SINT MAARTEN

SUSTAINABLE SOLID WASTE MANAGEMENT PROJECT

THE WORLD BANK
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Ministry of Public Housing, Spatial Planning,
Environment & Infrastructure
(VROMI)

CONSULTANCY SERVICES FOR ESTABLISHING INTEGRATED SOLID WASTE MANAGEMENT SYSTEM IN SINT MAARTEN

SOLID WASTE MANAGEMENT STRATEGY & ACTION PLAN

BY

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Acronyms

ANG	Netherlands Antillean Guilder
CARs	The States and Islands of the Caribbean Sea, including the West Indies
CARICOM	Caribbean Community and Common Market
CBO	Community Based Organizations
C&D	Construction / Demolition
DBO	Design – Build - Operate
EDMP	Emergency Debris Management Project
EHS	Environmental Haelth and Safety
EEE	Electrical Electronic Equipment
EPR	Extended Producer Responsibility Policy
EU	Europe Union
HHW	Household Hazardous Waste
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GNI	Gross National Income
HH	Houlseholds
HHW	Households Ahzardous Waste
IFC	International Finance Corporation (WBG)
ISWMF	Integrated Solid Waste Management Facility
ISWMS	Integrated Solid Waste Management System
MARPOL	International Convention for the Prevention of Pollution from Ships
MSW	Municipal Solid Waste
MRF	Material Recovery Facility
NIMBY	Not in My Back Yard
NGO	Non-Governmental Organization
NRRP	National Recovery & Resilience Plan
NRPB	National Recovery Program Bureau
PPE	Personal Protective Equipment
OCT	Overseas Countries & Territories
O&M	Operation & Management
US Federal RCRA	Resource Conservation and Recovery Act of 1976 (Waste Disposal)
SIDS	Small Island Developing States
SXM	Saint Martin / Sint Maarten
SXM STAT	Sint Maarten Statistic Department
SWM	Solid Waste Management
TA	Technical Assistance
TOR	Terms of Reference
UN	United Nations
UNEP	United Nations Environment Program
USEPA	United States Environmental Protection Agency
VROMI	Ministry of Public Housing, Spatial Planning, Environment and Infrastructure
WB	World Bank
WEEE	Waste Electrical Electronic Equipment
WTE	Waste to Energy
WTS	Waste Transfer Station
WHO	World Health Organization

EXECUTIVE SUMMARY

INTRODUCTION

OVERVIEW

This Strategy covers the whole value chain of municipal solid waste management, from generation, to collection, diversion, processing, disposal, and landfill operations in Sint Maarten. All the analyses and recommendations are based on existing data and/or data collected by the Consultant during technical and financial pre-feasibility studies conducted. However, this strategy will not cover the following waste types, although the relevant topics are addressed with the generic analysis and recommendations are covered in the strategy.

- Liquid wastes such as sewage;
- Gaseous wastes;
- Hazardous medical and industrial wastes; and
- Disaster wastes from natural events such as Hurricanes, storm surges, tsunamis, and earthquakes, and etc.;

Objective of this SWM strategy is to formulate a report that covers the strategies and actionable sector interventions for the transformation of the SWM of Sint Maarten into an Integrated Waste Management System (ISWMS), based on findings from the tasks previously conducted by the Consultant.

Sint Maarten is an Overseas Country that is part of the Kingdom of Netherlands as a part of Netherlands Antilles in the Caribbean Region. Consequently, Sint Maarten are dependent on the Netherlands for matters like foreign policy and defense, but are autonomous to a certain degree with their own parliaments in their internal affairs, international trade, and to establish relations with some international establishments and trade organizations. It, with own constitution, is representative parliamentary democracy organized as unitary state. Its administration consists of the Governor, who represent the Kingdom of the Netherlands.

BACKGROUND

The country has a population of 40,614 by January 01, 2018, and enjoys rapid economic growth by receiving the tourists of approximately 1,7 million by 2018 from cruise and stay-over arrivals every year while struggling with a weak municipal solid waste (MSW) management system.

Sint Maarten generates an estimated 128 ths. tonnes per year of waste (about 350 tonnes per day), which is managed by the Ministry of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI). The situation has been exacerbated since the Hurricane Irma hit the island on September 6, 2017 and destructed over 90% of its main infrastructures.

After Hurricane Irma Sint Maarten government accepted the pre-conditions set by Dutch Government for financial support. The Netherlands contracted the International Bank for

Reconstruction and Development (the World Bank) as an expert authority on redevelopment to manage the recovery via the "Reconstruction and Resilience Trust Fund" (herein after called the "Trust Fund"), which is comprised of a grant of €470 million. But, according to the National Recovery and Resilience Plan (NRRP) the rebuilding of Sint Maarten would require funding of an estimated US$ 2.3 billion.

Among other emergency recovery projects that have been planned and currently being implemented, Emergency Debris Management Project with an estimated budget of US$ 25 million and Long-Term Waste Management Project (this project) with an estimated budget of US$ 35 million are programmed to be committed.

COUNTRY SETTINGS

The country shares the same island with French part-Saint Martin with an area called "Collectivity of Saint Martin". The Sint Maarten occupies the south part of the island. The area of island is 87 sq.km, and divided roughly 60/40 between French Republic (53 sq.km) and Kingdom of Netherlands (34 sq.km). Two parts of the island are roughly equal in population. The division dates to 1648.

Lesser Antilles & Sint Maarten

The capital of Sint Maarten is Philipsburg, and the largest city is Lower Princess Quarter.

The static population (permanent residence) in January 2017 was slightly higher than 40,000, and at the beginning of 2018 it was 40,614. At the same period, 49% of the population was male and 51% was female. The Sint Maarten's static population density is 1,194 sq.km by 2018.

DEMOGRAPHY

As there is no uncertainty on the number of tourists both from cruise ships arrivals and stayover arrivals to the country, which is around 2.5 million in any high tourism year when we look at the statistics. Contribution of daily tourist population and undocumented residents to the daily dynamic population the country's daily dynamic population is assumed to be around 63,000 with high tourism scenario. Employed population consists of 20,850 persons, which is around 51% of the total static population. The male – female split of the Employed population is 53% to 47%, almost half-half. According to SXM STAT, the number of deaths also fluctuates every year. In 2017, 111 males and 61 females died, an overall total of 172 persons. Of every 1000 inhabitants 4.2 persons died. Because of high life expectancies the number of older persons is rising. This is especially notable for females.

Urbanization process in Sint Maarten mimics some other Caribbean SIDS which their economies heavily rely on tourism, tourism related activities, and off-shore finance.

SOCIO-ECONOMIC SETTING

Sint Maarten is classified as high-income country by UN and World Bank with nominal per capita GDP of US$ 26,500, which is slightly higher than regional average (US$ 20,000). Main economic drivers in the country are: i) tourism and tourism related activities, ii) ports and airport, iii) offshore finance, iv) international trade, marine transport, import/export, v) small scale local industries, mostly are light industries, and vi) weak cultural industries. There is no agricultural activity in the island.

As one of the largest sources of foreign exchange, tourism is a life-blood for the country as in many SIDS' economies in Caribbean region. The tourism sector also has strong linkages with other sectors such as financial services and international commerce and trades.

GNI per capita in the country is around US$ 29,002, which is almost 50% higher than the regional average (US$ 19,322). Only 14% of GNI is sourced from industry in Sint Maarten, and 85% form service sector.

However, the island and the similar SIDS in Caribbean Region are experiencing second economic shock after Hurricane Irma with COVID-19 outbreak and limitations applied since March, 2020.

There is only one international airport (Princess Juliana International Airport - PJIA) in the Island. It is located on the Sint Maarten side, and viewed as a major contributor to the Sint Maarten economy. Yearly average passenger capacity of PJIA is around 1.8 million passengers. In 2014 the airport and its users accounted for 60% of Sint Maarten's GDP and 52% of total employment. The airport itself had revenues over USD 59 million in 2014.

The cruise industry in Sint Maarten is one of the fastest growing sectors, but not uniformly seasonal. The cruise port now accommodates six cruise ships through its two piers, with the terminal handling anything from 6,000 to more than 20,000 passengers in a single day. Sint Maarten's cargo handling facilities have grown with the shipping lines calling at the island and it was a natural progression to expand the existing quay. The Captain David Cargo Quay was extended from 270 to 540 meters in 2009 and protection from the sea was achieved with a new breakwater at the southern end of the quay.

At a regional scale the Port of Philipsburg is a service port which connects with both intra-regional hub-ports as well as other service ports in the region, and global hub-ports in Caribbean region.

However, the port of Philipsburg in Sint Maarten is a transshipment hub for CMA-CGM. As OECS ports are looking to add cargo, the transshipment volumes in Philipsburg are a target

The N.V. GEBE is officially owned by the Government of Sint Maarten, which is responsible for electricity generation and distribution in the country. The approximately 20,000 customers of N.V. GEBE are as an average consuming around 1,500 kWh monthly, which is one of the highest consumption figures in the region. The N.V. GEBE is also single provider for drinking water to all Sint Maarten through its desalination plants from sea water in Cay Bay, Point Blanche and Lowlands with reverse osmosis water plants to meet the daily demands of water consumption in the country. While regional average of domestic electricity tariffs is around US$ 0.32 in CARICOM region, it is US$ 0.18 - 22 in Sint Maarten.

Apart from GEBE power plant, the major light industries in Sint Maarten primarily focused on rum and bear production and fish products. There are three rum, three brewery factories, and one water distilling and bottling company which also produces sparkling water. Yacht repair and maintenance firms also take important place in industrial activities in Sint Maarten.

There also exist few very small-scale chocolates producers. However, they are importing the chocolate bars mostly from Grenada and Trinidad & Tobago as there is no cacao plantation and big size chocolate bar producer from cacao beans in the country. Activities in cultural industry are also very weak. They are made up by few small workshops.

LEGAL & REGULATORY SETTING

The legal base of Saint Martin Island is complicated by its history. For Sint Maarten, there was a history of Dutch civil law with some influence of English common law. The Dutch monarch appoints the Joint Court judges that serve the earlier noted Netherlands Antilles islands, with appeals presented to the Supreme Court at Hague. It is a parliamentary democracy under the constitutional monarchy of the Kingdom. On the other hand, as a country, it appears to be free to create its own laws in keeping with its constitution.

There is no comprehensive solid waste institutional arrangement or regulatory framework at the moment, but the government is aware of this need and has expressed its desire to address it within their SWM Roadmap. Some norms from pre-independence time are still being used and there are piecemeal decrees to address some needs, as well as a draft environmental policy.

However, VROMI has organized recently preparation of a new draft waste ordinance. It is currently circulated for comments and revisions. The consultant's comments and recommendations for re-arranging the law are presented in Annex 4.

Although Sint Maarten is not bound to comply with solid waste regulation in the European Union, it is generally required to comply with treaties that Netherlands enters into. MARPOL and the Basel Convention on the Transboundary Movement of Wastes are particularly relevant.

The Hong Kong International Convention adopted in 2009 requires that ships being salvaged or recycled following their operational life have all potentially hazardous materials properly handled to not pose any risk to workers or adverse impacts to the environment.

Aside from the abovementioned international treaties that are obligatory as a member of the Kingdom of the Netherlands, the international airport is obligated to follow the international civil aviation organization's standards.

INSTITUTIONAL SETTING

There is no separate Waste Management Authority (WMA) established specifically for waste management in Sint Maarten. Solid waste collection and disposal operations are under the management of Ministry of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI), which also handles infrastructure planning and development.

