality	23,700	2,632	219	51	7
Subtotal Mountain Municipalities	**55,900**	**6,244**	**520**	**120**	**17**
Tourism [overnight stays/a]	595,507	297	25	6	1
Total Mountain Municipalities		**6,541**	**545**	**126**	**18**

Estimated waste collection in the mountain municipalities (2017)	Population	Mg/a	Mg/m	Mg/w	Mg/d
Keda Municipality	17,000	797	66	15	2
Shuakhevi Municipality	15,200	149	12	3	0
Khulo Municipality	23,700	1,281	107	25	4
Subtotal Mountain Municipalities	**55,900**	**2,228**	**186**	**43**	**6**
Tourism (overnight stays/a)	595,507	297	25	6	1
Total Mountain Municipalities		**2,525**	**210**	**49**	**7**

For the drafting of waste management concept options, the future generated and collected waste quantities need to be estimated. Based on the population and tourism forecast and the assumed specific waste generation quantities for different settlement areas the waste generation and collection to be expected over the planning horizon has been computed. The following tables summarise the waste generation and collection forecast for the mountain municipalities.

Waste generation forecast for the planning horizon				
Years	Keda Municipality	Shuakhevi Municipality	Khulo Municipality	Mountain Municipalities
	[Mg/a]	[Mg/a]	[Mg/a]	[Mg/a]
2019	2,127	1,821	2,692	6,641
2029	2,187	1,832	2,766	6,785
2038	2,087	1,706	2,610	6,402

Waste collection forecast for the planning horizon				
Years	Keda Municipality	Shuakhevi Municipality	Khulo Municipality	Mountain Municipalities
	[Mg/a]	[Mg/a]	[Mg/a]	[Mg/a]
2019	1,336	580	1,825	3,741
2029	1,610	1,041	1,912	4,563
2038	1,550	1,226	1,808	4,584

In the mountain municipalities, progress has been achieved recently in municipal solid waste management, particularly with regard to the preparation of local waste management plans, the closure of small local dumps and the expansion of waste collection services to rural areas. Nevertheless, in spite of substantial improvements there are still various short comings and challenges, as listed in the following:

- Need for improvement of waste collection and expansion of waste collection services to rural areas/ villages, to reach targets of the Georgian National Waste Management Strategy and Action Plan (90% by 2020, 100% by 2025)
- Long transport distance to envisaged regional landfill in Tsetskhlauri
- No fee collection from households and very limited cost recovery from businesses
- No formal recycling and/ or composting activities
- No comprehensive approach on public awareness and enforcement of environmental regulations (e.g. re illegal dumping)

In this regard, when developing conceptual options for the future development of municipal waste management, important issues have to be taken into account. Major issues are:

- Waste collection and transportation:
  Expanding the waste collection to the rural areas as well as transporting the waste to the envisaged regional landfill in Tsetskhlauri requires on the one hand

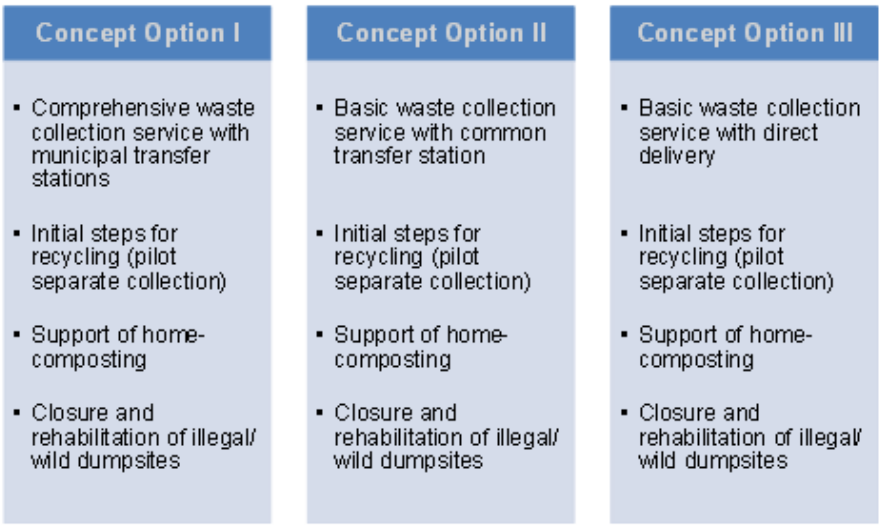
additional funds, basically to be collected from waste fees, on the other hand a strict enforcement of cost efficiency measures, as for example by implementing the services in inter-municipal cooperation.

- Recycling and composting:
  Recycling and composting measures need to be fostered, especially in order to comply with the existing legal and policy requirements.
- Financing of SWM/ fees:
  Generally, the main bottleneck is the funding of the SWM activities. Currently, the municipalities rely significantly on funds from the government and from other sources. The entire financing is not sustainably structured. Multiple reasons were identified such as a lack of political willingness to bill, of residents' awareness towards SWM service benefits, of cost efficiency, of revenue generation etc.

Conceptual Options for Future Solid Waste Management

Adapted to the current situation in SWM in the mountain municipalities, possible waste management options were proposed and discussed with relevant stakeholders. The most appropriate option was to be selected and recommended as future SWM procedure.

Three different integrated concept options, as shown in the following figure, have been compared.



Comparative assessment of the integrated SWM Concept Options I - III			
	Concept Option I	**Concept Option II**	**Concept Option III**
Economic aspects	High financial effort for both implementation and operation of the integrated SWM system. Highest specific costs per Mg.	Lowest financial effort for the implementation and operation of the integrated SWM system. Least specific costs per Mg.	Slightly higher financial effort for implementation and operation of the integrated SWM system as in Concept Option II. Slightly higher specific costs per Mg than in Concept Option II.
Ecological aspects	As also remote and poorly developed villages are covered by waste collection services, the risk of illegal dumping is lowest.	Danger of illegal dumping, as the population in the remote villages must organize themselves that their waste is brought to the collection points.	
Social aspects	Most jobs created, due to large number of collection vehicles needed and transfer stations established in every municipality. Highest costs per inhabitant. If costs are to be covered by tariffs, the rate per person/ household in this option would probably be above the affordability level. Household tariffs must necessarily be introduced and implemented in order to achieve the maximum cost coverage.	Few jobs created. Low costs per inhabitant. High degree of responsibility of population necessary to ensure that the household waste from remote villages is brought to the collection points. Improved law enforcement required to prevent illegal dumping.	

By promoting inter-municipal cooperation advantages can be considered for the improvement of municipal waste management service provision:

- Higher efficiency due to specialized staff and less staff
- Better redundancy for collection and transport equipment
- Improved maintenance of advanced technical equipment
- Better utilisation of vehicles
- More potential for private sector involvement (higher contract volume)

Consequently, the organisational and financial burden can be reduced if the mountain municipalities decide to provide their waste management services in inter-municipal cooperation.

Detailing of Preferred Option

Due to the high quality of service Option I was favoured, even though, taking into account the costs, Options II and III appeared to be the more realistic solutions. It was decided that a combination of Concept Option I & II, as detailed in the following, would be the Preferred Option for the development of future waste management in the mountain municipalities:

- No collection points, but waste collection with small 4x4 compaction trucks with a capacity of 3 Mg in the remote mountain villages (assumingly 1/3 of the waste to be collected in the rural areas will be collected by this kind of trucks)
- Waste collection with big compaction trucks in the administrative and touristic centres and in the well-developed rural areas (assumingly 2/3 of the waste to be collected in the rural areas will be collected by compaction trucks with 10 Mg capacity)
- Establishment of one transfer station (downhill in Keda)
- Initial steps for recycling (pilot separate collection in the administrative and touristic centres)
- Support of home-composting
- Closure and rehabilitation of illegal/ wild dumpsites

In the following tables, the costs of the Concept Options I – III are compared to the costs for the Preferred Option.

Comparative summary of the initial investment costs for the Concept Options I – III and the Preferred Option																
	Keda Municipality				Shuakhevi Municipality				Khulo Municipality				Mountain Municipalities (IMC)			
	Opt. I	Opt. II	Opt. III	Pref. Opt.	Opt. I	Opt. II	Opt. III	Pref. Opt.	Opt. I	Opt. II	Opt. III	Pref. Opt.	Opt. I	Opt. II	Opt. III	Pref. Opt.
	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]
Collection	306,900	134,866	178,866	218,900	194,700	108,206	196,206	194,700	333,128	153,663	241,663	234,575	559,900	308,460	308,460	471,900
Transport	280,446	97,984	-	97,984	271,138	97,984	-	97,984	286,471	97,984	-	97,984	739,054	293,952	-	293,952
Recycling (separate collection)	19,500	19,500	19,500	19,500	11,750	11,750	11,750	11,750	8,750	8,750	8,750	8,750	40,000	40,000	40,000	40,000
Composting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Closure and rehabilitation of illegal/ wild dumpsites	468	468	468	468	983	983	983	983	796	796	796	796	796	2,246	2,246	2,246
Total [EUR]	**607,314**	**478,570**	**198,834**	**336,852**	**478,570**	**218,923**	**208,939**	**305,417**	**629,145**	**261,193**	**251,209**	**342,105**	**1,341,201**	**642,412**	**348,460**	**805,852**
Total [GEL]	1,761,210	1,387,854	576,619	976,871	1,387,854	634,877	605,923	885,709	1,824,519	757,458	728,505	992,103	3,889,482	1,862,996	1,010,535	2,336,970

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Comparative summary of the average/ specific operating costs for the Concept Options I – III and the Preferred Option

		Keda Municipality				Shuakhevi Municipality				Khulo Municipality				Mountain Municipalities (IMC)			
		Option I	Option II	Option III	Pref. Opt.	Option I	Option II	Option III	Pref. Opt.	Option I	Option II	Option III	Pref. Opt.	Option I	Option II	Option III	Pref. Opt.
Collection	EUR/a	109,990	47,870	122,333	79,635	71,133	62,239	140,631	100,567	140,447	105,378	184,439	169,226	296,510	160,575	237,199	269,465
Transport	EUR/a	105,005	68,756	-	68,756	94,878	68,756	-	68,756	160,984	68,756	-	68,756	334,727	206,267	-	206,267
Recycling (separate collection)	EUR/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Composting	EUR/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Closure and rehabilitation of illegal/ wild dumpsites	EUR/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Disposal on regional landfill	*EUR/a*	*39,384*	*39,384*	*39,384*	*39,384*	*25,015*	*25,015*	*25,015*	*25,015*	*47,054*	*47,054*	*47,054*	*47,054*	*111,453*	*111,453*	*111,453*	*111,453*
excluding disposal	EUR/a	**214,995**	**116,626**	**122,333**	**148,391**	**166,011**	**130,994**	**140,631**	**169,323**	**301,431**	**174,133**	**184,439**	**237,982**	**631,237**	**366,842**	**237,199**	**475,732**
	GEL/a	623,486	338,214	354,766	430,333	481,431	379,884	407,829	491,037	874,149	504,987	534,874	690,147	1,830,586	1,063,842	687,878	1,379,622
including disposal	*EUR/a*	***254,380***	***156,010***	***161,718***	***187,775***	***191,026***	***156,010***	***165,646***	***194,338***	***348,484***	***221,187***	***231,493***	***285,036***	***742,690***	***478,295***	***348,653***	***587,185***
	GEL/a	*737,701*	*452,429*	*468,981*	*544,548*	*553,975*	*452,428*	*480,374*	*563,581*	*1,010,605*	*641,442*	*671,330*	*826,603*	*2,153,801*	*1,387,057*	*1,011,093*	*1,702,837*
Ø Spec. Ops Costs (excl. disposal)	EUR/Mg	**136**	**74**	**78**	**94**	**166**	**131**	**141**	**169**	**160**	**93**	**98**	**126**	**142**	**82**	**53**	**107**
	GEL/Mg	396	215	225	273	481	380	408	491	464	268	284	367	411	239	154	309
Ø Spec. Ops Costs (incl. disposal)	*EUR/Mg*	***161***	***99***	***103***	***119***	***191***	***156***	***166***	***194***	***185***	***118***	***123***	***151***	***167***	***107***	***78***	***132***
	GEL/Mg	*468*	*287*	*298*	*346*	*554*	*452*	*480*	*563*	*537*	*341*	*357*	*439*	*483*	*311*	*227*	*382*
Ø Ops Costs per Inhabitant (excl. disposal)	EUR/cap/a	**12.7**	**6.9**	**7.2**	**8.7**	**11.2**	**8.8**	**9.5**	**11.4**	**12.7**	**7.3**	**7.7**	**10.0**	**11.4**	**6.6**	**4.3**	**8.6**
	GEL/cap/a	36.8	19.9	20.9	25.4	32.5	25.7	27.5	33.2	36.7	21.2	22.5	29.0	32.9	19.1	12.4	24.8
	GEL/cap/m	3.1	1.7	1.7	2.1	2.7	2.1	2.3	2.8	3.1	1.8	1.9	2.4	2.7	1.6	1.0	2.1
Ø Ops Costs per Inhabitant (incl. disposal)	*EUR/cap/a*	***15.0***	***9.2***	***9.5***	***11.1***	***12.9***	***10.5***	***11.2***	***13.1***	***14.6***	***9.3***	***9.7***	***12.0***	***13.4***	***8.6***	***6.3***	***10.6***
	GEL/cap/a	*43.5*	*26.7*	*27.6*	*32.1*	*37.4*	*30.5*	*32.4*	*38.1*	*42.4*	*26.9*	*28.2*	*34.7*	*38.7*	*24.9*	*18.2*	*30.6*
	GEL/cap/m	*3.6*	*2.2*	*2.3*	*2.7*	*3.1*	*2.5*	*2.7*	*3.2*	*3.5*	*2.2*	*2.3*	*2.9*	*3.2*	*2.1*	*1.5*	*2.6*

The tables above show that both the initial investment costs and the average/ specific operating costs are high for the preferred option. The Concept Options II & III (basic collection services with collection points for villages in remote rural areas) are less expensive than the Concept Option I or the Preferred Concept Option (full waste collection service even in investment and operating costs) for villages in remote rural areas). Evidently a high service quality requires financial (and organisational) efforts.

