Solid and Liquid Waste Management Sector Study – Puntland

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EXECUTIVE SUMMARY

In the Puntland State of Somalia the solid and liquid waste management systems in place reflect a common approach that is applied in the urban centres of Garowe, Gardho and Bosaso. In terms of solid waste management, the adopted strategy utilises a two-step approach in which solid waste is collected from the source and then carried to a waste transfer station. In the second-step, waste trucks are used to collect the waste and transport it to the solid waste dump located outside the urban boundaries. In terms of liquid waste disposal there are no disposal facilities. In regards to polices and strategies, the Ministry of Environment, Range Wildlife and Tourism has been instrumental in developing a relevant environmental policy (2011) and waste management guidelines (2011). Furthermore in 2013, a sanitation policy was also in review at the Ministry of Health. However, all these policy documents should have been developed with closer coordination and delivered by an appropriate ministry such as a Ministry of Public Works, which is normally responsible for urban planning and infrastructural development.

Major Constraints

- No enforcement of environmental sanitation by-laws.
- Lack of approved local environmental sanitation strategies, which include such components as spatial planning, by-laws, PPPs and a medical waste strategy.
- Lack of solid and liquid waste management policy (sanitation policy drafted in 2013).

Recommended Course of Action

- Urgent focus on institutional capacity, policies and strategies.

High Priority

- Provide environmental sanitation workshop for sanitation departments – covering current problems / best practices / future sector planning.
- Develop and validate an environmental sanitation policy for Somalia.
- Develop and validate local urban environmental sanitation strategies –including components such as spatial planning, by-laws, PPPs and a medical waste strategy.
- Rehabilitate medical waste disposal facilities.

Medium Priority

- Develop low-cost ecological treatment for wastewater disposal.
- Develop organic waste resource recovery and reuse options.

Additional Recommendations

- Improve coordination between UN-Habitat and the World Bank.
- Improve public awareness in all aspects of environmental sanitation and SLWM.
- Introduction of community-based SWM livelihood activities for IDP settlements.

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Andrew Adam-Bradford, 04 July 2013

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1.0 INTRODUCTION

In this chapter, three sections are used to introduce and set the context of the solid and liquid waste sector study for Puntland. Firstly, the background to the sector study is provided detailing the project activities and outcomes, secondly, a brief summary of the methodology used is given, finally relevant definitions are listed to provide additional context.

1.1 Aims and Objectives of the Sector Study

The aim of the Solid and Liquid Waste Management Sector Study is to identify the current service delivery practices and capacities within the solid and liquid waste management sector in the Puntland State of Somalia, within the context of the existing policy documents and models adopted by the Ministries of Environment (MoE) and Public Works (MoPW), and individual district councils (DCs) of different sizes. Objectives also include advising on whether certain functions can be assigned to the district level and the recommendation of pilot investments to test the new decentralized and sustainable service models.

1.2 Methodology

The main data collection methods consisted of field observations, site assessments, group discussions and semi-structured interviews with key stakeholders. Also obtained and reviewed were a number of documents and reports including project reports, local by-laws and policy/strategy documents. The assessments and data collection took place in Puntland during 03 – 19 January 2013, and consisted of fieldwork in Garowe (03 – 13 January 2013) and Bosaso (14 – 19 January 2013), which included a one-day visit to Gardo (06 January 2013).

1.3 Definitions

The following is a list of terms and definitions that appear regularly in the scoping study.

Environmental health

Environmental health is a bread tem that encompasses water and sanitation intentions as well as such issues as air and noise pollution. Environmental health services are defined by the World Health Organisation as: “those services which implement health policies through monitoring and control activities. They also carry out that role by promoting the improvement of environmental parameters and by encouraging the use of environmentally friendly and healthy technologies and behaviours”.

Hazardous waste

Any solid waste or wastewater that poses a risk to public health or the environment due to its pathogenic, toxic or volatile nature including: abattoir wastes; chemical efflents such as detergents and fuels (diesel/kerosene/oil/petrol); medical waste; septic tank waste; and tannery wastes.

Sanitation

Refers to the disposal of human and animal excreta, vector control, solid waste disposal (includes the disposal of hospital waste and the disposal of mortal remains), and drainage.

Software/hardware

The terms software and hardware are frequently used to refer to different components of a sanitation programme. Software refers to the community aspects of the intervention i.e. how people use facilities, and hardware refers to the physical infrastructure such as new waste transfer stations, solid waste dumps and sludge disposal sites.

Solid waste

Solid waste consists of discarded refuse from households, hotels and restaurants, commercial enterprises and centres, industrial units and factories, institutes and government buildings and offices but excludes wastewater and hazardous wastes.

Solid waste management

Solid waste management (SWM) is the systematic process of safely managing solid waste that may include a combination of: waste minimization – waste separation – waste storage – waste collection – waste transportation – waste processing (recovery and reuse) – waste recycling – waste disposal. In some cases the term ***solid and liquid waste management*** (SLWM) may be used which is the combination of solid and liquid wastes (wastewater), and includes the same systematic process as identified for solid waste management.

Wastewater

A combination of one or more of the following: 1) domestic effluent consisting of black water (excreta, urine, and associated sludge) and grey water (kitchen and bathroom wastewater); 2) effluent from commercial establishments and intuitions, including hospitals; 3) industrial effluent; and 4) storm water and other urban run-off.

2.0 REVIEW OF PROJECT INTERVENTIONS AND POLICY DOCUMENTATION

This chapter contains a brief overview of recent sector developments and the external interventions that have taken place in solid and liquid waste management (SLWM) (Section 2.1); followed by a review of the policy and local strategy documentation (Section 2.2).

2.1 Recent Sector Developments and External Interventions

In terms of infrastructural development, external interventions have played a critical role in developing the solid-waste management sector which has mainly included the construction of waste transfer stations in urban areas and the excavation of waste disposal sites outside the urban periphery. In the Puntland State of Somalia the main implementing agency for SWM has been UN-Habitat, with implementing partners such as the Italian-based NGO CESVI. Current Habitat activities in the region are implemented through the United Nations Joint Programme for Local Governance and Decentralized Service Delivery (JPLG), itself a multi-agency programme working in partnership with ILO, UNDP, UNCDF and UNICEF that started in 2008. Previously, Habitat had been engaged in the region through the SUDP, again a multi-agency urban development programme for the Somalia region (2005-2008), which itself had evolved from early programmes including 'Good Local Governance and Leadership Training Programme (GLTP) and the 'Support to the Priorities in the Urban Sector (SPAUS) Programme, which were started in 2003 and 2002, respectively.

In all of these urban programmes the crucial component of 'capacity building' has been featured as a core activity, however in regards to the solid waste management sector the emphasis has been on infrastructural development focussing on implementing a waste collection service model based-on waste transfer stations and waste disposal sites. Consequently, there has been no development of low-carbon waste resource recovery and reuse models, which in a country facing severe energy and food security challenges is a major lost-opportunity, particularly as both solid and liquid waste offers high potentials for resource recovery and reuse in both energy and fertilizer production.

Furthermore, the emphasis on infrastructural development has also taken place with insufficient attention to the necessary policy and strategic frameworks that are required to ensure safe and sustainable delivery of solid waste management services. Only when such policy frameworks are in place can institutional capacity building actually take place as this can only occur when appropriate policy and strategic frameworks exist and local institutions have the human resources to implement and deliver them. In the Puntland State of Somalia, institutional capacity remains weak, as local authorities apply a 'fire-fighting' approach to solid waste management rather than implementing well-planned local strategies that are based on clear and well-defined policy guidelines. In recent years, there have been some attempts to rectify this lack of policy with the drafting of an environmental policy (2011),

solid waste management guidelines (2011), and then more recently a draft sanitation policy (2013); these documents are reviewed in the following section.

2.2 Review of Policy and Strategy Documentation

During the course of the fieldwork a number of project documents and reports were reviewed, some of which are referenced in this report, but these mainly provide only background information, for example, previous assessment reports that were conducted as early as 2005. Some documents, such as the environmental impact assessment (EIA) reports for the waste disposal sites were unobtainable from the implementing partner, highlighting shortfalls in knowledge access and ownership, as such reports should be easily available and also held by the relevant local authority.

In regards to polices and strategies, a list of what is currently in place in the Puntland State of Somalia is given in Table 1. From these the draft sanitation policy (2013) from the Ministry of Health (2013), and the draft environmental policy (2011), and solid waste management guidelines (2011) from the Ministry of Environment, Range Wildlife and Tourism are reviewed below in reverse chronological order.

