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Source-to-Sea Analysis of Plastic Waste Management

Vu Gia-Thu Bon River Basin



Plastic Waste Management in Vu Gia – Thu Bon basin

Quantitative and qualitative assessment characterizing plastic solid waste flows in the Vu Gia –Thu Bon basin from source-to-sea



Stockholm International Water Institute (SIWI)

Resource and Waste Advisory (RWA) Group



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Executive Summary

The Source-to-Sea framework for Marine Litter Prevention provides a structured approach to assess the situation of plastic pollution and generation of marine litter in a specific river system or basin and design adequate, holistic and cross-sectorial interventions to minimize the problem. The framework suggests six consecutive steps to achieve this. They are clustered into a three-step diagnostic and a three-step planning and implementation phase. This report aims to apply the first three steps of the framework for the Vu Gia – Thu Bon (VGTB) River Basin in central Viet Nam. The steps include:

- **Characterize:** Identify land-based sources of plastic pollution and understand their impacts from a source-to-sea perspective.
- **Engage:** Engage local and global stakeholders to gain control of plastic waste.
- **Diagnose:** Develop coherent governance, finance and management across sectors and at all scales.

The study consists of an assessment of the current situation of waste management and plastic recycling in the VGTB River Basin based on desktop research, stakeholder interviews, a field survey of plastic leakages from three different clusters within the basin in order to estimate the scale of the problem and a characterisation of stakeholders and the governance system relevant to the issue of plastic pollution. Plastic leakages are quantified with the Waste Flow Diagram (WFD) methodology, a tool based on expert assessment that is being developed by University of Leeds, EAWAG and Wasteaware for GIZ. The full methodology and guidance documents will be published in the first quarter of 2020. This study summarizes results in findings and recommendations that can be used for the planning phase within the source-to-sea approach.

The VGTB River Basin covers an area of 10,350 km², within mainly Quang Nam Province and Da Nang City and is located in central Viet Nam. Included are:

- Quang Nam Province: Urban areas (Hoi An City and Dien Ban town) and rural areas (Dai Loc, Duy Xuyen, Que Son, Nong Son, Hiep Duc, Tien Phuoc, Bac Tra Mi, Nam Tra Mi, Dong Giang and Tay Giang districts).
- Da Nang City: Urban districts (Cam Le, Hai Chau, Lien Chieu, Ngu Hanh Son, Son Tra and Thanh Khe) and rural district of Hoa Vang.

A full, statistically coherent sampling of plastic leakages for the whole basin was not possible within the scope of the study, hence a proxy approach was used with sampling in representative clusters and extrapolation from these. Characteristics of the clusters are:

1. Urban centres:
These are normally the areas with the highest waste generation (in waste per capita and total amounts), frequently close to rivers, and with available data for waste management services.
2. Low density settlements and rural areas:
Areas with lower waste generation (in waste per capita and total amounts), usually less waste management services and little to no data availability.

3. Coastal and/or touristic areas:

These are areas with proximity to the sea, higher risk of direct leakage and higher sensitivity to impacts.

Waste management services for these three clusters can be described as good service levels in urban areas and less coverage in rural areas. Plastic recovery activities are focussed on urban areas and touristic centres as well as coastal communities to some extent. Waste generation in cities is almost double as high (0.7 – 0.8 kg/capita and day) as in rural and coastal communities with 0.42 kg/capita and day). Plastic content in municipal solid waste reaches up to 20% by weight in touristic cities (Hoi An) but averages at a comparatively high 16% to 17% throughout the clusters.

The following table summarises waste quantities and the amount of uncollected waste per cluster from the samples taken in the field. It shows that a total of 38.6 metric tons per day of plastics are not collected in the VGTB River Basin. That amount originates mainly from rural communities due to their lower coverage in terms of waste collection.

Description	Unit	Urban	Rural	Coastal	Total
Population	inhabitants	1,208,245	699,196	251,697	2,159,138
Household waste generation	ton/day	926	294	106	1,326
Commercial waste generation	ton/day	225	44	16	285
Tourism waste generation	ton/day	38	-	-	38
Total municipal waste generation	ton/day	1,189	338	122	1,649
Total plastic waste generation	ton/day	206	55	20	281
Average waste service coverage	%	95%	60%	63%	86%
Total uncollected waste	ton/day	54	137	45	236
Total uncollected plastics	ton/day	9.3	22.1	7.3	38.6

The WFD methodology was applied to determine how much plastic is leaking into the aquatic environment from the respective clusters. The results are described in detail in Chapter 3.5 but can be summarized that it shows each person in the VGTB River Basin releases between 0.6 (urban) and 4 (rural) kg of plastic waste that enters waterways per year. This is equivalent to 120 (urban), 2,000 (rural) and 1,500 (coastal) plastic bags released per person per year.

Major impacts to the tourism sector and in terms of economic losses as costs for clean-ups are caused by this plastic pollution. Of particular concern is expanded polystyrene (EPS or commonly called Styrofoam) used for food packaging and for fishing activities as it is a) prominently visible and b) breaks into smaller, non-removable pieces very quickly. Touristic areas such as Hoi An have to conduct daily beach cleanings to maintain their attractiveness to visitors.

Key stakeholders that have to be addressed to change their behaviour and impacts are the general population, waste service providers (mainly URENCO), waste workers on local and rural level, informal waste collectors and fishing communities and their port management. Several ministries are involved in waste management and recycling services and are mostly represented through their provincial departments. International agencies are continuously increasing their engagement in the topic of plastic leakage and with a focus in Viet Nam, so that several initiatives and programmes could be found in the VGTB River Basin. Coordination and collaboration between these actors is still limited.

Priority actions that should be addressed in the short to medium term and are tackling rather quick improvements, both on national as well as on local level. These include:

- Addressing single-use plastics: Action plan for reduction and substitution, limitations of use, incentives for producers and retailers to move away from single-use plastics, levies on bags, target hospitality and food packaging industry to move from single-use to zero waste.
- Improving solid waste management services, particularly for rural and coastal areas, particularly addressing hotspots such as tourism areas and fishing ports.
- Support recycling value chains by introducing plastic banks, support pilot projects and innovations, cooperate with tourism and packaging industry, discuss and introduce extended producer responsibility (EPR) systems for selected packaging.
- Create awareness on consumer, producer (and retailer) and political decision maker level.

A second set of recommendations is provided as an initial food for thought on the consecutive steps within the source-to-sea approach. These are geared to:

- Sustainably secure service delivery and adequate technical standards for all (most) waste generators;
- Develop and promote value chains for all (most) types of plastics put on the market or consequently limit the output of plastics that have no value chain established; and
- Promote a societal development including all relevant stakeholders towards a more resource efficient and less wasteful economy, ultimately aiming for a comprehensive circular economy approach.

The recommendations include aspects that facilitate policy interventions, enable multi-stakeholder processes, strengthen formal and informal recycling activities, provide capacity development on technical and planning levels and promote sustainable financing and investments.

This study is a first attempt to address complex problems and interlinkages between various actors for a larger area such as the VGTB River Basin with comparatively little level of effort. While the provided data is not statistically comprehensive it paints a snapshot and overall idea of the situation on the ground, the relevant actors and their interlinkages. It identifies core problems and options for tackling them. Further research beyond the scope of the study is recommended to a) scope a statistically sound assessment of plastic leakages and provide linkage with other methodologies; b) quantify impacts (the study is limited to mostly qualitative descriptions, no internationally accepted methodology is available yet to quantify impacts of plastic leakage); and c) enter a more detailed analysis of stakeholder's drivers, barriers and motivations to refine stakeholder engagement.

Introduction

Source-to-sea management considers the entire source-to-sea system – stressing upstream and downstream environmental, social and economic linkages and stimulating coordination across sectors and segments. Source-to-sea management focusses on six key flows. These six source-to-sea flows – water, sediment, pollutants, biota, materials and ecosystem services – connect segments along the source-to-sea continuum at different spatial scales. All flows have natural ranges of variation that biodiversity and human activities have adapted to. Variation outside of these natural ranges can disrupt individual species' life cycles, impact human health, alter ecosystems and disrupt social and economic systems.

This report addresses the first three steps of the source-to-sea approach as described in *Implementing the Source-to-Sea Approach: A Guide for Practitioners*¹. This includes the characterization of a priority source-to-sea flow in the Vu Gia – Thu Bon (VGTB) River Basin Viet Nam with focus on solid waste flows (and specifically plastics). The purpose of the study is to provide insights into the sources, quantities and transport pathways for plastics to enter waterways and be delivered to coastal and marine environments and the governance, behaviours, management and finance that are contributing to plastic leakage. The study will be used to increase stakeholder awareness and to provide a basis for decision makers in considering steps toward preventing plastic pollution in the basin.

Vu Gia Thu Bon River basin consists of different Vietnamese provinces, namely Quang Nam, Da Nang, Kon Tum and Quang Ngai and extends from 14°90' to 16°20' N and from 107°20' to 108°70' E. (source: <http://www.basin-info.net/river-basins/vu-gia-thu-bon-information-centre-vietnam/natural-environment>).

The River Basin covers an area of 10,350 km², including mainly Quang Nam Province and Da Nang City (Figure 1).

¹ Mathews, R. E., Tengberg, A., Sjödin, J., & Liss-Lymer, B. (2019). *Implementing the source-to-sea approach: A guide for practitioners*. SIWI, Stockholm.



Figure 1: Location of VGTB River Basin in Viet Nam Map

Areas of Vu Gia-Thu Bon (VGTB) River Basin in Quang Nam Province and Da Nang City (Figure 2) include:

- Quang Nam Province: Urban area (Hoi An City and Dien Ban town) and rural area (Dai Loc, Duy Xuyen, Que Son, Nong Son, Hiep Duc, Tien Phuoc, Bac Tra Mi, Nam Tra Mi, Dong Giang and Tay Giang district).
- Da Nang City: Urban districts (Cam Le, Hai Chau, Lien Chieu, Ngu Hanh Son, Son Tra and Thanh Khe) and Suburban district of Hoa Vang.

VGTB River Basin is one of the 9 largest river systems in Viet Nam. The rivers are short with steep slopes (in the upstream) and consists of two main tributaries: 1) Vu Gia River, which is 204 km long until Da Nang City and 2) Thu Bon River, originating from the common border of three provinces of Quang Nam, Kon Tum and Quang Ngai, at an elevation of over 2,000 m and has a length until Giao Thuy of 152 km.



Figure 2: Map of VGTB River Basin (source: https://www.researchgate.net/figure/Overview-of-the-Vu-Gia-Thu-Bon-basin_fig1_288516298)

Quang Nam Province is a coastal province located in the central part of Viet Nam. The province borders to the north with Da Nang City, to the east with South China Sea (125 km coastal line), to the west with Kon Tum province and Lao Democratic Republic and to the south with Quang Ngai Province. With natural area of 10,406 km² the province is characterized by three river basins, i.e. Vu Gia, Thu Bon and Tam Ky River basin.

The province, with population of 1,567,890 people (2019 census), is administratively divided into 02 cities (Tam Ky and Hoi An City), 01 town (Dien Ban), and 15 districts (Tay Giang, Dong Giang, Nam Giang, Phuoc Son, Bac Tra Mi, Nam Tra Mi, Hiep Duc, Tien Phuoc, Nong Son, Duy Xuyen, Dai Loc, Thang Binh, Que Son, Nui Thanh and Phu Ninh) (Figure 3).



Figure 3: Administrative Map of Quang Nam Province (Source: Quang Nam, https://vi.wikipedia.org/wiki/Qu%E1%BA%A3nq_Nam)

Hoi An, as a part of Quang Nam Province, is an Ancient Town, a National Cultural Heritage Site since 1985 and an UNESCO World Heritage City since 1999². The coastal city is one of the most famous tourist destinations in central Viet Nam. In 2016, the city welcomed 2,624 million visitors, up 17.92 % compared to 2015³. In 2018⁴, the city welcomed nearly 5 million tourists while about 6.5 million tourists were in the entire Quang Nam Province.⁵

Da Nang, a coastal city in central part of Viet Nam, borders to the North with Thua Thien -Hue Province, to the East with Eastern sea, to the West and South with Quang Nam Province (Figure 4). The city includes 6 urban districts (Cam Le, Hai Chau, Lien Chieu, Ngu Hanh Son, Son Tra and Thanh Khe district), 1 rural district (Hoa Vang, and 01 island district (Hoang Sa). Natural area of Da Nang City is 1,285 km². The city has population of 1,234,310 people according to the 2019 census.

² UNESCO World Heritage Sites in Hoi An. <http://www.vietnam-guide.com/hoi-an/hoi-an-old-town.htm>
Read more at: <http://www.vietnam-guide.com/hoi-an/hoi-an-old-town.htm?cid=ch:OTH:001>.

³A review for Hoian's socio-economic of 2016 <http://hoianancienttown.vn/en/news/Hoi-An-Overview/a-review-for-hoian-s-socio-economic-of-2016-467.hwh>

⁴ Approximately 5 million tourists coming to Hoi An in 2018. December 19, 2018. <http://baoquangnam.vn/chinh-tri/201812/gan-5-trieu-luot-khach-den-hoi-an-nam-2018-829890/>

⁵ Quang Nam welcome more than 6.5 millions tourist in 2018 (dec.2018). <https://baodautu.vn/quang-nam-don-hon-65-trieu-luot-khach-trong-nam-2018-d92768.html>

Study objective and methodology

Study objective

The qualitative and quantitative assessment characterizing solid waste flows (especially plastics) in VGTB River Basin following the source to sea approach provides insights into sources of plastic pollution, quantities and transport mechanisms towards waterways. It also analyses the underlying governance, behavioural patterns as well as management and finance aspects that are contributing to the plastic leakage.

The outputs of this study are intended to be used to strengthen understanding of the issue of land-based plastic pollution in the Vu Gia – Thu Bon River Basin amongst local stakeholders. They will be the basis for engaging with local authorities in developing a source-to-sea approach to managing solid waste for improved social, economic and environmental outcomes.

The Source-to-Sea Framework for Marine Litter Prevention has a six step cycle⁶ but the objective of this study is focussing on the first three steps as shown in **Error! Reference source not found.5**.