Environmental permits issuance and enforcement in spatial development and environment are under responsibility of VROMI, it also provides environmental control on solid waste management activities.

Ministry of Health is responsible for regulating and overseeing the medical waste. Social issues are under the management of Ministry of Public Health and Social Development and Labor (VSA), which handles social development, labor, social inclusion and health.

VROMI outsources all SWM activities with open tenders to the contractors. VROMI reports that only five contractors are currently giving services for household and institutions (government departments and schools), and partly commercial waste collection and transport. Wastes from commercial enterprises and ships are not handled by government, and open subscription between the waste generators and private haulers is unregulated. VROMI also operates the landfills with its own staff, however, all machineries and equipment used in the landfills are hired from contractors with rates set by government.

The government is also conducting studies for future disposal and treatment. For purposes of the financial support from external entities for emergency response to the Hurricane Irma disaster, a special government body called the National Recovery Program Bureau (NRPB) reports directly to the office of the Prime Minister. The NRPB coordinates the government agencies and also arranges for the accountable, transparent management of the procurements and actions financed for the recovery activities, see DRM Context).

However, within the current waste management system, VROMI is not able to control the SWM system wholly because it does not have sufficient resources such as budget, human resource and legal infrastructure. Therefore, SWM components of collection/transport and disposal as well as recycling activities remain uncontrolled. The current system does also not support to secure the full-cost recovery of SWM operations.

DISASTER RISK MANAGEMENT (DRM) CONTEXT

Sint Maarten's disaster management plan was designed to provide both a technical and organizational plan which could deal with the first recovery processes of multiple disaster events in an efficient way. It has been created as a reaction to Hurricane Luis, as the previous system in place did not function during the preparation and aftermath phases. The plan was constructed for the entire Netherlands Antilles between 1995 and 2000 and adapted locally if necessary. In this plan the focus is not on the aspects regarding the technical implementation, but on the administrative, organizational and coordinating aspects when combatting a disaster. The development of this organizational structure could thus be identified as the development of a security apparatus, aiming at focusing on relief and recovery after a disaster.

Shortly after Irma (14th of September) a workgroup has been formed for establishing A National Recovery Plan (NRP). The workgroup produced an interim report focusing on a plan of approach regarding the rebuilding and recovery of St. Maarten. Within this report an analysis was made of the economic impact and actions required for the recovery of the communities and economy.

As a response to help and speed up the recovery on Sint Maarten the Dutch government made available a budget of €550 million. Of this budget seven million was made available

to finance projects in the first phase of the recovery. These projects were executed by local and international organizations such as the United Nations Development Program, the Red Cross and UNICEF.

Dutch Government made available a budget of €470 million to assist Sint Maarten. The Netherlands started negotiating with the World Bank if they could be able to play a role within the rebuilding processes on Sint Maarten. The agreement between the Netherlands, Sint Maarten and the World Bank was signed on the 16th of April, 2018.

A steering committee, consisting of representatives of the World Bank, Sint Maarten and the Netherlands, and an Interim Recovery Committee (IRC) have been established as an 'intermediary' between the ministries and the World Bank. The IRC consisted of eight to ten different members, who previously worked for different ministries, and it eventually developed itself into a National Recovery Program Bureau (NRPB).

FINANCIAL SETTING

The national budget of the Government of Sint Maarten allocates funds to the various ministries and organizational units as Operational Expenditure Budget to be used for recurring expenses, and as Capital Investment Budget to be used for larger scale 'one-time' project investments. The national budget 2018 of Sint Maarten had a deficit of ANG 197 million (US$ 110 million) and had a capital investment of ANG 22 million (US$ 12 million).

A governing program has been developed by the government in 2018. The goal of the government is to act swiftly to improve the quality of life for the people, rebuild a vibrant economy, restore a robust social fabric and promote a resilient sense of community. This governing program addresses the economic and infrastructural reality that the Country is facing. It reflects the objectives and plans of the government to restore and redevelop Sint Maarten.

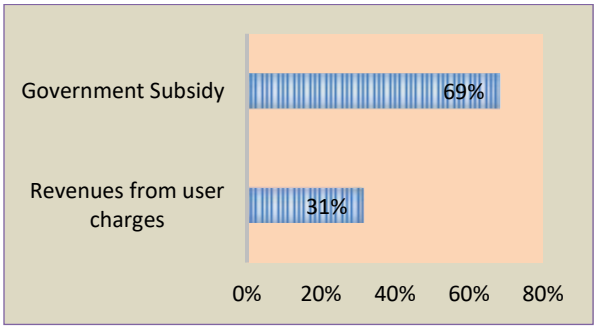
After Hurricane Irma Sint Maarten government accepted the pre-conditions set by Dutch Government for financial support. The Netherlands arranged for the International Bank for Reconstruction and Development (the World Bank) as an expert authority on redevelopment to manage the recovery via the Trust Fund, which is comprised of a grant of €470 million.

There is no waste collection and disposal tariff set by the government, no user charge for households and institutions (government departments and schools) in the country. There is also no billing system for SWM services. Except commercial waste collection and transport budget, all SWM budget is provided by the government as government subsidy, including collection and transport budget of household and institutional waste, area cleaning waste, and the budget for disposal and treatment.

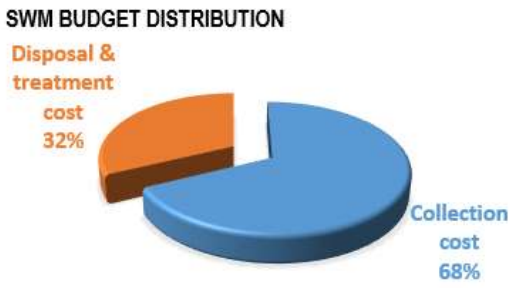
Waste collectors of household/institutional and area cleaning waste are paid by VROMI from the central government budget. VROMI has no revenue from the waste management activities as there are no tariffs charged to the household/institutional waste generators, and no tipping or gate fee at the entrance of the Pond Island MSW landfill for all waste

delivered to the landfill by all waste collectors and haulers, including commercial waste collectors.

According to recent data total estimated SWM budget of Sint Maarten is around US$ 10.2 million. Almost 69% of total SWM budget is government subsidy (from government budget based on environmental fee, utility fee and occupancy tax from the hotels, resorts and room-share apartments), and estimated 31.32% is provided by commercial waste generators through unregulated waste collectors. Almost 68% of SWM budget goes to collection services, and 32% to disposal and treatment services.



Current SWM Budget Structure



SWM Budget Distribution between Collection and disposal Services

It should be noted that the government subsidy does not imply that 69% of the SWM budget is fully government subsidy as the government collects funds through different economic instruments such as environmental fee charged through hotels/resorts and room-share apartments, and also occupancy tax charged per room per week at the hotels and resorts.

The recent analyses on available financial data show that O&M cost per ton of full SWM system by 2018 is US$ 77,99. SWM cost per person per year and month are US$ 162,16 and US$ 13.51 respectively.

When these figures are compared with the cost per ton rates in few European countries, per ton O&M cost in Sint Maarten seems too high as it is almost equal to SWM system O&M cost per ton in Germany, Belgium, Ireland and Spain.

If the service level in those countries is considered as a cost level function, it is apparently seen that cost per ton O&M cost of SWM services in Sint Maarten is too high or there is no liable data on SWM budget. The latter is more possible than the first assessment because of the fact that there is no functional weighbridge at the gate of main MSW landfill; VROMI does not have sufficient staff and infrastructure to measure and keep under control the SWM system performance, and suffers from lack of capital for enhancing the performance of the system components.

Nevertheless, no cost recovery is secured within the current financial model, which is not economically viable, and can no longer sustain the SWM system in Sint Maarten.

As the SWM operations in the country is government operation partly, there is no standard budget dedication methodology from the government budget specifically for SWM system, which will provide adequately splitting the budget collected as environmental and utility

fees. The budget provided to VROMI is not a resource allocation type budget, but only annual authorization type budget dedication method is applied according to next fiscal year requirements of VROMI, based on its contracts related to SWM and staff work in SWM department as there is no precise financial management framework for SWM operations.

ECONOMIC INSTRUMENTS, INCENTIVES/DISINCENTIVES

As there is no solid waste management fee set by the government for both collection/transport and disposal in Sint Maarten, collection and transport costs of household and institutional waste (government departments and schools) and all disposal costs in both landfills (MSW and Irma) are covered by the government budget. Waste collection and transport fee applied by private waste collectors to commercial and industrial waste generators is collected by the collectors, but the revenue provided by this activity is not included in government budget as they do not pay any tipping or gate fee at the gate of the landfill. There is also no regulation, which regulates the waste fee for all type of waste generators. User charges (direct revenue instruments) that are applied by private unregulated waste collectors for waste collection from commercial and industrial waste generators are summarized below. Direct and indirect revenue sources in force are:

Waste Generator	Rate *US$*
Small shops & retail business, including industrial workshops per month (est.)	30.00 - 50.00
Restaurants and bars, per month (est.)	80.00 - 150.00
Hotels and resorts, per room per month (est.)	10.00

Source: Consultant's own investigation.

Indirect Economic Instruments	Rate *US$*
Environmental fee, per person per day through hotels, resorts and room-share apartments	1.50
Utility Fee, per person per day through hotels, resorts and room-share apartments	3.00
Occupancy Tax, per week at hotels & resorts	50.00
Departure tax, for one-off entry payable at the airport	30.00

Source: Based on Hotel Bills and Airport information.

There is also no deposit refund system or other revenue instruments imposed by the Government. There also exist no incentives which encourage the waste minimization, reuse and source separation in the country, as well as no recycling policy, and other policies which cover the components of an Extended Producer Responsibility (EPR policy).

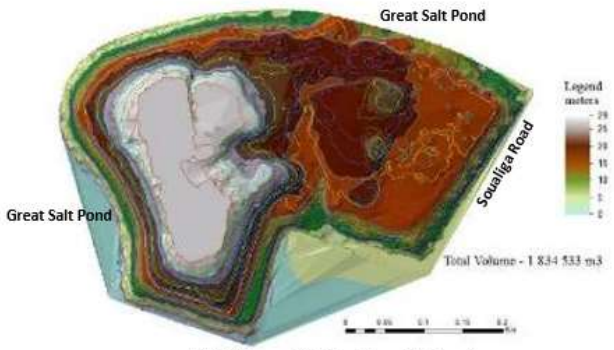
It should be noted that the government subsidy does not imply that 69% of the SWM budget is fully government subsidy as the government collects funds through different economic instruments such as environmental fee charged through hotels/resorts and room-share apartments, and also occupancy tax charged per room per week at the hotels and resorts.

WASTE SOURCES & CHARACTERISTICS

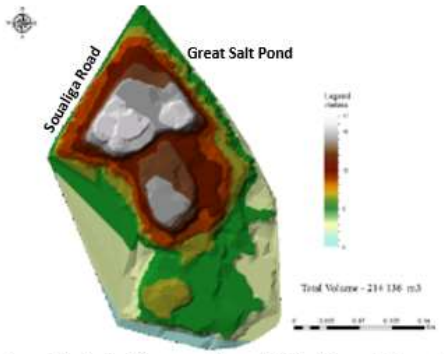
Waste types in Sint Maarten are classified under 11 categories depending on their sources for the purposes of this report. All studies since almost 10 years on waste generation in Sint Maarten show that this small island country has one of the highest per capita solid waste generation rates (WGR – 3.53 kg/capita/day) in Caribbean SIDS as it is one of the most favorable destination by cruise ships and stayover tourists.