Table 1 Policies and strategies in place in Puntland

	Policies and strategies in place					
	Sanitation policy	**Environmental policy**	**Solid waste management guidelines**	**Environmental sanitation strategy**	**Local by-laws**	**PPPs[1]**
Garowe	Draft 2013	Draft 2011	2011	No	No	No
Gardo	Draft 2013	Draft 2011	2011	No	No	No (requested)
Bosaso	Draft 2013	Draft 2011	2011	No	No	No (requested)

[1] Currently no SWM PPPs have been developed despite the production of a Draft Public-Private Partnership Policy (2012), from the Ministry of Interior Government and Rural Development to promote the implementation of public-private partnerships.

National Sanitation Policy (2013) Ministry of Health, Republic of Puntland/Somaliland

First version of the recently drafted National Sanitation Policy for Puntland/Somaliland, produced by the consultancy group Hydroconseil under contract by the NGO Caritas Swiss Group in collaboration with the Ministry of Health. The draft policy contains 23-pages and is divided into five sections as follows: preamble; sector Assessment; policy orientations and principles; national sanitation policy and; supporting measures for policy implementation. The policy document addresses sanitation from a broad perspective and consequently contains only brief sections on solid and liquid waste management but these can be found in Section D.2.4 Districts/Municipalities (2013: 15), which identifies the responsibilities of the

districts and municipalities in the context of sanitation as the following:

- Solid waste management from users' doorsteps to a proper disposal site, through a public entity or through delegation to the private sector
- Liquid waste management, from controlling standards and norms of facilities to providing rules and facilities for final desludging.
- Regulation and policing at local level (by-laws, sanctions, fines)
- Monitoring and evaluation of hygiene and sanitation activities in their territories
- Gathering the needs and demands in terms of sanitation

In Section D.2.4 International agencies/NGOs (2013: 17), a list of 14 responsibilities are given, many which are based on financing, networking and supporting local and national institutional in the delivery of sanitation services. The second point is of particular relevance: 'Development and test of new approaches and methodologies', as the current solid and liquid waste practices are based on an old paradigm that waste has no economic value and requires swift and safe disposal to maintain public health and a clean environment when in fact waste is a valuable resource that can be recovered and recycled to generate energy and/or fertilisers while also creating livelihoods and economic benefits.

In Section D.4 Approaches and methodologies for community mobilisation in hygiene and sanitation (2013: 19), and Section D.5 Technical options and managerial options (2013: 20), emphasis is made on the constraints in the current systems (detailed in the next chapter), rather than presenting a range of innovative options that would provide multiple entry points at a range of scales (discussed in subsequent chapters). Nevertheless, the document provides useful institutional context that would be useful for the development of a detailed solid and liquid waste management policy that for example would include detailed guidelines for waste resource recovery and reuse, medical and hazardous waste management, while also shifting the key responsibility of the policy from the Ministry of Health to the Ministry of Public Works which at the national scale remains responsible for urban planning, civil engineering and by default environmental sanitation engineering, all which form the foundations for a coordinated environmental sanitation response.

Draft Environmental Policy (2011) Ministry of Environment, Wildlife and Tourism, Puntland State of Somalia

The draft of the Environmental Policy for the Puntland State of Somalia was produced as a collaborative effort at the Ministry of Environment, Wildlife and Tourism, with technical assistance from the Qualified Expatriate Somalia Technical Support – Migration for Development in Africa (QUEST-MIDA) project, the United Nationals Development Programme (UNDP) in Somalia and the International Organisation for Migration (IOM); the author was Mr. Abdi Issa Jama. The draft policy contains 17-pages and is divided into five

sections with an addendum as follows: introduction; environmental bill of rights; decision making framework; sectoral guidelines and; policy instruments.

In the introduction it states that the 'environmental policy is expected to provide guidance in protection and management of environmental resources' and makes reference to SLWM by placing emphasise on the compliance and enforcement of environmental regulations; improvement of urban environment through urban greening, establishment community parks, management and proper disposal of waste and; conducting broad-based awareness program on key environmental issues that affect the people of Puntland. Also relevant for the SLWM sector is the inclusion of the 'Polluter Pays Principle' in the Environmental Bill of Rights section (page 8), which requires that the cost of pollution be borne by those who cause it. This section is followed with the Decision Making Framework, which provides a short description of the environmental decisions that remain the responsibility of the Ministry; however no reference is made to how these decisions can be integrated with other ministries and policy frameworks thus weakening the overall aims of the policy.

Section 4 contains the Sectoral Guidelines, with Section 4.3 addressing Waste Management (page 11-12), which states the following: The increasing solid and liquid waste in Puntland State would be properly managed and reduced. For this purpose, the government may:

a) Develop and implement waste management directives and guidelines.
b) Improve the waste collection, transportation and disposal infrastructure available in various municipalities in the State.
c) Develop and enforce regulatory guidelines for proper management of municipal, hazardous and hospital waste.
d) Develop and implement mitigation measures for chemical and oil spills.
e) Create a Marine Pollution Control Commission and adopt oil and chemical spill contingency plan.
f) Ban use of non-biodegradable plastic bags and encourage use of alternative basketry for shopping.
g) Prohibit littering and uncontrolled and illegal dumping of solid and liquid waste.
h) Launch public awareness campaign on sanitation at household level, health risks of household chemicals, pesticides and insecticides, and possible contamination of food and water resources.

The Section also includes guidance on air and water resources management, and in Section 4.5 Water Resources Management (page 12), it highlights that the government can:

a) Manage the water resources of Puntland State for long term sustainability and prevent water contamination and degradation of water quality for human use.
b) Prevent waste dumping in dry rivers and canals for water catchments, and prohibit the direct or indirect discharge of hazardous substances to surface water sources

and ground water aquifers.

In Section 5 Policy Instruments (page 14-16); details are given of the policy instruments that are to be developed and implemented to achieve the policy objectives these include:

1) Integration of Environment into Policy Planning
2) Capacity Development
3) Legislation and Regulatory Framework
4) Public Awareness and Education
5) Environmental Impact Assessment
6) Community Participation

Finally the Addendum contains short overviews on the Puntland State of Somalia, covering: brief history; geography, soils, climate and; natural vegetation.

The draft environmental policy provides useful guidance on some aspects of SLWM, however as the policy focuses of the 'state of the environment' rather than the complete waste management cycle it does not provide comprehensive guidance on all aspects of environmental sanitation. For example, there is reference to the management of medical wastes and the disposal of wastewater (human sludge and industrial effluent), both of which are contaminating the environment in Puntland. There is sufficient justification to draft a policy specifically addressing the SLWM sector that provides comprehensive guidance on all aspects of SLWM. It could also be argued that such a policy should be coordinated by the Ministry of Public Works as this ministry is better suited to provide guidance on the development and implementation of environmental sanitation infrastructures, while also supporting urban planning, which also has a role in the effective delivery of SLWM services. Of course regardless which ministry produces the policy, linkages and cross-references must be made to other relevant polices and ministerial responsibilities, for example the national sanitation policy, which then enhances the potential policy impacts and also mainstreams what are often cross-sector issues such as urban development, health and environment.

Solid Waste Management Guidelines: For Local Governments (2011) Ministry of Environment, Wildlife and Tourism, Puntland State of Somalia

The Solid Waste Management Guidelines: For Local Governments was produced as a collaborative effort at the Ministry of Environment, Wildlife and Tourism, with technical assistance from the Qualified Expatriate Somalia Technical Support – Migration for Development in Africa (QUEST-MIDA) project; the author was Mr. Abdi Issa Jama. The guidelines contain 11-pages and are divided into four sections as follows: background; strategies towards improvement of solid waste management; ways to reduce waste and; avoiding harmful chemicals.

Section 1 Background contains a brief overview of the waste management sector in the Puntland State of Somalia, and contains two sub-sections:

1.1 Status of Solid Waste Collection and Disposal System in Puntland.
1.2 Environmental Impact of Poor Solid Waste Management

In Section 1.1, details are provided of current SWM practices while also highlighting the problems associated with not using planned and excavated waste disposal sites, although these are currently being constructed in Garowe, Gardo and Bosaso. In regards to current SWM practice on page 4 the following description is given:

> The current waste Management system in Puntland relies completely on the municipal authorities who are expected to collect garbage from collection points and dispose them to the designated landfill sites. Women are often paid to carry household refuse in sacks to the garbage collection points. These garbage collection points consist of 20m x 10m concrete, walled rectangle with no dumpsters or any other waste collection receptacles designed for emptying waste into garbage trucks. Trash carrying sacks are in short supply and the refuse is often emptied and scattered inside the garbage collection points.
>
> Once in every two week, the municipality workers clean up the collection points and take the garbage to the designated waste disposal sites outside the cities. These designated sites act as the landfill sites for municipalities.