⁶Mathews, R.E. & Stretz, J., 2019. Source-to-Sea Framework for Marine Litter Prevention: Preventing Plastic Leakage in River Basins

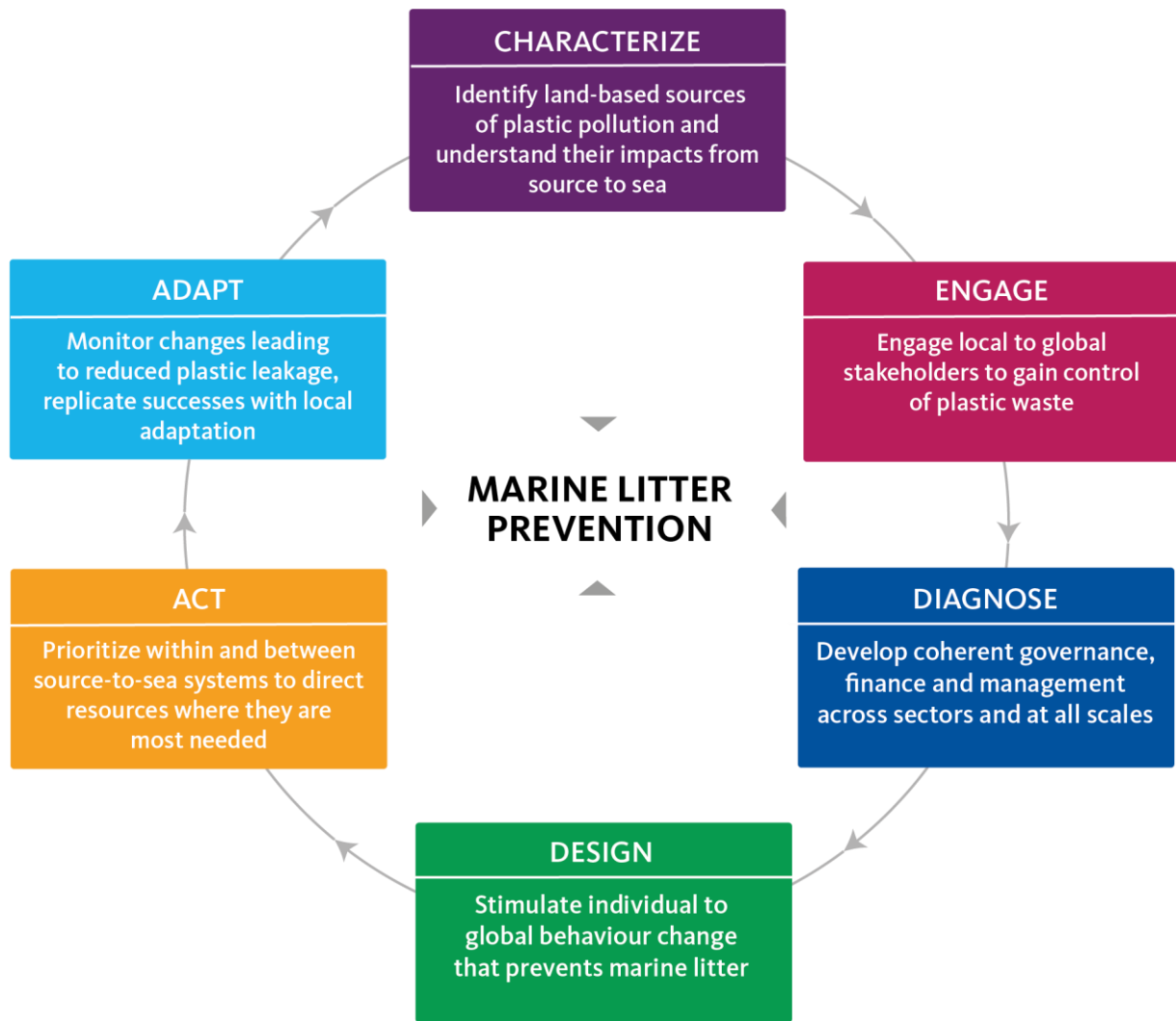


Figure 5: Six steps of Source to Sea Framework for Marine Litter Prevention and the objectives of this study in Vu Gia-Thu Bon River Basin

The findings of this report inform on the amounts of municipal solid waste (MSW) generated and collected, types and amounts of plastic waste generated and the paths they follow to their final destination. It further evaluates impacts of plastic pollution, identifies key stakeholders (primary, targeted, enabling, supporting and external) and challenges and opportunities in the governance system. The proposals and recommendations presented in this report follow the Source-to-Sea Framework for Marine Litter Prevention.

Methodology for implementation

This study is based on the primary data collected using the Source-to-Sea Framework for Marine Litter Prevention. Source-to-sea management considers the entire source-to-sea system – stressing upstream and downstream environmental, social and economic linkages and stimulating coordination across sectors and segments. The primary data which is mostly qualitative has been supplemented by secondary data from recent studies done post 2010.

The primary data have been collected during a field survey in VGTB River Basin from October 20 to October 31, 2019. It was conducted to understand and observe the real status of solid waste

management in VGTB⁷ River Basin, especially plastic waste flows in order to facilitate qualitative and quantitative characterization of plastic solid waste flows in the River Basin.

NOTE: It is important to point out that the model is based on expert assessment during field surveys and not actual measurements. Also, the upscaling to the whole river basin is indicative only and not statistically robust. For a statistically reliable assessment of the whole river basin more reliable and detailed data on waste generation rates, settlement structures and particularly the spatial distribution of residents would have to be taken into consideration. The required level of effort could not be executed within the scope of this study.

Within the scope of the study the whole basin could not be surveyed in close detail. The Consultant selected a number of representative areas in the VGTB River Basin to conduct the field survey. Findings from the field surveys together with results of reviewing available secondary data was used to estimate plastic waste flows in the surveyed areas. The data are then upscaled to the entire basin. The model used is based on the GIZ initiated methodology of the Waste

Flow Diagram⁸. This model is still under development but is currently the only available tool to estimate plastic waste flows based on field observations and the potential for plastics leaking into water systems from insufficient municipal waste management services. It is designed for use on the municipal level. A second available tool, the plastic pollution calculator⁹ is providing a significantly more detailed estimate but requires a much more substantial data set to operate.

In order to select the representative areas for the field survey, the study area (VGTB River Basin) is classified into clusters. Each cluster will include areas/districts/towns having particular characteristics. For VGTB River Basin, following clusters are defined:

- Urban centres:
These are normally the areas with the highest waste generation (in waste per capita and total amounts), frequently close to rivers, and with available data for waste management services.
- Low density settlements and rural areas:
These generally have lower waste generation (in waste per capita and total amounts), usually less waste management services, little to no data availability.
- Coastal and/or touristic areas:
These are areas with proximity to the sea, higher risk of direct leakage and higher sensitivity to impacts.

The clustering also considers upstream – downstream relationships where relevant as well as potential sinks within the water system such as dams or other water retaining installations. Specific point sources (e.g. plastics industries, dockyards) can be located throughout the river basin and will be evaluated separately. As a result of the clustering, areas (Figure 6) selected for the survey include:

- Urban Centres: Tam Ky, Hoi An and Da Nang City; and

⁸The concept and methodology are presented in: Renaud, P., Stretz, J., Latuheru, J., & Kerbachi, R. (2018). Marine Litter Prevention - Reducing plastic waste leakage into waterways and oceans through circular economy and sustainable waste management. Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

⁹ <https://www.iswa.org/home/news/news-detail/article/iswa-contributes-to-decrease-plastics-ending-up-in-the-ocean-in-bali/109/>

- Rural areas: Duy Xuyen, Dai Loc, and Nui Thanh districts

Tam Ky City and Nui Thanh district are not located in VGTB River Basin. However, the team has conducted the survey in the areas because of the followings:

- Tam Ky City is the capital city of Quang Nam Province where most of the provincial governmental offices are located. Involvement of the city's stakeholders in the survey process will improve their understanding of mechanisms of plastic pollution. This also helps the provincial government to understand the importance of waste management (especially plastic waste) as a part of integrated water management that needs to be coordinated by VGTB River Basin Joint Coordination Committee.
- Nui Thanh district¹⁰, although it does not belong VGTB River basin, is the district where two provincial landfills (Tam Xuan 2 landfill and Tam Nghia landfill) are located (waste from other districts in the province is disposed of in these landfills; Nui Thanh district is also connected to VGTB River system by Truong Giang River (that connects Tam Ky River Basin with Thu Bon River Basin). The team was informed by Nui Thanh district that Tam Hai Commune (an Island of the district) is the place that yearly receives hundreds tons of waste flowing from other areas, by currents, to the commune's seashore.

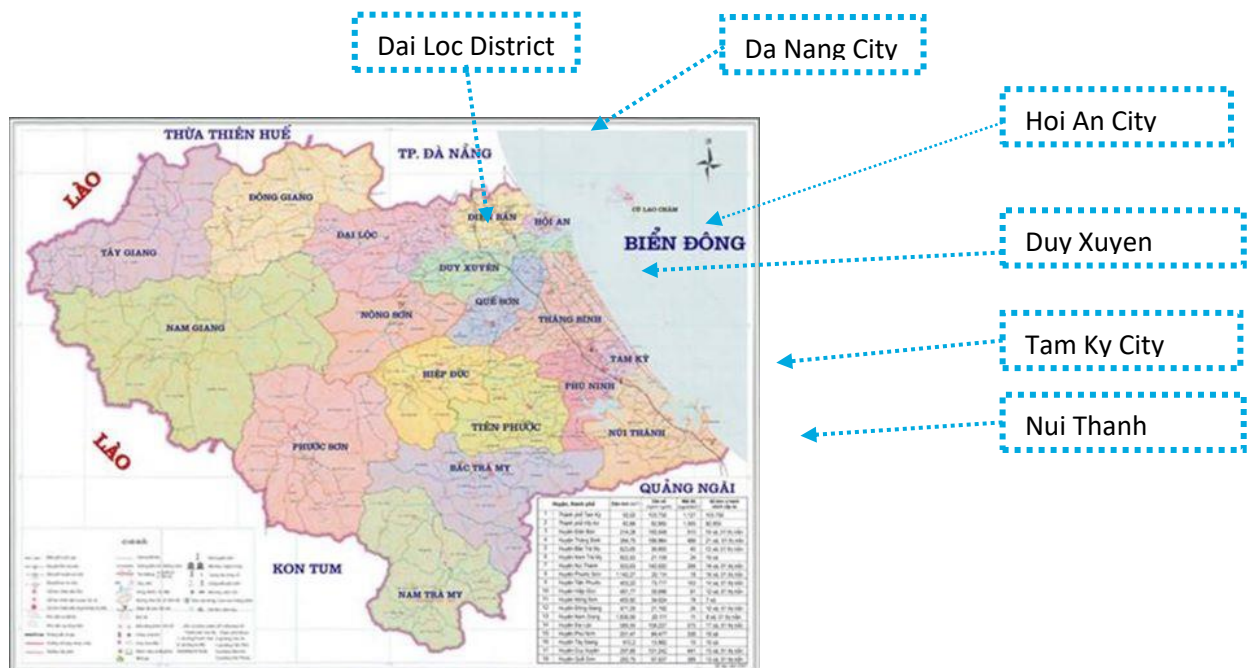


Figure 6: Cities/Districts selected for the Solid Waste Survey

The clustering then allows to determine characteristic potential for plastic leakage for the different areas. In the simplified approach used here the results from field observations are then simply upscaled to the whole population attributed to each of these clusters. The available secondary data allowed for a rather detailed clustering. It has to be noted however that this data could not be verified within the scope of the study.

Given the size of the VGTB River Basin and its numerous disposal sites and varying waste management characteristics a consolidated approach as used in the Lake Hawassa study was logistically not possible to implement. In addition, the limitations of the available secondary data on waste generation, composition and in particular on formal and informal separation and recycling

¹⁰The survey of Nui Thanh District is recommended by DONRE

activities would have required a widespread primary data collection exercise. The approach here therefore attempts to generate some meaningful estimates despite the limited data availability.

Land-based sources of solid waste

Current situation of solid waste management

Solid waste management (SWM) involves the generation, storage, collection, transportation and disposal/treatment of wastes which are generated from households, tourist activities, commercial premises, institutions, industries and other sources within municipal boundaries.

Solid waste management in Quang Nam Province

SWM in Quang Nam Province is assigned as follows:

- Quang Nam Urban Environmental Company (URENCO) is responsible for provision of waste services to Tam Ky City and nine districts (Phu Ninh, Tien Phuoc, Hiep Duc; Que Son, Thanh Binh, Duy Xuyen; Dien Ban, Dai Loc and Nui Thanh districts). The collected waste is disposed of at three provincial landfills (Tam Xuan 2, Tam Nghia and Dai Nghia Landfill) managed by Quang Nam URENCO;
- Hoi An Public Works JSC is responsible for SWM in Hoi An City, including management of the composting plant and Cam Ha landfill; and
- SWM is self – organized by the communes/district towns in seven mountainous districts. This is due to the large geographical area, complex topography, and low population density in the area.

In total, in the province there are twelve disposal sites with varying levels of management at provincial and city/district levels. See Figure 3 for the location of the main sites of landfills.

According to Quang Nam URENCO, solid waste daily collected in VGTB River Basin (Dai Loc, Duy Xuyen, Tien Phuoc, Hiep Duc and Que Son District Tra Mi, Nam Tra Mi, Dong Giang, Tay Giang, Nam Giang and Nong Son district) is about 348 metric tons/day.

Solid waste management in Hoi An City

According to Hoi An City Peoples' Committee (CPC), Hoi An Public Works JSC is the company responsible for solid waste management in Hoi An City. Waste generation in the city increased considerably in recent years, especially the plastic fraction. If in 2013, the amount of waste collected in the city was about 65.5 tons/day, the waste amount collected in 2018 was 92 tons/day and in 2019 was about 100 tons/day. Waste collected in the city is either composted (organic fraction) at the composting plant or disposed of at Cam Ha or provincial landfills.

Solid waste management in Da Nang City

According to Da Nang Department of Natural Resources and Environment (DONRE), solid waste amount collected daily in Da Nang City is more than 1,100 tons/day¹¹. The waste collection rate in 2018 was about 93-96 % of the generated waste in the urban area and about 70-75 % in the suburban areas. The collected wastes are disposed of at Khanh Son Landfill- the only landfill in Da Nang City.¹²

Average waste generation rate increased from 8-10 % annually for the period 2007-2017. From 2017-2018, the annual waste generation rate increased 16 -17 % per year, i.e. almost doubled compared to the period of 2007-2017¹³.

The city's waste management infrastructure includes 133 waste-bin transfer points, 5 transfer stations (Le Thanh Nghi, Cho Dau Moi, Nguyen Duc Trung, Hoa An and Hoa Tho), and Khanh Son landfill. The Khanh Son landfill is estimated to be filled by end of 2019 or beginning 2020.¹⁴

The following map (Figure 7) shows the location of Khanh Son landfill. It is not bordering or in close vicinity of open water bodies.