By providing waste management services in inter-municipal cooperation, financial (and organisational) efforts can be reduced. Nevertheless, the Preferred Concept Option remains the second most expensive one.

Outline of Next Steps

Independent of the Concept Option, which will finally be chosen for providing waste management services in the mountain municipalities in the future, from an economic point of view, it is recommended that the waste management services, i.e.

- Waste collection
- Waste transfer and transport to the regional landfill
- Introduction of pilot project for separate collection of recyclables
- Support of home-composting for diverting of organic waste from landfills
- Closure and rehabilitation of existing dumpsites as well as
- Fee collection and
- Public awareness

are implemented by the already existing Municipal Service Development Centre in inter-municipal cooperation.

The mountain municipalities themselves will continue to be responsible for street cleaning as well as tariff setting.

A project implementation plan has been prepared with a one year period of project preparation and a project horizon of twenty years until 2038.

1 Introduction

Within the project in inter-municipal cooperation in the Adjara Region, which is founded by the Council of Europe (CoE), the mountain municipalities of Keda, Shuakhevi and Khulo shall be supported in establishing inter-municipal cooperation in the waste management sector.

In May 2017 a pre-feasibility study has been completed, assessing how such an inter-municipal cooperation could be developed in an institutional/ organisational way. With the support of the Council of Europe, the Municipal Service Development Centre has been established. It is located in Keda Municipality and is to take over municipal services for the three mountain municipalities.

Since it is necessary to define technical objectives and options for solid waste management in the mountain municipalities in general and for inter-municipal cooperation in particular INFRASTRUKTUR & UMWELT has been contracted to

- Draft technical options for inter-municipal cooperation in the waste sector
- Show respective advantages and disadvantages and
- Support the municipalities in their decision making regarding a preferred option

The consultancy contract started in July 2017 and included the following main steps:

- Status-quo assessment
- Development of alternative options
- Preparation of recommendations for the further approach

This Summary Report sums up the main findings and recommendations of the assignment.

2 Regulatory Framework

On 26 December 2014 the “Code on Waste Management” has been adopted, coming into force in January 2015. The Code defines competencies of different institutions involved in waste management and provides detailed control mechanisms to avoid violations caused by improper waste management. Also, the Code provides obligations for keeping records and reporting on waste. Furthermore, it includes provisions on requirements for the construction, operation, closure and aftercare of landfills and special requirements for existing landfills. One of the important provisions of the Code is the permitting and registration of waste management activities.

2.1 Targets and Regulations for Separate Municipal Waste Collection

According to the Waste Management Code (Chapter II - Article 6 (1) f)) the “Ministry of Environment and Natural Resources Protection of Georgia shall be the competent authority for performing the promotion of waste prevention, separation, re-use and recycling measures”. Concrete planned measures to be taken for the establishment of separate collection and recovery of municipal waste, including biodegradable waste and packaging waste shall be specified in the respective Municipal Waste Management Plans pursuant to Article 13 (4) e) of the Waste Management Code. In this respect “Each municipality shall adopt a plan for the management of the municipal waste produced within its territory for a period of five years. A Municipal Waste Management Plan may be prepared jointly by neighbouring municipalities”, see Waste Management Code (Chapter III - Article 13 (1)). According to the Waste Management Code (Chapter IV – Article 16 (1)) the Municipalities shall provide for:

- municipal waste collection, establishment of collection system for this purpose and ensuring proper functioning of such system;
- the gradual introduction and operation of waste collection systems for separate collection of municipal waste.

2.2 Reduction of the Amount of Organic Waste Landfilled

Based on the current state of the Georgian legal framework, the amount of organic waste disposed on landfills is not limited up to a specific value. According to the Waste Management Code (Chapter III - Article 11 (2)) “The Ministry shall develop a Strategy on management of biodegradable municipal waste. This strategy shall contain targets and measures for the reduction of the amount of biodegradable municipal waste going to

landfill". So far, both Waste Management objectives and respective targets are defined in the National Waste Management Strategy of Georgia (draft Oct. 2015). Objective O.4 "Waste disposed in a safe manner for the human health and environment" contains the target T4.4 "Disposal of biodegradable waste to be minimized at the landfills". The National Waste Management Action Plan 2016-2020 builds on these objectives and targets and contains respective actions. The following actions are defined related to target T4.4:

- A 4.4.1: Strategy on biodegradable waste developed until 2017-2018 by MOENRP
- A 4.4.2: Campaign promoting home composting of household biodegradable waste conducted and pilot project considered in remote areas until 2018-2020 by MOENRP

2.3 Decree of Government of Georgia (#421) on the Construction, Operation, Closure and After-care of Landfills

On 11 August 2015 the Government of Georgia adopted the Decree #421, "on the construction, operation, closure and after-care of landfills". This decree provides information on

- landfill categories and waste types
- licensing procedures for landfills
- technical standards for the construction of landfills (including leachate and gas management)
- requirements for operation and maintenance of landfills
- supervision, monitoring and reporting
- closure and aftercare of landfills

Regulations are oriented towards the EU landfill directive and define common standards for landfills in the Republic of Georgia (without exceptions e.g. for rural or remote areas).

3 Status-quo Analysis

3.1 Project Area

The following figure shows the project area, which comprises the three mountain municipalities in Adjara.

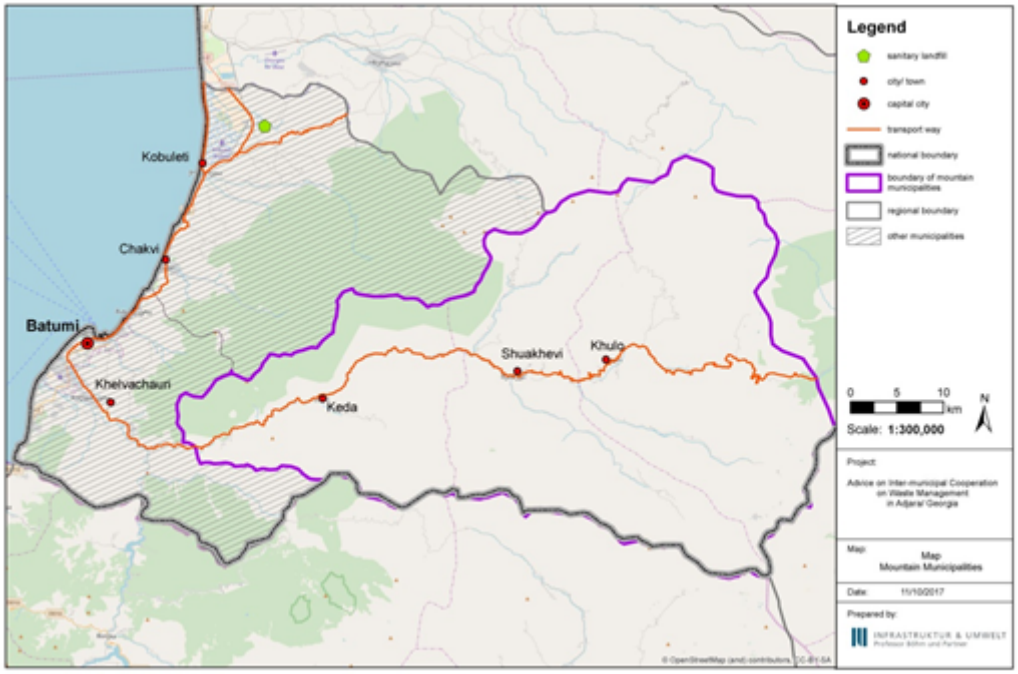

Figure 1 Project area in Adjara

3.2 Population and Population Forecast

3.2.1 Population

In the table below, the current (2017) population of the mountain municipalities, divided into urban and rural population, is presented.[1]

[1] Cp. National Statistics Office of Georgia: Population by municipalities for the beginning of the year; http://www.geostat.ge/index.php?action=page&p_id=473&lang=eng.

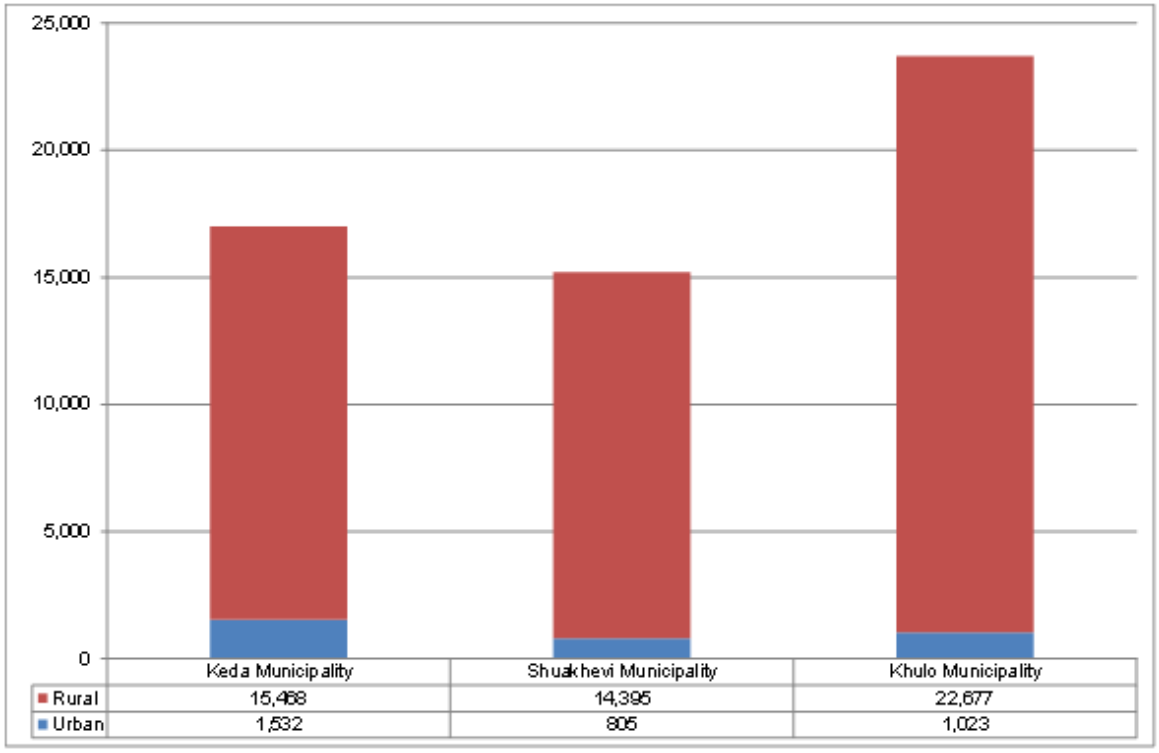

Figure 2 Urban and rural population in the mountain municipalities (2017)

At present (2017), 55,900 inhabitants are living in the mountain municipalities in total. Overall 6 % of the inhabitants are living in urban and 94 % are living in rural areas.

The urban population lives in the respective administrative centres of the municipalities, while the rural population lives in villages:[2]

- 60 villages in Keda Municipality
- 69 villages in Shuakhevi Municipality and
- 84 villages in Khulo Municipality

Based on the available information, for 2017 numbers regarding average village sizes etc. have been computed for the mountain municipalities and are summarised in the following table.

[2] Cp. Dakoli-Wilson, A., Wilson, I: Pre-feasibility Study on Inter-municipal Cooperation for Solid Waste Management in Adjara; May 2017.

Table 1 Average characteristics of villages in the mountain municipalities

	Keda Municipality	Shuakhevi Municipality	Khulo Municipality
Rural population	15,468	14,395	22,677
Number of villages[3]	60	69	84
Average population per village	258	209	270
Average number of persons per family	4	4	4
Average number of families per village	72	58	75
Average number of families living in one house	2	2	2
Average number of houses per village	48	39	50

3.2.2 Population Forecast

For the project's 20 years planning horizon (2019 – 2038) a population forecast has been prepared based on

- actual population figures for 2017[3] and
- recorded population development for the years 2002 – 2017,[4] also assuming that the population decrease will slow down until the end of the planning horizon, namely by 0.1 % each year in urban and by 0.05 % each year in the rural areas

In the mountain municipalities the population is forecasted to decrease from 56,516 in 2019 to 51,709 in 2038. The following table shows the forecasted population development by municipalities in the project area for the planning horizon.