Section 1.2, contains a brief description of the environmental impacts from poor solid waste management and although it mentions the impact of pharmaceutical wastes this should have been extended to address all hazardous medical wastes. Likewise, no mention is made to wastewater and abattoir wastes, which include livestock carcasses and bones. Although the guidelines are for solid waste, some reference should be made to wastewater to ensure this waste stream is being managed (wastewater may also be mixed with solid waste).

Section 2 Strategies Towards Improvement of Solid Waste Management is based on five components although insufficient detail is given in many of the objectives to provide the necessary guidance on how to plan, design and implement the individual suggestions. Section 2.1 Enhancement of Landfill Sites provides useful information which includes a list of 7 steps to achieve the objective (these steps are currently being addressed on the JPLG programme that is upgrading the main waste dump sites in Garowe, Gardo and Bosaso). Also in Section 2.2 Upgrading of Collection Points some very important points are made:

> The Ministry of Environment recommends the waste collection points to be improved from simple dumping site to a collection place equipped with skips or dumpsters.

> Women are often paid to carry the refuse from households to the collection points. Very often, the garbage is dumped and scattered on the ground. Dumping of refuse into the collection points makes it harder for municipal workers to make bi-weekly clean up and disposal. Skips, mini bins, dumpsters and other receptacles would make the collection-point clean up and waste disposal easier to manage.

The remaining components are all relevant for developing a SWM strategy but the lack of guidance and detail under each component reduces the likelihood of being implemented:

2.3 Improvement of Transportation of Waste
2.4 Privatization and Community Involvement
2.5 Establishment of Waste Management System for All Communities

The remaining two sections in the guidelines also cover relevant SWM issues but again provide insufficient details for them to provide clear guidance for the planning, design and implementation of SWM strategies. Section 3.0 Ways to Reduce Waste list only 3-elements:

1. Home Composting
2. Reduce
3. Re-use and Recycle

This important section is woefully short in detail as it uses less than half a page to address what is an important component in developing an integrated approach to waste management. This section also fails to make any reference to recent sector developments using innovative approaches to manage organic waste, often referred to as resource recovery and reuse, which is based on nutrient recycling and energy production.

Section 4 Avoiding Harmful Chemicals briefly looks at radioactive waste (in containers washed up on the shore), lead and pesticides. Again this section lacks sufficient detail such as current risks and recommendation for developing follow-up actions and local strategies.

3.0 SITUATION ANALYSIS

In the Puntland State of Somalia, solid and liquid waste management faces many challenges even to maintain its current levels of service delivery which for many urban residents remain woeful. While efforts and progress have been made, for example in the location and construction of official waste dumps (not landfills) and waste transfer stations, there remains urgent action required to safely manage hazardous wastes particularly medical waste (Garowe, Gardo and Bosaso), industrial effluent (Garowe) and wastewater (pumped into the sea at Bosaso). In this chapter, an overview of the solid and liquid waste management systems is given, followed by sections addressing Garowe, Gardo and Bosaso; each of these locations are examined in greater detail with supporting evidence provided in the form of digital images, to clearly highlight a range of solid and liquid waste management (SLWM) issues that are commonly found in Puntland.

3.1 Overview of Solid and Liquid Waste Management Systems

In Puntland the solid and liquid waste management systems in place reflect a common approach that is applied in the urban centres of Garowe, Gardho and Bosaso. The implemented systems are based on a dual approach that utilises manual labour to collect waste in wheelbarrows from households, markets and commercial properties to dispose of the waste as waste transfer stations. From this point waste collection trucks from local Sanitation Departments are used to transport the waste onto the solid waste dump. In the early stages of the interventions, local NGOs provided support to newly mobilised local CBOs (often IDP-based), which were equipped, trained and authorised to collect a fee for the waste collection services. This system still functions although now the system is less structured with individuals working in a similar way as informal waste collectors that also charge a small fee to remove waste. This two-staged approach is illustrated in Figure 1. From the diagram two points are relevant for future SLM planning and design. Firstly many residents and commercial units are already paying for some kind of waste collection service (upper half of diagram), which is highly relevant if considering a public private partnership system. Secondly all municipalities are subsidising solid waste collection thus drawing on limited municipal funds while also contravening the environmental policy of the Puntland State of Somalia that states ‘that the costs of pollution be borne by those who cause it’ (2011: 8).

In terms of liquid waste disposal there are no formal disposal facilities (see Table 2).

Fig. 1 Range of existing solid waste management systems in Puntland

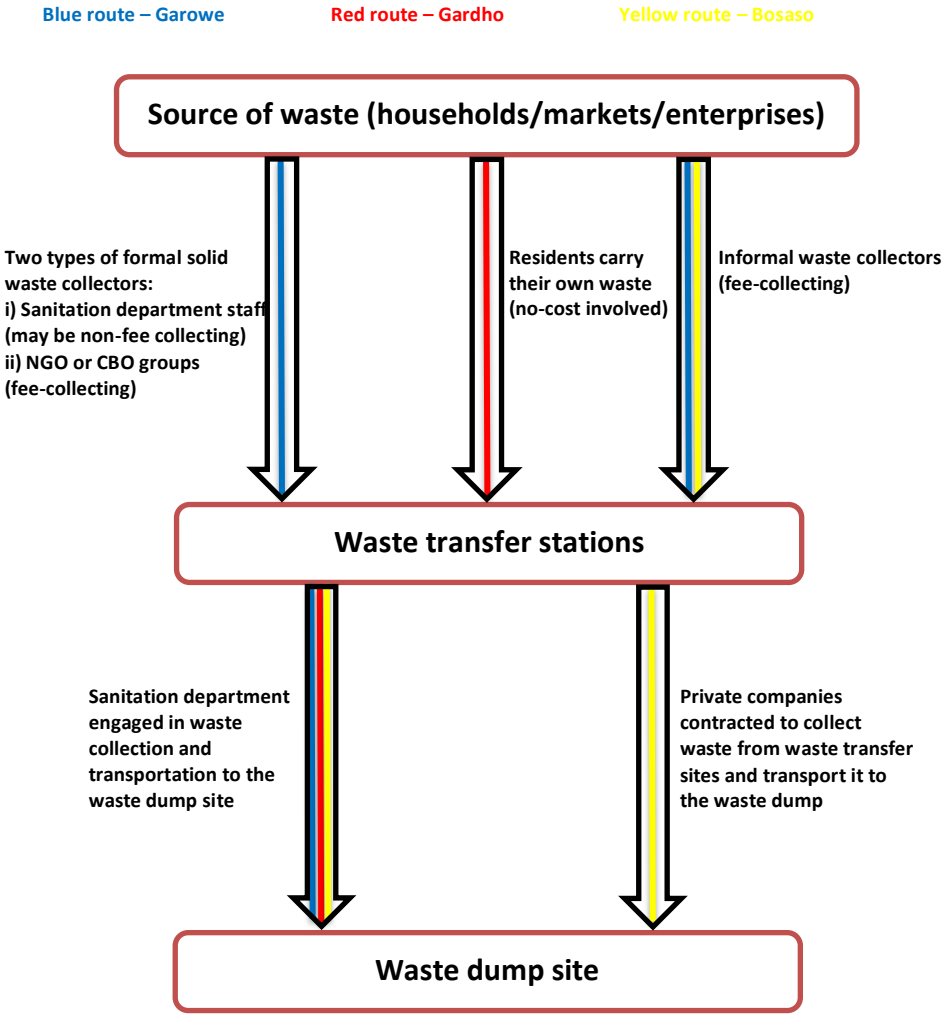


Table 2 Environmental sanitation infrastructure in place in Puntland

	Environmental sanitation infrastructure in place			
	Solid waste dump	**Wastewater disposal facilities**	**Solid waste transfer stations**	**Medical waste disposal facilities**
Garowe	Yes	No	Yes	Not functioning
Gardo	Yes	No	Yes	Not functioning
Bosaso	Yes	No	Yes	Not functioning

In the following sections, much critique in the form of a situation analysis is made on the current environmental sanitation practices but this remains an attempt to identify patterns in decentralized service delivery that can then be improved upon and/or upgraded

particularly through local governance mechanisms such as improved coordination and integration in the form of local environmental sanitation strategies.

3.2 Garowe

Garowe is the capital of the Puntland State of Somalia, and also the location of the regional parliament, the presidential parliament and the government ministries. The city is host to many schools, one major hospital, many private clinics, main market, prison, and two universities, Puntland State University and the East African University (see Table 3).