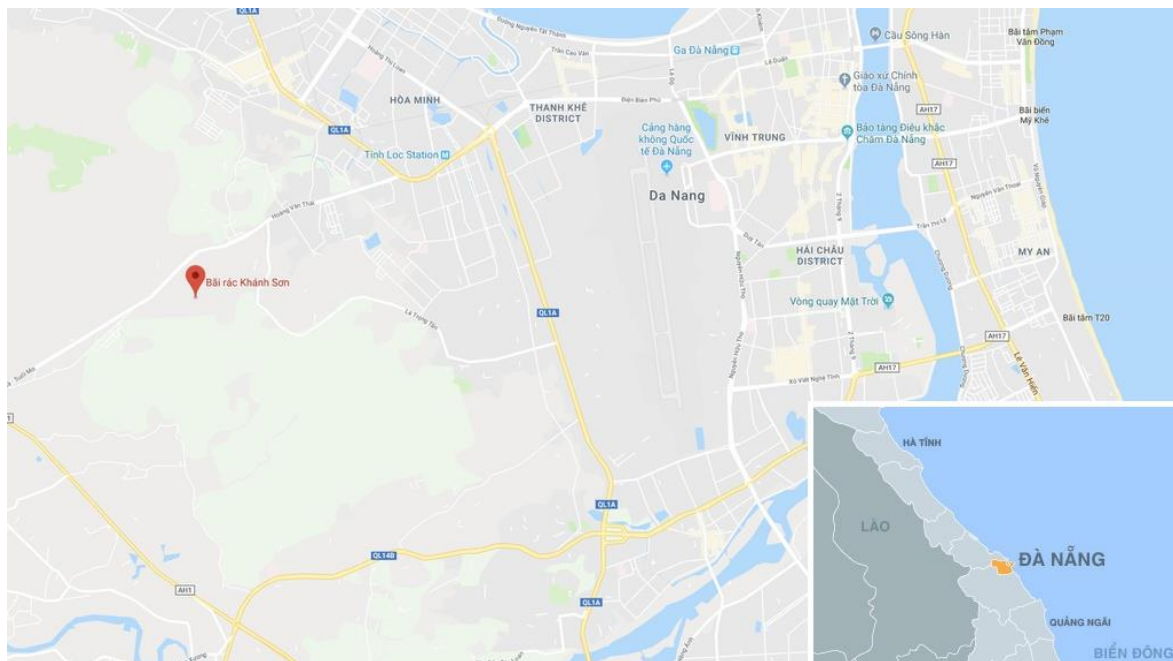


Figure 7: Location of Khanh Son landfill in Da Nang

The landfill, constructed with support from the World Bank, operates since 2007 and has an area of 48.3 ha. It receives about 1,200 tons/day (1,100 tons of domestic waste and about 100 tons from other sources, such as industrial waste). Located next to the landfill a waste incineration plant with a

¹¹Da Nang “struggle” to treat municipal waste. <http://dangcongsan.vn/xa-hoi/da-nang-gong-minh-xu-ly-chat-thai-ran-sinh-hoat-530911.html>

¹² Da Nang and challenges in MSW management (2018). <https://enternews.vn/da-nang-va-thach-thuc-quan-ly-chat-thai-ran-do-thi-141530.html>

¹³Da Nang: solid waste ... <https://www.thienhien.net/2019/03/01/da-nang-rac-thai-ran-chiem-ty-le-16-17/>

¹⁴ Da Nang addresses environment pollution at the only landfill of the City (Feb. 2019). <https://bnews.vn/da-nang-xu-ly-o-nhiem-moi-truong-bai-rac-duy-nhat-cua-thanh-pho/130329.html>

designed capacity of 650 tons/day. The plant was constructed by Viet Environment JSC. In 2009, the first phase of the plant (capacity of 250 tons/day) was put into operation but stopped after 6 months as it did not meet the technical and environmental standards. The plant occupies an area of 10 ha (allocated by the CPC) out of the above-mentioned 48.3 ha.

The CPC plans to upgrade Khanh Son landfill to become a waste treatment complex, hosting a waste treatment facility with a capacity of 1,000 tons/day, in addition to the above-mentioned incineration plant. Presently, the 1,000 tons of waste/day treatment plant is being tendered by the CPC. The 650 tons/day incineration plant of Viet Environment JSC is being revised (the EIA report is in the consultation process), using WTE technology in a joint venture with Everbright International (Hong Kong). A cell (No. 6) for waste disposal will be built (around 6 ha) to allow for waste disposal until completion of the waste treatment plants.

Solid waste generation sources


Main sources of solid waste in VG-TB River basin include:





- Household (HH) waste (urban and rural areas);
- Solid waste from tourist activities;
- Industrial, commercial and institutional waste, and
- Solid waste from agricultural activities;
- Others like street sweeping, drain silt, litter etc.

Since solid waste generated from agricultural activities such as empty bottles, plastic packages from pesticides or plant protection chemicals is considered a small amount and the waste is stored in concrete containers and then collected by local authority, the risks of this type of waste leaking into environment is low. The study therefore does not include this type of waste.





A summary of solid waste management (i.e. collection, transportation and disposal) in VGTB River Basin is presented in Table 1 below.

Table 1: Summary of solid waste management in VGTB River Basin

No	Clusters	Districts/ City/ town	Components of SWM	Collection frequency	Means/ Location
1	Quang Nam Province				
1.1	Rural areas	Delta rural districts: Dai Loc, Duy Xuyen, Tien Phuoc, Hiep Duc and Que Son District	Primary collection	1-2 times/ weeks (domestic waste)	


No	Clusters	Districts/ City/ town	Components of SWM	Collection frequency	Means/ Location
			Transfer points		
			Secondary collection		
			Waste disposal (Tam Xuan 2, Tam Nghia and Dai Hiep Landfills)		
		Mountainous Districts: Bac Tra Mi, Nam Tra Mi, Dong Giang, Tay Giang, Nam Giang and Nong Son	Primary collection	Self- organized	
			Transfer points		
			Secondary collection		
			Waste disposal		District dumping sites/landfills

¹⁵<http://baoquangnam.vn/xa-hoi/201909/xa-hoi-hoa-cong-tac-thu-gom-rac-thai-o-nong-son-874188/index.htm>

No	Clusters	Districts/ City/ town	Components of SWM	Collection frequency	Means/ Location
1.2	Urban Area	Hoi An City, Dien Ban Town	Primary collection	Daily	
			Transfer points		
			Secondary collection		
			Waste disposal at Cam Ha Landfill and composting plant		
1.3	Coastal area	Hoi An City, Dien Ban Town, Duy Xuyen District	Primary collection	Daily for Hoi An Twice/ week for Dien Ban town and Duy Xuyen District	See 1.2 for Hoi An City and See 1.1 for Dien Ban Town and Duy Xuyen District
			Transfer stations		
			Secondary collection		
			Waste disposal		
2	Da Nang City				

No	Clusters	Districts/ City/ town	Components of SWM	Collection frequency	Means/ Location
2.1	Urban Districts	Da Nang	Primary collection	Daily	
			Transfer stations/points		
			Secondary collection		
			Waste disposal: Khanh Son Landfill		
2.2	Rural area	Hoa Vang District	Primary collection (by communes)	Daily in district town Twice/	

¹⁶<http://moitruongdothidanang.com.vn/news/view/hoa-vang-chu-trong-bao-ve-moi-truong-nong-thon-moi.html>

No	Clusters	Districts/ City/ town	Components of SWM	Collection frequency	Means/ Location
			Transfer stations	week for communes	
			Secondary collection: by Dang Nang URENCO)		See 2.1
			Waste disposal: Khanh Son Landfill		

Waste composition within the study areas

In Viet Nam in general and in Quang Nam Province as well as Da Nang City in particular, data about waste composition is often unavailable.

Most of the available data on waste compositions are outdated or have not been analysed systematically or regularly. Following Table 2, Table 3 and

Table 4) are available data on waste compositions done in VG-TB River Basin and in Viet Nam.

Table 2: Waste composition in Da Nang City, Source: JICA Study on Solid Waste Management in Viet Nam, March 2011

Waste type	Percentage (%)
Organic matters	68.47
Paper	5.07
Textile	1.55
Wood	2.79
Plastic	11.36
Leather and rubber	0.23
Metal	1.45

¹⁷<https://baodanang.vn/channel/5403/201510/xay-dung-huyen-moi-truong-hoa-vang-nhieu-thach-thuc-2448061/>

Glass	0.14
Porcelains	0.79
Soil and sand	6.75
Hazardous substances	0.02
Mud	1.35
Miscellaneous	0.03
Total	100

Table 3: Waste composition in Viet Nam, Source: The World Bank, March 2012

Waste type	Percentage (%)
Organic matters	60
Paper	2
Plastic	16
Metal	6
Glass	7
Miscellaneous	9
Total	100

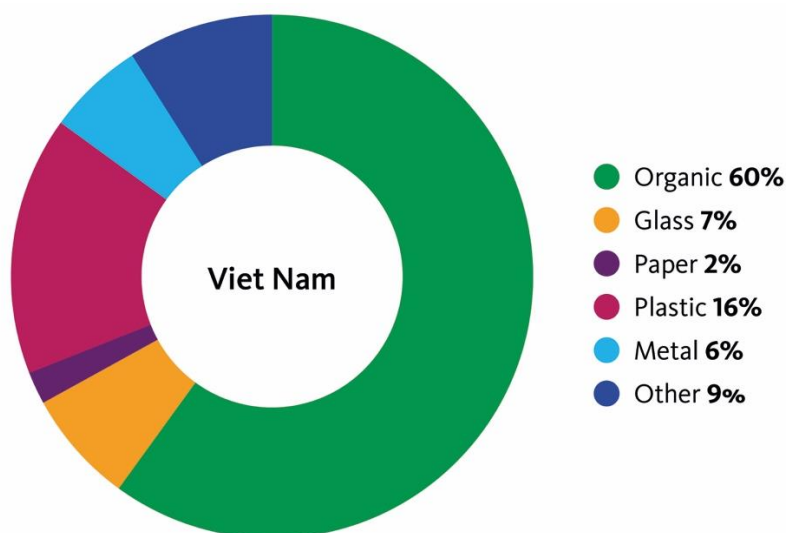


Figure 8: Waste composition in Viet Nam, Source: The World Bank, March 2012

Another analysis of waste composition done in Da Nang City in 2015 is from Centre of Environmental Protection Research (Da Nang University). The analysed waste composition was however done for a very short-time and therefore it's difficult to represent waste composition for Da Nang City.

Hoi An City did recently analyse municipal waste composition which is presented in Table 4 and Figure 9 below.

Table 4: Waste composition in Hoi An City, Source: Hoi An CPC, 2018

#	Items	Compositions	Percentage (%)
1	Organic waste (for composting)	Food waste	16.6
2		Garden waste	29.1
3		Tissues	2.8
4		Tea/coffee residuals	0.8
5	Recyclable materials	Carton	2.7
6		Newspaper, books, journalists	0.7
7		Alumni cans	0.2
8		Iron cans	0.3
9		Plastics	1.7
10		Pet bottles	0.7
11	Mix Waste (for disposal)	Waste from sea foods	2.8
12		Textile	9.4
13		Rubbers, industrial leather	0.6
14		Wood	0.2
15		Glass, ceramics	3.1
16		Stone, sand	4.9
17		Nylon, straws, plastic cups	23.4
18		Others	0.0
Total			100.0

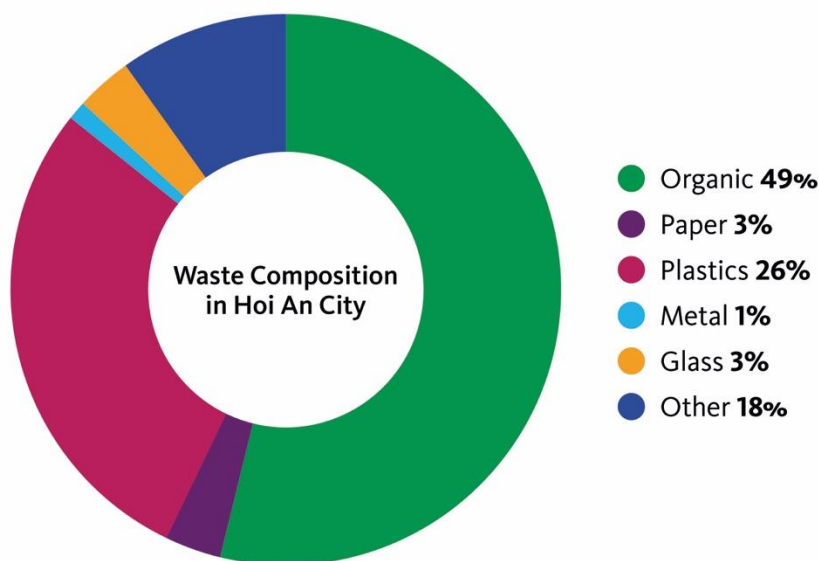


Figure 9: Waste Composition in Hoi An City, Source: Hoi An CPC, 2018

Considering the above-mentioned available waste composition data, it can be concluded that:

- The World Bank waste composition data (Table 3 and Figure 8) is considered more reliable for the study of solid waste management, especially plastic flow, for VGTB River Basin (except for Hoi An city). In Viet Nam in recent years, the plastic consumption, especially single-use plastic bags/packages, has significantly increased. This factor will be considered in calculation of the plastic waste generated in VGTB River Basin, because the World Bank data on waste composition was done in 2012.
- Hoi An waste composition (Table 4 and Figure 9) will be used for the study of solid waste management, especially the plastic flow. The high plastic fraction in Hoi An solid waste is likely linked to the high number of tourists in the city (5 million tourists stayed on average 2.2 days in the city in 2018). The plastic fraction (26%) in Hoi An solid waste is still exceptionally high, even when compared to other touristic places. In order to apply a relatively conservative approach to estimating plastic leakage the study uses a discounted percentage of 20% for the plastic fraction. This generates relatively lower leakage numbers but considers that in touristic areas more attention is given to cleanliness and the combatting of littering. In addition, in recent times more activities try to reduce the use and leakage of plastics. The effect of these is not yet reflected in the composition analysis shown above. The study therefore assumes the discounted value of 20% to be more realistic for the current situation.

Estimation of waste generation

There is no credible data depicting the waste generation rate in Viet Nam. Time for the field survey (from Oct 20th – Oct 31, 2019) was very limited, the following data, presently used by local authorities, will be therefore suggested for use in this study.

- Waste generation rate in Quang Nam Province (except for Hoi An city): 0.42 kg/capita/day.
- Waste generation rate in Hoi An City: 0.7 kg/capita/day;
- Waste generation rate in Da Nang City: 0.8 kg/capita/day.

The basis for calculation of waste generated in VGTB River Basin is presented in Table 5. Results of municipal waste and plastic waste generation in the basin are presented in

Table 6 and is illustrated in Figure 10 and Figure 11.