Waste Type	
1	Household Waste (residential)
2	Commercial Waste (including restaurants, touristic facilities and resorts, and small and large retail markets, grocery stores, entertainment facilities, airport, port facilities and cruise ship wastes)
3	Marine and coastal litters from land-based and sea-based sources, i.e., ocean dumping by boats, accidental container spillages, wind blown solid waste, (paper, plastic, etc) from urban areas and waste landfills, and tourism activities in beaches and coastal zones
4	Institutional Waste (schools, government offices and medical facilities)
5	Industrial Waste (non-process and non-hazardous waste from the human activities)
6	Mixed Construction and Demolition Waste – Mixed C&D Waste
7	Car wrecks/tires
8	Medical Waste (non-hazardous waste from the human activities
9	Hazardous Medical Waste
10	Hazardous Industrial Waste
11	Disaster Waste

There are two authority disposal facilities in Sint Maarten, MSW landfill and Irma Debris Disposal Site (IDDS). Both are located in Pond Island of Philipsburg. MSW landfill is accepting all waste types along with municipal waste types. IDDS occupies some 6.5 hectares of land. The MSW landfill occupies approximately 16 hectares of land in northwestern part of the Pond Island, and is in service for some 50 years. Its operable life time is almost finished. The current total fill in MSW landfill is around 1.85 million cubic meters by the end of 2019. Approximately 215,000 cubic meter debris (disaster waste) are placed in IDDS since October, 2017.



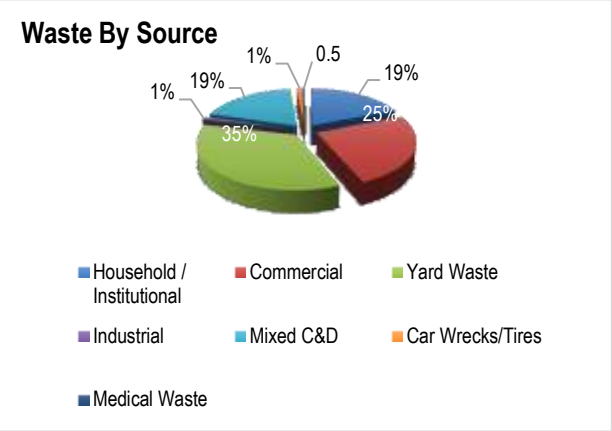
MSW Landfill in Pond Island



Irma Debris Disposal Landfill in Pond Island

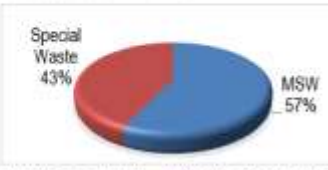
Almost all waste types are collected commingled, and disposed to MSW landfill. Currently, there is no functional weighbridge in both landfills. Both of them are not equipped with a functional weighbridge that records the weight and other source information on the waste delivered to the landfills. Adequate compaction and placement are not performed in both landfills as VROMI has no sufficient M&E, staff and budget. Nevertheless, VROMI has achieved little improvements in 2019 in MSW landfill with its own possibilities, carrying out partly compaction by bulldozer and ADC application for covering the waste.

Analyses on waste data from 2009 to the end of 2015 showed averagely 19% of waste disposed has come from households and institutions, 25% commercial sources, 35% from area cleaning activities as yard waste, 19% from construction sector as C&D waste, respectively. Averaged yearly waste generation is around 127.4 ths. tonnes in the period of 2009-2015.



WASTE CATEGORIES

Mixed Municipal	Special Waste
Paper/cardboards	C&D Waste
Plastics	Hazardous Medical Waste
Metals	WEEE and Durables
Organic Waste (food)	Car Batteries
Textile	Hazardous industrial waste
Tire & Rubber	
Inorganic Fractions	
Yard Waste	
HHW	
Other waste	

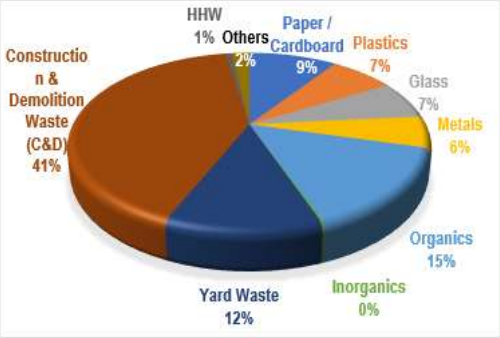


Waste Composition – MSW Vs. Special Waste

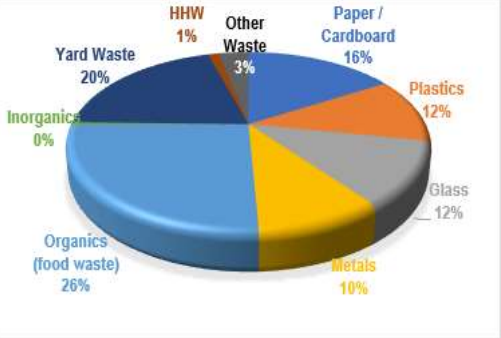
Waste types are categorized as Municipal Solid Waste and Special Waste Types for the purposes of this project as special waste types require special attention during collection/transport, and disposal/treatment. C&D waste can contain hazardous construction chemicals which require special care, and industrial waste also requires special treatment techniques according to its industrial processes. WEEE and durables also require different collection and treatment/disposal processes. While 57% of waste generated in the country is MSW, 43% is special waste.

WASTE COMPOSITION

Analyses show that the waste composition in the country, including and excluding C&D waste by fraction groups, based on waste characterization survey conducted in 2009. Of the total waste generated, 41% is C&D waste, 9% paper, 15% organic waste,12% yard waste, 7% glass, and 7% plastics, respectively. If C&D waste would be separated from the municipal solid waste stream as a separate category assuming that it will be handled and treated separately, the waste composition would be as follows: 16% of the generated waste would be paper & cardboard, 12% plastics, 12% glass, 10% metals, 26% organics, 20% yard waste.

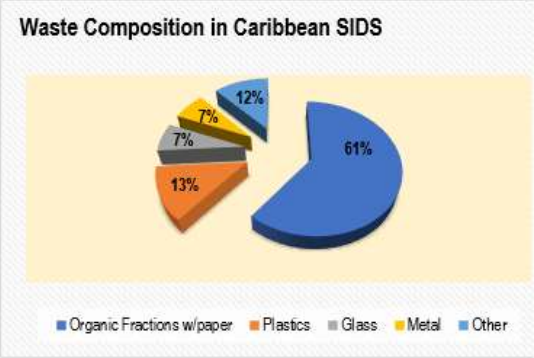


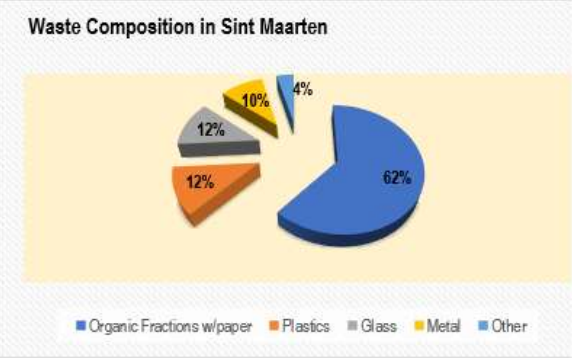
Waste Composition, including C&D Waste



Waste Composition, excluding C&D Waste

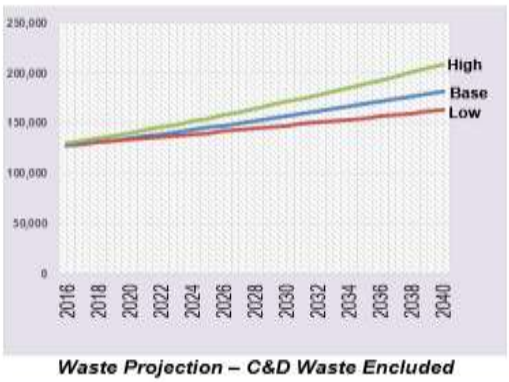
The similarity of MSW composition of Sint Maarten with Caribbean SIDS is remarkable. The following comparison shows that MSW composition in Sint Maarten almost mimics the character of waste generated in Caribbean SIDS.



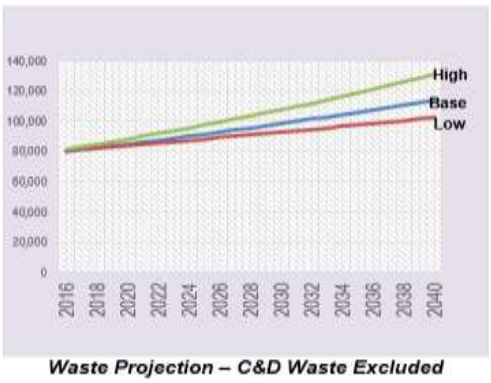


WASTE GENERATION

Based on analysis of historical data on waste generation, it is assumed that waste generation (including C&D waste) by 2016 in Sint Maarten was around 127.4 thousand tonnes. Projected waste generation capacity from 2016 to 2040 is given below, assuming that the incremental increase per year will be in parallel with the population growth rate of 1.5% for base case scenario, 1.00% for low case scenario, and 2.0% for high case scenario by dynamic population. It seems that Sint Maarten could have waste generation capacity of 182,103 tonnes per annum by 2040 including C&D and other special waste types, and 114,579 tonnes excluding C&D waste.



Waste Projection – C&D Waste Encluded



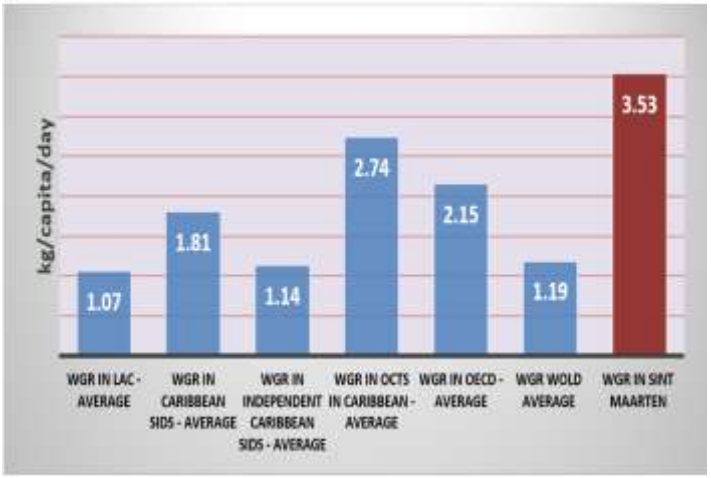
Waste Projection – C&D Waste Excluded

Waste generated by stayover tourism activity is included in this projection, but no ship waste is projected in this projection, except the boats moored in the marinas, as the tourists coming by own boats are using the communal containers for disposing their waste. Waste from commercial establishments and households are collected as mixed waste, and transported to the Pond Island landfill. However, a sharp decrease is expected on waste generation due to COVID-19 implications from March, 2020 to present. Based on research to date, the waste value chain does not appear to spread COVID-19. However, the SWM sector has felt impacts. Waste production has shifted from industry and commercial centers to residential areas.