Table 3 Garowe background details

Climate	Temperature range between 18 and 34 degrees Celsius. Annual rainfall is 10.8 mm, highest monthly level in May averages 51 mm.
Population	30,000 – 40,000 (highest estimate 70,000)
Daily generated waste[1]	Low range 12 – 18 tonnes per day High range 16 – 24 tonnes per day (highest estimate 28 – 42 tonnes per day)
Daily waste volume[2]	Low range 30 – 60 m^3 per day High range 40 – 80 m^3 per day (highest estimate 70 – 140 m^3 per day)
Medical waste	Open burning at main hospital; open dumping from private clinics
Human effluent	Wastewater ponds located outside the city
Industrial effluent	Effluent pit (walled) outside city; also evidence of open dumping
Sludge tankers	1 (private sector)
Waste collection trucks	3
Waste disposal sites	1
Waste transfer stations	8

[1] Based on estimated populations and a standardised formula. [2] Based on average of daily generated waste.

In Garowe, solid and liquid waste management comes under the responsibility of the Sanitation Department in the Social Affairs Office of the Garowe Municipality. The department is equipped with 3x solid waste trucks and in the town there are 8x waste transfer stations at strategic locations which were funded through the JPLG programme. Community members, mainly women IDPs, were equipped with wheelbarrows and trained by a local NGO to collect waste at and deliver it to the various waste transfer stations. The waste collectors charge a small fee for removing the waste. The Sanitation Department also has cleaning teams that clean the waste from strategic locations such as public spaces and the city market. It then remains the responsibility of the Sanitation Department to clear the waste transfer stations using trucks to collect the solid waste and delivery it to the official waste dump located outside the town (also recently reconstructed through the JPLG programme) (see Map 1). The activities of the Sanitation Department are funded through

the municipal budget so no cost recovery or revenue generation methods linked to solid waste production are applied. Household members may pay an informal fee to a waste collector for domestic waste removal but this is not a statuary requirement.

Map 1 Garowe main dump site

In terms of policies and strategies that in place, the Head of the Sanitation Department has highlighted that while a generic byelaw exists – Law No.7 of 18th/09/2003 on the Laws of the District Councils of the Puntland State of Somalia – these only cover administration of local governance and service delivery. Consequently, local environmental sanitation byelaws specific to local context are lacking. Also highlighted was the lack of capacity to develop and implement appropriate sanitation byelaws.

Garowe – Manual loading of waste trucks

Plate 1

Direct loading of a sanitation department truck with solid waste. The waste that is being loaded is from the town market and brought to the truck by sanitation department cleaning teams. Tipper trucks are designed to carry high density heavy weights such as stone rather than solid waste.

Plate 2

The flatbed tippers currently being used have a capacity to carry circa 6 m^3 of solid waste but with the fitting of extended panels to the vehicle sides this volume may be doubled to over 12 m^3. This will then drastically improve efficiency and operational costs by lowering fuel expenditure.

Garowe – Solid and liquid waste disposal sites

Plate 3

The recently constructed waste dump site outside Garowe which consists of a large flat rectangular area that is surrounded by a 1 metre high earth mound which has one main vehicle entrance. Waste is being dumped in the far corner and then ignited and left to burn.

Plate 4

On the approach road to the effluent disposal site and waste dump industrial effluent has been discharged randomly along the dirt track. Although not confirmed, this is likely to be chemical waste from a local tannery and thus hazardous to people, livestock and wildlife.

Garowe – Wastewater disposal site

Plate 5

Located adjacent to the waste dump site is a disposal pit for wastewater that is contained within a walled structure. The pit has been used to dispose both human and industrial effluents.

Plate 6

Pooling wastewater in such conditions and without protecting the underlying groundwater can lead to possible groundwater contamination. It also fails to use the climatic conditions to aid in the drying of wastewater though evaporation.

Garowe – Sludge disposal pits outside Garowe

Plate 7

Four hundred metres beyond the solid waste dump and the effluent disposal site are a number of sludge disposal pits used by a private sludge tanker that discharges septic tanks in Garowe.

Plate 8

Creating deep sludge pools reduces natural evaporation however discharging the sludge over gradual convex slopes provides a low-cost ecological treatment method that maximises the benefits of solar radiation by killing pathogens and rapidly drying the sludge matter.

Garowe – Unmaintained medical waste incinerators outside the main hospital

Plate 9
The medical waste incinerators at the main hospital no longer function due to a lack of maintenance. Such costing must be budgeted into hospital running costs and not neglected

Plate 10
Locating the incinerators in an open public area with no restrictions on public access reduces the infection control measure of the facility if it was indeed working in the first place.

3.3 Gardho

Gardho is the capital of Gardho District, located between Garowe and Bosaso in the Puntland State of Somalia. The city has several primary and secondary schools, and is host to a military base, prison, hospital, and has a commercial retail area, vehicle workshops, hotel accommodation and a number of mosques located in the commercial and residential areas (see Table 4).

Table 4 Gardho background details

Climate	Temperature range between 18 and 34 degrees Celsius. Annual rainfall is 10.8 mm, highest monthly level in May averages 51 mm.
Population	25,000 – 40,000 (highest estimate 70,000)
Daily generated waste[1]	Low range 10 – 18 tonnes per day High range 16 – 24 tonnes per day (highest estimate 28 – 42 tonnes per day)
Daily waste volume[2]	Low range 28 – 56 m^3 per day High range 40 – 80 m^3 per day (highest estimate 70 – 140 m^3 per day)
Medical waste	Open dumping
Human effluent	Disposed informally outside town
Sludge tankers	1 (private sector)
Waste collection trucks	3
Waste disposal sites	2
Waste transfer stations	8

[1] Based on estimated populations and a standardised formula. [2] Based on average of daily generated waste.

In Gardho, there is limited solid and liquid waste management infrastructure and limited capacity to delivery what services are in place. Solid and liquid waste management comes under the responsibility of the Social Affairs Office of the Gardho Municipality, which receives some institutional support provided by the Office of the Regional Governor. The department is equipped with 3x solid waste trucks and in the town there are 8x waste transfer stations at strategic locations, 3x of which were recently constructed through the JPLG programme along with the provision of a waste truck (although no formal handover had yet been conducted). The Head of Social Affairs also highlighted that they expected additional support to improve the sanitation as Gardho had no local bye-laws in place.

Residents are expected to carry their own waste to the waste transfer stations, and then the waste trucks are used to clear the waste from the waste transfer stations and transport it to the main solid waste dump. It's estimated that each vehicle carries 6-8 loads of waste per day, with the total journeys to the waste dump between 15-20 trips per day (see Map 2), which uses a substantial amount of fuel per day. These costs are funded through the municipal budget as there are no cost recovery or revenue generation methods in place. In regards to liquid waste management, the local authority has no liquid waste management equipment. Septic tanks are used at the household lever and are emptied through private contractors that charge between $25 and $50 per tank. The contractors are instructed not to discharge the sludge in drainage systems or over open areas in town consequently faecal sludge is then disposed outside town on informal sites.

Map 2 Gardho main dump site

Gardho – Open dumps and the construction of waste transfer sites

Plate 11
In several areas around the town informal waste dump sites can be observed; these unsightly sites are also contaminated with medical waste.

Plate 12
Newly constructed waste transfer station being used inappropriately by a local youth. Dumping the waste in the entrance will soon block access.

Garowe – New and old solid waste dump sites

Plate 13
The recently constructed solid waste dump outside Gardho, which is awaiting the digging of drainage to prevent the site from flooding during the rainy season. Local authority staff highlighted that the site had yet to be formally handed over.

Plate 14
Located on the track between Gardho and the new solid waste dump is current waste dump which is still in operation. The solid waste is spread over a large surface area and the site has received little attention in confining the spread.

3.3 Bosaso

Bosaso is located on the north coast of Somalia and serves as the main port town of the Puntland State of Somalia. The city is host to schools, a number of commercial centres, hospital, private clinics, markets, the fish market near the harbour, and hosts the main campus of the East African University (see Table 5).

Table 5 Bosaso background details

Climate	Hot coastal zone with temperatures over 40 degrees Celsius during the dry season
Population	100,000 (varies between 80,000 and 120,000 during the dry and wet seasons, respectively)
Daily generated waste[1]	40 – 60 tonnes per day
Daily waste volume[2]	100 – 200 m^3 per day
Human effluent	Wastewater ponds located outside the city
Sludge tankers	1 (private sector)
Waste collection trucks	9 (7x Sanitation Department; 2x private sector)
Waste disposal sites	1
Waste transfer stations	7

[1] Based on estimated populations and a standardised formula. [2] Based on average of daily generated waste.