Table 5: Calculation factors of solid waste and plastic waste generation in VGTB River Basin

Description	Urban	Rural	Coastal
Waste generation rate in kg/person/day	0.7 – 0.8	0.42	0.42
Commercial, industrial, institutional waste	20% - 30%	15%	15% - 20%
Tourism waste	Only urban, 0.75 kg/tourist/day		
Plastic fraction of MSW	17% (Da Nang)- 20% (Hoi An)	16%	16%
Estimated reduction of uncollected plastics through separation efforts	7.5%	4%	7.5%
Districts in Quang Nam Province (Section of VGTB River Basin)	Hoi An, Duy Xuyen, Da Nang urban districts	Dai Loc, Nong Son, Que Son, Hiep Duc, Tien Phuoc, Bac Tra Mi, Man Tra Mi, Dong Giang, Tay Giang, Nam Giang, Hoa Vang	Communes of Dien Ban, Hoi An, and Duy Xuyen
Districts in Da Nang City	Cam Le, Hai Chau, Lien Chieu, Ngu Hanh Son, Son Tra, Thanh Khe	Hoa Vang	none

Table 6: Calculation of plastic waste generation and unmanaged waste

Description	Unit	Urban	Rural	Coastal	Total
Population	inhabitants	1,208,245	699,196	251,697	2,159,138
Household waste generation	ton/day	926	294	106	1,326
Commercial waste generation	ton/day	225	44	16	285
Tourism waste generation	ton/day	38	-	-	38
Total Municipal waste generation	ton/day	1,189	338	122	1,649
Total Plastic waste generation	ton/day	206	55	20	281

Average waste service coverage	%	95%	60%	63%	86%
Total uncollected waste	ton/day	54	137	45	236
Total uncollected plastics	ton/day	9.3	22.1	7.3	38.6

The total solid waste (SW) generated in VGTB River Basin (Figure 10) is the sum of waste generated by households (HHs), the premises (industries, Commercial centres and institutions), and waste from tourist activities, both in Quang Nam Province and Da Nang City.



Figure 10: Waste generation per cluster

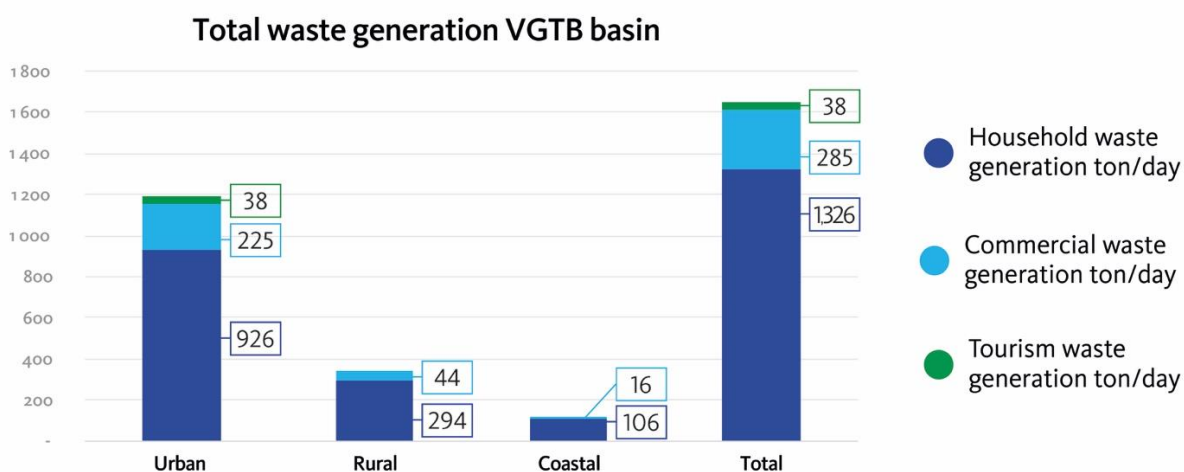


Figure 11: Waste generation per cluster and source

Management of plastic waste

Generally, plastic wastes are not separately collected in VGTB River Basin. The plastic wastes can be divided into recyclable and non-recyclable.

- Non-recyclable wastes or low value plastics (often single-use plastic bags, packages, straws, etc), which account for the largest fraction of the total plastic waste generated, are collected together with other types of municipal waste and are disposed of at the landfills.
- Recyclable plastics, due to its value, are often informally recovered: 1st by households/waste generators; 2nd by waste pickers/collection workers along the waste collection pathways; and 3rd (finally) by waste pickers at the landfills. There is however no data about the amount of recyclable plastic waste recovered by this informal sector.
- In addition, in recent years, there are a number of good initiatives voluntarily implemented by individuals, business and government offices in reduction of plastic use. A number of good examples of plastic reduction efforts observed during the field survey is presented in Table 7.

Table 7: Efforts of plastic waste reduction/recovery in VGTB River Basin

#	Individuals/business/institutions	Plastic waste reduction efforts	Amount reduced	
			kg/day	tons/year
I	Quang Nam Province			
1	Government offices (including those in Hoi An City)	Elimination of PET bottle water (estimated 100 PET bottles reduced per day, with weight of about 29 g/bottle)	2.9	0.09
2	Women in the province	Initiative in reduction of single-use plastic bags by using more sustainable bags	No data	No data
II	Hoi An City			
1	Long Kayak Tour	Volunteer collection of waste in Hoai River (about 500 - 700 kg/every Saturday). About 80% plastic waste and about 80% of collected waste is directly from water-based plastic pollution	80	3.84
2	Jack Tran Tours	Reduce about 48,000 PET bottle water use in 2018 or about 132 PET bottle/day, by serving tourists water from glass bottles	3.83	1.40
3	General Managers (GEM) of a group of 3-star hotels in Hoi An and Da Nang City	Reduce about 1,000 PET bottles water/day, by serving water in glass bottles	29	10.59
4	EMIC Hospitality/The Field Restaurant	Reduce plastics by serving glass bottle water, non-use of single-use plastic bags/packages	No data	No data

#	Individuals/business/institutions	Plastic waste reduction efforts	Amount reduced	
			kg/day	tons/year
5	Elision Refill Shop	Reduce 3,444 plastic bottles in 11 months	0.30	
III	Da Nang City			
1	Government Offices in the city	Non-use of PET bottle water (estimated 150 PET bottles reduced per day, with weight of about 29 g/bottle)	4.35	1.57
2	Recyclable materials Recovery Center, Hai Chau District	Recovery of recyclable plastics	7.43	2,711.95
Total plastic reduced/recovered in VGTB River Basin			127.81	46.65

Uncollected plastic waste (38.6 tons/day) as calculated in Table 8 includes recyclable and non-recyclable plastics. The recyclable fraction, due to its value, are partly reduced and recovered by volunteer activities as mentioned in Table 7; partly recovered by individual households, waste pickers and waste collection workers. There is no valid estimate of the quantities that are being recovered through these activities. The remaining amount (mainly single-used plastics) is uncontrolled or freely dispersed in the environment, either on land or in water bodies/ocean. Table 8 summarises the uncollected waste flows in the VG-TB River Basin.

Table 8: Calculation of unmanaged plastic waste

Description	Unit	Urban	Rural	Coastal	Total
Total Plastic waste generation	ton/day	206	55	20	281
Total uncollected plastics	ton/day	9.3	22.1	7.3	38.6
Estimated reduction of uncollected plastics through separation/recovery efforts	ton/day	0.7	0.9	0.5	2.1
Total unmanaged plastics	ton/day	8.6	21.2	6.7	36.5
Percentage of unmanaged plastics out of the total plastics	%	4.3%	38.4%	25.9%	13.0%

In brief, the flows of solid waste and plastic waste in VGTB River Basin are summarized in Figure 12.

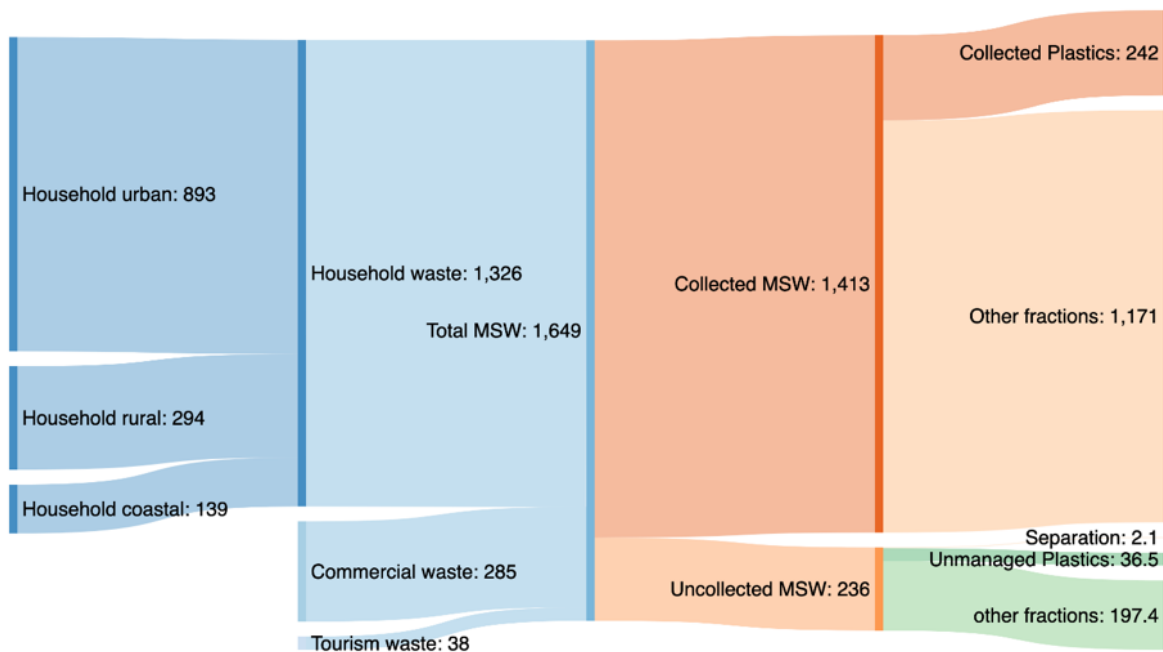


Figure 12: Flows of solid waste and plastic waste in VGTB River Basin in ton/day

The Waste Flow Diagram Method (still under development) was used to assess the fates of unmanaged plastic waste into the environment. This includes the different sources of pollution, such as uncollected waste, leakages from waste management services, landfills and activities of the informal and processing sector. The model is based on secondary data and field observations that then estimate the amount of potential leakage into the environment and water bodies in particular.

Table 9 gives an overview of the results first on the total amounts of plastic waste and its flow within the waste management system. These numbers are slightly different from the numbers above as they were calculated through the model. The model uses slightly different assumptions on various flows than the secondary data-based calculations in

Table 6 and Table 8.

Table 9: Waste Flow Diagram: Plastic waste management in ton/year

Waste Flow Diagram - Waste management results summary

	Plastic waste			
	TOTAL	Urban	Rural	Coastal
Municipal solid waste generation (ton/year)	113,452	86,797	19,600	7,056
Collected waste (ton/year)	99,929	83,234	12,074	4,621
Collected waste	88%	96%	62%	66%
Uncollected waste (ton/year)	13,524	3,563	7,526	2,434

Uncollected waste	12%	4%	38%	35%
Waste recovered for reprocessing (ton/year)	7,998	6,732	756	510
Waste recovered for reprocessing	7%	8%	4%	7%
Recovered for reprocessing by formal sector	0%	0%	0%	0%
Recovered for reprocessing by informal sector	7%	8%	4%	7%
Energy from waste (ton/year)	0	0	0	0
Energy from waste	0%	0%	0%	0%
Disposal in designated disposal sites (ton/year)	91,672	76,342	11,251	4,078
Disposal in designated disposal sites	81%	88%	57%	58%

All quantities are displayed in ton per year. The table shows the significantly higher collection rate in urban areas compared to rural and coastal communities. On average for the whole VGTB delta about 12% of all plastic waste is not collected. This corresponds to 13,524 tons of uncollected plastics per year compared to 113,452 tons generated. Separate collection and recycling are relatively low with only 7% being captured informally with no formal system in place. This includes estimates for the informal picking activities. The calculation is based on available secondary data thus it cannot be verified to what extent the reduction measures displayed in Table 7 are already reducing the amounts presented here.

The following table shows the estimated fates of the unmanaged waste. Unmanaged waste is a combination of uncollected waste as displayed in Table 9 and leakages from waste management operations such as collection, treatment and final disposal.

Table 10: Waste Flow Diagram: Mismanaged plastic waste in ton/year

Waste Flow Diagram - Mismanaged plastic waste results summary

	Plastic waste			
	TOTAL	Urban	Rural	Coastal
Unmanaged plastic waste (ton/year)	13,783	3,723	7,593	2,467
Unmanaged plastic waste	12%	4%	39%	35%
Contribution from uncollected waste	98.12%	95.71%	99.12%	98.66%

Contribution from collection service leakage	0.27%	0.16%	0.30%	0.33%
Contribution from informal value-chain collection leakage	0.16%	0.37%	0.06%	0.13%
Contribution from formal treatment	0.00%	0.00%	0.00%	0.00%
Contribution from informal treatment	1.28%	3.69%	0.31%	0.64%
Contribution from transportation to designated disposal sites	0.17%	0.06%	0.21%	0.23%
Contribution from designated disposal sites	0.00%	0.00%	0.00%	0.00%
Plastic waste retained on land (ton/year)	6,851	2,792	3,061	998
Plastic waste retained on land	50%	75%	40%	40%
Plastic waste openly burnt (ton/year)	1,992	0	1,505	487
Plastic waste openly burnt	14%	0%	20%	20%
Plastic waste retained in drains(ton/year)	672	217	232	224
Plastic waste retained in drains	5%	6%	3%	9%
Plastic waste to waterways (ton/year)	4,268	714	2,795	758
Plastic waste to waterways compared to uncollected plastic waste	31%	19%	37%	31%
Plastic waste to waterways compared to total plastic waste generated	4%	1%	14%	11%

Applying the WFD for the three distinct clusters delivers the results presented in Table 10. These are based on a detailed assessment of leakage points and fates for leaked plastics based on information and observations collected by the survey team in the field. The assessment uses expert estimates that are guided by clustered analysis of the potential fates. The total amount of leakage occurring in the system is balanced against measures in place that either tip the leakage towards one or the other fate or reduce the likelihood of plastics following a certain fate. For example, fully covered drains with retention systems are less likely to retain plastics than open systems.