[3] See 2014 General Population Census; http://census.ge/en/results/census

[4] See National Statistics Office of Georgia: Population and Regional Statistics; http://geostat.ge/index.php?action=0&lang=eng

Table 2 Forecasted population development by municipalities (2019 – 2038)

Years	Population											
	Keda Municipality			*Shuakhevi Municipality*			*Khulo Municipality*			Mountain Municipalities		
	Total	Urban	Rural	*Total*	Urban	Rural	*Total*	Urban	Rural	Total	Urban	Rural
2019	***17,194***	1,551	15,643	***15,313***	812	14,501	***24,009***	1,038	22,971	**56,516**	3,402	53,115
2020	***17,268***	1,560	15,708	***15,347***	815	14,532	***24,130***	1,045	23,085	**56,745**	3,420	53,325
2021	***17,325***	1,568	15,757	***15,367***	818	14,549	***24,227***	1,051	23,176	**56,920**	3,437	53,483
2022	***17,366***	1,575	15,791	***15,372***	820	14,552	***24,302***	1,057	23,245	**57,040**	3,452	53,588
2023	***17,390***	1,582	15,809	***15,362***	822	14,540	***24,353***	1,062	23,291	**57,105**	3,466	53,639
2024	***17,398***	1,588	15,811	***15,336***	823	14,513	***24,380***	1,067	23,313	**57,114**	3,477	53,637
2025	***17,390***	1,592	15,797	***15,296***	824	14,472	***24,383***	1,071	23,312	**57,069**	3,488	53,581
2026	***17,364***	1,597	15,768	***15,241***	825	14,417	***24,363***	1,075	23,288	**56,968**	3,496	53,472
2027	***17,323***	1,600	15,722	***15,172***	825	14,347	***24,318***	1,078	23,241	**56,813**	3,503	53,310
2028	***17,264***	1,603	15,662	***15,088***	825	14,263	***24,251***	1,080	23,170	**56,603**	3,508	53,095
2029	***17,190***	1,605	15,585	***14,990***	824	14,166	***24,159***	1,082	23,077	**56,339**	3,511	52,828
2030	***17,100***	1,606	15,494	***14,878***	823	14,055	***24,045***	1,084	22,960	**56,022**	3,513	52,509
2031	***16,993***	1,606	15,388	***14,752***	821	13,931	***23,907***	1,085	22,822	**55,653**	3,512	52,140
2032	***16,872***	1,605	15,267	***14,613***	820	13,794	***23,747***	1,086	22,661	**55,232**	3,510	51,722
2033	***16,735***	1,604	15,131	***14,462***	817	13,645	***23,565***	1,086	22,479	**54,762**	3,507	51,255
2034	***16,584***	1,602	14,982	***14,298***	814	13,483	***23,361***	1,085	22,276	**54,242**	3,501	50,741
2035	***16,418***	1,599	14,819	***14,122***	811	13,310	***23,136***	1,084	22,052	**53,676**	3,494	50,182
2036	***16,238***	1,595	14,643	***13,934***	808	13,126	***22,891***	1,082	21,809	**53,063**	3,485	49,579
2037	***16,045***	1,590	14,455	***13,735***	804	12,932	***22,627***	1,080	21,547	**52,407**	3,474	48,933
2038	***15,839***	1,585	14,255	***13,527***	800	12,727	***22,343***	1,077	21,266	**51,709**	3,462	48,247

Regarding the further development of tourism[5] it is assumed that the number of overnight stays will increase 1 % per year until the end of the planning horizon.

The number of overnight stays of tourists in the mountain municipalities is forecasted to develop as listed in the following table.

Table 3 Forecasted tourism development by municipalities (2019 – 2038)

Years	Overnight stays per year (tourism)			
	Keda Municipality	Shuakhevi Municipality	Khulo Municipality	**Mountain Municipalities**
2019	361,593	216,956	28,927	**607,477**
2020	365,209	219,126	29,217	**613,552**
2021	368,861	221,317	29,509	**619,687**
2022	372,550	223,530	29,804	**625,884**
2023	376,275	225,765	30,102	**632,143**
2024	380,038	228,023	30,403	**638,464**
2025	383,839	230,303	30,707	**644,849**
2026	387,677	232,606	31,014	**651,297**
2027	391,554	234,932	31,324	**657,810**
2028	395,469	237,282	31,638	**664,388**
2029	399,424	239,654	31,954	**671,032**
2030	403,418	242,051	32,273	**677,743**
2031	407,452	244,471	32,596	**684,520**
2032	411,527	246,916	32,922	**691,365**
2033	415,642	249,385	33,251	**698,279**
2034	419,799	251,879	33,584	**705,262**
2035	423,997	254,398	33,920	**712,314**
2036	428,237	256,942	34,259	**719,437**
2037	432,519	259,511	34,602	**726,632**
2038	436,844	262,106	34,948	**733,898**

[5] Cp. National Statistics Office of Georgia: Tourism Statistics; http://geostat.ge/index.php?action=0&lang=eng for the actual tourism figures. The figures have been adapted based on information provided by the mountain municipalities.

3.3 Waste Composition, Quantities and Waste Forecast

3.3.1 Waste Composition

In the course of the WMTR project a qualitative waste analysis has been conducted for the Adjara region. In discussions with regional stakeholders it has been confirmed that this waste composition can in principle also be assumed for the mountain municipalities.

The average waste composition measured during this analysis is summarised in the following figure.[6]

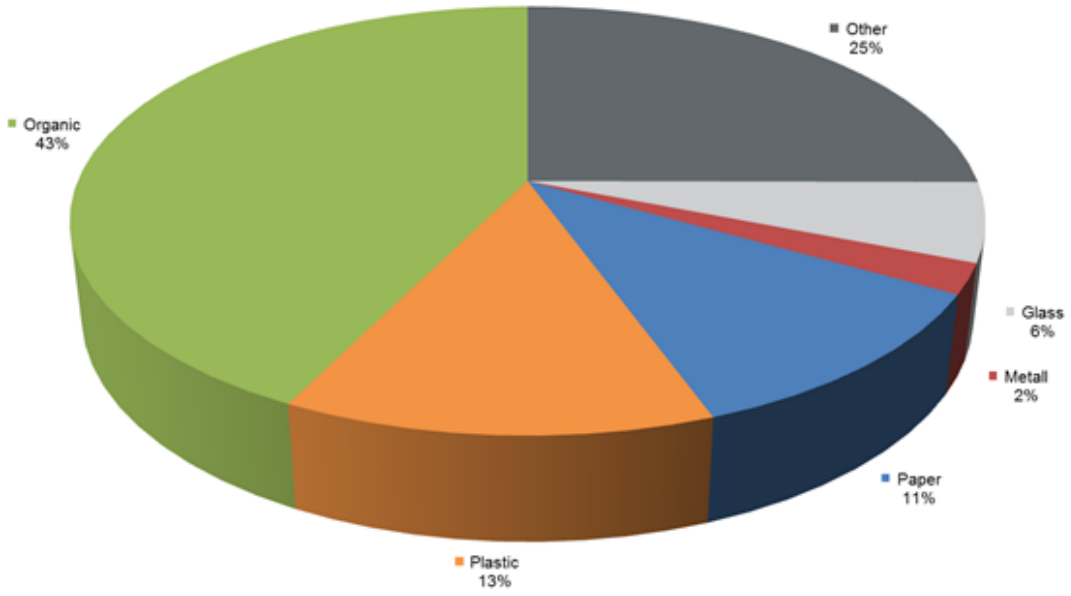

Figure 3 Waste composition in the Adjara region

3.3.2 Waste Quantities

The waste collected in the project area is disposed on the landfill in Batumi. Since this landfill is not equipped with a weighbridge, there is no reliable data available on the quantity of municipal solid waste. This means that also no conclusions about specific waste generation rates can be made, neither in general and even less under

[6] Cp. International City/ County Management Association: Waste Management Technologies in Regions, Georgia – Quarterly Report, Period: April – June 2016; Washington 2016.

consideration of different settlement structures. Specific waste generation rates are however needed in order to assess the present and future waste amounts generated in the project area. For the design on suitable waste management measures and facilities, future waste quantities need to be estimated.

For this reason the Consultant developed a theoretical model based on his findings in the project area as well as on previous findings in Georgia and the region. In the following table the assumed specific waste generation in relation to the size of a settlement area is presented.

Table 4 Assumed specific waste generation quantities for urban and rural areas

Settlement area	Specific waste generation quantities per capita and day
Urban population in administrative centres	0.4 kg
Rural areas	0.3 kg

In addition, it is also assumed, that a tourist generates 0.5 kg waste per overnight stay.

It is assumed, that the specific waste generation quantities already include household-like business and commercial waste.

Based on these specific waste generation quantities for different settlement areas and on the available figures regarding population and population distribution, the current waste generation in the project area can be computed. The following table summarises the waste generation in the project area for the year 2017.

Table 5 Estimated waste generation in the mountain municipalities (2017)

Municipality	Population	Mg/a	Mg/m	Mg/w	Mg/d
Keda Municipality	17,000	1,917	160	37	5
Shuakhevi Municipality	15,200	1,694	141	33	5
Khulo Municipality	23,700	2,632	219	51	7
Subtotal Mountain Municipalities	**55,900**	**6,244**	**520**	**120**	**17**
Tourism [overnight stays/a]	595,507	297	25	6	1
Total Mountain Municipalities		**6,541**	**545**	**126**	**18**

In Georgia in general and also in the project area, the waste amounts collected and delivered to landfills differ from the generated waste amounts, because waste collection services do not cover all settlement areas, especially in rural areas.

Based on the information received by the Consultant during his field visits in August 2017, the current waste collection rate has been estimated. The following assumptions are the basis for the estimations:

- In all administrative and tourism centres the waste collection service coverage is 100 %, i.e. the waste generated by the urban population and by tourists is collected to 100 %.
- In Keda Municipality, the waste collection service coverage is 60 % (based on the total population).
- In Khulo Municipality the waste collection service coverage is 70 % (based on the total population).
- In addition to the administrative and tourist centres in Shuakhevi Municipality the waste collection service coverage is low. It is assumed that 3 % of the rural areas (relative to the rural population) receive waste collection services.

Based on the estimated waste generation and the assumed waste collection for the different settlement areas the collected waste amounts have been computed. The results are summarised in the following table.

Table 6 Estimated waste collection in the mountain municipalities (2017)

Municipality	Population	Mg/a	Mg/m	Mg/w	Mg/d
Keda Municipality	17,000	797	66	15	2
Shuakhevi Municipality	15,200	149	12	3	0
Khulo Municipality	23,700	1,281	107	25	4
Subtotal Mountain Municipalities	55,900	2,228	186	43	6
Tourism (overnight stays/a)	595,507	297	25	6	1
Total Mountain Municipalities		2,525	210	49	7

3.3.3 Waste Forecast

Based on the population and tourism forecast and the assumed specific waste generation quantities for different settlement areas the waste generation and collection to be expected over the planning horizon has been computed. In order to take account of the likely change in consumption habits of the population and a respective increase in waste generation per capita, the waste generation rate is estimated to rise by 0.2 % per year. The following table provides an overview on the assumed specific waste generation quantities for different settlement areas over the planning horizon.

Table 7 Assumed specific waste generation quantities for urban and rural areas over the planning horizon

Settlement area	Specific waste generation quantities per capita and day		
	2019	2028	2038
Urban population in administrative centres	0.40 kg	0.41 kg	0.42 kg
Rural areas	0.30 kg	0.31 kg	0.31 kg

In addition, it is also assumed, that a tourist generates 0.5 kg waste per overnight stay for the whole planning horizon.

The following table shows the waste generation forecast for the planning horizon (2019 – 2038).

Table 8 Waste generation forecast for the mountain municipalities (2019 – 2038)

Years	Keda Municipality				Shuakhevi Municipality				Khulo Municipality				Mountain Municipalities			
	Total	Urban	Rural	Tourism	***Total***	Urban	Rural	Tourism	***Total***	Urban	Rural	Tourism	**Total**	Urban	Rural	Tourism
	[Mg/a]	[Mg/a]	[Mg/a]	[Mg/a]	***[Mg/a]***	[Mg/a]	[Mg/a]	[Mg/a]	***[Mg/a]***	[Mg/a]	[Mg/a]	[Mg/a]	**[Mg/a]**	[Mg/a]	[Mg/a]	[Mg/a]
2019	***2,127***	227	1,720	180	***1,821***	119	1,594	108	***2,692***	152	2,525	14	**6,641**	499	5,839	303
2020	***2,142***	229	1,730	182	***1,830***	120	1,601	109	***2,711***	153	2,543	15	**6,682**	502	5,874	306
2021	***2,154***	231	1,739	184	***1,837***	120	1,606	110	***2,728***	155	2,558	15	**6,718**	506	5,903	309
2022	***2,165***	232	1,746	186	***1,842***	121	1,609	111	***2,742***	156	2,571	15	**6,748**	509	5,927	312
2023	***2,173***	234	1,752	188	***1,845***	121	1,611	113	***2,753***	157	2,581	15	**6,772**	512	5,944	315
2024	***2,180***	235	1,756	189	***1,847***	122	1,612	114	***2,762***	158	2,589	15	**6,789**	515	5,956	318
2025	***2,185***	236	1,758	191	***1,847***	122	1,610	115	***2,768***	159	2,594	15	**6,801**	517	5,962	322
2026	***2,189***	237	1,758	193	***1,846***	123	1,607	116	***2,772***	160	2,596	15	**6,806**	520	5,961	325
2027	***2,190***	238	1,756	195	***1,843***	123	1,603	117	***2,772***	161	2,596	16	**6,805**	522	5,955	328
2028	***2,189***	239	1,753	197	***1,838***	123	1,597	118	***2,771***	161	2,594	16	**6,798**	524	5,943	331
2029	***2,187***	240	1,748	199	***1,832***	123	1,589	119	***2,766***	162	2,588	16	**6,785**	525	5,925	335
2030	***2,183***	241	1,741	201	***1,824***	123	1,580	121	***2,759***	162	2,580	16	**6,765**	526	5,901	338
2031	***2,177***	241	1,733	203	***1,814***	123	1,569	122	***2,749***	163	2,570	16	**6,740**	527	5,871	341
2032	***2,169***	241	1,723	205	***1,803***	123	1,556	123	***2,737***	163	2,557	16	**6,709**	528	5,836	345
2033	***2,160***	242	1,711	207	***1,790***	123	1,543	124	***2,722***	164	2,541	17	**6,672**	529	5,795	348
2034	***2,148***	242	1,697	209	***1,776***	123	1,527	126	***2,704***	164	2,523	17	**6,629**	529	5,748	352
2035	***2,135***	242	1,682	211	***1,760***	123	1,511	127	***2,684***	164	2,503	17	**6,580**	529	5,696	355
2036	***2,121***	242	1,665	214	***1,744***	123	1,493	128	***2,662***	164	2,480	17	**6,526**	528	5,639	359
2037	***2,105***	242	1,647	216	***1,725***	122	1,474	129	***2,637***	164	2,456	17	**6,467**	528	5,577	362
2038	***2,087***	241	1,628	218	***1,706***	122	1,453	131	***2,610***	164	2,428	17	**6,402**	527	5,509	366

For the mountain municipalities the waste generation is expected to decrease from 6,641 tons in 2019 to 6,402 tons in 2038.