In Bosaso, like other Puntland towns, the solid and liquid waste management comes under the responsibility of the Sanitation Department in the Social Affairs Office of the Bosaso Municipality. The department is equipped with 4x solid waste trucks (it was noted that they are not always functioning), and in the town there are 7x waste transfer stations at strategic locations. In a similar strategy to Garowe, community members, again mainly women IDPs, have been equipped with wheelbarrows and trained by a local NGO to collect waste from households and carry it to the various waste transfer stations. Again the waste collectors charge a small fee for removing the waste. The sanitation department also has cleaning teams that clean the waste from strategic locations such as public spaces and the city market. It then remains the responsibility of the Sanitation Department to clear the waste transfer stations using trucks to collect the solid waste and delivery it to the official waste dump located outside the town (also recently reconstructed through the JPLG programme) (see Map 3). In addition to using its own vehicles for waste removal, the sanitation department have also contracted a private company to provide additional vehicles for waste removal. Thus a private company provides two waste trucks for a monthly-based fee. All the activities of the sanitation department are funded through the municipal budget so again no cost recovery or revenue generation methods linked to solid waste production are applied. Other than household members paying an informal fee to the informal waste collectors for domestic waste removal but this again is not a statuary requirement and negotiable.

Map 3 Bosaso main dump site

In terms of policies and strategies that are in place, there are no local environmental sanitation byelaws specific to the local context and the current contract with the private company was established as fixed contract based on vehicle provision rather than a public-private-partnership.

Bosaso – Main waste dump in current operation

Plate 15
The main solid waste site located on the outskirts of Bosaso. The distance between the site and the town is reducing as Bosaso expands.

Plate 16
The site is spread over an extensive acreage. Like most of the waste dumps in Puntland, the waste is ignited and the left to burn then smoulder.

Bosaso – Dual approach to solid waste management and new dump site

Plate 17

The other approach in solid waste management systems in Bosaso is the use of skip trucks (above) and waste trucks to collect and transport waste. In this context all drivers and vehicle crews are male often directly employed by the municipality or a private company.

Plate 18

The new waste dump outside Bosaso is located further away than the old site so the increased distance will increase solid waste management operational costs which highlight the need to develop income generation mechanisms.

4.0 RISK ASSESSMENT AND IMPLICATIONS

In this chapter the risks associated with ineffective solid and liquid waste management systems and their implications are briefly outlined. The chapter includes sections on: environmental risks; public health risks; gender dimensions and; the case of waste transfer stations. Due to limited survey data it must be highlighted that many of these areas require further investigation to fully quantify the environmental and public health impacts that stem from the solid waste management systems that are currently in place in Puntland.

4.1 Environmental Impacts

As solid and liquid waste is unregulated in Puntland, the risks from environmental impacts are high due to the likely contamination of the waste flows and the disposal in inappropriate locations such as water courses, drainage systems, beaches and steep slopes. For example evidence exists of informal discharging of hazardous tannery liquid wastes (high in chromium) on hill slopes outside Garowe, and the discharging of human sludge into the sea along the Bosaso coastal area. Other hazards include the practice of burning the refuse mounds at waste dumps which releases hazardous emissions, while the waste dump sites including the recently constructed waste dumps are not lined, which poses additional environmental risks due to potential for leachate seepage to enter the groundwater.

Garowe – Open dumping of waste in the dry riverbed that runs through the city

Plate 19
The open dumping of waste is occurring in multiple locations along the dry riverbed that runs through the city. During the rainy season the solid waste and debris is then washed downstream into the rural areas.

Plate 20
The recycling of waste is limited to waste pickers collecting plastic containers which are washed then sold for reuse. There is no recovery of the organic waste which is the highest proportion of solid waste.

Garowe – Open dumping of waste adjacent to a waste transfer station

Plate 21
Old practices can be difficult to change. The continued open dumping of solid waste in the vicinity of a newly constructed waste transfer station. The discarded waste is also contaminated with medical waste.

Plate 22
In addition to solid waste, residents are also dumping livestock manure which has extremely high potential for waste recovery and reuse. Such practices indicate a lack of innovation in waste recovery and reuse for energy and fertiliser.

4.2 Public Health Risks

Ineffective sold and liquid waste management systems in Puntland, poses multiple health risks for local residents (particularly children that play on and near waste dumps), workers employed in solid waste management, and waste pickers from the informal waste sector. To highlight some of the risks that are faced by workers employed in solid waste management a survey was conducted during a solid waste management workshop held for the Sanitation Department of the Benadir Regional Administration in Mogadishu: From the 34 participants:

- 21 reported having their skin pricked from a hypodermic needle from handling urban waste that is contaminated with medical waste.
- 26 reported handling pathological medical waste without protection, including blood stained clothes, bandages, and old dressings.
- 27 reported handling some kind of munitions or ordinances while handling urban waste.

In addition to the routine hazards in solid waste management, such as handling sharps (razors/broken glass), materials contaminated with industrial contaminants and/or pathogens, the waste flows in Puntland contain a range of potential hazards due to a lack of regulation in the health (medical waste)and livestock (caucus waste) sectors. Other potential hazards include anthrax (from livestock carcasses), cholera (and other pathogens), disease vectors (flies, mosquitoes, rats), unexploded ordinances, medical waste, sharps, snakes and vermin. Of particular concern are four types of hazardous waste that could be potential present in Puntland which can be categorised into the following groups:

- Human effluent
- Livestock waste
- Medical waste
- Munitions and ordinances

Bosaso – Public health and environmental hazards in the town

Plate 23
Waste transfer station equipped with waste loading ramp that is no longer used. The accumulating garbage in the station poses serious public health risks particularly during the rainy season when disease vectors multiple.

Plate 24
Overflowing liquid waste from the Bosaso abattoir poses both environmental and public health risks. Behind the pool an uncovered deep pit is located containing liquefied livestock entrails and remains.

Garowe – Open burning of medical waste at the main hospital site

Plate 25
At the back of the main hospital site medical waste is disposed on open piles and then ignited and left to burn. Such rudimentary incineration does not reach the required temperatures to safely destroy all pathogens in medical waste.

Plate 26
Although the piles are sporadically burnt the hazardous waste is left in the open where waste scavengers and roaming livestock can access the piles containing sharps, needles, syringes, stained bandages, and pharmaceuticals.

4.3 Gender Dimensions

In many societies women are predominately responsible for managing the household which includes obtaining foodstuffs and other provisions and also keeping the household clean and disposing waste (often done by female children). In Puntland, women also form the majority of workers engaged as formal and informal waste collectors, collecting waste from households and commercial areas and delivering it to waste transfer stations. Many of the waste collectors are IDPs and have even been recruited into the role through NGO programmes with the objectives of creating employment for vulnerable women due to poverty and limited livelihood access. Overtime, NGO support for the women may decline or end once funding ceases and women then become informal waste collectors that survive on small profit margins while exposing themselves to risks from handling hazardous wastes often with no protective equipment. A small percentage of women without the use of wheelbarrows or carts can be seen carrying sacks of solid waste on their head as the move refuse to the waste transfer stations.

While these programmes may start out with good intentions they can overtime expose women to the public-health risks associated with unregulated solid waste management systems. However, with some innovative design such community-based and IDP-based programmes can incorporate decentralised waste processing methods thus opening a second revenue stream for vulnerable groups while also reducing the volumes of solid waste entering urban waste flows. It is therefore important to include women in the development of waste management policies and strategies to ensure the interests and views of women, particularly from marginalised and vulnerable groups are represented.

Bosaso – Use of IDPs in solid waste management programmes

Plate 27

IDPs are frequently engaged by NGOs to participate on community-based waste collection programmes. Participants are often poor women that have limited alternative opportunities. After such projects disband many women continue to engage in informal waste collection often with no support services that may have been provided by a NGO. All workers engaged in solid waste management should have access to health and safety training and protection measures.

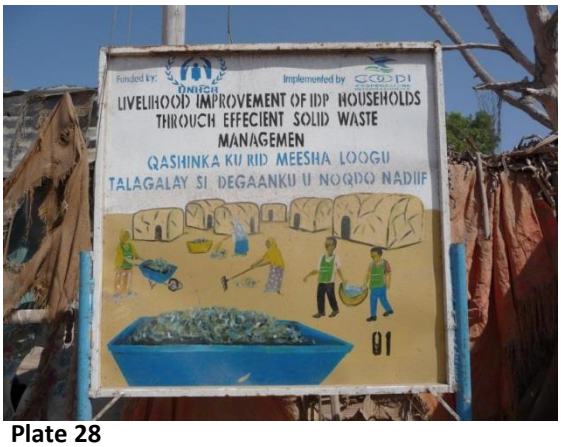


Plate 28

The use of IDPs in such programmes may become a substitute for cheap labour and can even exploit vulnerable groups. In IDP programmes innovative dimensions that add value should be incorporated such as processing organic waste into fuel briquettes or producing fertiliser for local markets or enterprises.