The results show clearly that the main contribution to unmanaged waste stems – not surprisingly – from uncollected waste (average of 98%) and that other leakages are comparatively insignificant. Based on the observations in the field most of the uncollected waste is retained on land (50%), while some is either burned or accumulates in drains. The potential average leakage to waterways is estimated to be around 31% of unmanaged plastic waste with the urban areas releasing only 19% due to their better collection services and coverage. Due to their large amount of waste generated this still accumulates to 714 ton/year. A total of 4,268 tons of plastic waste or 4% of the total plastic waste is estimated to enter the waterways in the VGTB River Basin from municipal waste sources.

Table 11: Per capita equivalent of plastic pollution

Description	Urban	Rural	Coastal	
Plastic waste ending up in water per person	0.6	4.0	3.0	kg per person/year
Plastic waste ending up in water per person	120	2,000	1,500	Equivalent in plastic bags (5 gram) per person/year

NOTE: It is again important to note that these results are indicative only and statistically not confirmed. They give an orientation on where the main sources of plastic pollution are and what is causing them. Actual measurements or more refined modelling of plastic pollution would require surveys and primary data significantly beyond the scope of this assignment.

Table 11 shows that each person in the VGTB River Basin releases between 0.6 (urban) and 4 (rural) kg of plastic waste that enters waterways per year. This is equivalent to 120 (urban), 2,000 (rural) and 1,500 (coastal) plastic bags released per person per year.

The following waste flow diagrams – Figure 13, Figure 14, Figure 15 – give a visual representation of the differences between the three clusters within the VGTB River Basin. Reprocessing represents recycled waste.

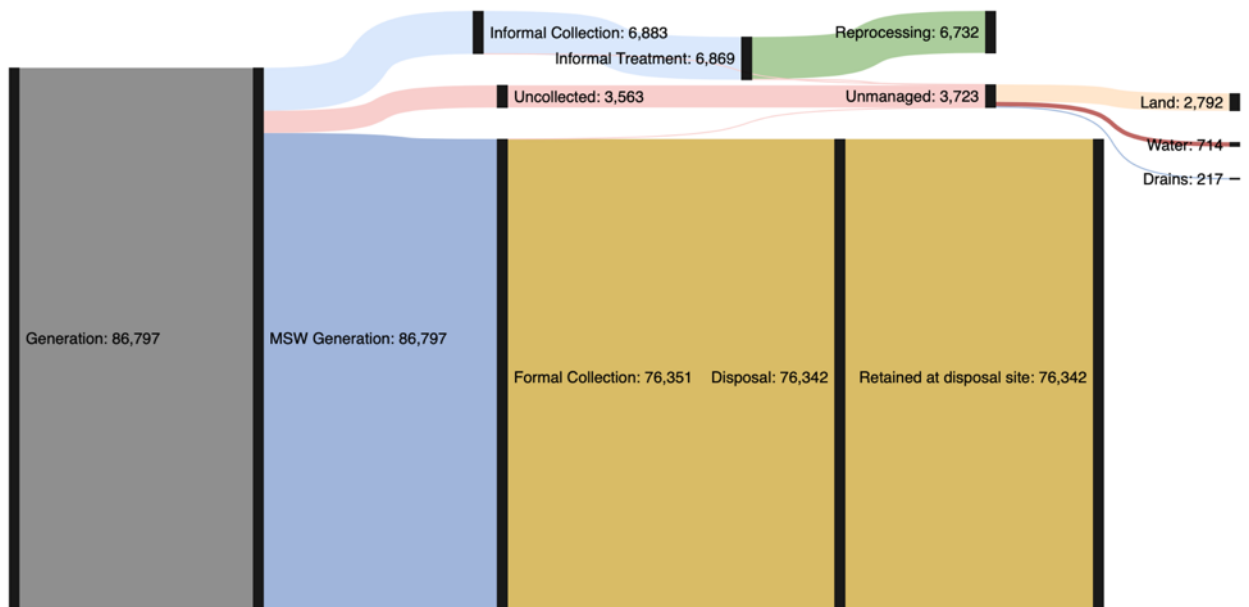


Figure 13: Waste flow diagram urban cluster in ton/year

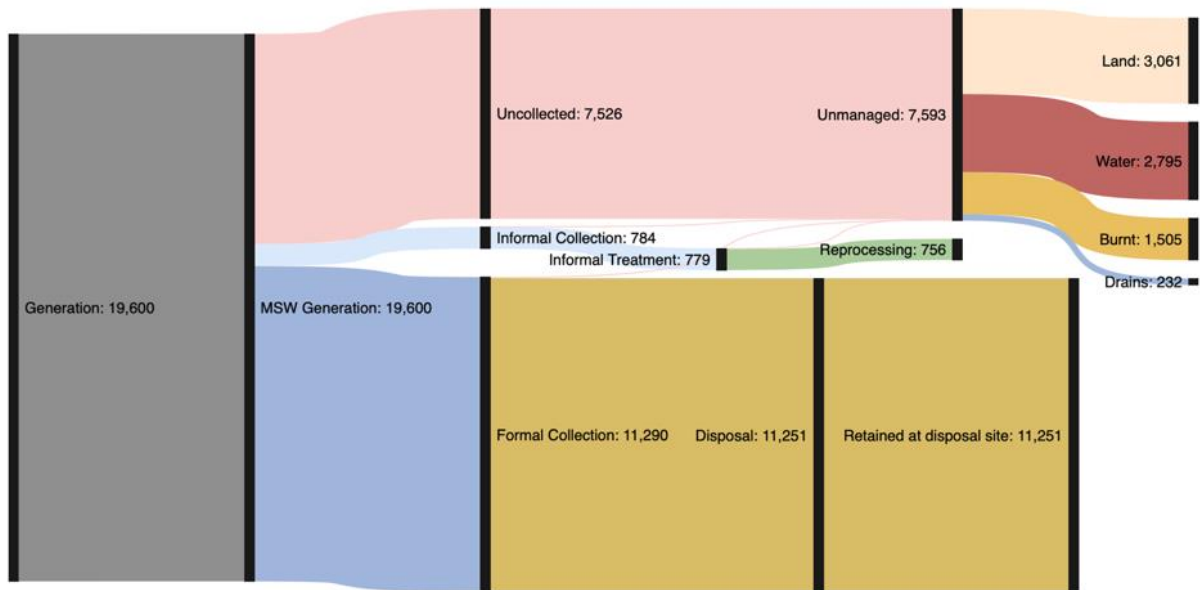


Figure 14: Waste flow diagram rural cluster (ton/year)

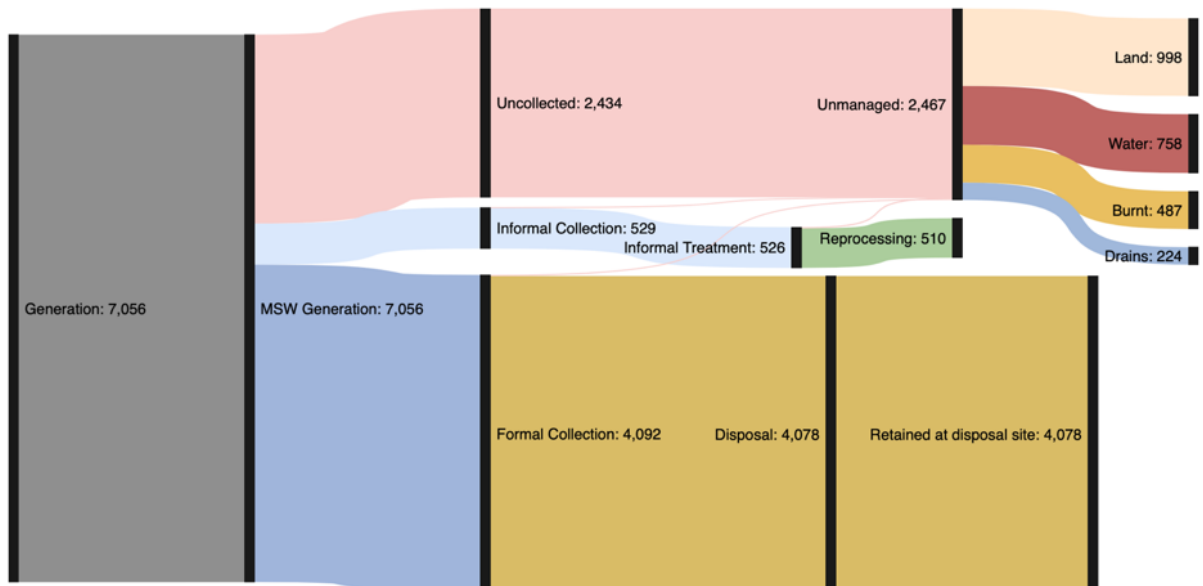


Figure 15: Waste flow diagram coastal cluster (ton/year)

The waste flow diagrams are representing the flows of municipal plastic waste sources. Point sources such as ports along the coast are not included in these quantities and will be addressed in the following chapters as separate hotspots that need directed attention rather than a structural approach as suggested by the results for the MSW system.

Challenges in solid waste management in VGTB River Basin


It was recognized during the field survey that poor management of solid waste, availability of single-use plastics and low awareness of the people are the main reasons leading to the plastic waste leakage to environment, water bodies and from there to the marine environment. Though there are informal sector waste recyclers (waste pickers, itinerant buyers and small scrap dealers) their collection of waste is limited to only high value plastics (PET and virgin plastic packaging materials). As they are picking close to the first line of collection services and only focussing on the valuable materials their impact on plastic leakages is negligible for the purposes of the study. Spillage caused by them is covered with the factors applied for the collection points. Listed here are challenges that the municipal/provincial authorities are facing:



- Poor management of solid waste in general and plastic waste in particular together with constantly increasing amounts of solid waste, in particular plastic waste in the VGTB River Basin.
- Existing waste disposal areas (landfills) are almost full. Developing appropriate approaches for waste management (collection and treatment) as well as finding suitable locations for new waste treatment/disposal facilities is a challenge. This could result in a high leakage potential of solid waste, especially plastic waste, to the environment and eventually to water bodies and the marine environment.
- Insufficient financial allocations for districts to organize/properly manage waste.
- Non-professional waste services provided by rural and mountainous districts leading to increased illegal discharge of waste to empty land, river sides and seashore.
- Increasing use of single-use plastic bags/ packages due to their convenience and low costs in markets generates more amounts of plastic waste with a higher probability to enter the environment and eventually waterways.
- Waste separation at source or other recovery mechanisms are established on a practical level for valuable plastic items on household and commercial levels. This is organized through informal collectors or other selective mechanisms. Separation of plastics (and other recyclables) is however not structurally integrated in the MSW services and does not cover types of plastics/materials that currently have no or very low market value. This posts an impediment to broaden the material base for recycling but has to be analyzed in detail as to its costs and environmental implications.
- High amounts of solid waste from upstream in the VGTB River Basin are impacting the downstream communities. (Hoi An, Nui Thanh, Duy Xuyen, Da Nang), especially in the rainy and/or flooding season. No efficient coordination between Quang Nam Province and Da Nang City in addressing the problem or to reduce its occurrences causes high costs for authorities in downstream regions to clean up the river.
- There is low awareness of people regarding marine litter and plastic pollution.
- There is no bridge between the formal and informal sector in integrating them for any possible enhanced recovery of plastics.
- Regulation and policy framework to limit/reduce production and use of plastics (especially single-use plastics) is not yet in place.

Mapping of hotspots

Land-based hotspots (Table 12) and potential sources of direct plastic pollution into the marine environment as observed during the field survey is presented in table below.

Table 12: List of hotspots in VGTB River Basin

#	Description of the hotspots	Photo illustrated
1	<p>An Luong Dockyard (Duy Hai Commune, Duy Xuyen District, Quang Nam Province)</p> <p>The dockyard, located along an embankment (length of about 500 m) and right at a village market, is the place where fishing boats arrive for the fishermen to sell their fishes and buy necessary things before going fishing again. The dockyard is located right at Cua Dai Estuary of Bon River. Waste is poorly managed in the area. Along the embankment (river side) where boats anchor, huge amount of waste, especially plastics are accumulated and the accumulated waste is not regularly collected.</p> <p>Duy Xuyen District informs that wastes from upstream of Bon River flow to this area and accumulate in the dockyard. It is observed however that there exist both old and new wastes accumulating in the area.</p> <p>Interviewing local residents, it is found that the waste service was not provided to the commune for several months. As a result, local residents often throw their waste on the riverbanks, seashore, or in the forests. Waste deposited in these areas has high risks of flowing directly to the sea.</p>	

2	<p>Tho Quang Dockyard (Son Tra District, Da Nang Province)</p> <p>The dockyard is larger scale than An Luong dockyard. The generated solid waste, although regularly collected by a waste service, poses risks of environment pollution and risks of direct plastic leakages to the sea.</p>	 <p>18</p>
3	<p>Communes' transfer stations (Dai Loc district, Hoi An city)</p> <p>At all three waste transfer stations (at village/commune level) visited by the survey team, it was observed that wastes are poorly managed as indicated in the photo (example). High risks of waste dispersed into surrounding environment and then to water bodies by run-off water existed.</p>	

¹⁸<https://moitruong.net.vn/au-thuyen-tho-quang-da-nang-tiep-tuc-o-nhiem-khung-khiiep-nguoi-dan-keu-troi/>

<p>4</p>	<p>Hoi An city</p> <p>Hoi An city is an attractive tourism area. A large number of tourists yearly come to the city (about 5 million tourists in 2018), which creates generation of large amounts of plastic waste such as empty PET bottles, single-use plastic bags, empty packages, straws, cups, etc. The high rate of plastic generation is reflected in Hoi An waste composition (about 20% of the total waste generated in the city is plastics).</p> <p>Although the waste is collected by Hoi An city for disposal, there exist risks of leakages of plastic waste into environment and then to water bodies and finally finding ways to the sea as the city is located along the river and near the seashore.</p> <p>A considerable number of initiatives are being voluntarily implemented in the city with efforts to reduce uses of plastics, especially restaurants, tours, hospitality sectors, etc. The initiatives could be good showcases for scaling-up if assistance is provided.</p>	 <p>Cam Ha dumping site – Hoi An City</p>
<p>5</p>	<p>Markets</p> <p>At all three markets (Tam Ky Market, Nam Phuoc Market, Ai Nghia Market) visited by the survey team, it was observed that wastes are poorly managed as indicated in the photo (example). High risks of waste dispersed into surrounding environment and then to water bodies by run-off water exists.</p>	 <p>Nam Phuoc Market, Duy Xuyen District</p>

Description of impacts of plastic pollution in VGTB River Basin

Using the Source-to-Sea Framework for Marine Litter Prevention (p. 17), impacts of plastic pollution in the VGTB River Basin (**Error! Reference source not found.**) and its surroundings raised by interviewees are:

1. Fishermen or other people interviewed near the rivers or beaches (restaurant owners, tourists, local people) identified plastic pollution more as a visual problem rather than a pollution problem. Most of them weren't aware of the harm it causes to the marine environment and human health. They therefore do not care much about reducing the use of plastics or to recover the plastic material for recycling. They did not verify any repercussions (enforcement) in place to prohibit polluting behaviour.
2. Aesthetics seem to be a bigger concern for people both around the rivers, along the shoreline (Hoi An) and on sea beaches as these have great impacts on tourists in the city.
3. Fishermen especially complained about quantities of plastics but did not mention that it has impacted their fish catch.
4. Many did not see plastic pollution in the water (river/sea) as much of a concern due to both lack of awareness as well as lack of stringent laws preventing plastic or waste pollution.
5. Impacts of plastic pollution on local economic development in Hoi An are being recognized by local government, a number of sectors, especially tourist and business sector. Significant number of restaurants, tours, or hotels (e.g., The Field Restaurant, EMIC Hospitality, Jack Tran Tours, Long Kayak Tours, a Group of General Manager of 3-star hotels in Hoi An & Da Nang City, The Refill shop, etc.) voluntarily take actions to refuse and reduce the use of plastics in their business activities. This is very good start to upscale to wider stakeholders toward zero plastics.
6. The Tour Operators' Association did share serious concerns of plastic pollution, mostly littering and their visibility on sea beaches and other water sources and claimed that it will have serious impact on tourism. They stated that with these concerns they had to make their own interventions to reduce plastic.
7. A kayak water sports operator also claimed that plastic pollution had seriously impacted the tourist interest and owing to that, he had to start weekly river clean-up campaign, which he has been continuing since last 4 years.
8. In most parts of the river basin, plastic was observed to be either floating or accumulated on the banks, with weeds and algae.
9. High costs for river cleaning due to land-based waste/plastic waste pollution and waste from upstream flowing to downstream areas, especially for Hoi An and Da Nang City.
10. Increased risk of flooding due to blockage (example of Hoi An city): It is clear that there are leakages from land and river basin but quantifying of plastic pollution from river to sea is difficult. For example, the flood on the bank of Hoi An river last year was partially blamed on plastic clogging drains, while others blamed excessive rain. Some even said that the drains are too narrow to carry water and hence the flooding.

The Next Wave Report prepared by Trash Free Seas Alliance states “a modelling for Viet Nam reveals that if total per capita waste generation levels were reduced by 8% and significant improvements were achieved in collection, recycling, treatment facilities and sanitary landfill levels, there would be an inspiring 30% reduction in mismanaged waste. Still, 9 million metric tons would be considered “mismanaged” — waste that is either not collected or collected but then either dumped or stored in unsanitary dumpsites; all are significant contributors to marine leakage. The business as usual scenario paints a far drearier picture. Without intervention, mismanaged waste is expected to grow 130%, with 20 million metric tons forecasted to be mismanaged by 2050. These models illustrate the

amplifying effect of waste generation growth against the ability to manage it. Clearly there is a need for fast action on a large scale¹⁹.

Table 13: Impact of plastic pollution in the VGTB River Basin

DIRECT	INDIRECT
Economic losses	
<p>Increase in cost of clean-up: Plastic bags and PET bottles appear in significant proportion in Hoi An and other rivers as well. Littering of plastic baskets used for lamps, packaging of food in thermocol containers (EPS) and PET were significant. The administration every morning sends a boat to pick up plastic lodged at different places.</p> <p>Direct clean-up and opportunity cost for locals: The kayak operator organizes direct clean-up campaign and often more than 20 people contribute through voluntary labour for 3-4 hours, cleaning up plastic along with other waste (candles). He said that foreign tourists often engage in regular clean-ups and pay money to remove the garbage collected. Initially they collected 1000-1200 kg every Saturday and clean up along 4-5 km but more recently it has come down to 500-700 kg. But the clean-up is done only in the patches of kayak range and not further. It can be estimated that considering its monthly cost (4-5 Saturdays a month) 400-500 USD considering USD 20 per person for labour contribution.</p>	
Biota and ecosystems	
<p>Pressure on aquatic species (observation-based potential): MSW debris including significant plastic waste (plastic bags, straws, thermocol pieces, broken small pieces of plastics, abandoned and broken fishing nets) cause entanglement of fish and smothering of aquatic organisms. Though this has not been studied, there are plenty of stories of it. Micro plastic which often goes unnoticed causes much bigger problem for fishes than actually large pieces of plastics which also eventually break down and cause problems. But plastic is not the only material that is being dumped, there are other materials as well which is found during the clean-up campaigns.</p>	Bioaccumulation of toxic substances (potential)
Infrastructure and disaster risk	
<p>Increased risk of flooding due to blockage of storm water drainage: This is a major risk during the rainy season. Hoi An in particular experiences flooding in the city but this is blamed more from small drain sizes than plastic blocking though plastic was cited for clogging the drains here and there. There is no conclusive evidence how much plastic blocking drains is a problem but it constitutes one of</p>	<p>Higher maintenance and clean-up costs for storm-water drainage and riverbanks: In Hoi An boats are being used daily to clean up the river particularly of the</p>

¹⁹The Next Wave Report – Ocean Conservancy, page 19

DIRECT	INDIRECT
the reasons of blockage. Here also thermocool appeared to be a bigger problem than other types of plastics.	city stretch and other places of tourist interest.
Human health	
<p>Risk of micro-plastics consumption through the food-chain (potential): The potential risk factors for these are the numerous, flimsy plastic bags that find their way into the river and to the sea, the fishing nets that are directly abandoned in the sea or sea beaches; small plastic pieces that pass through sewage that reportedly finds its way into the river/sea from near-by hotels and resorts. Sewage from the high-end hotels and resorts can be expected to contain micro-plastics resulting from toothpaste, washing machines, cosmetics that eventually find their way into rivers/sea.</p>	<p>Contamination through water-based food (potential): Fish and vegetables grown along the riverbank/seashore can potentially be contaminated by micro-plastics in the water.</p>
Quality of life	
<p>Decreased quality of recreational services: Plastic blight on the riverbank and seashore particularly of tourist areas has the dormant potential to decrease the quality of recreational services. The Tourist Association of Hoi An recognises this as one emerging problem and have taken voluntary action in both clean up and providing alternatives to some of single use plastic products.</p> <p>Open dumping on roadsides, empty plots of land and some open burning of waste (in rural areas to a certain extent) has the potential to blemish the image of these places and reduce quality of life (foul air, etc.).</p>	<p>Reduction of aesthetic value and beauty of the riverbank/sea beaches: The VGTB River Basin is a lush green area but sites of plastic waste and other MSW is gradually creating a bad image. Hoi An which is a World Heritage site and has the threat of losing its touristic value if actions are not taken to contain plastic in particular and other waste in general.</p>

Stakeholders

The stakeholder mapping is organised based on the Source-to-Sea Framework for Marine Litter Prevention (Figure 16). The identification of the stakeholders was done through interviews conducted during the field work (qualitative primary data) and review of relevant studies and reports (both qualitative and quantitative secondary data) provided by mostly government agencies and NGOs. The impacts on these stakeholders have been separately discussed in the previous section. A complete list of all the stakeholders interviewed is presented in Annex 2.

Source-to-sea stakeholders in preventing marine litter

- **Primary stakeholders:** those who are negatively impacted by plastic pollution and who will benefit from intervention strategies preventing it.
- **Targeted stakeholders:** individuals or groups whose practices are contributing to the amount of plastic pollution leaked to riverine and marine environments and whose behaviour change is directly targeted.
- **Enabling stakeholders:** institutions that provide enabling conditions for behaviour changes and benefits to occur and be sustained over time.
- **Supporting stakeholders:** development partners or financiers whose strategies are aligned with preventing plastic leakage.
- **External stakeholders:** individuals or groups outside the system boundary who share an interest in preventing marine litter.

Figure 16: The source-to-sea stakeholder mapping framework. Source: SIWI (2019). Source-to-sea framework for marine litter prevention: Preventing plastic leakage from river basins (p.19)

Primary stakeholders

According to the guide, the research question used to determine this information is: “which individuals or groups are affected by plastic pollution and will directly benefit from its prevention?”

For the study area, these include communities in the targeted cities, communes, (urban, coastal, rural, riverbanks) the districts that manage MSW, the Peoples Committees, tourism sector, fishermen communities.

Targeted stakeholders

The guiding question used to determine this group (Table 14) was: “Which individuals or groups are contributing to plastic pollution and whose behaviours and practices must be directly targeted to prevent it?”

Table 14: Targeted stakeholders in VGTB River Basin

#	Stakeholders	Functions	Behaviour or practice
1	Consumers (households, pedestrians and tourists)	Buying or using plastic packages, especially single-use plastic bags/packages/ bottles in daily activities	Women in households and tourists often use a lot of single-use plastic bags/packages due to their convenience, durability and low cost. The single-use plastics after use are not recovered but collected and disposed of at landfills together with other types of waste
2	Waste Service Providers, i.e. URENCOs with their employees (waste collection and street cleaning workers, drivers, workers at waste disposal sites)	Responsible for collection, transportation and disposal of waste at the landfills and/or treatment of the waste at treatment facilities	Waste transfer points (where waste collection carts gather) are not well maintained and waste often litters the ground, including plastic wastes
3	Waste collectors, transporters and workers at district landfills/dumping sites organized by rural districts	Collect waste at village/commune level and bring waste to designed places (waste transfer points) Drivers transport waste from the waste transfer points to landfill/dumping sites Dispose of waste at the dumping sites	Waste collectors are locally hired, by communes. They are not official long-term employed; no social insurance is provided to them and their salary is low. In addition, they are not professional workers (i.e. no training). Many of them leave the work after a short term contract. The drivers and workers in the mountainous districts where solid waste transportation and disposal are self-managed by the districts, it can be anticipated that they are in similar situation with the waste collectors. Poor management of dumping sites results in high risk of plastic waste leaked into surrounding environment and then to water bodies
4	Informal waste pickers (along streets and at landfills)	Collect/recover recyclable materials along streets, at waste transfer points and at landfills	Risk of littering of low value plastic waste to surroundings is high when looking for recyclable materials, especially at waste transfer point where waste pushcarts are parked. Littering of low value plastic waste around areas where recycling materials collected by waste pickers are gathered

5	Market: <ul style="list-style-type: none"> - Management Board, - Traders, - Consumers, visitors 	Management Board: Responsible for management of solid waste generated at a market Traders: selling food/goods in the market Consumer: buying foods, stuffs, etc.	Poor management of solid waste is observed at three markets visited by the survey team. Waste are not stored in the waste house but piled outside this makes the area unsanitary and increases risk of plastic waste blown by wind or washed away by run-off water; Use a lot of single-use plastic bags and Styrofoam, especially for storing fish; Willing to use single-use plastic bags for containing their foods/goods;
6	Fishing dockyards: <ul style="list-style-type: none"> - Commune/ Management Board - Fishermen - Traders - Residents 	Commune/ Management Board: Responsible for sanitation and waste management at the fish dockyard; Selling their fish after each fishing Buying fish	Poor management of waste which leads to high risk of marine pollution, impacts to community health by various types of waste, especially wastewater and plastic bags that are convenient for fish or raw seafoods; The last two target groups: use many single-used plastic bags and/ or Styrofoam containers for food storage

Although the activities of the collection of waste by the informal sector contributes to the circular economy, their unorganized activities can also have their own contribution to plastic leakage during the collection, sorting and transport of plastics. Of specific interest is the plastic labels removed from PET bottles, which are very light and are not often stored properly for safe disposal. They are often found in the open in front of PET bottle scrap dealers and recyclers, which could be easily washed away in the rainy season or blown by wind.

Enabling stakeholders

The guiding question here is: “Which institutions provide or should provide enabling conditions for behavioural changes and benefits to occur and be sustained over time”?

At the national level, authorities are responsible for the adoption of national planning, policy and regulation for solid waste management. At provincial level, local governments (provincial, city, districts, commune and village) are responsible for the management of solid waste in their respective territories. A summary of the enabling stakeholders is presented in the Table 15.

Table 15: Summary of enabling stakeholders

#	Stakeholder	Function
1	Ministry of Natural Resources and Environment (MONRE)	<ul style="list-style-type: none"> - In cooperation with MOC, adopt strategy for solid waste management - Planning infrastructure for solid waste disposal/treatment - Control/supervision /monitoring of solid waste, hazardous waste - Issue environmental regulations, laws associated with solid waste management

		<ul style="list-style-type: none"> - International conventions associated with solid waste management (Stockholm, Basel Conventions)
2	Ministry of Construction (MOC)	<ul style="list-style-type: none"> - Adopt strategy for solid waste management, in corporation with MONRE - Planning and developing infrastructure for solid waste disposal/treatment
3	Ministry of Finance (MOF)	<ul style="list-style-type: none"> - Adopt initiative, preferred financial associated policies and regulation on plastic waste, including plastic tax
4	Ministry of Planning and Investment (MPI)	<ul style="list-style-type: none"> - Adopt plans / strategies associated with sustainable development, green development, including waste/plastic waste - Review, appraise foreign Investment in solid waste treatment in Viet Nam
5	Ministry of Agriculture and Rural Development (MARD)	<ul style="list-style-type: none"> - Responsible for rural and agricultural solid waste
6	Ministry of Industry and Trade (MOIT)	<ul style="list-style-type: none"> - Responsible for industrial wastes
7	Ministry of Culture, Sport and Tourist	<ul style="list-style-type: none"> - Responsible for tourism associated aspects
8	Provincial/city Peoples' Committee (P/CPC), DONRE, DOC, DOCST, DARD, Department of Education (DOC)	<ul style="list-style-type: none"> - Responsible for planning (long term plan/strategy for SWM, landfill, treatment facilities, etc.) and overseeing solid waste management in the province
	<p>Findings:</p> <ul style="list-style-type: none"> - It is difficult to find appropriate locations for building solid waste disposal/treatment facilities - Limited resources and capacity for solid waste management 	
9	District Peoples' Committee (DPC), DOC	<ul style="list-style-type: none"> - Responsible for planning and overseeing solid waste management at the district level
	<p>Findings:</p> <ul style="list-style-type: none"> - Lack of budget for maintaining solid waste services at district levels - Poor infrastructure of solid waste collection, transportation and disposal - Mountainous districts are in even more difficult situation compared to districts located in the lower basin, due to low population density 	
10	Commune People Committee (CPC)	<ul style="list-style-type: none"> - Responsible for solid waste management in the commune level
	<p>Findings:</p> <ul style="list-style-type: none"> - Lack of budget for waste collection - Poor waste collection service provided - Lack of infrastructure for solid waste collection (waste bins, small trucks, etc.) 	