For the waste collection it is again assumed, that the waste amount collected and delivered to the landfills will differ from the generated waste amounts also in the future. Since the mountain municipalities are to meet the targets stipulated in the Georgian National Waste Management Strategy and Action Plan, which require 90 % waste collection service coverage by 2020 and 100 % waste collection service coverage by 2025, the following enhancement in waste collection service coverage is assumed for the coming years:

- 3 % increase in administrative centres each year
- 15 % increase in rural areas until 2020 and 3 % increase in rural areas from 2020 - 2038

Regardless of the waste collection service coverage, for the rural areas it has to be taken into account that part of the organic waste will be used locally for agricultural purposes and thus will not be collected. Therefore, it is assumed that the waste to be collected in the rural areas is reduced by 33 %.

The following table summarises the waste collection forecast for the mountain municipalities over the project's planning horizon (2017 – 2036).

Table 9 Waste collection forecast for the mountain municipalities (2019 – 2038)

Years	Keda Municipality				Shuakhevi Municipality				Khulo Municipality				Mountain Municipalities			
	Total	Urban	Rural	Tourism	***Total***	Urban	Rural	Tourism	***Total***	Urban	Rural	Tourism	**Total**	Urban	Rural	Tourism
	[Mg/a]	[Mg/a]	[Mg/a]	[Mg/a]	***[Mg/a]***	[Mg/a]	[Mg/a]	[Mg/a]	***[Mg/a]***	[Mg/a]	[Mg/a]	[Mg/a]	**[Mg/a]**	[Mg/a]	[Mg/a]	[Mg/a]
2019	***1,336***	227	928	180	***580***	119	352	108	***1,825***	152	1,659	14	**3,741**	499	2,939	303
2020	***1,519***	229	1,108	182	***744***	120	515	109	***1,872***	153	1,704	15	**4,135**	502	3,326	306
2021	***1,563***	231	1,148	184	***779***	120	549	110	***1,883***	155	1,714	15	**4,226**	506	3,411	309
2022	***1,588***	232	1,170	186	***815***	121	582	111	***1,893***	156	1,723	15	**4,296**	509	3,475	312
2023	***1,595***	234	1,174	188	***849***	121	615	113	***1,901***	157	1,729	15	**4,346**	512	3,518	315
2024	***1,601***	235	1,176	189	***883***	122	648	114	***1,908***	158	1,734	15	**4,392**	515	3,559	318
2025	***1,605***	236	1,178	191	***917***	122	680	115	***1,912***	159	1,738	15	**4,434**	517	3,595	322
2026	***1,608***	237	1,178	193	***949***	123	711	116	***1,915***	160	1,740	15	**4,472**	520	3,628	325
2027	***1,610***	238	1,177	195	***981***	123	741	117	***1,916***	161	1,739	16	**4,507**	522	3,657	328
2028	***1,611***	239	1,175	197	***1,012***	123	770	118	***1,915***	161	1,738	16	**4,537**	524	3,682	331
2029	***1,610***	240	1,171	199	***1,041***	123	798	119	***1,912***	162	1,734	16	**4,563**	525	3,704	335
2030	***1,608***	241	1,167	201	***1,069***	123	825	121	***1,907***	162	1,729	16	**4,585**	526	3,721	338
2031	***1,605***	241	1,161	203	***1,097***	123	851	122	***1,901***	163	1,722	16	**4,603**	527	3,734	341
2032	***1,601***	241	1,154	205	***1,122***	123	876	123	***1,893***	163	1,713	16	**4,616**	528	3,743	345
2033	***1,595***	242	1,146	207	***1,147***	123	899	124	***1,883***	164	1,703	17	**4,625**	529	3,748	348
2034	***1,588***	242	1,137	209	***1,170***	123	921	126	***1,871***	164	1,691	17	**4,629**	529	3,749	352
2035	***1,580***	242	1,127	211	***1,191***	123	941	127	***1,858***	164	1,677	17	**4,630**	529	3,746	355
2036	***1,571***	242	1,116	214	***1,211***	123	960	128	***1,843***	164	1,662	17	**4,625**	528	3,738	359
2037	***1,561***	242	1,104	216	***1,229***	122	978	129	***1,827***	164	1,645	17	**4,617**	528	3,726	362
2038	***1,550***	241	1,091	218	***1,226***	122	974	131	***1,808***	164	1,627	17	**4,584**	527	3,691	366

For the mountain municipalities the waste collection is expected to increase from 3,741 tons in 2019 to 4,584 tons in 2038.

3.4 Current Waste Management in the Mountain Municipalities

3.4.1 Institutional Arrangements

On the national level, the Georgian Ministry of Environment and Natural Resource Protection (MOENRP) is responsible for the development of policies and strategies in the waste management sector. The Georgian Ministry of Regional Development and Infrastructure (MRDI) is responsible for the organisation and management of non-hazardous waste landfills as well as the development and management of long-distance/ regional waste transport and transfer and related infrastructure (i.e. transfer stations). For this purpose the MRDI has founded the Solid Waste Management Company of Georgia (SWMCG). 100 % of the shares of the SWMCG are owned by the state. The company operates landfills throughout Georgia except for the Municipality of Tbilisi and the Adjara Autonomous Republic.

In the Autonomous Republic of Adjara the responsibility for construction, operation and closure of non-hazardous waste landfills is in the competence of the Adjara Ministry of Finance and Economy (MoFE). The MoFE has commissioned the company Hygiena Ltd. to take over these tasks. The company is established and wholly owned by the Autonomous Republic of Adjara.

Furthermore, the regional government is empowered to oversee the extent to which requirements laid down in national laws or regulations are met by municipal decisions or actions.

The mountain municipalities are responsible for organising municipal waste management. Every municipality has departments with core functions and responsibilities in the area of solid waste management as well as units with solid waste management-related responsibilities, such as financing, budgeting or procurement.

In the mountain municipalities the waste collection services are either provided by the municipalities or by limited liability companies:

- In Keda Municipality the waste collection is provided by the municipality itself and transport to the current landfill in Batumi is provided by Sandasuptaveba Ltd, which is fully owned by Batumi Municipality.

- In Shuakhevi Municipality waste collection services as well as transportation of the collected waste to the current landfill in Batumi is provided by external service providers.
- In Khulo Municipality the waste collection and transport to the current landfill in Batumi is provided by Sandasuptaveba Ltd.

All major equipment, including containers or trucks, is owned by the municipalities. Only the vehicles that Sandasuptaveba Ltd uses to transport the waste to the landfill in Batumi belong to this company.

3.4.2 Street Sweeping, Waste Collection and Transport

According to the law, municipalities in Georgia are responsible for sweeping and waste collection within their administrative borders. In all mountain municipalities sweeping services are provided.

The municipal waste collection is mainly carried out in the administrative and touristic centres. The waste collection service coverage in the villages/ rural areas varies:[7]

- With a general collection coverage of 70 % in Khulo Municipality (relative to the total population), it must also be assumed that waste collection services are provided for the major part of the population in the rural areas.
  Assuming that 100 % of the urban population is provided with waste collection services, this result in calculated waste collection coverage of 68 % of the rural population.
- With a general collection coverage of 70 % in Keda Municipality (relative to the total population), it must also be assumed that waste collection services are provided for about half of the population in the rural areas.
  Assuming that 100 % of the urban population is provided with waste collection services, this result in calculated waste collection coverage of 51 % of the rural population.
- In Shuakhevi Municipality waste collection is mainly carried out in the administrative centre, while in the majority of the villages in the region there is no waste collection service.
  It is assumed that 100 % of the urban and 3 % of the rural population is provided with waste collection services.

Just recently Keda and Khulo Municipalities have considerably improved their waste collection by expanding to the rural areas. Their efforts, at least partially, are based on the

[7] As stated by the local stakeholders during the Consultant's field visit in August 2017.

current Local Waste Management Plans, which were developed with the support of the WMTR project and provide guidance for comprehensive future SWM planning.

The municipal waste is collected from residents by using 1.1 m³ containers (cp. the following figure).

Figure 4 Examples of 1.1 m³ steel containers used for primary waste collection

It is to be feared that, especially in rural areas, the containers are only used by the population, who live within short walking distance. As a consequence, it is not unlikely that practically fewer inhabitants are using the provided waste collection measures than are theoretically connected to the waste collection system.

3.4.3 Disposal

In the mountain municipalities there is no official landfill for disposal of collected household waste. At present the collected municipal waste is transported to and disposed on the landfill in Batumi. For the mountain municipalities this means that transport distances between about 40 and 80 km (or more) must be covered already today (cp. Table 10).

The implementation of the planned regional landfill in Tsetskhlauri will start shortly. The fairly accurate location of the envisaged regional landfill is shown in Figure 1 (green pentagon).

The tender for the respective EBRD-funded implementation project closed in September 2017. It is planned that the landfill will be operational in 2019. As soon as the planned regional landfill is operational, all other landfill sites in the Adjara region are to be closed and all collected waste is to be delivered and disposed on the Tsetskhlauri landfill. The transport distances, which are already large, will be further extended for the mountain municipalities, as summarised in the following table.

Table 10 Transport distances from the mountain municipalities to Batumi and Tsetskhlauri

Mountain Municipality	Transport distance to Batumi	Transport distance to Tsetskhlauri
	[km]	[km]
Keda Municipality	38	77
Shuakhevi Municipality	65	103
Khulo Municipality	81	120

The use of illegal/ wild dumpsites is a widespread phenomenon in the mountain municipalities. The main reasons for this are the inadequate collection of household waste, especially in the rural areas, as well as an insufficient awareness of the inhabitant regarding the handling of waste.

The Consultant has been provided with a compilation of small illegal dumpsites in the mountain municipalities (as of July 2017), as listed in the following table.[8]

[8] The table is compiled based on information provided by Georgian Experts.

Table 11 Compilation of illegal dumpsites in the mountain municipalities

No.	Location		Type of dumped waste	
	Description	GPS coordinates	household waste	construction waste
Keda Municipality				
1	in the ravine of the village Chanchkeri in the centre of the village Makhuntseti	X-0738208 Y-4606213		X
2	in the ravine of the river Adjaristskali, in the village Makhuntseti	X-0739079 Y-4606391	X	X
3	in the ravine of Adjaristskali river on the way to the Socar gas station in the village Tskhemnimindori	X-0742632 Y-4608938	X	X
4	on the road side in the village Tskhemnismindori	X-0742929 Y-4608652		X
5	on the right side of Batumi-Khulo highway near the turn to the village Dzentsnami	X-0743332 Y-4608701		X
6	opposite the stadium on Aghmashenebeli street in Daba Keda	X-0744547 Y-4609321		X
7	on the right side of Batumi-Khulo highway on the way to the former furniture factory in the village Zvare	X-0747659 Y-4611407		X
8	in Abanoghele river ravine near the bridge in the village Kokotauri	X-0256551 Y-4613903	X	X
9	in the riverbed of the river Peranga in the village Akho	X-0255038 Y-4618117		X
10	in the riverbed of the untitled narrow gorge near the turn to Kveda Bzubzu in the village Babuchoglebi	X-0736089 Y-4605222		X

No.	Location		Type of dumped waste	
	Description	GPS coordinates	household waste	construction waste
Shuakhevi Municipality				
1	in Daba Khichauri on the territory of "Caucas-Energo" the riverbed of the river Adjaristskali is polluted	X-0261000 Y-4615166		X
2	on the ravine of the river Chvanistskali on the way to Chvana bridge in Daba Khichauri	X-0261186 Y-4614242	X	X
3	in the Chvanitskali river ravine on the way to the village Chvana	X-0261825 Y-4615809	X	
4	in the ravine downwards the Public school in the village Takidzeebi	X-0261845 Y-4615823	X	
5	in the untitled narrow gorge in the way to the village Takidzeebi	X-0261281 Y-4663389	X	
6	near the untitled narrow gorge on the way to the village Chala	X-0265058 Y-4616961	X	
7	in the untitled narrow gorge on the border of the villages Chala and Akhaldaba	X-0263897 Y-4616598	X	
8	in the Sakenia narrow gorge on the way to the village Akhaldaba	X-0264274 Y-4615595	X	X
9	on both banks of the river Adjaristskali in Daba Shuakhevi	X-0265091 Y-4612050	X	X
10	along the road on the territory of the former juice factory in the Mareti ravine	X-0266276 Y-4611125		X
11	in the untitled gorge, Mareti ravine	X-0268983 Y-4606173	X	X
12	in the ravine at the beginning of the village Paposhvilebi	X-0274834 Y-4605367	X	X
13	in the untitled narrow gorge in Gorgoshauli district in the village Oladauri	X-0274367 Y-4604372	X	X
14	in the adjacent territory of the untitled narrow gorge, the district of Didi Qva, the village Oladauri	X-0274200 Y-4604135	X	X
15	on the right side of the ravine on the way to the village Oladauri	X-0273674 Y-4605542	X	
16	in the riverbed of Uchamba narrow gorge in the village Okropilauri	X-0264963 Y-4610452	X	X
17	in the adjacent territory of the car repair shop in Daba Shuakhevi (so called MGS)	X-0266270 Y-4611927		X