However, we will not truly know the answers without systems modeling of waste management data. The goal of this perspective is to bring attention to the need for better real-time waste management data and systems thinking in the context of the COVID-19 pandemic and beyond.

WASTE GENERATION RATE (WGR) BY DYNAMIC POPULATION

Waste Generation Rate (WGR) has been evaluated for two cases of C&D waste is included or excluded. WGR is 5.99 kg per capita per day, including C&D waste, and 3.53 kg per capita per day excluding C&D waste by dynamic population. The WGR in Sint Maarten is one of the highest in Caribbean region. However, many of the highest waste generators are the active tourist economies in SIDS like Sint Maarten in Caribbean region.



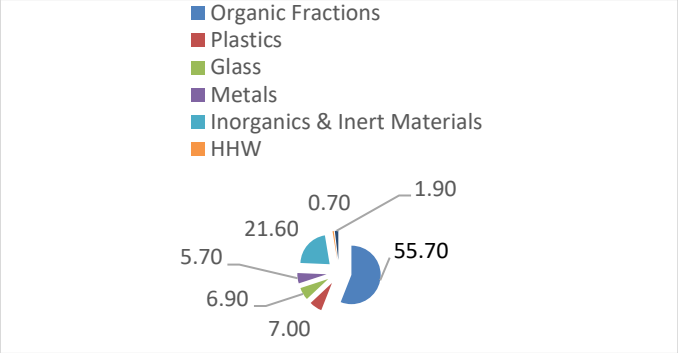
However, it is expected that WGR in Sint Maarten with COVID-19 effects may drop down to level of average WGR in the independent Caribbean SIDS (1.14 kg per capita per day). Nevertheless, it should be noted that this Strategy is a planning instrument for the future waste management in the country, all projections in this report have been conducted according to waste generation rate of 3.53 kg per capita day for MSW generation without C&D waste and the rate of 5.99 kg per capita per day including C&D waste, considering the fact that the waste generation rate will rise up to the projected figure gradually following the future end of COVID-19 pandemic. Because of this reason, the total waste generation in the country using the average WGR rate in the independent Caribbean SIDS, has been adjusted to start relatively low and gradually rise for the periods of 2020 – 2021 due to lowering impact of COVID-19.

WASTE CHARACTER

According to the results of waste characterization survey conducted in 2009, 41% of the total waste (including C&D waste) generated in the country is C&D waste. However, 47.83%% of C&D waste is formed from wooden fractures. This waste composition suggests that the topological distribution of waste generated is 55.70% organic fractions,

21.60% inorganic and inert materials, 7% plastics, 6.90% glass, 5.70% metals. Other small fractions make up 2.80% of total waste generated.

As there is no reliable waste density measurements or surveys previously conducted for Sint Maarten, based on the consultant's experience worldwide and the literature review, the average MSW densities depending on where it is placed are given below for referencing.

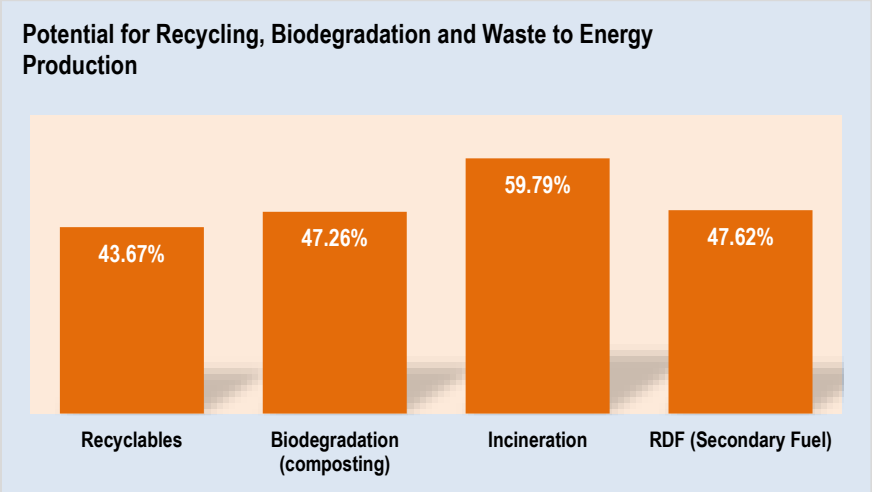


Waste Compacted / Un-compacted	Density
	kg/m³
Mixed MSW in container	280 - 300
Messy waste in open truck	350 - 400
Compacted mixed waste in truck	650
Waste in skid containers for hook lift trucks - 3 - 4 m^3	350
Compacted waste in landfill	1,200
Suitably uncompacted waste in landfill	800 - 850

An approximate average calorific value on potential for incineration alternative has been conducted with the sector specific caloric values of combustible fractions for overall waste stream, assuming that all wood fractions from C&D waste will go to the incinerator. The assessment has been conducted on 21 waste fractions. The resulting wet weight low and high calorific value may be around 2,803 and 3,514 kcal/kg respectively.

The topological dynamics of waste deposited is given in the following Figure. Approximately 55.70% of waste disposed is putrescible organics, including paper/cardboard, organic waste (food waste, wooden fractions, tire and rubber, and yard waste. 54.20% of it is biodegradable (compostable), 46.60% recyclable, 63.90% combustible, and 57.10% can be converted into RDF for use as secondary fuel.

Out of the total waste stream the following Figure below shows the percentages for recycling and resource recovery.



It should be noted that the last waste characterization survey does not represent the seasonal variations, and conducted 10 years ago. A more comprehensive waste characterization survey should be conducted to ensure the updated waster character and seasonal variations in the waste generation.

CLIMATE RISKS FOR SINT MAARTEN

The threats of climate change for Sint Maarten are very serious as in other Caribbean SIDS, with major negative impacts on socioeconomic conditions and biophysical resources emphasizing the need for timely and effective adaptation measures. The major threats of climate change are i) see level rise, ii) near term temperature, iii) long term temperature, and iv)Temperature extremes.

The global mean sea level during the 20th century rose at a rate between 1.3 and 1.7 mm every year, with an acceleration since 1993, when the level started rising at 2.8 to 3.6 mm every year. In the Caribbean, the mean rate of sea level rising over the past 60 years has been 1.8 mm/year[1]. Virtually all socioeconomic sectors are affected, with major impacts on tourism, freshwater resources, fisheries and agriculture, human settlements, financial services, and health. However, sea level rise is only one of the climate stressors that impact a small island; other important drivers include air and ocean temperature, ocean chemistry, rainfall patterns, wind speed, wave climate, and extreme events such as hurricanes, drought, and distant storm swell events.

The World Bank consultants projected anthropogenic warming of surface air temperature to increase more rapidly over land than over oceans. Increases in seasonal mean and annual mean temperatures relative to natural internal variability are expected to be larger in the tropics and subtropics than in mid-latitudes.

Regional projections for the Caribbean indicate that for the Caribbean the median projected regional temperature by 2100 increases by 0.5°C to 0.9°C compared to 1986 2005. Rainfall

[1] Sustainable Solid Waste Management in Sint Maarten, Resilience to Climate and Natural HazardsWB, January, 2021.

records show an average reduction of 0.18 mm/year over the Caribbean region from 1900-2000, with the projected rainfall showing a similar trend. In the Caribbean northerly swells have been damaging beaches, marine ecosystems and coastal infrastructure. Increased aridity in the Sahel will also impact the eastern Caribbean in the form of dust levels. As all small islands, Sint Maarten is vulnerable to the spread of invasive alien species due to the migration of aquatic and terrestrial fauna across regions, which can result in indigenous species decline or extinction and loss of biodiversity, or the spread of aquatic pathogens, which can seriously threaten the local ecosystem, such as the coral reef morbidity and mortality.

Impacts of Climate Change in Waste Management

Increased Heat:

- Increased heat will cause to increased water demand for operations in site such as dust suppression;
- Increase the risk of heat stress on the workers;
- Increased bioaerosol releases and pathogen activity, increasing the risk of disease transmission from putrescible waste;
- Degradation of waste in community bins with increase rates of decomposition, odors, insect infestation and bioaerosol releases; Which can impact frequency of collection;
- Increased odor nuisance may require odor and bioaerosol control measures, reduction of waste to be stored and reduction of pre-treatment time;
- Increased temperature may change the decomposition rate, which would affect the quantity of landfill gas generated and the length of the active gassing phase, and composting processes, anaerobic digestion, and biological processes;
- Impacts on soil, by reducing soil moisture with potential risks of subsidence
- Increased stress to vegetation and planting in landscaping areas, and
- Increased combustion risk.

Precipitation:

- Increased risk of flooding and inundation from groundwater, surface water and coastal waters, and increased risk of release into the environment of contaminants in the soil, sediments, ground water, surface water, and coastal waters;
- Disruption to infrastructure operations such as road viability with disruption in waste delivery, and electric power supply blackout risk;
- Impact on the combustion processes due to higher content of moisture, leading to changes to the amount of chemicals and reagent used in the flue gas treatment system.
- Increased risk of slope instability
- Increased risk of erosion of bunds and capping layers.
- Reduction of water availability in the summer
- Impacts on waste degradation biological processes

Storms:

- Increased storm debris that will need to be appropriately disposed of;
- Stronger winds increasing the risk of dispersion of windblown litter and debris waste in the environment and on site increasing the risk of personal injury;
- Impact on outdoor operations

- Increased risk of damage to landfill sites and facilities

Sea Level Rise:

- Increased risk of inundation of coastal dumpsites; and
- Increased erosion of coastal areas due to increase storm surge.

WASTE MARKET OF SINT MAARTEN

The waste market in Sint Maarten can sustain estimated 100 tonnes per annum recyclable waste, including wood fractions in C&D waste and yard waste) in a normal tourism season. The packages of imported materials increase the amount of recyclable waste generation in Sint Maarten. Almost 64% of the generated waste (approx. 100 tonnes per annum MSW) in total is recyclables with 85% separation & collection efficiency, including wood fractions in C&D waste.

However, any fluctuation on tourist capacity of the country due to natural events and disasters can heavily affect the size waste market.

Market review also shows that packaging waste (paper – 11.81%, plastics - 7.88%, glass – 8.86%, and wood pallets) plays important role on amount of recyclable waste generated. Sint Maarten together with sister islands (Saba and St. Estatius) consume over 30 million bottles of beer.

Sint Maarten shows many similarities to other SIDS in the Caribbean Region from the perspective of demographics, economic drivers and economic dependency on tourism, tourism related activities and tourism dependent industries, dependence or connections to regional and global market, transport capability and difficulties to haul their processed or semi-processed waste to the regional and global market, dependency on use of fossil fuel for energy, and being exposed to natural disasters such as tropical storms.

Currently, the major players in Sint Maarten waste market are the waste management authority (VROMI), relevant government agencies/authorities, the waste generators, waste recyclers/processors, general public, and non-governmental organizations (NGOs). The airport authority, port authority, and big hotels and resorts should also count as major players in waste management because they are major waste generators in the country.

Because of the fact that these stakeholders act independently in a disorganized manner from the main waste management authority (VROMI), the overall waste management in Sint Maarten is unfortunately unable to be perceived as a cohesive and holistic waste management scheme. As a result, VROMI is solely relegated to performing collection of the solid waste from households/institutions and area cleaning as well as managing landfills within their own limited resources, leaving the collection and transport of commercial waste unregulated.