	- Waste collectors employed by the commune, as temporary workers are low paid, no social security and therefore they often leave after a certain time working for the commune
11	<p>“Vu Gia – Thu Bon Information Center” (VGTB RBIC), the Central Department of the Viet Nam Academy of Water Resources, Da Nang City</p> <p>- A cross-sector neutral space to discuss fair water allocation and IWRM</p>

Almost all District Committees, URENCO (major waste player in collection, transportation, processing and disposal) and DONRE said that resources are limited for waste management and cited this as a key constraint along with policy measures. There is also “Vu Gia – Thu Bon Information Center” (VGTB RBIC) at the Central Department of the Viet Nam Academy of Water Resources in Da Nang. It offers a cross-sector neutral space to discuss fair water allocation and IWRM. The Joint Coordination Committee (JCC) for Vu Gia – Thu Bon River Basin and Quang Nam and Da Nang coastal area was established in 2016 to address shared issues. Hence the JCC can play an important role in addressing source-to-sea issues.

From a policy point of view the Department of Education can play an important role particularly in areas that are source-to-sea plastic leakage hotspots. These can be both as “informative and educative”, namely carrying out “responsible education” with a view to set up examples in managing waste in general and plastics in particular (setting plastic banks in schools and colleges) or move towards zero waste campuses and encouraging habits of regular clean-ups.

Supporting stakeholders

The guiding question to identify this group is “Are there development partners or financiers whose strategies are aligned with marine litter prevention?”

The information provided by the relevant stakeholders of government authorities as well as non-government organizations indicate that there are several development partners and financiers engaged directly and indirectly on the issue of MSW and plastic pollution, though there is no consolidated information on who is doing what exactly. There are some who are working on litter prevention and processing of MSW (alternatives to plastics, organic waste to compost, plastic collection etc) and also some specifically working on reducing plastic pollution (clean-up campaigns in rivers).

The GIZ has done a study of MSW earlier and is a key partner in Viet Nam. JICA has been closely involved with government. World Bank and ADB (waste to energy investments) are also looking at investments in MSW sector in Viet Nam. China Everbright International Limited has signed a deal of 100 million USD for a waste to energy plant. Japan’s New Energy and Industrial Development Technology Organization (NEDO) is focussing on waste technologies with one 75 million USD plant set up in Hanoi. Besides these there are many other independent projects run by the NGOs which are supported by external donors. GAIA has been promoting alternatives to plastics as well as change in consumer behaviour.

It would be prudent to consider the role of non-government organizations as well as other sector people (tourism, hospitality, local associations) as strong supporting stakeholders. There are already a few who have been making impactful interventions (Zero Waste Alliance Viet Nam, Tourist Association of Hoi an, the kayak tour operator in Hoi An) either in collaboration with local government agencies or on their own.

External stakeholders

The guiding question here is: Are there individuals or groups outside the system boundary who share an interest in marine litter?

Potentially, there are many bilateral and multilateral donors, organisations who have evinced interest in MSW sector in Viet Nam. In 2016, Ocean Conservancy and Trash Free Sea Alliance²⁰ made an estimate for investment in the waste sector, focussing on plastics that have attracted interest from financial institutions. This is something that needs further exploration in terms of interest and those who are really committed to invest this or next year.

²⁰ The Next Waste Report, 2016

Waste management policy landscape – strength and challenges in Viet Nam²¹

There are several laws and regulations guiding solid waste management in Viet Nam. The important regulations regarding environmental protection and solid waste management are presented in Table 16.

Table 16: Overview of relevant policies, regulations and standards enacted in Viet Nam regarding environmental protection and solid waste management

- Law on Environmental Protection [No. 55/2014/QH13)
- Decree No. 19/2015/ND-CP dated February, 2015 of the Government detailing a number of articles of the Law on Environmental Protection
- Decree No. 18/2015/ND-CP dated 14/02/2015 Prescribing environmental protection master plan, strategic environmental assessment, environmental impact assessment and environmental protection plan;
- Decree 38/2015/ND-CP dated 22 April 2015 on Management of waste and scrap;
- Decree 40/2019 / ND-CP dated May 13, 2019 on Amending and Supplementing a Number of Articles of Decrees detailing and guiding the implementation of the Law on Environmental Protection;
- Decree 59/2007/ND-CP dated April 9, 2007 on Solid Waste Management
- Circular No. 27/2015/TT-BTNMT dated May 29, 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plan.
- Circular No. 36/2015/TT-BTNMT dated June 30, 2015 of the Ministry of Natural Resources and Environment on management of hazardous wastes;
- Circular No. 34/2017/TT-BTNMT dated October 4, 2017 regulating collecting and handling of discarded products;
- Directive No. 08/CT-CP dated July 15, 2019 on strengthening measures for plastic waste reduction in Trade and Industrial sectors;
- Letter No. 5539/BTNMT-TCMT dated October 10, 2018 launching the movement of anti-plastic waste;
- Decision No. 2149/QD-TTg of the Prime Minister issued in 2009 approving National Strategy on Integrated Solid waste management to 2015 with vision to 2050;

²¹The Next Wave Report – Ocean Conservancy, page 80

- Decision No. 491/QĐ-TTg of the Prime Minister approving the Revised National Strategy on Integrated Solid waste management to 2025 with vision to 2050;
- Circular No. 32/2015/TT-BCT regulating project development and power purchase contract applying for WTE projects;
- Decree 121/2008/TT-BTC dated December 12, 2008 guiding preferred mechanism and financial support for investment in solid waste management;
- Decree No. 63/2018/ND-CP dated May 4, 2018 on investment under Public-Private Partnership form.
- Law on Environmental protection tax (2010)
- Decree No. 67/2011/NĐ-CP dated August 8, 2011 guiding in details implementation of a number of Law on Environmental Protection Tax
- Decree No. 69/2012/ND-CP dated September 14, 2012 revising, supplementing Clause 3, Article 2, Decree No. 67/2011/ND-CP guiding in details implementation of a number of articles of Law on Environmental Protection Tax.
- Circular 152/2011/TT-BTC dated November 11, 2011 guiding implementation of decree No 67/2011/ND-CP on implementation of a number of articles of Law on Environmental Protection tax.
- Circular No. 159/2012/TT-BTC dated September 28, 2012 revising, supplementing circular No. 152/2011/TT-BTC dated November 11, 2011 guiding implementation of decree No. 67/2011/ND-CP dated August 8th guiding in details a number of articles of Law on Environmental Protection Tax.

An assessment of the strengths and challenges of this governance framework are presented in Table 17.

Table 17: Strengths and challenges associated with governance framework for solid waste management

STRENGTH	CHALLENGES
Waste management is one of seven priority programs of the National Strategy for Environmental Protection	Despite an exemplary early mover initiative for integrated waste management, it is held back from a lack of action plans and adequate funding to meet the ambitious targets.
The National Strategy on Integrated Solid Waste Management sets ambitious targets and provides for charging sanitary fees from waste generators.	Mechanisms for revenue collection are insufficient and far from full-cost recovery.
Viet Nam encourages private sector and foreign investment, and Viet Nam's amended constitution in 1992 recognizes the role of the private sector in the economy.	Manifesting the opportunity to attract more private investments and increase the national budget allocation toward waste management.

Provision of financial support for environmental protection activities (including 3R activities) through the Viet Nam Environment Protection Fund (VEPF).	Need for greater transparency and control of private sector monopolies.
	Overlapping roles and responsibilities among agencies involved in waste management.

Governance for preventing plastic leakage to waterbodies

The analysis of the governance system for preventing plastic leakage to waterbodies is formulated around the guiding questions as provided in the Source-to-Sea Framework for Marine Litter Prevention (p. 22). The principles of environmental policy making, which are used in the effort to bring about sustainable production and consumption, are used as an additional analytic lens. In practice, the transition from the take-make-waste (linear) system of production and consumption to sustainable (circular) economy calls for the design, packaging and enforcement of environmental policy instruments, from within regulatory, economic, informative and voluntary alternatives.²² With that in mind, we could borrow the concept of “Carrot, Stick and Sermon” from Bemelmans-Videc et al. (1998, 2003) as an additional tool to guide the discussion.²³

Based on the above, **Error! Reference source not found.** below summarises the findings and some pointers towards good governance as it applies to preventing plastic leakage into waterbodies.

²² For more on the principles and practices of environmental policy making, see for instance Field, B. (2007). *Environmental policy: An introduction*. Literature abound on the principles of environmental policy making with the objective of internalising or correcting market and institutional failures.

²³ Bemelmans-Videc et al. (1997). Carrots, sticks & sermons: Policy instruments and their evaluation

Table 18: Governance for preventing plastic marine litter - findings and pointers for action

Guiding Questions	Findings & Pointers
<p>1- What are the institutions, legal and regulatory frameworks, rights, ownership, informal agreements that define the framework for preventing plastic leakage at each step of the cycle of plastic production, consumption and disposal?</p>	<p>Institutions:</p> <p>Key regulations are provided above in the “enabling stakeholders” section. The key ministry is MONRE at the central level and DONRE at the provincial level. Other central ministries of importance are Ministry of Planning and Investment and Ministry of Finance.</p> <p>Regulatory Frameworks:</p> <ul style="list-style-type: none"> • Law on Environmental Protection [No. 55/2014/QH13) Revised in 2014]: • Decree on Solid Waste Management [Decree No 59/2007/ND-CP dated April 9, 2007] <p>Other important waste management legislations, regulations, strategies and guidelines</p> <ul style="list-style-type: none"> • Decision No. 2149/QĐ- TTg of the Prime Minister issued on 2009 - National Strategy on Integrated Solid Waste Management until 2025 • Waste and scrap management Decree [Decree 38/2015/ND-CP dated 22 April 2015] – effective from 15 June 2015 • Circular No.: 32/2015/TT-BCT Regulations on project development and electricity purchase contract applying for generator projects using solid waste • Decree No. 67/2011/NĐ-CP [plastic bag tax] • Decree 121/2008/TT-BTC dated 12/12/2008 [guides the preferential policies and financial support for establishment of solid waste treatment (eligibility incentives and support for financial incentives and financial support for the solid waste disposal facilities)

Guiding Questions	Findings & Pointers
	<ul style="list-style-type: none"> The Prime Minister's Decision No. 71/2010/QĐ-TTg dated November 09, 2010 on promulgating the regulation on pilot investment in the public-private partnership form indicates waste treatment plants as one of the nine sectors for pilot investment in the public-private partnership form
<p>2- Are these in conflict with or complementary to one another and where are the gaps in governance that lead to plastics leaking to riverine and marine environments?</p>	<p>Punitive Measures or Stick:</p> <ul style="list-style-type: none"> Lack of clear guidelines on punitive measures on those who violate the waste adherence policies whether household or industry Weak enforcement of existing by-laws on some illegal dumping and burning of solid waste particularly in rural areas and communes. Accountability to be fixed Make certain plastic items either expensive or stop production <p>Incentive or Carrot:</p> <p>Incentivize plastic collection, use of alternative materials for certain type of plastic products, put eco-taxes on plastic bags; promote deposit and refund systems for PET bottle (plastic bank, E waste collection centres) or collection and storage of other types of plastics</p> <p>Policy Requirements:</p> <p>Initiate Extended Producer Responsibility (EPR), voluntary or compulsory take back systems by producers, which could be a precursor for more advanced EPR initiatives.</p>
<p>3- In addition to the public sector, are there other actors, e.g., companies or non-governmental organizations that can improve governance related to</p>	<p>Business- Voluntary space/ self-regulation:</p> <ul style="list-style-type: none"> Zero Waste Alliance Viet Nam has made good pilot projects which both included alternatives of plastics, change in packaging in hotel cosmetics, Clean Campaign particularly in Hoi An. There is not much information available for other areas

Guiding Questions	Findings & Pointers
<p>plastics and what is the relative capacity of each to prevent marine litter?</p>	<ul style="list-style-type: none"> - Major consumers of single disposable plastic items such as hotels, restaurants, vegetable packaging supermarkets, factories etc who can easily switch over to reusables - Development partners/ donors - Preparing a list of major donors and setting up a coordination for higher impact; lack of information on funding sources shows there is lack of harmonization and opportunity for improved impact <p>Civil society:</p> <ul style="list-style-type: none"> - Environmental NGOs exist but technical capacity (to drive circular economy) is limited <p>Others:</p> <ul style="list-style-type: none"> - Academia, local traders' associations, tourist associations; educational institutes including school and colleges
<p>4- Is the behaviour of the targeted stakeholders in line with the governance framework or is there a failure in enforcement?</p>	<p>Currently there is lack of both information and required awareness and its practice. Awareness and clear communication was stated almost by all stakeholders as a pre-requisite for better waste management</p> <ul style="list-style-type: none"> -Market is not adequately ready for alternatives -Institutional failure on enforcement (lack of a clear policy may be a reason)
<p>5- Are there mechanisms for stakeholders to be involved in decision making are there procedures in place for resolving conflicts that may arise between stakeholders and are these being effectively applied?</p>	<ul style="list-style-type: none"> - There are small donor funded projects in Hoi An but its impact at the surface level seems very high but there is no data to measure the impact. Initiatives of ZWAV and Tourist Association indicates huge reduction in single disposable plastics. Government's circular on not having PET water bottles in government meetings has been fully implemented in districts we visited and shows that it may have already prevented thousands of bottles being consumed. Joint initiatives between URENCO, DONRE NGOs and Tourism Associations and Hotel Association can create huge impact in a shorter span of time. This could be considered as one means of stakeholder involvement and consultation.

Guiding Questions	Findings & Pointers
	– IUCN is well placed in facilitating a multi-stakeholder partnership approach involving government, private sector and NGOs.

Recommendations for the VGTB River Basin

This section summarizes suggestions for the development of source-to-sea based project interventions based on the interviews and surveys conducted during this study. In a first section, priority actions are identified that could yield an immediate or short-term impact on the reduction of plastic pollution in the VGTB River Basin. These actions would be locally sound and adjustable and help local decision makers and other stakeholders to advance in their goal to minimize pollution and negative impacts.

The second section lists broader intervention areas for a more strategic or mid-term development that are might be valid even beyond the scope of this assignment. They should provide a starting point for the discussion on relevant interventions in the scope of a mid- to long-term of the source-to-sea framework for the VGTB River Basin. These are more generic than the priority actions by nature but still driven by our team's assessment of the situation and potential development paths.