No.	Location		Type of dumped waste	
	Description	GPS coordinates	household waste	construction waste
18	on the right side of Batumi- Khulo road near the turn to the village Skhefi	X-0266597 Y-4612267	X	X
19	on the right side of the turn to the village Buturauli	X-0271584 Y-4611399	X	X
20	in the untitled narrow gorge along the road to the village Buturauli	X-0270839 Y-4611534	X	
21	in the ravine near the spring in the village Purtio	X-0272437 Y-4602296	X	

No.	Location		Type of dumped waste	
	Description	GPS coordinates	household waste	construction waste
Khulo Municipality				
1	along the road to village Skhalta	X-0273424 Y-4604444	X	X
2	in the untitled narrow gorge along the road to village Didadjara, this side of the centre of Shailuri	X-0279571 Y-4615660	X	
3	in the ravine along the road this side of Iremadzeebi turn on the way out of village Didadjara	X-0279847 Y-4616743	X	X
4	in small untitled narrow gorge in the village Iremadzeebi on the way to the village Ghordjomi	X-0280360 Y-4617458		X
5	along the road in the adjacent territory of slaughterhouse in the centre of the village Ghordjomi	X-0281111 Y-4621149	X	X
6	in the riverbed of the river Ghordjomi on the turn to the village Tunadzeebi	X-0280770 Y-4620337	X	
7	on the left side of the road near the bridge in the village Pksadzeebi	X-0280925 Y-4613872		X
8	in the factory gorge near the bridge in the village Tabakhmela	X-0284622 Y-4612199	X	
9	in the ravine on the left side of the road on the way out from the village Bodzauri	X-0286146 Y-4613257	X	X
10	on the way to the village Riketi at the end of the Kapnistavi area on the left side of the road in the untitled narrow gorge	X-0286462 Y-4613252	X	
11	in the ravine on the left side of the road in the village Danisparauli	X-0288470 Y-4613581	X	
12	in the ravine on the right side of the road on the way out from the village Danisparauli near the resort Goderdzi	X-0289901 Y-4613668	X	
13	on the left side of the road on the way to Goderdzi Pass	X-0292561 Y-4611363		X
14	in the riverbed of Skernali narrow gorge	X-0294913 Y-4610783	X	
15	in the ravine on the left side of the road to the resort Beshumi	X-0294916 Y-4610788	X	X
16	in the riverbed near the bridge in the resort Beshumi	X-0295823 Y-4608883		X
17	in the riverbed in so called Lazebi District in the resort Beshumi	X-0296021 Y-4608999	X	

3.4.4 Financial Framework

For municipal waste management service provision all three mountain municipalities rely heavily on governmental grants. The revenue generation potential from internally-generated own local funds is very limited.

If at all, SWM tariffs are only charged to commercial enterprises/ business entities, while residential tariffs are not charged at all. Currently, costs are paid from various sources.

3.4.5 Environmental Impacts

Currently, the assumed waste collection rate ranges between 3 % (rural areas of Shuakhevi Municipality) and 100 % (administrative centres of all mountain municipalities). Consequently, it can be assumed that a large amount of the generated waste in rural areas is disposed at wild dumpsites or other inappropriate places.

Figure 5 Examples of illegal/ wild dumpsites in the mountain municipalities [Keda (left), Shuakhevi (middle), Khulo (right)]

Thus uncollected waste is polluting the environment, and is causing negative effects on human health and local economy (tourism).

3.4.6 Recycling and Composting

Currently in the mountain municipalities there is no formal recycling or composting system in place.

In any of the municipalities separate collection of the recyclable or organic fraction is formally conducted. Also waste pickers are not common in the area, since there are no traders or dealers for recyclables located in the area. Thus, also informal recycling activities seem to be very limited in the mountain municipalities.

Since the majority of the population of the mountain municipalities is active in agriculture, the organic fraction is already being used for agricultural purposes (composting as well as feeding to farm animals), especially in the villages in the rural areas. Furthermore, one of the specific objectives of the USAID-funded WMTR project is to "establish systems and practices at the community level for composting". However, currently there are no official details available regarding the implementation of this objective in the mountain municipalities.

3.5 Summary of Key Challenges and Conclusions

In the mountain municipalities, progress has been achieved recently in municipal solid waste management, particularly with regard to the preparation of local waste management plans, the closure of small local dumps and the expansion of waste collection services to rural areas. Nevertheless, in spite of substantial improvements there are still various short comings and challenges, as listed in the following:

- Need for improvement of waste collection and expansion of waste collection services to rural areas/ villages, to reach targets of the Georgian National Waste Management Strategy and Action Plan (90% by 2020, 100% by 2025)
- Long transport distance to envisaged regional landfill in Tsetskhlauri
- No fee collection from households and very limited cost recovery from businesses
- No formal recycling and/ or composting activities
- No comprehensive approach on public awareness and enforcement of environmental regulations (e.g. re illegal dumping)

In this regard, when developing conceptual options for the future development of municipal waste management in the mountain municipalities, important issues have to be taken into account. Major issues are:

- Waste collection and transportation:
  Expanding the waste collection to the rural areas as well as transporting the waste to the envisaged regional landfill in Tsetskhlauri requires on the one hand additional funds, basically to be collected from waste fees, on the other hand a strict enforcement of cost efficiency measures, as for example by implementing the services in inter-municipal cooperation.
- Recycling and composting:
  Recycling and composting measures need to be fostered, especially in order to comply with the existing legal and policy requirements.

- Financing of SWM/ fees:
  Generally, the main bottleneck is the funding of the SWM activities. Currently, the municipalities rely significantly on funds from the government and from other sources. The entire financing is not sustainably structured. Multiple reasons were identified such as a lack of political willingness to bill, of residents' awareness towards SWM service benefits, of cost efficiency, of revenue generation etc.

4 Conceptual Options for Future Solid Waste Management

Adapted to the current situation in SWM in the mountain municipalities, possible waste management options, as presented in the following subchapters, were proposed and discussed with relevant stakeholders of the mountain municipalities. The most appropriate option shall be selected and recommended as future SWM procedure, as detailed in the following chapter 5.

4.1 Technical Options

4.1.1 Waste Collection and Transport

The waste collection system in the mountain municipalities needs significant improvements in order to increase the waste collection coverage,[9] especially in rural areas, and to improve its efficiency.

In the future the primary waste collection system with the 1.1 m³ steel containers shall continue to be used and be gradually further expanded to the rural areas. The waste shall be collected weekly with compaction trucks, both in urban and in rural areas.

In order to optimise the long-distance transportation to the envisaged regional landfill site, it is necessary to assess the use of vehicles with large transport capacities, possibly in connection with transfer stations, where the waste is loaded from the collection trucks into large volume trucks for long distance transport.

Possible options for waste collection and waste transport to the envisaged regional landfill are as follows:

- Option 1: Comprehensive collection service with municipal transfer stations
- Option 2: Basic collection service with common transfer station
- Option 3: Basic collection service with direct delivery

[9] As detailed in the waste forecast, the following enhancement in waste collection service coverage is assumed for the coming years: 3 % increase in administrative centres each year as well as 15 % increase in rural areas until 2020 and 3 % increase in rural areas from 2020 – 2038.

4.1.1.1 Option 1: Comprehensive Collection Service with Municipal Transfer Stations

Option 1 provides a comprehensive collection service that also covers remote and poorly developed villages. 1.1 m³ steel containers are set up for primary collection of household waste in all villages and emptied weekly by 4x4 compactions trucks, which have a capacity of 3 Mg.

Figure 6 Example for 1.1 m³ steel container (left) and small 4x4 compaction truck (3 Mg capacity) (right) for waste collection

Since it is uneconomical to travel long distances with these comparatively small trucks, it is planned to establish transfer stations in each municipality.

Figure 7 Example for a transfer station (as established in Kvareli/ Kakheti Region)

At the transfer stations the waste is transferred from the collection vehicles into transfer containers with a capacity of 30 m³. As soon as they are full, the transfer containers are transported to the regional landfill by means of hook lift truck and trailer.

Figure 8 Example for hook lift truck for long distance transportation

Both the initial investment costs and the average annual operating costs have been calculated. In addition to the amount of waste to be collected (cp. Table 9), the calculation is based on assumptions as detailed in the following table.

Table 12 Assumptions for calculation of initial investment and operating costs for waste collection and transport (Option 1)

Item	Amount	Unit
Waste collection		
waste density in 1.1 m³ container	0.2	Mg/m³
filling rate per 1.1 m³ container	90	%
waste amount per 1.1 m³ container	0.20	Mg
	198.00	kg
container reserve for 1.1 m³ containers	20	%
capacity of 4x4 compaction truck	3	Mg
filling rate of 4x4 compaction truck	90	%
number of 1.1 m³ containers per 4x4 compaction truck	14	
number of working days per week	5	
number of tours per 4x4 compaction truck/d	2	
number of reserve 4x4 compaction truck	1	per municipality
number of drivers per 4x4 compaction truck	1	
number of workers per 4x4 compaction truck	2	
working reserve driver per 4x4 compaction truck	10	%
working reserve worker per 4x4 compaction truck	10	%
calculation of drivers and workers without reserve truck	-1.0	per municipality

Item	Amount	Unit
Waste transport		
waste density in 4x4 compaction truck	0.5	Mg/m³
transfer container volume	30	m³
waste density in transfer container	0.35	Mg/m³
filling rate of transfer container	90	%
waste amount in transfer container	9	Mg
transfer container reserve	10	%
number of containers per hook lift truck & trailer	2	containers
maximum number of transfer trips	1	trip/day
	2	containers/trip
working day	5	days/week
maximum transfer capacity	10	containers/week
reserve truck & trailer[10]	0.3	per municipality
number of drivers per hook lift truck	1	
number of workers per transfer station	2	
working reserve driver per hook lift truck	10	%
working reserve worker per transfer station	10	%
calculation of drivers and workers without reserve truck	-0.3	
Investment Costs		
1.1 container	250	EUR
4x4 compaction truck	80,000	EUR
transfer station	150,000	EUR
hook lift truck with trailer	90,000	EUR
transfer container	5,000	EUR
contingencies	10	%

Item	Amount	Unit
Operation Costs		
salary driver	175	EUR
salary worker	145	EUR
number of salaries	12	per employee/ a
expenditure for tools and uniform	200	EUR/employee/a
Distribution of 1.1 m³ containers		
rural areas	3	containers
per	5	km
urban areas + tourism	2	containers
per	0.5	km
distance to transfer station	3	km (one way)
	2	times per tour
weeks per year	52	
distance to landfill		
Keda	77	km
Shuakhevi	103	km
Khulo	120	km
fuel	15	l/100 km
	7	l/1 km
fuel price	0.57	€/l
repair and maintenance	5	% of investment costs
administration, incl. PR	10	% of operation costs
contingencies	10	%
number of 1.1 m³ containers per 4x4 compaction truckload	14	
urban & tourism	3.5	km
rural	23.3	km
Exchange rate		
	1	EUR
	2.9	GEL

Based on the assumptions described above, the following material and personnel requirements[10] as well as initial investment[11] and average annual operating costs result.

[10] For simplicity, the material and personnel requirements have been calculated based on the average amount of waste to be collected.

[11] The initial investment costs are not considering already existing equipment and are assuming that no second hand equipment is purchased in order to keep the repair & maintenance costs under control.

The following table also shows the average specific operating costs per ton of waste and per inhabitant.

Table 13 Initial investment and average/ specific operating costs for waste collection and transport (Option 1)

		Keda	Shuakhevi	Khulo
Waste collection				
1.1 m³ container	[no]	184	117	220
4x4 compaction truck (3 Mg capacity)	[no]	3	2	3
Driver	[no]	2	1	2
Worker	[no]	4	3	4
Waste transfer and transport				
Transfer station	[no]	1	1	1
Transfer container	[no]	4	2	4
Worker	[no]	2	2	2
Hook-lift truck and trailer (2 x 30 m³)	[no]	1	1	1
Driver	[no]	1	1	1
Transport to regional landfill	[km]	77	103	120
Initial Investment Costs	**[EUR]**	**587,346**	**465,838**	**619,599**
Initial Investment Costs	[GEL]	1,703,303	1,350,929	1,796,837
Average Annual Operating Costs	**[EUR/a]**	**214,995**	**166,011**	**301,431**
Average Annual Operating Costs	[GEL/a]	623,486	481,431	874,149
Average Specific Operating Costs	**[EUR/Mg]**	**136**	**166**	**160**
Average Specific Operating Costs	[GEL/Mg]	396	481	464
Average Operating Costs per Inhabitant	**[EUR/cap/a]**	**12.7**	**11.2**	**12.7**
Average Operating Costs per Inhabitant	[GEL/cap/a]	36.8	32.5	36.7
	[GEL/cap/m]	3.1	2.7	3.1

4.1.1.2 Option 2: Basic Collection Service with Common Transfer Station

In Option 2 the waste collection is provided with large compaction trucks with a capacity of 10 Mg.

For future reinvestments, it is to be expected that the containers must be replaced every five years and the vehicles every ten years in order to keep the repair & maintenance costs under control.

Figure 9 Example for a compaction truck with 10 Mg capacity

These large collection vehicles cannot reach all villages due to the prevailing spatial conditions in the mountain municipalities (mountainous terrain, in some cases poor and/ or unpaved roads). Therefore, 1.1 m³ steel containers [cp.