This situation enables local recyclers to opportunistically seek out the international markets through regional recyclers, bypassing regulations and best practices all the while selling the recyclable fractions in the main waste stream as semi-processed recyclables, since there is no robust enough industrial infrastructure to support a circular economy which revolves around these local recyclers, and also there is no industrial and agricultural base for sustaining material reuse & internal processing of recyclables.

Thus, these local recyclers are compelled to respond to the existing demand within the Caribbean waste market, and they conform their scrap recycling procedures according to hub areas around the Caribbean.

According to Aim Texas consultants' research on regional waste market, estimated 350 – 400 recyclable materials shipments per year leaving Port Philipsburg and arriving of Port Everglades in Florida exclusively, through local and regional Scrap Collectors/Dealers; They accept only scrap metal, car batteries, small amount of plastics and electronic waste, and very small amount of scrap paper. Recovered Paper supply in the region is in fact much lower than either Metal or Plastic Scrap Supply, and no scrap wood and glass demand in regional market.

WASTE MANAGEMENT

COLLECTION & TRANSPORT

Currently, curbside collection is applied in the country, except the large-scale touristic facilities, airport and main port in Point Blanch district. The waste collected is hauled directly to Pond Island MSW landfill in Philipsburg. There is no waste transfer station within the collection system.

All waste collection and transport activities in Sint Maarten are under responsibility of VROMI. The waste collection and transport of household waste (HH waste) and institutional waste including schools are executed by outsourcing the services to private service provider firms through open tenders with a Terms of Reference (TOR) prepared by VROMI for the period from April 01, 2016 to March 31, 2021 (five years). District cleaning waste activities are also arranged and executed by outsourcing the services to private service providers through open tenders for the period from August 01, 2019 to July 31, 2022 (three years), with the possibility of an extension for a maximum period of two (2) years.

Commercial waste is collected by private un-contracted waste collectors in un-regulated form. There is an open subscription system between the waste generators and private haulers for collection and transport of commercial waste. Unregulated and uncontrolled form of commercial waste collection in the country cause informal diversion of recyclable materials from main stream. These private collectors/haulers do also not pay any tipping fee at the gate of the Pond Island MSW landfill. There are more than 10 private companies, though their numbers are changing time to time, which collect waste from commercial premises, hotels and restaurants, and dispose the waste into the MSW landfill without paying any tipping fee, despite the fact that they collect fee from their customers. The collection fees imposed by private collectors vary according customer's type of business and size.

Relatively big size light industrial facilities haul their waste directly to Pond Island MSW landfill with their vehicles without paying tipping fee. VROMI reports that there is also no special program to collect / transport and processing the C&D waste. C&D waste owners (individuals and/or companies) bring them to the landfill for dumping with their vehicles, and all of them are simply dumped in landfill area. Medical waste collection, deposition and processing are currently handled by the medical facilities themselves according to directives of Ministry of Health of Sint Maarten.

No special collection programme exists for collection and disposal of WEEE in Sint Maarten. VROMI reports that WEEE owners (individuals and/or companies) bring them to the landfill for dumping with their vehicles, and they are simply dumped in landfill without no tipping fee. There are also no scrap processors which collect those for processing or selling out of the island. No processor deals with the car battery processing. Some scrap dealers are collected and export them out of island through regional recyclers.

The hazardous industrial waste eventually ends up in the Pond Island MSW landfill as disposal of this type of waste is not under control despite the fact that the waste law of Sint Maarten has some articles which arrange handling of hazardous industrial waste.

Irma debris is deposited in 2017 without separation of wooden fractions, and some contaminated building materials and concrete parts in IDDS in Pond Island. Auto bodies, large metal fractions are separately collected and accumulated in a metal junk yard nearby IDDS for dismantling the car wrecks. The junk yard is operated by a private contractor. The government also planned to remove the mixed disaster debris IDDS and junk yard under Emergency Debris Management Project (EDMP) of Sint Maarten.

Effects of COVID-19 on waste collection may be experienced in Sint Maarten in the following form:

- Most collected waste, including recyclables, may be transported to landfills or accumulates at temporary dumps;
- Hazardous materials in waste stream based on increasing of use of plastic-based personal protective equipment (PPE) such as gloves, masks, and disinfectant bottles, as well as packaging materials, may increase during COVID-19.

WASTE DISPOSAL & TREATMENT

As mentioned before, there exist two landfills (MSW landfill and IDDS) in Pond Island of Philipsburg. Both landfills are managed by VROMI by its own staff in limited number. Infrastructure Management Department of VROMI has 20 staff. Of these staff, only 11 of them are employed for solid waste management, including landfill management.

The current waste disposal practices do not meet basic hygiene, sanitation, and ecological requirements. There is practically no waste neutralization and treatment, and they are merely used to amass waste. There is no leachate or gas control and treatment, no groundwater or gas monitoring, there is inappropriate M&E at best, and little or none waste recording is performed. No compaction activity with an appropriate compactor is currently performed in both landfill due to lack of equipment. Although open fires are stopped, the hot spots are determined in the Aerial Infrared Thermographic Survey conducted on 2018 and 2019. Nevertheless, VROMI has achieved little improvements in 2019 in MSW landfill with its own possibilities, carrying out partly compaction by bulldozer and ADC application for covering the waste.

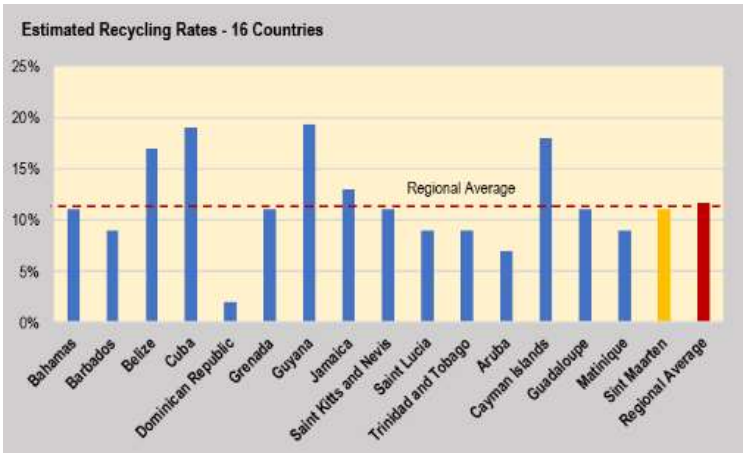
RECYCLING & RECOVERY & RECYCLING MARKET

The overall waste management in Sint Maarten is unfortunately unable to be perceived as a cohesive and holistic waste management scheme. This situation leaves recycling market unregulated without overseeing. VROMI's Infrastructure Management Department, as single waste management authority in the country, suffers from lack of necessary equipment, human resource, capacity and budget shortage during managing the system. Due to lack of policies and regulations that arrange the recycling market from import to export, absence of robust enough industrial infrastructure to support a circular economy which revolves around the recyclers cause the local recycling market incapable to process the recyclables locally. So that the local recyclers seek out the international markets through regional recyclers, and they are compelled to respond to the existing demand within the Caribbean waste market, and they conform their scrap recycling procedures according to hub areas around the Caribbean. There is also no material recovery facility

(MRF) publicly or privately owned within Sint Maarten waste management scheme in order to separate the recyclable fractions from the main waste stream for pre-processing or processing. The local recycler companies have only small scrap yards for separating the fractions into specific categories or cleaning or baling them, to sale out of the island.

Although weak waste minimization efforts are in place in few hotels, restaurants and resorts, using metallic, glass, and porcelain table wares in cooperation with few local recyclers, these efforts remain weak, and do not have wide coverage. There are also no public awareness campaigns and officially approved programmes, which support the public education on waste prevention and minimization. Today several environmental Non-Governmental Organizations, Non-Profit organizations and initiatives are trying to be active in the environmental sector, presented a collaborative support letter to the members of parliament for the implementation of the ban on single-use plastic bags, plastic straws and Styrofoam initiated by Member of Parliament Sarah Wescot-Williams.

The organizations active in the environmental sector on St. Maarten would like to urge the members of parliament to vote in favor for the proposed legislation to ban single-use plastics in the upcoming public session of Parliament. Nature Foundations St. Maarten, Green initiatives SXM Collaboration, WasteFactory, Waste2Work Foundation, Environmental Protection in the Caribbean, Freegan Food Foundation, Green SXM, Greenbox, Spaceless Gardens and the St. Maarten Pride Foundation have collaboratively showed their support and are looking forward to hearing about a fruitful continuation to implement the single-use plastic ban.



No monitoring is conducted by a government department over the waste minimization and recycling activities as there is no government policy, which regulates the recycling market in the country. The estimated recycling rate in Sint Maarten is around 11%, which is slightly below the regional average of 12%, see following Figure. Regional average is probably higher than 12% as the data and information on recycling in Haiti and Dominic Republic are very scarce. The waste market analyses showed that the CARICOM countries like in Sint Maarten, have not sufficient industrial infrastructures which support processing the recyclables in-house or in the region, rather they rely on export of the recyclables as secondary material to the markets/countries that have more developed industrial infrastructures such as USA, China, India, Taiwan, and for small amounts to Canada and European countries. This also means that approximately 85 - 88% of waste ends up in landfills in CARICOM region as in Sint Maarten.

Only one beer producer is working with a local recycler company (Meadowlands) to collect and export the scrap beer bottles form the island. It is also developing a campaign for offering its clients a rebate for empty amber colored bottles towards a purchase on the next case. It also plans to coordinate to locate color-coded containers in some points in the

country for both collection of glass containers and create awareness. However, the company's plans are postponed due to Covid-19 outbreak and limitations.

There is no energy recovery from waste either by WTE or gasification in the MSW landfill. However, there is an initiative in French part by Verde Company which is operator of the landfill of French part, to establish a WTE in the capacity to meet the demand of French part initially.

STRATEGY FOR INTEGRATED SOLID WASTE MANAGEMENT SYSTEM (ISWMS) AND PLANING

KEY PRINCIPLES

The following key principles are adopted for development of ISWMS for Sint Maarten, considering the local and regional waste market characteristic and limitations:

- Using an integrated waste management approach, to optimize the cost-effectiveness of the solid waste activities from collection to disposal;
- Using a holistic perspective that looks at the whole life of equipment and facilities and total costs to maintain, operate and use them, and also looks at closure and post-closure costs;
- Accepting the waste hierarchy and its 4 R's of waste reduction, reuse, recycling and resource recovery as priority steps to minimize land disposal;
- Adopting the polluter-pays-principle coupled with an appreciation for the ability-to-pay of various waste generators in developing cost recovery concepts;
- Optimizing economies-of-scale through defining waste processing and landfilling systems;
- Outlining enabling frameworks of supportive laws, institutions, financing, economic instruments, social inclusion, and private sector participation; and
- Assessing the full array of possible environmental, social, and health impacts for optimization of choices and inclusion of mitigation measures.

Choices for establishing an ISWMS for the country were separated into two categories:

1. Technical choices, and
2. Enabling framework choices.

Technical Arrangements directly involve investment in infrastructure and new services. The benefits that result are specified in the designs and contracts for the goods, civil works, and operations.

On the other hand, the Enabling Framework Arrangements create the support systems, incentives and disincentives that encourage a change in behavior. Enabling Framework Arrangements are meant to result in significant public cooperation, private sector investment, and more environmentally/socially conscientious activities. Without the Enabling Framework Arrangements, the Technical Arrangements would not be likely to be successful. But, even with Technical Arrangements, the Enabling Framework Arrangements would lead to solid waste improvements. Together, the speed and cost-effectiveness of upgrading the solid waste system would be optimized.