4.4 Case of Waste Transfer Stations

Waste transfer stations have been constructed in Garowe, Gardho and Bosaso. In many of the locations these facilities are being misused and consequently contributing to direct environmental and public health risks. Consequently by-laws should be developed to ensure safe practices are followed where solid waste transfer stations are being used, such practices should include:

- Prevention of accumulating solid waste.
- Following daily operations the waste transfer station is cleared.
- Waste transfer should not be used to store solid waste.
- If solid waste is left on-site it should be bagged or covered to prevent uncontrolled access and the spreading of wastes by roaming livestock, vermin and/or waste scavengers.
- Banning of fires.

Garowe – Lack of coordination and management of the waste transfer stations

Plate 29

Informal waste collector after dumping her wheelbarrow load in the dry riverbed (behind the waste transfer station). The waste transfer station largely remains unused although on the back wall there are marks from the recent open burning of waste which are clearly evident.

Plate 30

Further down the dry riverbed an older waste transfer station is located that is overloaded and presents a public health risk. The decomposition of the organic element of the solid waste clearly indicates that this waste transfer station has remained in this condition for some time.

Garowe – Lack of coordination and management of the waste transfer stations

Plate 31

The incorrect use of waste transfer stations in urban areas can contribute to environmental and public health hazards by increasing the risk of fires and contributing to the spread of diseases and infections as sites become breeding grounds for disease vectors and disposal sites of medical waste such as sharps and syringes.

Plate 32

Recently constructed waste transfer station. The contents of the site were burned during the night by an arsonist. Storing solid waste in large qualities in waste transfer stations poses a direct fire risk to local residents.

Garowe – Unsuitable location of waste transfer stations (no vehicle access)

Plate 33

The site of a former IDP camp. The terraces to the left and in the distance once located IDP shelters. The yellow trapezoid highlights what was the waste dump that consisted of a deep gully in the middle of the camp. The red square indicates the recently constructed waste transfer station which is adjacent to the dry riverbed.

Plate 34

The contents of waste transfer station shown in Plate 9. Other than some discarded rubbish the waste transfer station is hardly in use. Furthermore, the site has no direct access approach as the area has been fenced so waste disposal trucks cannot easily access the site.

Garowe – Overfilling of waste transfers stations in town

Plate 35

Stone built waste transfer station in the centre of Garowe. Waste is deposited here by formal and informal waste collators using wheelbarrows. Waste collection trucks from the Garowe Sanitation Department are used to transfer the waste from the station to the waste dump.

Plate 36

Waste transfer stations that are not correctly managed and overloaded become breading sites for disease vectors, including flies, mosquitoes and rats (and snakes), often in close proximity to residential areas. Livestock are also attracted due to the high organic content of the solid waste.

Garowe- Waste transfer stations

Plate 37

There are 8x waste transfer stations in Garowe. During the fieldwork six of these stations were visited and from this six, only one waste transfer station was in correct use. This example shows an acceptable level of waste awaiting collection and the waste is piled in one corner and predominantly packed in sacks or bags which allows for easy and hygienic handling.

5.0 POLICY FRAMEWORK – CREATING AN 'ENABLING ENVIRONMENT'

In the chapter, the policy framework required for creating an 'enabling environment' for the safe delivery of solid and liquid waste management services is discussed. Of particular relevance is the use of economically viable systems that create local livelihoods while also providing the private sector with opportunities to invest in future service delivery. The chapter consists of four-sections; first the case for an environmental sanitation policy for Somaliland is briefly introduced. This is then followed by a brief introduction to local urban environmental sanitation strategies, and sections addressing some potential components such as SLWM by-laws, PPPs and; medical waste strategy.

5.1 National Environmental Sanitation Policy

Many of the problems identified in Section 3.1, are compounded by a lack of policy support that provides clear direction and overall guidance for the management of the solid and liquid waste sector. Once an environmental sanitation policy is in place this is then used to support local urban environmental sanitation strategies which consists of specific hardware and software components that are developed for the local context (see Table 6). The lack of effective policy serves as a major constraint to the development of effective waste management strategies, as is the case with medical waste in Garowe, Gardho and Bosaso. Hence policy measures must be developed to address a range of management and technical issues that occur throughout the waste management cycle, that include preventative strategies such as waste reduction to the treatment and disposal of hazardous wastes.

The production of a policy document would also provide the opportunity for long-term planning in the sector, by allocating the necessary resources to maximise the efficiency and effectiveness of the current fragmented activities. In the Puntland State of Somalia, the solid and liquid waste sector is ad hoc and fragmented solutions that can best be described as applying a 'fire-fighting' to environmental sanitation, whereas a well-planned policy will pre-empt many of the problems providing guidance and direction based on appropriate technologies. Good planning and coordination alone can reduce many of the risks associated with ineffective SLWM systems.

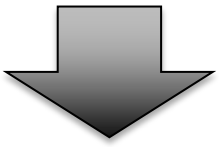
Table 6 Developing an environmental sanitation policy

Broad Policy Areas	Examples of Relevant Issues
Institutional linkages	Roles and responsibilities of other ministries Auditing of hazardous waste materials
Legal aspects	Laws Legal regulations Administrative regulations Technical Regulations Municipal byelaws
Environmental monitoring	Risk assessment Enforcement methods and procedures
Economic aspects	Public private partnerships (PPP) Marketing and utilization of wastes
Technical and infrastructural management	Landfill management Waste collection and transportation Medical waste management Industrial wastes Wastewater treatment and disposal Waste reduction, reuse and recycling Community-based solid waste management Decentralised waste solid management Planning urban environmental strategies

5.2 Local Urban Environmental Sanitation Strategies

Each urban centre should develop a local urban environmental sanitation strategy that consists of specific hardware and software components that are designed to meet the environmental sanitation policy requirements while being developed by local staff and for the local context. Some examples of potential components of the strategy are listed in Table 7. In the policy document some of these activities would be identified as compulsory such as: risk assessment, infrastructure plan; by-laws; wastewater strategy and; medical waste strategy. It is inconceivable that SLWM systems will function safely without some of the vital software components such as risk assessment and the implementation of local by-laws. Some of these components such as public-private partnerships may not be so relevant depending on the local context and scale, for example if a small urban centre at the district level develops its own sanitation department and introduces a fee-based collection system which then funds the operation and maintenance of the delivered service.

Table 7 Relationship between national policy and local strategies

National environmental sanitation policy for Puntland State of Somalia
Provision of clear direction and overall guidance for solid and liquid waste management strategies

Local urban environmental sanitation strategies
Set in local context at the appropriate municipal/district level the potential components may include:

Risk assessment	Infrastructure plan	By-laws	Public Private Partnerships	Solid waste recovery and reuse plan	Wastewater strategy	Medical waste strategy

4.3 Solid and Liquid Waste Management By-laws

The problems of ineffective SLWM (and PPPs when in place), is often compounded by the lack of local SLWM by-laws which can be a powerful and educational tool to change human behaviour though increased public awareness and the knowledge that environmental enforcement penalties exist for illegal activities, such as the burning, burying and/or dumping of waste. The lack of effective environmental by-laws is a major constraint to the development of an effective waste management strategy which also applies to the implementation of waste collection services, as by-laws can enforce citizen participation and the required payment of waste collection fees to ensure sustainability. Also regulations and by-laws are also applicable in addressing a range of health and safety issues that occur throughout the waste management cycle, examples of some of these entry points are illustrated in Figure 3 on page 40.

Following the development of appropriate by-laws the enforcement of the regulations must be conducted by an independent body preferably outside of the sanitation department. Then in cases where services and facilities are contracted out to public-private-partnerships and community-based initiatives this then allows the sanitation department to take on the role of monitoring and evaluation and the management of key infrastructures such as a centralised landfill facility. However the enforcement of environmental regulations and by-laws should remain within an independent body which can be allocated to a national agency such as the ministry of the environment or an environmental protection agency or to a municipal authority such as a municipality police force. Environmental sanitation by-laws should remain generic and applicable to all agencies including local authorities, private waste enterprises, the commercial sector, residents and also individuals engaged in the informal waste sector.