Figure 6 (left)] used for primary collection are placed where they can be approached by the collection vehicles. As far as the villages are well developed, the containers are placed there and emptied weekly. For the less-developed/ undeveloped villages, collection points are to be identified and constructed along the well-developed access roads, where the 1.1 m³ containers will be placed and also emptied weekly. It will be the responsibility of the local population to bring their waste from their villages to the collection points.

Since the larger vehicles can drive longer distances without major efficiency losses, a joint transfer station (cp. Figure 7) is planned for the mountain municipalities (to be located downhill in Keda Municipality). At the transfer station the waste is transferred from the collection vehicles into transfer containers with a capacity of 30 m³. As soon as they are full, the transfer containers are transported to the regional landfill by means of hook lift truck and trailer (cp. Figure 8).

Again, both the initial investment costs and the average annual operating costs have been calculated, based on the amount of waste to be collected (cp. Table 9) and assumptions as detailed in the following table.

Table 14 Assumptions for calculation of initial investment and operating costs for waste collection and transport (Option 2)

Item	Amount	Unit
Waste Collection		
waste density in 1.1 m³ container	0.2	Mg/m³
filling rate per 1.1 m³ container	90	%
waste amount per 1.1 m³ container	0.20	Mg
	198.00	kg
1.1 m³ container reserve	20	%
capacity compaction truck	10	Mg
filling rate of compaction truck	90	%
number of containers per compaction truck	45	
Distribution of 1.1 m³ containers		
average number of 1.1 m³ containers	3	per village
average number of villages	5	per collection point
working days per week	5	
tours per collection truck/d	2	
reserve collection truck[12]	0.3	
number of drivers per compaction truck	1	
number of workers per compaction truck	2	
working reserve driver per compaction truck	10	%
working reserve worker per compaction truck	10	%
calculation of drivers and workers without reserve compaction truck	-0.3	

Item	Amount	Unit
Waste Transfer		
waste density in compactor	0.5	Mg/m³
transfer container volume	30	m³
waste density in transfer container	0.35	Mg/m³
filling rate of transfer container	90	%
waste amount in transfer container	9	Mg
transfer container reserve	10	%
capacity hook lift truck & trailer	2	containers
maximum number of transfer trips	1	trip/day
	2	containers/ trip
working day	5	days/week
maximum transfer capacity	10	containers/ week
number of drivers per hook lift truck	1	
number of workers per transfer station	2	
working reserve driver hook lift truck	10	%
working reserve worker transfer station	10	%
Investment Costs		
1.1 m³ container	250	EUR
compaction truck	80,000	EUR
collection point	500	EUR
transfer station	150,000	EUR
hook lift truck with trailer	90,000	EUR
transfer container	5,000	EUR
contingencies	10	%

Item	Amount	Unit
Operating Costs		
salary driver	175	EUR
salary worker	145	EUR
number of salaries	12	per employee/ a
expenditure for tools and uniform	200	EUR/ employee/a
distribution of 1.1 m³ containers		
rural areas	15	containers
per	15	km
urban areas + tourism	2	containers
per	0.5	km
distance to transfer station		
Keda	0	km (one way)
Shuakhevi	29	km (one way)
Khulo	45	km (one way)
	2	times per tour
weeks per year	52	
distance to landfill		
Keda	77	km
Shuakhevi	103	km
Khulo	120	km
fuel	15	l/100 km
	7	l/1 km
fuel price	0.57	€/l
repair and maintenance	5	% invest costs
administration, incl. PR	10	% ops costs
contingencies	10	%
1.1 m³ containers per compaction truckload	45	
km per truckload		
urban & tourism	11.25	km
rural	45	km
Exchange Rate		
	1	EUR
	2.9	GEL

Based on the assumptions described above, the following material and personnel requirements[12] as well as initial investment[13] and average operating costs result.

The calculations are based on the assumption that waste transfer and transport will be organised in inter-municipal cooperation. Therefore, waste collection as well as waste transfer and transport are presented in different tables.

Table 15 Initial investment and average/ specific operating costs for waste collection (Option 2)

		Keda	Shuakhevi	Khulo
1.1 m³ container	[no]	184	117	220
collection points	[no]	9	6	14
compaction truck (10 Mg capacity)	[no]	1	1	1
driver	[no]	1	1	1
worker	[no]	2	2	2
transport to transfer station	[km]	0	29	45
Initial Investment Costs	**[EUR]**	**134,866**	**108,206**	**153,663**
Initial Investment Costs	[GEL]	391,112	313,798	445,623
Average Annual Operating Costs	**[EUR/a]**	**47,870**	**62,239**	**105,378**
Average Annual Operating Costs	[GEL/a]	138,823	180,492	305,595
Average Specific Operating Costs	**[EUR/Mg]**	**30**	**62**	**56**
Average Specific Operating Costs	[GEL/Mg]	88	180	162
Average Operating Costs per Inhabitant	**[EUR/cap/a]**	**2.8**	**4.2**	**4.4**
Average Operating Costs per Inhabitant	[GEL/cap/a]	8.2	12.2	12.8
	[GEL/cap/m]	0.7	1.0	1.1

[12] For simplicity, the material and personnel requirements have been calculated based on the average amount of waste to be collected.

[13] The initial investment costs are not considering already existing equipment and are assuming that no second hand equipment is purchased in order to keep the repair & maintenance costs under control.
For future reinvestments, it is to be expected that the containers must be replaced every five years and the vehicles every ten years in order to keep the repair & maintenance costs under control.

Table 16 Initial investment and average/ specific operating costs for waste transfer and transport (Option 2)

		Mountain Municipalities
Transfer station	[no]	1
Transfer container	[no]	10
Worker	[no]	2
Hook-lift truck and trailer (2 x 30 m³)	[no]	1
Driver	[no]	1
Transport to regional landfill	[km]	77
Investment Costs	**[EUR]**	**293,952**
Investment Costs	[GEL]	852,460
Average Annual Operating Costs	**[EUR/a]**	**206,267**
Average Annual Operating Costs	[GEL/a]	598,175
Average Specific Operating Costs	**[EUR/Mg]**	**46**
Average Specific Operating Costs	[GEL/Mg]	134
Average Operating Costs per Inhabitant	**[EUR/cap/a]**	**3.7**
Average Operating Costs per Inhabitant	[GEL/cap/a]	10.8
	[GEL/cap/m]	0.9

4.1.1.3 Option 3: Basic Collection Service with Direct Delivery

In Option 3, the waste collection is organised in the same way as in Option 2 (cp. 0). Unlike Option 2, however, no transfer station is foreseen and the collected waste will be transported directly to the regional landfill site.

Again, both the initial investment costs and the average operating costs have been calculated, based on the amount of waste to be collected (cp. Table 9) and assumptions as detailed in the following table.

Table 17 Assumptions for calculation of initial investment and operating costs for waste collection and direct delivery (Option 3)

Item	Amount	Unit
Waste Collection		
waste density in 1.1 m³ container	0.2	Mg/m³
filling rate per 1.1 m³ container	90	%
waste amount per 1.1 container	0.20	Mg
	198.00	kg
1.1 m³ container reserve	20	%
waste amount per compaction truck (10 Mg capacity)	10	Mg
filling rate of compaction truck	90	%
1.1 m³ containers per compaction truck (10 Mg capacity)	45	
distribution of 1.1 m³ containers		
average number of 1.1 m³ containers	3	per village
average number of villages	5	per collection point
working days per week	5	
tours per compaction truck/d	2	
reserve compaction truck	1	per municipality
number of drivers per truck	1	
number of workers per truck	2	
working reserve driver per truck	10	%
working reserve worker per truck	10	%
calculation drivers and workers without reserve truck	-1	
Investment Costs		
1.1 m³ container	250	EUR
compaction truck	80,000	EUR
collection point	500	EUR
contingencies	10	%

Item	Amount	Unit
Operating Costs		
salary driver	175	EUR
salary worker	145	EUR
number of salaries	12	per employee/ a
expenditure for tools and uniform	200	EUR/employee/a
distribution of 1.1 m³ containers		
rural areas	15	containers
per	15	km
urban areas + tourism	2	containers
per	0.5	km
weeks per year	52	
distance to landfill		
Keda	77	km
Shuakhevi	103	km
Khulo	120	km
fuel	15	l/100 km
	7	l/1 km
fuel price	0.57	€/l
repair and maintenance	5	% of investment costs
administration, incl. PR	10	% of operating costs
contingencies	10	%
containers per truckload	45	
km per truckload		
urban & tourism	11.25	km
rural	45	km
Exchange rate		
	1	EUR
	2.9	GEL

As before, based on the assumptions described above, the following material and personnel requirements[14] as well as initial investment[15] and average annual operating

[14] For simplicity, the material and personnel requirements have been calculated based on the average amount of waste to be collected.

[15] The initial investment costs are not considering already existing equipment and are assuming that no second hand equipment is purchased in order to keep the repair & maintenance costs under control.
For future reinvestments, it is to be expected that the containers must be replaced every five years and the vehicles every ten years in order to keep the repair & maintenance costs under control.

costs result. Again, the following table also shows the average specific operating costs per ton of waste and costs per inhabitant.

Table 18 Initial investment and average/ specific operating costs for waste collection and direct delivery (Option 3)

		Keda	Shuakhevi	Khulo
1.1 m³ container	[no]	184	117	220
collection points	[no]	9	6	14
compaction truck (10 Mg capacity)	[no]	2	2	2
Driver	[no]	1	2	2
Worker	[no]	2	2	3
Direct transport to landfill	[km]	77	103	120
Initial Investment Costs	**[EUR]**	**178,866**	**196,206**	**241,663**
Initial Investment Costs	[GEL]	518,712	568,998	700,823
Average Annual Operating Costs	**[EUR]**	**122,333**	**140,631**	**184,439**
Average Annual Operating Costs	[GEL]	354,766	407,829	534,874
Average Specific Operating Costs	**[EUR/Mg]**	**78**	**141**	**98**
Average Specific Operating Costs	[GEL/Mg]	225	408	284
Average Operating Costs per Inhabitant	**[EUR/cap/a]**	**7.2**	**9.5**	**7.7**
Average Operating Costs per Inhabitant	[GEL/cap/a]	20.9	27.5	22.5
	[GEL/cap/m]	1.7	2.3	1.9

4.1.2 Recycling

The Georgian national policies foresee the introduction of source separation for recyclables within the next years.

For the mountain municipalities, separate collection of recyclable materials shall start with pilot projects in urban and touristic areas. It is recommended that the municipalities provide 1.1 m³ mesh-wire containers for primary collection of recyclables in their administrative as well as touristic centres.

Figure 10 Example of a mesh-wire container for separate collection of recyclables

For the collection, processing and marketing of recyclables, close cooperation with the private sector is to be established, in order to reduce operating costs as far as possible. Due to the proximity of the mountain municipalities to the port cities of Batumi and Poti, it can be assumed that it is possible to identify private companies interested in the collection and further processing of the recyclable materials.

At present, PET bottles and metal cans are the best marketable recyclables in Georgia. It is therefore recommended that the separate collection should first concentrate on these valuable materials.

Based on the waste composition (cp. Figure 3) and the amount of waste to be collected (cp. Table 9) as well as the following assumptions, the required number of mesh wire containers for separate collection as well as the necessary initial investment costs are calculated.

Table 19 Assumptions for calculation of initial investment costs for separate collection of recyclables

Item	Amount	Unit
Separate Collection		
metal	2	% of waste
plastics	13	% of waste
collection rate recyclables	40	%
container capacity	26.4	kg (80% filled)
collection frequency	1	time/m
Investment Costs		
1.1 m³ mesh wire container	250	EUR
Exchange Rate		
	1	EUR
	2.9	GEL

Based on the assumptions described above, the following material requirements[16] as well as initial investment costs result.

Table 20 Initial investment costs for separate collection of recyclables

		Keda	Shuakhevi	Khulo
1.1 m³ mesh-wire container	[no]	78	47	35
Initial Investment Costs	[EUR]	**19,500**	**11,750**	**8,750**
Initial Investment Costs	[GEL]	56,550	34,075	25,375

For future reinvestments, it is to be expected that the containers must be replaced every five years.

Since the private sector is to take over the collection, processing and marketing of the recyclables, no operating costs are estimated.

In the medium- to long-term further development of the system for separate collection/ recycling is to be developed based on the gained experiences. This further development

[16] For simplicity, the material requirements have been calculated based on the average amount of recyclables (PET bottles and metal cans) to be collected.

may involve both the expansion of the collection area and/ or the collection of further recyclable materials.

4.1.3 Composting

For composting/ diverting organic waste from landfills it is proposed to support home-composting. Due to the high percentage of population working in agriculture, the organic fraction of the household waste is already used to a large extent for agricultural purposes (as a fertiliser as well as a livestock feed).[17] This should be further supported.

Figure 11 Example for home composting

Since regarding the diversion of organic waste from landfills the focus will be placed on home-composting neither investment nor operating costs will incur. Furthermore, home-

[17] Therefore, in the waste collection forecast it is already assumed that the waste to be collected in the rural areas is reduced by 33 % (cp. chapter 3.3.3).

composting can make a decisive contribution to cost reduction for collection, transport and disposal (as well as further treatment) of municipal waste.

4.1.4 Closure and Remediation of Existing Dumpsites

All dumpsites in the mountain municipalities are to be closed and if necessary to be rehabilitated, as far as this is not yet done. A detailed manual for closure of illegal dumpsites is provided by the USAID-funded WMTR project with the *Illegal Dumpsite Closure Guide*, published in July 2015.

Key element of landfill closure and rehabilitation measures is, according to the EU Landfill Directive and respective Georgian regulations, a properly designed surface sealing. In order to prevent leachate generation and gas emissions it should consist of gas drainage layer, impermeable mineral layer, drainage layer, and top soil cover.