TECHNICAL OPTIONS

As a result of gap analysis conducted on the current waste management system of Sint Maarten by the consultant, the following technical options are evaluated for developing the country's ISWMS:

1. Collection Options

Equipment

While Sint Maarten's waste is relatively low dense due to high amount of packaging waste, compaction trucks still can offer some value because they push the waste up from a low loading height into the high body of the truck, thus enabling easy loading of a large volume of waste. Therefore, the following collection vehicles are recommendable for waste collection system.

- Compaction trucks can be filled from a wide range of containers, ranging from plastic bags to metal liftable containers, as a result compactor trucks are recommendable for household, institutional and commercial waste collection; and
- Open trucks for yard waste and area cleaning waste collection.

Collection Type

The following collection type would be recommendable for type of waste collection in the country.

- Curbside collection for households, institutions, private and public office spaces, and central business districts;
- Compound by compound or building by building collection for resorts and hotels;
- Door-to-door collection for schools, and medical facilities for collection of non-hazardous medical waste;
- On-site pick up for large commercial and industrial districts

The consultant recommends that the following arrangements related to waste collection system should be implemented for achieving the ISWM objectives:

- Regulate the unregulated current commercial and industrial waste collection system Regulate the unregulated current commercial and industrial waste collection system;
- Examine and draft contracts for waste collectors (unregulated private collectors and contracted collectors) according to the results of collection routing and system configuration analysis;
- Develop Waste Fee Framework and Tariff Study for waste collection and transport/transfer;
- Conduct collection route optimization and system configuration analysis;
- Locate the color-coded containers that will be placed at different points, to support the separate collection of recyclables;

- Develop and implement comprehensive, transparent, equitable, and inclusive contracting and licensing arrangements for all waste collectors;
- Provide policy support by waste management authority/government for efforts of CBOs, NGOs, and commercial community for separate collection of waste;
- Provide policy support for EHS measures in waste collection and transport;
- Consider climate change risks identified during planning the collection operations such as use of lid in the communal containers to reduce the water content in collected waste, increased frequency of collection of waste, which can affect the treatment and disposal processes.
- Arrange collection frequency in accordance with the climate change risks;
- The type of containers necessary to collect the different types of waste, i.e., residential, commercial and institutional with two bins for wet and dry waste,

2. Transfer Options

As Sint Maarten is a small island, and the longest hauling distance from collection area will not exceed 30 km, transfer station option is not a case for Sint Maarten.

3. Recycling & Resource Recovery Options

Recycling processing involves mechanical systems to sort, screen, clean, air classify, and magnetically separate commodity materials from mixed wastes. The output of processing municipal waste includes: paper, cardboard, glass, metal, rubber, and plastics. If the recycling process is established to focus on construction and demolition debris, the output of processing is concrete aggregate, asphalt aggregate and metal.

Resource recovery processing would involve three basic approaches for converting organics in waste to a new resource, as follows:

Biological conversion

Biological conversion facilities are dealing with putrescible organics and thus attract insects and birds. The main pollutions of importance are fine particulates and bioaerosols, because these can trigger respiratory disease.

Therefore, an enclosed biological conversion unit (compost) with suitable capacity to local demand would be preferrable for the country.

Thermal conversion

Thermal conversion involves the use of heat and possibly pressure to convert any type of organic material to either syngas, synfuel, or steam for electricity generation. The common thermal conversion methods are combustion and gasification. Under incineration, the variations offer different feeding and furnace designs. A key factor in the implementation of thermal conversion systems is that the air pollution controls that are recommended for these technologies have a cost and land area requirement that is roughly equal to the thermal conversion facilities alone.

However, as the country has their capacity limited by local and regional waste market, and suffers from lack of land for establishing more environmentally sound waste

treatment facilities in order to apply largely the biological and mechanical conversion options for resource recovery, the thermal treatment option (optional waste-to-energy plant) with an optimized capacity along with other resource recovery options would be recommendable.

Mechanical conversion

Mechanical conversion involves the use of simple mechanical sorting, screening, processing and pelletizing to process dry organic materials into refuse-derived fuel, or the more quality-controlled secondary recovered fuel that is able to meet EU import standards. As with any handling systems for solid waste, localized air emission of fine particulates and dusts are possible. However, there are no high temperatures to create volatilized emissions and no stacks to discharge air emissions to a high elevation. An important aspect of creating RDF is that the country needs to have special emission requirements for any industrial burners or kilns that are using these fuels, as the emissions are significant and unique from the coal or other solid fuels for which their furnaces have been designed, if the RDF will be used in country.

Therefore, this resource recovery option would be recommendable for the country with taking necessary measures for avoiding environmental impacts of the mechanical conversion processes because of the fact that the country doesn't have the possibility to internally use the RDF produced in-house. An enclosed MRF that has RDF production capacity would be useful for the country, to adequately separate the mixed waste into recyclable fractions by mechanical sorting and screening. This would also support the country's resource recovery capacity through providing pre-processed recyclables for both local recovery and selling them out of island to the regional recyclers or processors.

Establishing a separate C&D waste processing facility would also provide significant resource recovery option for recovery of at least 60 - 70% of C&D waste generated in the country as almost 70 – 80% of it recoverable. This option would also help to reduce the waste volume to be delivered to MS landfill because the space in the current landfill is a serious concern, and will be in the future.

4. Landfill Options

There are three options for landfilling of wastes, which are as follows;

- Controlled Landfill (CLF);
- Sanitary Landfill (SLF); and
- Sanitary Landfill with Pre-processing (SLF w/PP).

A controlled landfill refers to a landfill which provides equipment to spread, grade, compact and cover the wastes, but it is not engineered to provide full containment and management of leachate and landfill gas to the same extent as sanitary landfill. But a sanitary landfill is the internationally accepted method of handling wastes that remain after efforts of recycling and resource recovery. As countries develop and close their open dumps, they may transition immediately to sanitary landfills, or they could have an interim step called controlled landfills. A sanitary landfill is underlined with

impermeable material to protect groundwater resources and enable the collection of the contaminated drainage (leachate). That impermeable material could be indigenous impermeable clay, or an imported clay material, and/or a plastic liner. Usually a network of perforated underdrainage piping is created below the initial waste cells and protected with gravel and a layer of permeable geotextile.

As the Sint Maarten already has a controlled dumpsite with no leachate collection, gasification, appropriate daily cover and final capping. Therefore, it will be improved with this project, upgrading it. However, this site is apparently will be closed within 2028 or 2029 as it is very close to complete its lifetime. There is also a decision for improving it to be a Controlled Landfill. As a result, Sint Maarten will need a new Sanitary landfill with smaller capacity after 2028. Other options above is the case for the country.

In the future if a new landfill land is dedicated, the Consultant recommends that the new landfill should be a Sanitary Landfill (SLF) with leachate collection, gasification and other necessary facilities.

The following siting criteria should be considered during selection of the location of the new landfill:

- The new landfill should be located away from;
  - Lakes and rivers
  - Flood plains, forests
  - Residential areas
  - Coastal areas and wetlands
  - Groundwater resources
  - Airports
  - Unstable terrain prone to landslides or near fault zone

5. Economies of Scale of Technical Options

To compare technical options involves understanding how their capital and recurrent costs vary. Each unit of waste handling equipment and each facility for waste processing have an economic life, which is the period where preventative maintenance and repairs are economically feasible versus replacement with a new unit or facility. These economic life periods are commonly used as the depreciation periods for the capital investment. These periods are also used to determine the minimum cost-effective periods for contracts that provide economic pay-back periods for the investments made. For various components of the solid waste system, economic pay-back periods for investment are commonly:

- 4 - 6 years - small collection equipment systems for primary collection that is labor-intensive.
- 8 - 10 years - Collection trucks of 3-20 cubic meters for secondary collection, or door-to-door or curbside collection in laid out areas, which is modern and not labor-intensive.
- 10 -15 years - Transfer trucks of 20-40 cubic meters for transfer, including any mechanized loading systems.

- 25 - 30 years – Buildings and other civil works, as well as key stationary equipment, which comprise the facilities for transfer, processing, or sanitary landfill.

Recommendations for Technical Arrangements

Collection System

The consultant recommends that the following arrangements related to waste collection system should be implemented for achieving the ISWM objectives:

- Regulate the unregulated current commercial and industrial waste collection system;
- Examine and draft contracts for waste collectors (unregulated private collectors and contracted collectors) according to the results of collection routing and system configuration analysis;
- Develop Waste Fee Framework and Tariff Study for waste collection and transport/transfer;
- Conduct collection route optimization and system configuration analysis;
- Locate the color-coded containers that will be placed at different points, to support the separate collection of recyclables;
- Develop and implement comprehensive, transparent, equitable, and inclusive contracting and licensing arrangements for all waste collectors;
- Provide policy support by waste management authority/government for efforts of CBOs, NGOs, and commercial community for separate collection of waste;
- Provide policy support for EHS measures in waste collection and transport.

Waste Disposal & Treatment

- Provide and install a mobile weighbridge for the landfill with a suitable software in order to start recording the waste delivered to the landfill;
- Procure the landfill equipment for compaction, spreading, earth moving, excavation and fire suppression;
- Establish a temporary MRF like waste pre-processing facility (TDSR) to pre-process the accumulated scrap tire, wood waste, scrap glass, and yard waste, and procure the required equipment;
- Remove the debris in IDDS site, and haul the debris to new C&D waste facility area;
- Provide budget for removal of debris in Irma landfill;
- Start the landfill improvement activities, including fire suppression activities;
- Establish a separate C&D waste handling facility;
- Establish an Integrated Waste Management Facility (ISWMF);
- Prepare a pre-feasibility study and ESIA;
- Take emergency measures for protecting the residential/commercial community south and southeast of the MSW landfill in Pond Island;
- Develop Waste Fee Framework and Tariff Study for waste disposal and treatment;

- Develop Software Package for Tracking the Waste, Revenues/Expenditures, and Billing;
- Prepare a guidance that complies with best practice applications and EU regulations for landfill management and closure activities;
- Develop a DBO Contract for improvement and operation of MSW landfill;
- Develop a DBO Contract for ISWMF construction and operation;
- Develop a DBO Contract for C&D waste facility construction and operation;
- Develop a DBO contract for New Sanitary Landfill;
- Take measures for mitigating the environmental and social impacts of daily operation of the landfills, including EHS measures;
- Put in effect a programme and schedule immediately to avoid the hazardous waste disposal into both landfills as a result of COVID-19.

Waste Minimization, Reuse, and Recycling & Recovery

- Regulate the recycling market centrally;
- Develop strategy to promote informal private recyclers to integrate in main waste management scheme;
- Develop systems of bring back, buy banks, drop off centers, bring banks, or civic amenity centers;
- Create a special unit within current or prospective waste management authority (ISWMA) to study marketing activities for recyclables;
- Improve networking between recyclers and buyers;
- Create incentives for waste generators to recycle and also reduce their wastes;
- Give supports to the current initiatives on waste minimization, reuse and recovery activities, including composting activities;
- Provide policy support for energy recovery from the waste;
- Coordinate with the waste collectors to improve their cooperation with the recycling agenda;
- Provide public education to children, adults, and commercial establishments on the need for and value of recycling.

Disaster Response

- Commission an emergency debris site for accumulating the disaster waste;
- Prepare the emergency debris site in accordance with the lessons learned from previous disaster situations.