Priority actions

At the central level, supportive priority actions could include:

- Develop an Action Plan to reduce the use of single-use plastics, with a clear timeline for gradual transition from single use plastics to alternative materials or phasing them out.
- Issue a regulation/ordinance clearly limiting the use of single-use plastics.
- Test the viability of EPR systems (either voluntary or mandatory) for major types of plastics including PET bottles by starting with major brands and other local bottlers with markets in Viet Nam. The main purpose here is to incentivise the informal sector waste collectors through creating value for all types of plastics rather than just a few items as it stands today.
- Develop and implement Incentives for companies to switch to more environmentally friendly packaging and for companies producing environmentally friendly alternatives for single-use plastics (bags, straws, packages).
- Instruct on the introduction of a substantial levy on plastic bags in shops and malls.
- Introduce a nationwide ban on all kinds of plastic waste imports.
- Implement a ban on Styrofoam food packaging – this is one of the most visible plastic waste materials and has currently zero recycling opportunities.

Some of these actions can be partially implemented on city or provincial level but with less effectiveness. Local ordinances on single-use plastics can be implemented but are more difficult to enforce as production and trading is not stopping at provincial borders. The same is valid for bans. Other aspects such as economic incentives usually require a national approach.

Nevertheless, provinces and cities, in this case the ones located in the VGTB River Basin have several options for priority actions to be implemented in their respective area of responsibility.

- The most significant impact can be achieved by improving the solid waste management system, and here especially the collection systems for communities in rural districts. They constitute the major source of pollution with plastics.
- Focus improvements and efforts on areas which are clearly visible as hotspots (riverbanks, sea beaches with resorts and other hospitality industry, fishing dock yards, communes and urban areas near to sea beaches/riverbanks.
- Target the hospitality and food packaging industry to switch over from plastics towards zero waste and plastic free tourism.
- Assess the feasibility and setup collection centres (plastic banks) for plastics in major plastic waste generation areas, such as schools, commercial and tourism areas; use dedicated stakeholders as frontrunners to promote such initiatives.
- Promote the provision of alternatives to plastic bags in supermarkets (cloth or other durable bags), in addition to introducing a purchase fee for plastic bags.
- Introduce extensive awareness to various stakeholders, especially local residents, tourists, fishermen towards plastic waste free.
- Support and implement pilot projects to identify and test appropriate alternatives for single-use plastics in cooperation with the plastic producing industry and universities; this can be linked to innovation competitions and environmental certificates.
- Continuously support and scale up successful initiatives of plastic reduction, collection or recycling that are being implemented in Hoi An and Da Nang city.

Particular hotspots have to be addressed specifically and can yield a significant impact with comparatively little effort. One of these **hotspots** are the **fishing communities** and in particular their port facilities, which as described above are prone to littering and consume significant amounts of Styrofoam boxes.

Immediate actions for fishing communities would include:

- Introduce education awareness to fishermen (Figure 17), establish control mechanisms for mandatory bins in all boats (fishing and passenger boats), and provide collection points near the dockyards; and



Figure 17: Examples of awareness material for fisherman

- Set up and secure regular and reliable collection systems from the communes and rural areas (Figure 18) to prevent plastics being burnt or spilled to rivers and beaches. Proximity to the

beaches means a particular sensitivity to uncollected waste. The likelihood of leakage is increased.



Figure 18: Examples of pollution close to ports

Strategic and longer term interventions

The actions mentioned above already address the substantial causes of pollution and would lead to a significant reduction in plastic pollution. They require support and assistance to guarantee a successful implementation. However, structural shortcomings of the recycling value chain and waste management services require a more strategic and long-term approach. While exceeding the scope of the study, the team suggests the following areas of interventions to be considered in the next steps of developing a suitable application of the Source-to-Sea Framework for the VGTB River Basin.

The objectives of such longer-term interventions would be:

- Sustainably secure service delivery and adequate technical standards for all (most) waste generators;
- Develop and promote value chains for all (most) types of plastics put on the market or consequently limit the output of plastics that have no value chain established; and
- Promote a societal development including all relevant stakeholders towards a more resource-efficient and less wasteful economy, ultimately aiming for a comprehensive circular economy approach.

The interventions are structured along several key entry points for support provided by a potential development programme.

Facilitate policy interventions: Coherent planning and regulatory systems require further support. While some of the aspects mentioned under the priority actions can be implemented with little effort, a more holistic and comprehensive policy, regulatory and planning framework is needed to

develop the service chain (waste management services) and the plastic value chains (from production and market placement to separate collection and recycling). Policy instruments such as EPR and incentivising taxation require complex negotiation and implementation processes. Examples from other countries might not be suitable for the specific circumstances of Viet Nam. Also, the link between national government and local implementation by cities and provinces requires further support. A Source-To-Sea Framework-based project could support in developing a mid- to long-term strategic plan to establish the necessary instruments as a coherent approach to address plastic pollution.

On the level of the VGTB River Basin such support would extend to strengthening the local regulatory framework and capacitating institutions and key players to promote actions and strategies. Local strategic planning processes that detail national or regional frameworks need strengthening as well.

All policy interventions require sound information and data in order to evaluate the viability and impacts of different intervention options. Support to detailing and refining information on plastic production and distribution, on recycling and fates in the environment is key for consistent planning and policymaking.

Multi-stakeholder process facilitation: One of the key paradigms of the Source-to-Sea Framework is the participation of and negotiation between all involved stakeholders, particularly those who pollute (targeted), those who are impacted (primary) and those who regulate (enabling). Often those actors are not communicating or defend rather particular interests rather than contributing to solutions. Any support should attempt to identify driving actors, those with the most active or relevant agenda. This is often more on a local or provincial level where impacts are felt directly. In the VGTB River Basin drivers are the areas and cities depending on tourism. However, attention has to be shifted to rural and coastal villages (and fishing activities) that have a significant contribution to pollution. The use of Styrofoam is still widespread despite its persistence in the environment. Supporting the linkage between touristic and rather competent cities and poorer coastal or rural communities might create a combined and stronger response to the issue. A similar aspect that would profit from facilitation is between the formal recycling sector, informal recyclers and city administrations in whose territory those activities take place.

An additional aspect is the coordination (or its limitations) of different donor agencies supporting different actors in the basin. Driving a coherent approach and coordinated interventions is crucial and should be addressed in any intervention.

Strengthening of informal and formal recycling capabilities: Economically feasible recycling is one of the most efficient approaches to avoid plastic leakage into the environment. The informal and formal recyclers play a vital role in capturing and processing plastics that then return to the markets. While the development of a circular economy requires much more comprehensive changes to the production, consumption and recovery of materials, existing recycling efforts are the primary starting point and have to be supported. This can be achieved by facilitating linkages and exchange between producers and recyclers to improve the recyclability of products and phase out non-recyclable materials. Another aspect is technical support and assistance in the development or introduction of additional value chains. This can be achieved through knowledge exchange, pilot projects and capacity development.

Technical capacity building: Human capacity in MSW management and accompanying skills of URENCO and municipalities are not sufficient to drive the change needed on different intervention levels. These are improved services for even remote communities and rural areas and addressing particular waste streams, such as single use plastics or Styrofoam with particular measures. Technical

assistance and capacity development measures can support improving understanding and practical application of technology options and improved and more efficient operations. Other key areas are financial instruments (taxation and service fees, cost calculations, Public Private Partnerships, models of private sector participation, partnerships with NGO in awareness raising, etc.).

Of particular importance is to support responsible officials on local and provincial level in adequate planning procedures and corresponding monitoring systems. This is to avoid or minimize recurring costs for clean-ups and other non-sustainable remediation measures. A clear understanding of integrated waste management and the linkages to the plastic recycling value chains should guide strategic, financial and operational actions. Behaviour change measures require technical support on programming and the development of suitable materials to address different target groups in a coherent and mid- to long-term awareness program.

At the central level it would be prudent to train decision makers and technical staff in ministries on new policy instruments like EPR, take back systems, and how to incentivise collection service extensions and improvements. Exchange opportunities between different actors and regions within the basin can foster mutual learning and experience exchange.

Another dimension of technical capacity building is the value chain development with formal and informal actors. These are closely linked to the section on strengthening of informal and formal recycling capabilities and would require a more detailed needs assessment of technical knowledge and innovation.

Ultimately, upgrading services and value chains require **sustainable financing and investments**. Supporting pilots and facilities (new or upgrading) that can develop into improved recycling services with improved income generation is one opportunity that can be further investigated. Facilitating a cooperation between public and private sectors through PPP models could drive this process. Upgrading and expanding services and respective facilities with due investments has to be driven in cooperation with the authorities and URENCO. Models for service extension (e.g. through private operators or community-based models) could be supported by providing collection equipment.

Annexes

Annex 1: Estimation of plastic waste value chain investment in different components/activities

The estimates are made for 100,000 population based on experiences from the developing country scenario

Component	Cost
Material Recovery Facility (for mixed waste input) Infrastructure – Shed – 10000-12000 sqft	150,000 USD CAPEX
Machinery – Shredder, Pellet making machine, Lumber – 8 Ton capacity per day	450,000 USD CAPEX
OPEX for running the MRF	400,000-500,000 USD OPEX
Pyrolysis Plant 8 ton per shift capacity	\$16,873,000 – 25,384,000 – CAPEX
OPEX for Pyrolysis (the next wave report – page 84)	\$1,460,000 – 2,100,000 – OPEX
Note: Pyrolysis is a specialised high-investment technology that requires substantial knowledge for operations and is suitable for mono-fractions only. This means separation at source or in an MRF is still required.	

CAPEX: Capital Expenditures

OPEX: Operational Expenditures

Annex 2: List of stakeholders interviewed

1.) Quang Nam DONRE

- Nguyen Hoang Yen: Deputy Director, Quang Nam Marine & Island Agency (MIA)

0905 324603

- Tran Quoc Hien Trung: Staff, Quang Nam Marine & Island Branch Agency (MIA)
- Hoang Thi Kim Chung: Environmental Protection Agency (EPA)
- Le van Thụ: Quang Nam Irrigation Agency (IA)

2.) Quang Nam URENCO

- Nguyen Thanh Dung, Deputy Director
- Võ Đình Tường, Head of Technical and Planning Department
- Từ Vũ, Staff, 077.551.7707. tuvu.shu@gmail.com

3.) Duy Xuyên District

- Nguyễn Bốn, Deputy Chairman, Duy Xuyên DPC, Quang Nam Province
- Phạm Văn Sang, Head of Division of Natural Resources and Environment
- Lương Tấn Việt – Office of District People Council – DPC
- Lê Ngọc Mẫn Tĩnh – Staff, Division of Natural Resources and Environment: 0983 968 357
- Email: tinhduyxuyen@gmail.com
- Tran Thị Kiều Oanh: Environmental staff

4.) Núi Thành District

- Trương Văn Trung, Phó Chủ tịch Huyện Núi Thành
- Bùi Thị Hồng – Deputy Head, environmental Unit; hongenvint@gmail.com

Representatives from communes

- Mr. Thịnh – Land administration, Tam Hiệp Commune
- Mr. Binh – Deputy chairman Tam Hoa Commune
- Mr. Hung – Deputy Chairman Tam Hai Commune
- Mr. Xứng – Chairman, Tam Anh Nam Commune
- Mr. Nam – Deputy Chairman, Tam Nghĩa Commune

- Mr. Thong – Deputy chairman, Tam My Dong Commune
- Mt. Thanh – Deputy Chairman, Nui Thanh town
- Mr. Hai – Deputy Chairman, Tam Anh Bac Commune
- Mr. Anh – chairman Tam My Dong Commune
- Ms. Dung – Deputy Chairman Tam Giang Commune
- Mr. Nam – Policy of Nui Thanh district.

5.) ĐạiLoc District

- Mr. Ho Thanh Phuong, Head of Environment Division, Dai Loc DPC;
- Ms Nguyen Anh Thi, Environmental expert, Environment Division;
moitruongdailoc@gmail.com
- Mr. Chung Hoang Tinh, Director, District URENCO
- Representative of 18 communes/district town
 - o Dai Phong Commune
 - o Dai Tan Commune
 - o Dai Minh Commune
 - o Dai Lanh Commune
 - o Dai Hoa Commune
 - o Dai hong Commune
 - o Dai Dong Commune
 - o Dai Quang Commune
 - o Dai Cuong Commune
 - o Dai Hiep Commune
 - o Dai Nghia Commune
 - o Dai An commune
 - o Dai Thanh Commune
 - o Dai Thang Commune
 - o Dai Hung Commune
 - o Dai Son Commune
 - o Dai Chanh Commune

6.) Hoi An City

6.1 Visit the Field Restaurant (VongNhi Village, Cam Thanh Commune, Hoi An City)

- Le Lan Loi (Lê Lan Lợi), Environmental staff (0905966011)
- Tran Thi MỹÁnh, Environmental Unit, Hoi An CPC

6.2 Cam Ha landfill and composting Plant

- Mr. Tam, Hoi An DONRE
- Mr. Vo Van Trung, Director of the composting plant

6.3. Hoi An Kayak Tour

Mr. Long – Owner of Kayak Tour (office near Thuan Tinh Bridge, Hoi An City): 0916 645 858

27/10/2019

6.2 Meeting with tourist enterprises

- Phan Xuân Thanh (Director of EMIC Hospitality, owner of the Field, Hoi An)
- Tran Van Khoa (Owner of Jack Tran Tour, Hoi An City)
- Pham Jenny (Sea' LavieBoutigque Resort; Sealavie.vn)

28/10/2019

6.3 Meeting with Hoi An CPC

- Nguyễn Văn Sơn, Deputy Chairman of Hoi An CPC
- Võ Hữu Dũng, Head of Urban Management Department;
- Nguyễn Thanh Sơn, Expert of Department of Natural Resources and Environment (DONRE); thanhsonha2006@gmail.com
- Lê Trung Định, Expert, Department of Economy
- Mr. Tai, Office of Hoi An CPC
- Mr. Nghiem, Deputy Director of Hoi An URENCO

29/10/2019

Interview URENCO workers removing waste on Hoai River (Hoi An City)

Interview staff of River Suites Hotel (Hoi An)

30/10/2019

Meeting with Da Nang PPC

- Tran Ngoc Bien, Staff, Da Nang Department of Mineral and Water Resources (DMWR)
- Pham Nguyen Tat Nhien, staff, Da Nang Department of Mineral and Water Resources (DMWR);
- Doan Thi Kim Anh, Head of General Office, Da Nang Environmental Protection Agency (Chi Cục BVMT): 0905 290 049
- Tra Minh Quang, staff, Da Nang DARD
- Hoang Thi Ngoc Hieu, Head of Environment Technology Division, Da Nang URENCO

Khanh Son Landfill

- Mr. Quang, Deputy Director of Long Khanh Landfill Management Enterprise; 0905 124 223

31/10/2019

- Ms Xuan, Zero Waste Alliance (097 3322 325)
- Ms. Hoa, Centre for Environment and Community Research (CECR): 098 2794 555