A closure and remediation concept for the mountain municipalities can only be developed on the basis of a detailed inventory of the existing illegal/ wild dumpsites, which not only identifies but also characterises them (cp. Table 21). Due to size and expected environmental impact existing dumpsites can then be allocated to different categories. Besides environmental impacts caused by landfill gas, leachate, odour and vermin, further environmental impacts, like the distance to the next settlement, the distance to a water body (lake, river or drainage channel), and the distance to water wells, should also be taken into consideration. Moreover, regular open fires at dumpsite can require immediate measures and are considered together with the other mentioned factors in the following classification.

Table 21 Examples for Dumpsite Categories

Category	Size (quantity)	Expected env. impact	Proposed measures*)
A	< 4,000m³	Low	Excavation and transport of waste to the new sanitary landfill
B	> 4,000m³	Medium	Levelling the waste, flatten of slopes and compaction of the waste Top sealing system Passive degassing
C	> 4,000m³	High	Levelling the waste, flatten of slopes and compaction of the waste Passive degassing with option to change to an active degassing system Additional protection measures**): • Leachate collection • Fence • Guard • River bank protection (if applicable)

**) Final decision should be based on case-by-case review always*

***) The measures have to be specified for each single dumpsite*

The method for rehabilitation of the dumpsites is selected on the base of disposed waste amount, density, composition, and condition of the disposed waste (already decomposed or burned), surface and height of the dumpsite, topography of the dumpsite, and potential risks to the environment and human health. Consequently the total as well as specific costs might differ considerably from dumpsite to dumpsite.

The following assumptions are made for a first rough cost estimate for closure and remediation of the illegal dumpsites.

Table 22 Assumptions for calculation of initial investment costs for closure and rehabilitation of illegal/ wild dumpsites

Item	Amount	Unit
no of illegal dumpsites in Keda Municipality[18]	10	
no of illegal dumpsites in Shuakhevi Municipality[19]	21	
no of illegal dumpsites in Khulo Municipality[20]	17	
average waste amount per illegal dumpsite	9	Mg
Investment Costs		
average costs for closure and rehabilitation	5.2	EUR per Mg
Exchange Rate		
	1	EUR
	2.9	GEL

Based on the assumptions described above, the following initial investment costs result.

Table 23 Initial investment costs for closure and rehabilitation of illegal/ wild dumpsites

		Keda	Shuakhevi	Khulo
illegal/ wild dumpsites	[no]	10	21	17
Initial Investment Costs	[EUR]	**468**	**983**	**796**
Initial Investment Costs	[GEL]	1,357	2,850	2,307

4.2 Comparative Evaluation

Since there is interdependency among all elements of a waste management system the decision for the most appropriate SWM system should be based on an assessment of system options as a whole and not by just looking at the single elements. Three different integrated concept options, as shown in the following figure, are compared.

[18] Cp. Table 11.
[19] Cp. Table 11.
[20] Cp. Table 11.

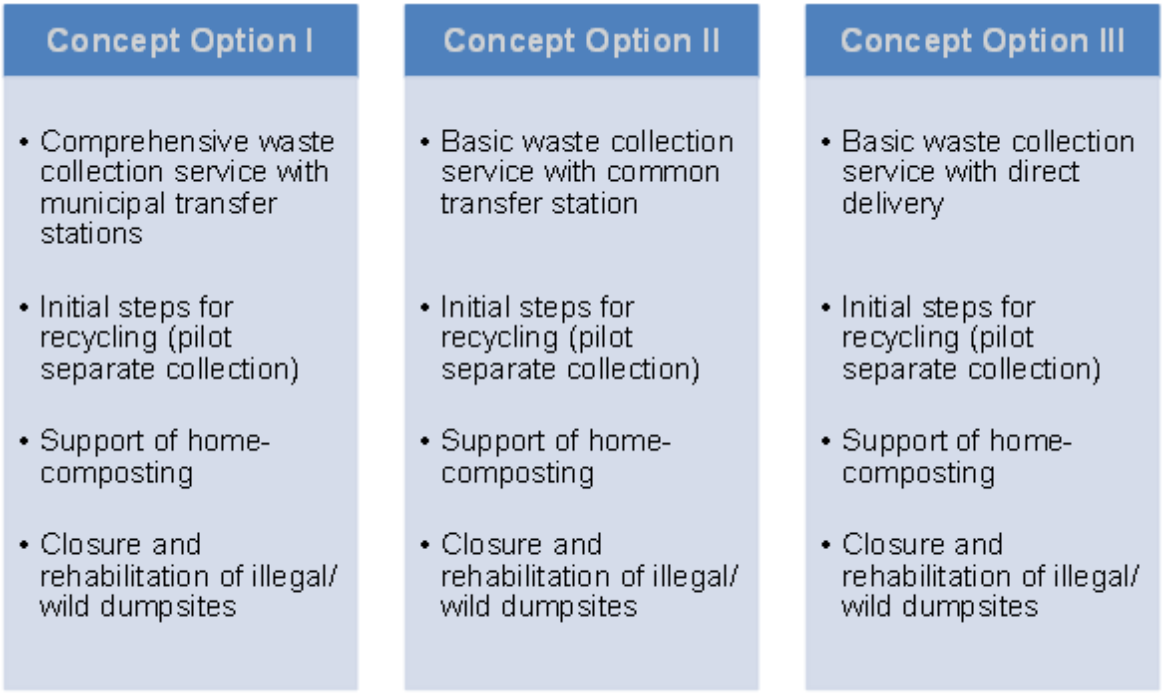

Figure 12 Concept options for integrated SWM in the mountain municipalities

For a better comparability, the following tables show the initial investment costs and the operation costs of the three integrated solid waste management concept options. It should be noted, that additional costs for disposal at the regional landfill site will have to be added to the operating cost. These are expected to be in the range of 25 EUR/ Mg (72.5 GEL/ Mg).[21]

[21] Expected additional costs for disposal at the regional landfill site are displayed in italics in Table 25.

Table 24 Initial investment costs for integrated SWM Concept Options I – III in the mountain municipalities

	Concept Option I			Concept Option II			Concept Option III		
	Keda	**Shuakhevi**	**Khulo**	**Keda**	**Shuakhevi**	**Khulo**	**Keda**	**Shuakhevi**	**Khulo**
	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]
Collection	306,900	194,700	333,128	134,866	108,206	153,663	178,866	196,206	241,663
Transport	280,446	271,138	286,471	97,984	97,984	97,984	0	0	0
Recycling (separate collection)	19,500	11,750	8,750	19,500	11,750	8,750	19,500	11,750	8,750
Composting	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Closure and rehabilitation of illegal/ wild dumpsites	468	983	796	468	983	796	468	983	796
Total [EUR]	**607,314**	**477,588**	**628,349**	**252,350**	**217,940**	**260,397**	**198,366**	**207,956**	**250,413**
Total [GEL]	1,761,210	1,385,004	1,822,212	731,815	632,027	755,151	575,262	603,198	726,198

Table 25 Average/ specific operating costs for integrated SWM Concept Options I – III in the mountain municipalities

		Concept Option I			Concept Option II			Concept Option III		
		Keda	Shuakhevi	Khulo	Keda	Shuakhevi	Khulo	Keda	Shuakhevi	Khulo
Collection		109,990	71,133	140,447	47,870	62,239	105,378	122,333	140,631	184,439
Transport		105,005	94,878	160,984	68,756	68,756	68,756	-	-	-
Recycling (separate collection)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Composting		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Closure and rehabilitation of illegal/ wild dumpsites		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Disposal on regional landfill		*39,384*	*25,015*	*47,054*	*39,384*	*25,015*	*47,054*	*39,384*	*25,015*	*47,054*
excluding disposal	**[EUR/a]**	**214,995**	**166,011**	**301,431**	**116,626**	**130,994**	**174,133**	**122,333**	**140,631**	**184,439**
	[GEL/a]	623,486	481,431	874,149	338,214	379,884	504,987	354,766	407,829	534,874
including disposal	***[EUR/a]***	***254,380***	***191,026***	***348,484***	***156,010***	***156,010***	***221,187***	***161,718***	***165,646***	***231,493***
	[GEL/a]	*737,701*	*553,975*	*1,010,605*	*452,429*	*452,428*	*641,442*	*468,981*	*480,374*	*671,330*
Average Specific Operating Costs (excluding disposal)	**[EUR/Mg]**	**136**	**166**	**160**	**74**	**131**	**93**	**78**	**141**	**98**
	[GEL/Mg]	396	481	464	215	380	268	225	408	284
Average Specific Operating Costs (including disposal)	***[EUR/Mg]***	***161***	***191***	***185***	***99***	***156***	***118***	***103***	***166***	***123***
	[GEL/Mg]	*468*	*554*	*537*	*287*	*452*	*341*	*298*	*480*	*357*
Average Operating Costs per Inhabitant (excluding disposal)	**[EUR/cap/a]**	**12.7**	**11.2**	**12.7**	**6.9**	**8.8**	**7.3**	**7.2**	**9.5**	**7.7**
	[GEL/cap/a]	36.8	32.5	36.7	19.9	25.7	21.2	20.9	27.5	22.5
	[GEL/cap/m]	3.1	2.7	3.1	1.7	2.1	1.8	1.7	2.3	1.9
Average Operating Costs per Inhabitant (including disposal)	***[EUR/cap/a]***	***15.0***	***12.9***	***14.6***	***9.2***	***10.5***	***9.3***	***9.5***	***11.2***	***9.7***
	[GEL/cap/a]	*43.5*	*37.4*	*42.4*	*26.7*	*30.5*	*26.9*	*27.6*	*32.4*	*28.2*
	[GEL/cap/m]	*3.6*	*3.1*	*3.5*	*2.2*	*2.5*	*2.2*	*2.3*	*2.7*	*2.3*

The following table compares the main characteristics of the concept options.

Table 26 Comparative assessment of the integrated SWM Concept Options I - III

	Concept Option I	Concept Option II	Concept Option III
Economic aspects	High financial effort for both implementation and operation of the integrated SWM system. Highest specific costs per Mg.	Lowest financial effort for the implementation and operation of the integrated SWM system. Least specific costs per Mg.	Slightly higher financial effort for implementation and operation of the integrated SWM system as in Concept Option II. Slightly higher specific costs per Mg than in Concept Option II.
Ecological aspects	As also remote and poorly developed villages are covered by waste collection services, the risk of illegal dumping is lowest.	Danger of illegal dumping, as the population in the remote villages must organize themselves that their waste is brought to the collection points.	
Social aspects	Most jobs created, due to large number of collection vehicles needed and transfer stations established in every municipality. Highest costs per inhabitant. If costs are to be covered by tariffs, the rate per person/ household in this option would probably be above the affordability level. Household tariffs must necessarily be introduced and implemented in order to achieve the maximum cost coverage.	Few jobs created. Low costs per inhabitant. High degree of responsibility of population necessary to ensure that the household waste from remote villages is brought to the collection points. Improved law enforcement required to prevent illegal dumping.	

4.3 Advantages of Inter-municipal Cooperation

By promoting inter-municipal cooperation the following respective advantages can be considered for the improvement of municipal waste management service provision:

- Higher efficiency due to specialized staff and less staff
- Better redundancy for collection and transport equipment

- Improved maintenance of advanced technical equipment
- Better utilisation of vehicles
- More potential for private sector involvement (higher contract volume)

Consequently, the organisational and financial burden can be reduced if the mountain municipalities decide to provide (part of) their waste management services in inter-municipal cooperation.

The following tables show the initial investment costs and the operation costs of the three integrated solid waste management concept options, if they are implemented in inter-municipal cooperation.[22]

Table 27 Initial investment costs for integrated SWM Concept Options I – III in the mountain municipalities implemented in inter-municipal-cooperation

Inter-municipal cooperation	Option I	Option II	Option III
	[EUR]	[EUR]	[EUR]
Collection	559,900	308,460	308,460
Transport	739,054	293,952	-
Recycling (separate collection)	40,000	40,000	40,000
Composting	-	-	-
Closure and rehabilitation of illegal/ wild dumpsites	2,246	2,246	2,246
Total [EUR]	**1,341,201**	**642,412**	**348,460**
Total [GEL]	3,889,482	1,862,996	1,010,535

[22] Expected additional costs for disposal (25 EUR/ Mg) at the regional landfill site are displayed in italics in Table 28.

Table 28 Average/ specific operating costs for integrated SWM Concept Options I – III in the mountain municipalities implemented in inter-municipal-cooperation

Inter-municipal cooperation		Option I	Option II	Option III
Collection	[EUR/a]	296,510	160,575	237,199
Transport	[EUR/a]	334,727	206,267	-
Recycling (separate collection)	[EUR/a]	-	-	-
Composting	[EUR/a]	-	-	-
Closure and rehabilitation of illegal/ wild dumpsites	[EUR/a]	-	-	-
Disposal on regional landfill	[EUR/a]	*111,453*	*111,453*	*111,453*
excluding disposal	[EUR/a]	631,237	366,842	237,199
	[GEL/a]	1,830,586	1,063,842	687,878
including disposal	*[EUR/a]*	*742,690*	*478,295*	*348,653*
	[GEL/a]	*2,153,801*	*1,387,057*	*1,011,093*
Average Specific Operating Costs (excluding disposal)	[EUR/Mg]	142	82	53
	[GEL/Mg]	411	239	154
Average Specific Operating Costs (including disposal)	*[EUR/Mg]*	*167*	*107*	*78*
	[GEL/Mg]	*483*	*311*	*227*
Average Operating Costs per Inhabitant (excluding disposal)	[EUR/cap/a]	11.4	6.6	4.3
	[GEL/cap/a]	32.9	19.1	12.4
	[GEL/cap/m]	2.7	1.6	1.0
Average Operating Costs per Inhabitant (including disposal)	*[EUR/cap/a]*	*13.4*	*8.6*	*6.3*
	[GEL/cap/a]	*38.7*	*24.9*	*18.2*
	[GEL/cap/m]	*3.2*	*2.1*	*1.5*

5 Detailing of Preferred Option

On September 21, 2017 a workshop took place in Batumi, during which the conceptual options to improve SWM in the mountain municipalities have been presented and discussed in order to select the most favourable one and to assess how the implementation can be supported by inter-municipal cooperation.