ENABLING FRAMEWORK OPTIONS

Enabling frameworks provide the support systems that enable solid waste technical activities to be successful and sustainable. Enabling frameworks lay out the laws, regulations, policies, institutional structures, enforcement systems, financial systems, cost recovery mechanisms, market incentives, private sector incentives and other support systems. Through these frameworks, an approach to capacity building at every level of government is implemented. The choices are many and it is up to Government to decide

among the options and create the enabling framework that best fits Sint Maarten needs and conditions.

For all of the enabling framework topics we have outlined proposed arrangements within this report. Because the legal and institutional frameworks are the foundation of support for the solid waste system, we have given particular attention to discussing these in detail in Annex 4. The legal and institutional efforts highlight the urgent need for the country's solid waste law to be upgraded and for a new national institutional entity to be created to guide and manage solid waste improvements.

We propose that the national entity be a national authority (ISWMA) which has overall powers of regulation and knowledge development, as well as supervision and monitoring. Including another mission within the ISWMA which would separately be able to focus on knowledge development, capacity building, data compilation and planning, would be a center of excellence. Separating these functions under the national authority allows them to focus on their respective activities, avoid conflict of interest between operations and regulation, and function with optimized accountability to government.

Enabling Framework options are examined under the following five (5) spheres:

1. Legal/regulatory and Institutional options;
2. Financial options;
3. Economic Instruments options;
4. Social Inclusion options; and
5. Private Sector Participation options.

Legal & Regulatory Options

Laws and regulations for the solid waste sector stipulate the requirements that all waste generators need to meet. They elaborate on the roles, responsibilities, and authorities that each level of government has relative to the solid waste system. They also establish how the private sector can participate as an agent of government to build, own, and/or operate solid waste systems.

Sint Maarten has many gaps in its legislative coverage for the solid waste sector. Also, the laws are not accompanied with regulations that spell out standards and requirements in detail. Annex 4 on Legal/Regulatory and Institutional Arrangements discusses the points of clarity in the main solid waste law, as well as the other legal issues needing resolution.

Aside from specific law for the solid waste sector, laws that provide clarity on private investor's rights, establish clear rules for contract arbitration, establish the rights of association and contracting at different levels of government, create government rules for raising infrastructure bonds, and define liability coverage are part of the general legal framework for doing business that could support the solid waste sector.

Legal and regulatory arrangements include national law, municipal law, and related regulatory and enforcement systems. The consultant recommends to complete drafting the newly being revised law, taking into consideration the consultant's revisions and additions for in within this report.

Following the development of the national law, a comprehensive set of national regulations are needed. The law lays the foundation of policy and provides overarching guidance. The regulations would set out the precise standards, specifications, systems, tariffs, and other requirements to be met.

Once the solid waste national law is finalized and enacted, there may need to be some changes in municipal ordinances, where they may exist, to make them fully compatible with the new national law. In any case, the new solid waste law would supersede municipal ordinances or codes.

Institutional Options

Currently, Sint Maarten does not have an institutional arrangement that could seamlessly implement the solid waste management systems that the country needs. The structures and entities are not established and the capacity is not available.

There exists no separate Waste Management Authority (WMA) established specifically for waste management in Sint Maarten. Solid waste collection and disposal operations are under the management of Ministry of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI), which also handles infrastructure planning and development.

Environmental permits issuance and enforcement in spatial development and environment are under responsibility of VROMI, it also provides environmental control on solid waste management activities.

Within the current waste management system, VROMI is not able to control the SWM system wholly because it does not have sufficient resources such as budget, human resource and legal infrastructure. Therefore, SWM components of collection/transport and disposal as well as recycling activities remain uncontrolled. The current system does also not support to secure the full-cost recovery of SWM operations.

Institutional Arrangements and Governance Framework are described separately in Annex 4 of this report. In summary, separate bodies are needed as follows:

- A service entity, such as a solid waste authority, to conduct the planning, siting, design, tendering, operations oversight, public education, customer relations and cost recovery for solid waste service delivery to be achieved. The service entity has an inspection role to issue warnings and notices to waste generators and waste contractors and licensees.

- A regulatory entity, such as a Ministry department or a utility regulatory supervising bureau, to provide inspection and oversight of the laws and regulations, to assure that the solid waste service organization conducts its business appropriately.

- A judicial entity, such as a municipal court, that would process the enforcement of the civil warnings and notices issued by the service entity. If the issues are not civil, but criminal under the law, existing judicial systems would handle through their prosecutors. Illegal disposal of hazardous waste or deliberate pollution acts are possible criminal offences.

Financial Options

Financing of investments and operations can come from many sources, whether loans, bonds, private sector funds, government's general revenues, waste generator user charges, gate fees to use solid waste facilities, environmental taxes on trade licenses, private hauler and service provider license, penalties for those not addressing legal requirements, carbon credits, and/or waste processing by-product sales.

As no financial instrument, except government subsidy and waste collection fee collected from commercial waste generators by private hauler companies, no cost recovery is secured in Sint Maarten. There is also no complete full cost accounting and billing system in SWM of the country.

Additionally, there are financial options for how government would choose to disburse viability gap financing. Some possibilities are:

- Construction grants to help cover capital costs of service providers over the construction period;
- Minimum revenue grants to compensate service providers for shortfalls in projected revenue;
- Operational grants to address the expenditure and revenue gap, when user charges and tipping fees are not able to be adequate to cover operating costs;
- Annuity payment mechanism paid periodically by government to the service providers for specified expenditures.
- Guarantees to service providers for credit, market demand for services, market demand for processing by-products, revenues from users and sales of by-products, and rate adjustments related to changes in government legal or contractual requirements.

Economic Instruments

Economic instruments are market-based incentives and disincentives that mobilize the self-interest of consumers, producers, recyclers, and service providers to improve solid waste management. These incentives and disincentives embrace the polluter-pays principle of covering the costs of environmental externalities from the combined population of waste generators – not necessarily from each waste generator based on quantity and pollution hazard per generator. They also embrace the 4 Rs of reduce, reuse, recycle and recover as priorities in the waste hierarchy over disposal. Many economic instruments are focused on developing revenues, with examples such as:

- Developing industrial demand for waste-derived by-products of waste processing (e.g., paper, metal, glass, plastic, rubber, used oil, recycled concrete aggregate, recycled asphalt aggregate, wood, and compost);
- Carbon trading (e.g., offsets of fossil fuel energy generation by waste-to-energy facility, landfill gas avoidance by biological conversion and thermal conversion, landfill gas capture and recovery or flaring, offsets of inherent energy in materials by recycling);

- Renewable energy preferential pricing (e.g., biological digestion of waste to methane gas, incineration to steam and electricity, gasification or pyrolysis to synthetic fuel, refuse derived fuel for direct co-burning in industrial boilers or cement kilns);
- Preferential procurements of products with recycled content and products that are taken back for refurbishing after use;
- Deposit refunds programs for recyclables (e.g., lubricating oil, tires, car batteries, beverage containers);
- User charges that influence waste generators to reduce their waste production;
- Disposal gate fees and/or landfill taxes that influence waste generators and industries to minimize disposal.

Economic instruments have potential for providing incentives to the most desired solid waste actions and providing disincentives to the least desired solid waste actions. Incentives include special pricing policies for renewables to be purchased for power grids at higher rates than fossil fuels. Disincentives include landfill taxes on the quantity of total waste received at landfills. The various categories of economic instruments are briefly outlined below.

A) Revenue generating instruments generate income from consumers, producers and service providers from:

- Charges (e.g., tipping fees - gate fees, waste generation fees, waste service user charges, contractor and waste generator business licensing fees),
- Taxes (e.g., landfill taxes, municipal taxes/fees, product taxes on packaging and plastic bags, taxes on nonrenewable fuels).

B) Revenue providing instruments enable producers and service providers to obtain income from government through:

- Tax reduction to investors (e.g., customs duties, corporate income taxes),
- Fiscal incentives including accelerated depreciation (e.g., to investments in equipment that enables use of recycled feedstock in industry, to investments in resource recovery facilities),
- Development rights (e.g., to developers mitigating the environmental & health impacts),
- Concessions for processing wastes (e.g., marketing rights to recovered materials or resources from wastes), and
- Funds (e.g., ozone funds, carbon funds, priority organic pollutant funds).

C) Non-revenue instruments motivate without generating or providing revenues, using means such as:

- Emission trade-off arrangements (e.g., sulfur dioxide, nitrous oxide, carbon),

- Deposit-refund systems (e.g., tires, aluminum cans, glass beverage bottles, lubricating oil),
- Product stewardship and take-back systems (also called extended producer responsibility - EPR, and including take back of computers, printer cartridges, cell phones, used car batteries, farm produce crates),
- Production and product change incentives (e.g., to enable use of recycled material as manufacturing feedstock, or use of refuse-derived fuel in industrial boiler or cement kiln systems),
- Convenient collection points (e.g., supermarket collection of recyclable cans, bottles, plastic bags and batteries; vehicle gas and repair station collection of tires and used oil)
- Bans on certain projects (e.g., thin plastic film bags, incandescent light bulbs)
- Performance disclosure in contracts (e.g., use of recycled materials in construction, use of energy from waste, use of equipment with refurbished/recycled components),
- Performance disclosure in industrial waste reduction (e.g., internet lists of company reduction and stewardship, government list of industrial polluters and industrial successes, recognized certification of green companies),
- Liability law (e.g., reduction of hazards by use of goods with minimal hazard content, liability projection to contractors using recycled construction/demolition aggregates approved for use), and
- Preferential procurement policies (e.g., products with recycled content, minimal hazard content or refurbished component content, construction materials from recycled demolition wastes, products with take-back arrangements).

Social Inclusion Options

Social Inclusion provides opportunities for all people be included in the solid waste services and livelihood opportunities created, and also seeks to protect people whose livelihood and residence could be at risk by a new solid waste facilities or services (e.g., the livelihood of existing informal sector waste recyclers).

Special measures could seek to include certain groups, such as women or displaced people (if a case in Sint Maarten), in solid waste system's opportunities. Groups of women could be organized to monitor that waste collection is well done, or they could even be organized into micro-enterprises to establish private collection service in return for payment.

Social inclusion also provides opportunities for all people to have a voice in the process of planning, siting, design, and operation of solid waste activities. Types of public involvement include:

- surveys of public needs and willingness to pay, consideration of affordability, discussion of public preferences;

- siting criteria discussions, public review of facility siting and planning at various stages;
- public information of tendering processes and schedule;
- public comment on environmental impact assessments and public input to mitigative measures.

One approach for long term public involvement could be a citizen task force representative of key stakeholders that could meet regularly with government to help guide government's public involvement activities.

Private Sector Participation Options

For purposes of this document, we use the term Private Sector Participation (PSP) as the overarching term. PSP in government infrastructure and services can take many forms, as discussed below.

Private Sector Outsourcing (PSO) is conducted through service contracts, management contracts, concessions, and leasing are traditional methods where government pays for solid waste activities to be conducted. It is also possible to arrange contracts that do not involve payment by government, such as licensed open competition or giving the private sector a franchise to handle the activities and obtain the user fees for a zone.

Public-private partnership (PPP) involves setting up a long-term joint venture or contract arrangements where a private-sector party invests in a facility to provide public service to or on behalf of the public sector. In a PPP the public sector may provide major assets or significant capital investment.