In conjunction with the development of by-laws appropriate penalties and fines must be developed with acceptable levels of enforcement through fines and other legal means to discourage inappropriate behaviour and promote the acceptance of the standards as indicated in the by-laws. While a draconian approach should be avoided and rather an educational approach should be adopted and applied through rigorous public awareness and participation, a firm resolve has proven to be successful in some cases, although environmental sanitation should be promoted as a public duty and commitment.

5.4 Public Private Partnerships

The use of public private partnerships (PPP) is well suited for the delivery of solid waste management (SWM) services. SWM PPPs are based on the introduction of a fee-based collection service. In many cases residents and commercial enterprises may already be paying informally for waste collection services but the introduction of a PPP standardises such services and ensures that formal waste management city is conducted in light of local environmental station by-laws. Consequently, the PPP document should provide innovative solutions is all about creating an 'enabling environment' for the safe delivery of solid waste collection services, using an economically viable system that creates local jobs while also providing the private partners with opportunities to invest in future services. The actual PPP document should emerge from a process of negotiation between the municipality and each respective private waste collection company so the document is embedded in the relevant local political ecology context and not based on external polices or templates. An example of the contents of a locally developed PPP for solid waste management is given in Table 8.

5.5 Medical Waste Strategy

In Garowe, Gardho and Bosaso, medical waste can be found in many of the waste transfer stations, and is clearly inappropriately managed at the main hospital in Garowe. Contamination of waste flows with medical waste is a common occurrence throughout Somalia. In Garowe, the main hospital was equipped with incinerators, but these units are no longer in operation, which is often due to a gross failure in project management which stems from the lack of a strategy to manage medical waste. Often a lack of enforcement procedure coupled with a lack of cost recovery mechanisms results in a lack of funds to operate and maintain such sites. Cost recovery is a crucial component of a medical waste management strategy and should be designed within the strategy to ensure economic sustainability of the site, as someone must pay to run and maintain such facilities.

In the case of urban centres with multiple hospitals and/or clinic facilities, the management of medical waste would be best served through a PPP with one private company taking on the management of all sites through a central incinerators located at a main hospital facility.

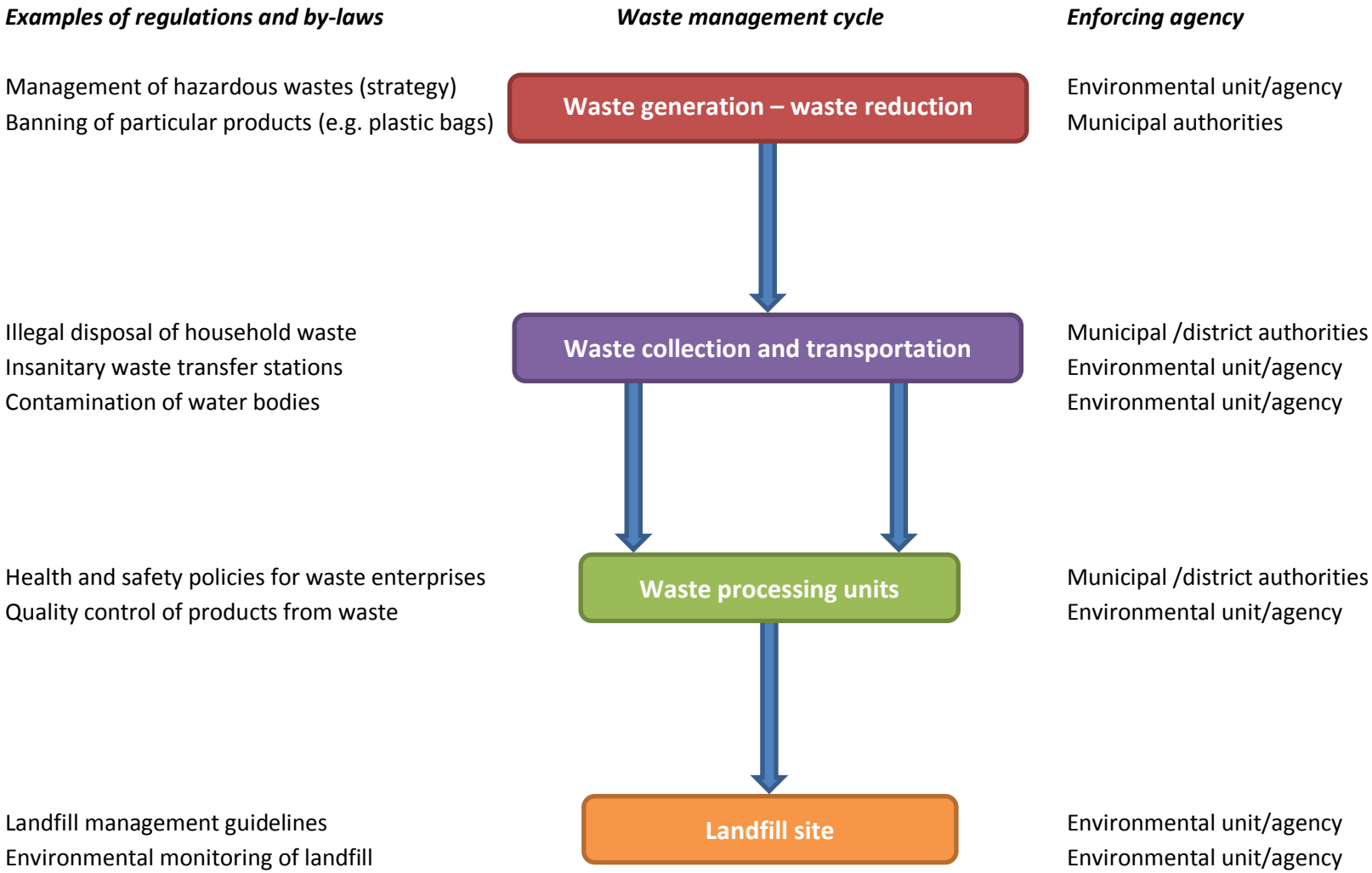
These sites could then serve as strategic locations for three wider catchment areas which would include all clinics and private medical facilities in each respective catchment area. As each private clinic has to register monitoring participation would be straightforward and with appropriate by-laws such facilities would have to pay for the collection of medical waste which would be conducted by the private company using the correct storage and transportation facilities.

The medical waste strategy should form a sub-component of an environmental sanitation or solid and liquid waste management policy for the city. This would create the 'enabling environment' for a long-term solution for the problems of dealing with medical waste.

Table 8 PPP contents for solid waste management in Mogadishu

Section	**Contents**
Definitions	
Project description	
PPP duration	
PPP monitoring and evaluation	
Details of private partner	
Contact points for information exchange	
Municipality responsibilities	SWM infrastructure Environmental sanitation decree and enforcement Public awareness campaign SWM operator's licence Monitoring of service delivery Fee pricing for waste collection
District responsibilities	Community-based public awareness Community-based enforcement of fee payment
Private partner responsibilities	Action plans Waste collection practices Employment rights Health and safety SWM equipment
Risk management strategy	
Statutory and regulatory requirements	
Termination provisions	
Force majeure	
Effective date	

Fig. 2 Entry points for environmental sanitation regulations and by-laws



6.0 INFRASTRUCTURAL DEVELOPMENT

In regards to infrastructural development this chapter focuses on two aspects, firstly the development of the sludge disposal site to maintain safe operations while using ecological principles to thus produce outputs from the waste such as biomass which can then be used for energy production. The second aspect includes the introduction of resource recovery and reuse technologies for faecal sludge and organic solid waste utilization in energy and fertilizer production. Such interventions are particularly well suited for community-based SWM livelihood activities for IDP settlements and can be designed accordingly for small-scale operations.

6.1 Faecal Sludge Disposal

In regards to human effluent, the main sanitation system used in urban areas is septic tanks which are desludged by the private sector using vacuum tankers; there are no formal sludge disposal sites. In areas populated with internally displaced persons (IDPs) there are limited sanitation facilities and where pit latrines are not available open defecation occurs. Major constraints to wastewater treatment are lack of sanitation infrastructure, limited technical expertise and knowledge, no financial resources and limited public awareness.

Since 1991, as a result of the conflict there has been very limited research activity in Somalia, particularly in South-Central Somalia. In the context of wastewater there has been no research conducted in any of the regions of Somalia. In Somaliland and Puntland research on related topics such as environmental health and sanitation has been conducted although these are predominately linked to some dimension of the humanitarian crises. One example of a recent publication that is relevant to the wastewater theme in Somalia is:

World Health Organization (2011) *Environmental Health Situation Analysis in Somalia 2010*. WHO Somalia and WHO Regional Office for the Eastern Medit erranean.