Due to the high quality of service the workshop participants were in favour of Option I, even though, taking into account the costs, waste collection Options II and III appeared to be the more realistic solutions. It was therefore decided that a combination of concept Option I & II, as detailed in the following, would be the Preferred Option for the development of future waste management in the mountain municipalities:

- No collection points, but waste collection with small 4x4 compaction trucks with a capacity of 3 Mg in the remote mountain villages (assumingly 1/3 of the waste to be collected in the rural areas will be collected by this kind of trucks)
- Waste collection with big compaction trucks in the administrative and touristic centres and in the well-developed rural areas (assumingly 2/3 of the waste to be collected in the rural areas will be collected by compaction trucks with 10 Mg capacity)
- Establishment of one transfer station (downhill in Keda)
- Initial steps for recycling (pilot separate collection in the administrative and touristic centres)
- Support of home-composting
- Closure and rehabilitation of illegal/ wild dumpsites

The initial investment costs and the average annual operating costs for the Preferred Option, as described above, have been calculated, based on the amount of waste to be collected (cp. Table 9) and assumptions as detailed in the following table.

Table 29 Assumptions for calculation of initial investment and operating costs for waste collection and transport (Preferred Option)

Item	Amount	Unit
Waste collection		
1.1 m³ container		
waste density in 1.1 m³ container	0.2	Mg/m³
filling rate per 1.1 m³ container	90	%
waste amount per 1.1 m³ container	0.20	Mg
	198.00	kg
1.1 m³ container reserve	20	%
waste collection by 3 Mg compaction truck	33	% of waste to be collected in rural areas
waste collection by 10 Mg compaction truck	67	% of waste to be collected in rural areas as well as in urban and tourism areas
Distribution of 1.1 m³ containers		
rural areas	3	containers
per	5	km
urban areas + tourism	2	containers
per	0.5	km
working days per week	5	
4x4 compaction truck (3 Mg capacity)		
waste amount per truck	3	Mg
filling rate of truck	90	%
number of containers per truck	14	
tours per truck/d	2	
reserve truck	0.3	
number of drivers per truck	1	
number of workers per truck	2	
working reserve driver per truck	10	%
working reserve worker per truck	10	%
calculation without reserve truck	-0.3	
containers per truckload	14	
km per truckload		
urban & tourism	3.5	km
Rural	23.3	km

Item	Amount	Unit
Compaction truck (10 Mg capacity)		
waste amount per truck	10	Mg
filling rate of truck	90	%
containers per truck	45	
tours per truck/d	2	
reserve truck	0.3	
number of drivers per truck	1	
number of workers per truck	2	
working reserve driver per truck	10	%
working reserve worker per truck	10	%
calculation without reserve truck	-0.3	
containers per truckload	45	
km per truckload		
urban & tourism	11.25	km
rural	75	km
Waste Transfer		
waste density in compactor	0.5	Mg/m³
transfer container volume	30	m³
waste density in transfer container	0.35	Mg/m³
filling rate of transfer container	90	%
waste amount in transfer container	9	Mg
container reserve	10	%
capacity hook lift truck & trailer	2	containers
transfer trips	1	trip/day
	2	containers/trip
working days	5	days/week
maximum transfer capacity	10	containers/week
number of drivers per hook lift truck	1	
number of workers per transfer station	2	
working reserve driver	10	%
working reserve worker	10	%

Item	Amount	Unit
Investment Costs		
1.1 m³ container	250	EUR
compaction truck [4x4 compaction truck (3 Mg) as well as compaction truck (10 Mg)]	80,000	EUR
transfer station	150,000	EUR
hook lift truck with trailer	90,000	EUR
transfer container	5,000	EUR
contingencies	10	%
Operation Costs		
salary drivers	175	EUR
salary workers	145	EUR
number of salaries	12	per employee/ a
expenditure for tools and uniform	200	EUR/employee/a
distance to transfer station		
Keda	0	km (one way)
Shuakhevi	29	km (one way)
Khulo	45	km (one way)
average	25	km (one way)
	2	times per tour
weeks per year	52	
distance to landfill		
Keda	77	km
fuel	15	l/100 km
	7	l/1 km
fuel price	0.57	€/l
repair and maintenance	5	% invest costs
administration, incl. PR	10	% ops costs
contingencies	10	%
Exchange rate		
	1	EUR
	2.9	GEL

Based on the assumptions described above, the following material and personnel requirements[23] as well as initial investment[24] and average operating costs result.

[23] For simplicity, the material and personnel requirements have been calculated based on the average amount of waste to be collected.

The costs are presented both for the alternative that the municipalities provide the waste management services themselves, as well as for the alternative that the waste management is provided in inter-municipal cooperation (IMC). Waste collection as well as waste transfer and transport are presented in different tables, because it is assumed that in any case waste transfer and transport is organised in inter-municipal cooperation.

[24] The initial investment costs are not considering already existing equipment and are assuming that no second hand equipment is purchased in order to keep the repair & maintenance costs under control.
For future reinvestments, it is to be expected that the containers must be replaced every five years and the vehicles every ten years in order to keep the repair & maintenance costs under control.

Table 30 Initial investment and average/ specific operating costs for waste collection (Preferred Option)

		Keda[25]	Shuakhevi[26]	Khulo[27]	IMC[28] (Mountain Municipalities)
1.1 m³ container	[no]	184	117	220	520
4x4 compaction truck (3 Mg capacity)	[no]	1	1	1	2
compaction truck (10 Mg capacity)	[no]	1	1	1	3
Driver	[no]	2	2	2	5
Worker	[no]	4	4	4	9
Transport to transfer station	[km]	0	29	45	25
Initial Investment Costs	[EUR]	**218,900**	**194,700**	**234,575**	**471,900**
Initial Investment Costs	[GEL]	634,810	564,630	680,268	1,368,510
Average Annual Operating Costs	[EUR/a]	**79,635**	**100,567**	**169,226**	**269,465**
Average Annual Operating Costs	[GEL/a]	230,941	291,645	490,755	781,447
Average Specific Operating Costs	[EUR/Mg]	51	101	90	60
Average Specific Operating Costs	[GEL/Mg]	147	291	261	175
Average Operating Costs per Inhabitant	[EUR/cap/a]	4.7	6.8	7.1	4.8
Average Operating Costs per Inhabitant	[GEL/cap/a]	13.6	19.7	20.6	14.1
	[GEL/cap/m]	1.1	1.6	1.7	1.2

[25] These costs are per respective municipality.
[26] These costs are per respective municipality.
[27] These costs are per respective municipality.
[28] These costs are for all three mountain municipalities together.

Table 31 Initial investment and average/ specific operating costs for waste transfer and transport (Preferred Option)[25]

		IMC (Mountain Municipalities)
Transfer station	[no]	1
Transfer container	[no]	10
Worker	[no]	2
Hook-lift truck and trailer (2 x 30 m³)	[no]	1
Driver	[no]	1
Transport to regional landfill	[km]	77
Investment Costs	[EUR]	**293,952**
Investment Costs	[GEL]	852,460
Operating Costs	[EUR/a]	**206,267**
Operating Costs	[GEL/a]	598,175
Average Annual Operating Costs	**[EUR/Mg]**	**46**
Average Annual Operating Costs	[GEL/Mg]	134
Fee for Covering Ops Costs (100%)	**[EUR/cap/a]**	**3.7**
Fee for Covering Ops Costs (100%)	[GEL/cap/a]	10.8
	[GEL/cap/m]	0.9

The following tables summarise the costs for the integrated Preferred SWM Concept Option.

Table 32 Initial investment costs for integrated Preferred SWM Concept Option

	Keda	Shuakhevi	Khulo	IMC
	[EUR]	[EUR]	[EUR]	[EUR]
Collection	218,900	194,700	234,575	471,900
Transport	97,984	97,984	97,984	293,952
Recycling (separate collection)	19,500	11,750	8,750	40,000
Composting	-	-	-	-
Closure and rehabilitation of illegal/ wild dumpsites	468	983	796	2,246
Total [EUR]	**336,384**	**304,434**	**341,309**	**805,852**
Total [GEL]	975,513	882,858	989,796	2,336,970

[25] These costs are for all three mountain municipalities together.

Table 33 Average/ specific operating costs for integrated Preferred SWM Concept Option

		Keda	Shuakhevi	Khulo	IMC
Collection		79,635	100,567	169,226	269,465
Transport		68,756	68,756	68,756	206,267
Recycling (separate collection)		n/a	n/a	n/a	-
Composting		n/a	n/a	n/a	-
Closure and rehabilitation of illegal/ wild dumpsites		n/a	n/a	n/a	-
Disposal on regional landfill		*39,384*	*25,015*	*47,054*	*111,453*
excluding disposal	**[EUR/a]**	**148,391**	**169,323**	**237,982**	**475,732**
	[GEL/a]	430,333	491,037	690,147	1,379,622
including disposal	***[EUR/a]***	***187,775***	***194,338***	***285,036***	***587,185***
	[GEL/a]	*544,548*	*563,581*	*826,603*	*1,702,837*
Average Specific Operating Costs (excluding disposal)	**[EUR/Mg]**	**94**	**169**	**126**	**107**
	[GEL/Mg]	273	491	367	309
Average Specific Operating Costs (including disposal)	***[EUR/Mg]***	***119***	***194***	***151***	***132***
	[GEL/Mg]	*346*	*563*	*439*	*382*
Average Operating Costs per Inhabitant (excluding disposal)	**[EUR/cap/a]**	**8.7**	**11.4**	**10.0**	**8.6**
	[GEL/cap/a]	25.4	33.2	29.0	24.8
	[GEL/cap/m]	2.1	2.8	2.4	2.1
Average Operating Costs per Inhabitant (including disposal)	***[EUR/cap/a]***	***11.1***	***13.1***	***12.0***	***10.6***
	[GEL/cap/a]	*32.1*	*38.1*	*34.7*	*30.6*
	[GEL/cap/m]	*2.7*	*3.2*	*2.9*	*2.6*

The tables above show that both the initial investment costs and the average/ specific operating costs are high for the preferred option. The Concept Options II & III (basic collection services with collection points for villages in remote rural areas) are less expensive than the Concept Option I or the Preferred Concept Option (full waste collection service even in investment and operating costs) for villages in remote rural areas). Evidently a high service quality requires financial (and organisational) efforts.

By providing waste management services in inter-municipal cooperation, financial (and organisational) efforts can be reduced. Nevertheless, the Preferred Concept Option remains the second most expensive one.

6 Outline of Next Steps

Independent of the Concept Option, which will finally be chosen for providing waste management services in the mountain municipalities in the future, from an economic point of view, it is recommended that the waste management services, i.e.

- Waste collection
- Waste transfer and transport to the regional landfill
- Introduction of pilot project for separate collection of recyclables
- Support of home-composting for diverting of organic waste from landfills
- Closure and rehabilitation of existing dumpsites as well as
- Fee collection and
- Public awareness

are implemented by the already existing Municipal Service Development Centre in inter-municipal cooperation.

The mountain municipalities themselves will continue to be responsible for street cleaning as well as tariff setting.

The following figure shows necessary activities and measures for implementation for the planning horizon (2019 – 2038) plus one year of project preparation.

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Activity	Preparation	Implementation and Operation																								
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2036	2038
Preparatory Activities																										
Decission on preferred technical Concept Option for SWM in the mountain municipalities																										
Decission on preferred institutional/ organisational option for implementation of SWM in the mountain municipalities																										
Clarification of tasks and responsibilities of the stakeholders involved																										
Implementation of Institutional Set-up and Organisational Structure																										
Further development of existing organisational and institutional set-up (municipalities and Municipal Service Development Center)																										
Concept for efficient, user charges based tariff system, which considers the affordability to pay and guarantees a sound financing of SWM services on the long run																										
Development of operator model for the different SWM services (excluding operation of envisaged regional landfill)																										
Develop/ harmonise procurment procedurres, contract conditions and performance monitoring																										
Develop and establish waste monitoring planning system																										
Improvement of the Technical Operation and Management of SWM-Services																										
Waste Collection																										
Development of a concept/ plan for continous improvement of waste collection, especially in rural areas																										
Tendering of necessary supplies for waste collection																										
Delivery of supplies for waste collection																										
Extension of service provision to rural areas																										
Recycling																										
Verification and detailing of approach for separate collection of recyclables (PET bottles and metal cans)																										
Tendering of supplies for separate collection of recyclables (mesh wire containers)																										
Coordination with private off-taker(s) for separately collected recyclables																										
Public awareness and public relation activities to foster public awareness and participation																										
Monitoring of recycling activities (acceptance, costs, performance) and necessary adaptations																										
Stepwise extension of separate collection activities to further areas and/ or recyclable fractions																										
Transfer and Transport																										
Implementation planning and other applications																										
Construction of the transfer stations in the municipalities																										
Verification of required input of equipment																										
Tendering of supplies for transfer and transport systems																										
Delivery of supplies for transfer and transport systems																										
Tendering of supplies for transfer and transport systems																										
Service provision to the entire project area																										

Main activity period
Secondary activity period
Activities after implementation measures are completed

Figure 13 Implementation Plan


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