Available at: http://applications.emro.who.int/dsaf/EMROPUB_2011_EN_735.pdf

Skills and training are required in all aspects of wastewater management including knowledge and skills in the safe use of wastewater in resource recovery and reuse. In addition to limited infrastructure for solid and liquid waste management, Somalia also faces challenges linked to climate change (water availability) and food security. As the main method of sanitation in Somalia consists of septic tanks and the main disposal of solid waste is on open dumps (often burnt) this provides opportunities for faecal sludge and organic waste recycling for energy production and much needed fertilizer inputs in (urban) agriculture. Therefore priorities in urban areas should include:

- Sludge treatment and reuse for agricultural inputs and energy production.
- Biogas production for energy.
- Co-composting of human sludge and organic waste.
- Rehabilitation of urban drainage systems.

6.2 Options for Organic Waste Resource Recovery and Reuse

The following concepts offer opportunities for quick-win interventions that can be implemented as stand-alone decentralized projects servicing an urban sector or district thus minimizing expensive transportation costs as waste collection, processing and recovery takes place in the area where waste is generated. In each intervention income is generated through charging a waste collection fee from local residents and businesses coupled with the production of an output from the waste such as an energy briquette and/or compost. Providing opportunities for resource recovery and reuse along with the second income stream ensures a higher degree of sustainability as waste collection services that only wholly dependent on collection fees are vulnerable to a range of factors including increased fuel costs, economic decline, and insufficient revenue generation, particularly if the services were established with a grant and then this subsidy is removed. Also having a resource recovery and reuse component within a waste collection enterprise increases public awareness in the benefits of waste utilization but more over provides a sustainable and localized solid waste management system.

Briquette Production – Energy / Waste Management

Aim – production of energy briquettes from urban organic waste
Benefits for implementing in urban centres – the remains high demand for energy fuel which is currently supplied by charcoal produced from outside the city thus any alternative energy production also reduces deforestation in rural areas; briquettes can be used for energy provision, particularly cooking at the household level with improvised cooking stoves and at the institutional levels with large cooking stoves.

Biogas Production – Energy / Environmental Sanitation

Aim – production of biogas for cooking and lighting from human effluent
Benefits for implementing in urban centres such as Hargeisa – the remains high demand for communal toilet provision, particularly in schools, hospitals, prisons and other institutional settings but such toilets can also feed bio-digesters thus providing a sustainable sanitation alternative to septic tanks and pit latrines as the human effluent is utilized for methane

production which can then be used for cooking in institutional kitchens and the lighting of local buildings.

Compost Production – Waste Management / Urban Greening

Aim – production of compost from urban organic waste
Benefits for implementing in urban areas – everyday in the cities of Somaliland, substantial amounts of organic waste are generated and disposed of through unsustainable practices that include burning, open dumping in dried-river beds and disposal at the unmanaged waste disposal sites. However organic waste can be collected and composted to provide valuable inputs for the use in 'urban greening' activities such as tree planting in open spaces, parks and along riverbanks.

Charcoal Production – Energy and Environmental Management

Aim – production of charcoal in improvised kilns using wood from Prosopis juliflora
Benefits for implementing in peri-urban areas – the remains very high demand for charcoal which is currently supplied by charcoal produced from rural areas thus local charcoal production will contribute to reducing deforestation in rural areas. Please note the invasive tree species *Proposophis juliflora* is endemic in many urban areas in Somaliland resulting in a loss of urban bio-diversity and thus requires uprooting (and utilizing) to allow for the regeneration of indigenous trees. This activity may not be directly related to solid and liquid waste, however its adoption can support other directly related activities therefore should be consider as a component of an integrated approach to resource recovery and reuse.

Soap Manufacturing – Livelihoods / Abattoir Waste

Aim – production of soap from livestock bone waste
Benefits for implementing in urban areas – high amounts of livestock waste is generated throughout the cities in Somaliland often to be disposed of informally at unmanaged waste disposal sites creating a public health risk and a hazardous environment. Instead fresh livestock bone can be used to manufacture soap through simple boiling processes that abstract a liquid-gel from the bone that is then poured into moulds to produce soap. This is currently being implemented on UK DFID-funded project in Hargeisa at a relatively large-scale. However decentralized plants may be more appropriate in other urban centres as these can also be attached to local abattoirs.

Urban Agriculture – Livelihoods / Urban Ecology

Aim – small-scale production of food/fibre/medicines in urban and peri-urban areas
Benefits for implementing in urban areas – the remains a high demand for fresh foods and herbal medicines in the city and some of these products are ideally produced in community-based market garden projects that can also utilize urban wastes as fertilizer inputs in intensively managed market gardens that are based on small plots of land, equipped with shallow wells and fabric-tunnels (similar to a poly-tunnel) for micro-climate control.

Puntland – Potentials for organic waste recover and reuse

Plate 38
Urban tree nursery in Garowe located at the Ministry of Environment, Range Wildlife and Tourism. Tree nurseries can also be found in Gardho and Bosaso and are facilities that require high amounts of compost inputs.

Plate 39
Agriculture in the peri-urban areas of Bosaso. Where such farming activity takes place then markets for compost and other fertilizer-based products can be generated thus also contributing to food security strategies.

7.0 CAPACITY BUILDING

Capacity building is a crucial component in all aspects of environmental sanitation and SWM; some current requirements are listed in Table 9.

Table 9 Capacity building matrix

Agency/stakeholder	High priority	Medium priority
Central government	Development of a liquid and solid waste management policy Development of a medical and hazardous waste strategy Establish an independent environmental protection team Allocate medical waste management responsibility to ministry level	Develop laboratory testing facilities
Municipalities	Draft environmental sanitation by-laws Review all aspects of current SWM-PPPs Issue protective clothing to sanitation workers Mobilisation of municipality police in environmental enforcement Training of sanitation department staff in first aid Training of sanitation department staff in unexploded ordinances and munitions safety Enhance coordination of relief/development agencies, particularly with UN-Habitat, World Bank and other aid agencies	Create environmental sanitation network Train and mobilise environmental sanitation inspectors
District offices	Training of sanitation officers in basic environmental sanitation	
Hospitals	Allocation of medical waste responsibilities to senior management Training of hospital maintenance staff in medical waste management Development of medical waste management network	
Private companies	Create awareness in opportunities for waste collection enterprises	Provide grants to fund start-up of waste collection services Training in managing a waste collection services Create awareness in resource recovery and reuse interventions
NGOs		Training in environmental sanitation (SPHERE Guidelines) Create awareness in resource recovery and reuse Provide small grants to fund community-based waste management
Urban residents	Public awareness campaigns in environmental sanitation	
IDPS		Provide training in community-based WASH approaches Create awareness in community-based resource recovery and reuse

9.0 CONCLUSION AND RECOMMENDATIONS

In this sector study a range of issues and constraints that can be found in the liquid and solid waste management sector in the Puntland State of Somalia have been highlighted. Of clear relevance to the JPLG programme are the policy aspects that are required to enhance and improve current solid and liquid waste management practices. In terms of enhancing environmental sanitation, infrastructural development is only one component of a wider picture, as a better use of human and financial resources through improved coordination may well improve environmental outcomes rather than investing in high-tech solutions for solid and liquid waste management. Consequently, tackling the major constraints that are linked to the development of policy and strategy frameworks should be priority in Puntland.

Major Constraints

- No enforcement of environmental sanitation by-laws.
- Lack of approved local environmental sanitation strategies, which include such components as spatial planning, by-laws, PPPs and a medical waste strategy.
- Lack of solid and liquid waste management policy (sanitation policy drafted in 2013).

Recommended Course of Action

- Urgent focus on institutional capacity, policies and strategies.

High Priority

- Provide environmental sanitation workshop for sanitation departments – covering current problems / best practices / future sector planning.
- Develop and validate an environmental sanitation policy for Somalia.
- Develop and validate local urban environmental sanitation strategies – which include such components as spatial planning, by-laws, PPPs and a medical waste strategy as sub-components.
- Rehabilitate medical waste disposal facilities.

Medium Priority

- Develop low-cost ecological treatment for wastewater disposal.
- Develop organic waste recovery and reuse options.

Additional Recommendations

- Improve coordination between UN-Habitat and the World Bank.
- Improve public awareness in all aspects of environmental sanitation and SLWM.
- Introduction of community-based SWM livelihood activities for IDP settlements in accordance with Sphere Guidelines.