However, most private sector participation in Sint Maarten should be done through private sector outsourcing methods. The wide array of these options is outlined below, and explained comprehensively in Chapter 4.2.2:

- Licensed Open Competition (also called Private Subscription);
- Franchise Agreement;
- Service Contract;
- Lease or Divestiture Agreement coupled with Service Agreement;
- Management Contract;
- Concession Contract.

None of the private sector participation methods discussed above are "privatization", which is defined as the full transfer of former public infrastructure and service responsibility to the private sector. In general, privatization is not done for the solid waste sector, because it is not a natural monopoly as you would see for managing a water supply watershed, sewerage piping network, electricity grid, telecom network, or air traffic control system. The system is largely based on facilities that have modest economies-of-scale and on collection by a fleet of vehicles that have no economies-of-scale.

<u>Disaster Response & Recovery</u>

Prepare a mor robust "Disaster Response and Recovery Plan (DRRP) which addresses the response and recovery phases activities in accordance with the

major SWM phases of "i) Generation, ii) Collection, iii) Transportation, iv) recovery/recycling and v) disposal". DRRP should include the principles in "Waste Management Guidelines of Joint UNEP/OCHA Environment Unit.

COVID-19 Pandemic Related Risks:

The main risks in waste management related COVID-19 implication are:

- Risk of uncontrolled dumping and open burning of healthcare and infectious waste, with consequent health and environmental impacts;
- Health and protection risks (including heightened social stigma) for waste management personnel, including those employed in the informal (or unregulated) waste management sector formed by the most vulnerable (women, children, people on the move, etc.);
- Loss of livelihoods for waste pickers or workers employed by informal recyclers, if recycling is discontinued;
- Adverse health and environmental impacts linked to the uncontrolled disposal of masks and other personal protective equipment (PPE).

RECOMMENDATIONS FOR ENABLING FRAMEWORK ARRANGEMENTS

Legal & Regulatory

- Define the potential involvement of private sector as agents of government in meeting service needs;
- Describe issues of social inclusion, labor protection, health, safety and environmental protection;
- Establish incentives, and define disincentives and potential for sanctions under the law;
- Legally organize improved control over waste generator behavior;
- Finalize development of a country solid waste law;
- Develop related regulations under the solid waste law;
- Create legally developed standards and regulations on separate collection of recyclables, pre-processing and processing;
- Define the "Residual'', ''Reuse'', ''Separation for Reuse'', ''Source Separation'' in the law;
- Itemize the waste classes in the current Solid Waste Law;
- Develop to amend a detailed Recovery Policy Framework to the enhanced Solid waste Law;
- New Regulations should have comprehensive environmental response, compensation and liabilities;
- New Regulations should govern most of the environmental mission/operational related and closure-related compliance activities;
- Establish a Comprehensive Life Cycle and End-of-Life criteria with the regulations;
- Develop a generic carbon credit system on reuse or recycle of the recovered materials;
- Prepare a Legal Framework for Management of WEEE e-waste;

- Prepare a safeguard policy specifically for management of WEEE, which addresses Basel Convention and ILO rules;
- Employ with an amendment EU Directive 75/442/EEC (Eu, 2002a) for comprehensive WEEE e-waste definitions in the relevant environmental and Solid Waste legislation / regulations;
- Specify the roles and responsibility of the following stakeholders in the legislation and regulations;
    - Generator / Producer
    - Exporter / Importer
    - Collector / Transporter
    - Treatment operator
    - Regulatory Agencies (Local / National).

Institutional

- Assess separately the capability and capacity of Department of Infrastructure Management (DOIM) of VROMI for management of solid waste system;
- Train VROMI staff and Waste Management Operators both in collection and disposal sides;
- Actively examine the creation of a new solid waste authority (ISWMA), and implement the activities on developing its capacity;
- Create improved staffing for ISWMA.

Financial & Economic

- Set a tariff system by an independent authority for solid waste services, including collection, treatment and disposal such as flat and variable user charges, landfill and ISWMF gate fees;
- Tariffs set should be reviewed in every five (5) years, and updated;
- Develop a tariff cost recovery mechanism, tied to the framework of the new solid waste law;
- Ensure that distribution of the fund be clearly stated between the solid waste management components;
- Establish a reliable billing system;
- Establish a reliable accounting system which tracks all solid waste management activities in the country, expenses and revenues;
- The fees collected for solid waste management should be kept separate from the funds of other services, and should be used only for the development of the sector;
- Establish trade license fees for private waste collectors and recyclers;
- Develop a tool to calculate SWM costs, taking into account the financial sustainability and performance indicators;
- Establish a waste collection database, and provide access to the public
- Provide data availability by ensuring access and updating regularly;
- Develop revenue, generating, revenue providing and non-revenue instruments.

Social Inclusion, Public Awareness and Gender Mainstreaming

- Conduct robust research on the informal waste sector for formalizing it in the country;
- Develop public awareness programmes;
- Hire staff to be community liaison specialists who conduct public information as part of both the VROMI's waste management staff and the new institutional structure for waste management;
- Provide public education of the changes in the legal and regulatory arrangements in order to clarify roles and responsibilities of all parties in waste management;
- Create a system for handling and tracking complaints and suggestions (GRM);
- Create a website for the public to know all requirements, contact points, system schedules and deliverables, fees;
- Provide public education to children, adults, and commercial establishments on the need for and value of recycling;
- Support collaborative efforts of CBOs and NGOs which involve in waste management activities through the main waste management authority;
- Provide policy support be in place in accordance with the waste management programmes and strategies prepared and applied by VROMI or new ISWMA;
- Assure that there are specifications for performance focused on inclusion and gender mainstreaming in the contracts;
- Conduct awareness programme to enlighten the public on disposing the contaminated PPE materials at haphazard due to COVID-19.

Private Sector Involvement

- Support, oversee, control, and regulate the private sector participation and their activities in solid waste management without reducing their involvement by a holistically prepared government programme;

Disaster Response

- Prepare more robust "Disaster Response and Recovery Plan (DRRP)" which addresses the response and recovery phases activities in accodance with the major SWM phases of "i) Generation, ii) Collection, iii) Transportation, iv) recovery/recycling and v) disposal", and include in DRRP the principles in "Waste Management Guidelines of Joint UNEP/OCHA Environment Unit; ;
- The response to and preparedness for the disaster should have phased approach of i) Phase 1 – immediate and short term actions, ii) Phase 2 – medium term actions, iii) Phase 3 – long term actions, and iv) contingency planning, taking into account the vulnerable and fragile Sint Maarten economy against disaster situations and worldwide economic shocks.

COVID-19 Pandemic Resilient SWM Management

The rapid expansion and reorganization to respond to COVID-19 also emphasized the need for a strong workforce as an integral part of the health system in all countries Considering the limited resources for COVID-19 related interventions, the following

measures are recommended to be in place during pandemic period in waste management for eliminating the risks during pandemic.

- Develop a situation analysis on COVID-19 risks appeared;
- Support the continuity of waste management activities during pandemic;
- Support the waste collectors to provide hygiene products/kits for their workers during waste management activities, providing financial support;
- Ensure that waste collectors and informal recycling sector employees (including migrant workers) have access to hygiene products/kits and personal protective equipment for avoiding the COVID-19 contamination, providing financial support;
- Ensure that the healthcare waste is collected by dedicated staff/employees with suitable PPE;
- Ensure that contaminated healthcare waste is handled adequately and separately in accordance with VSA's regulations put in effect during pandemic;
- Track and monitor the pandemic related waste; and
- Conduct public communication campaign on disposing of pandemic related waste.

SCHEDULING OF THE PLANS

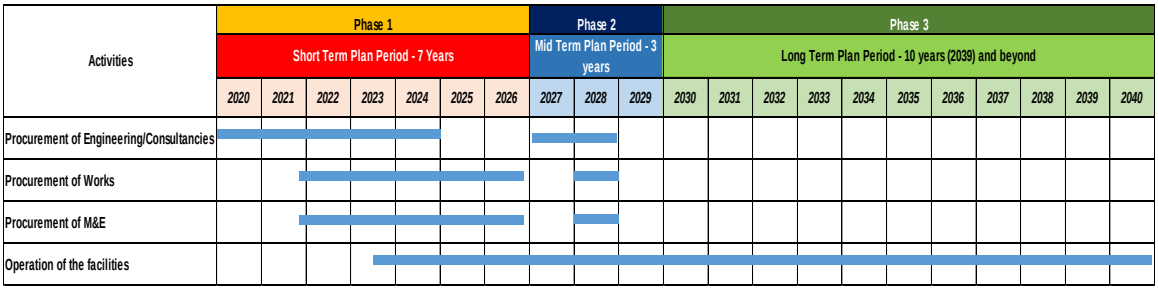
As this strategy is a long-term planning instrument, plans in this strategy considered the applications in long-term within the normal conditions as well as considering extraordinary, but temporary conditions despite the fact that it cannot be predictable how many times those will continue. However, all short, mid and long term needs of ISWMS are planned to be implemented within expected time schedule, as discussed with the WB team and Government.

PLANNED ACTIVITIES & IMPLEMENTATION BY PHASES

The project comprises the following sub-projects and activities by phases based on discussions conducted from the project's early stages until now with Government of Sint Maarten and WB team.

1. Phase 1: Short term plan period activities, and related sub-projects;
2. Phase 2: Mid term plan period activities and related sub-projects; and
3. Phase 3: Long term plan period activities and related sub-projects.

Short term plan period activities and related sub-projects also comprise the priority activities, and the related sub-projects that will be delivered in the Short Term plan period from 2020 until end of 2026. Mid term plan period activities is planned to be completed until the end of 2029. The long term plan period activities will comprise only running of the facilities and some studies for modification of the projections according to technical, environmental and social requirements that will be emerged during lon term period. See following Figure.



Phase 1: Short Term Plan Period Activities and Related Sub-projects

The following activities indicated as priorities within the seven (7) years from 2020 to the end of 2026) years of this Short Term plan period by Aim Texas as a result of all efforts spent for identifying the needs of the Sint Maarten to have a long term sustainable solid waste management system. These activities and sub-projects would support the medium and long term integrated solid waste management activities.

The Short Term Plan period activities and sub-projects could be implemented under three components, which are as follows:

Component 1: Engineering and Consultancy activities

Component 2: Procurement of Works

Component 3: Purchasing of Machineries and Equipment (M&E)

All engineering and consultancy, construction and M&E purchase have been planned to be completed in short and mid term plan period.

As mentioned earlier, Sint Maarten should also prepare a more robust "Disaster Response and Recovery Plan (DRRP) which addresses the response and recovery phases activities in accordance with the major SWM phases of "i) Generation, ii) Collection, iii) Transportation, iv) recovery/recycling and v) disposal".

For the purpose of this framework, the response to and preparedness for the disaster can be divided into four phases.

1. Phase 1 - Immediate & Shor Tern Actions;
2. Phase 2 – Medium Term Actions;
3. Phase 3 – Long Term Actions; and
4. Phase 4 – Contingency Planning.

Nevertheless, the following studies/activities would be needed to determine in the long term plan period whether to increase design capacity and/or treatment facilities based on the studies/works conducted/procured above, regarding:

- Market development and cost recovery potential for recycling of secondary commodity materials, such as paper, cardboard, plastic, metal, glass, textile, and rubber;
- Market development and cost recovery potential for resource recovery, such as production of compost from resource recovery of putrescible organics, production of refuse derived fuel from resource recovery of combustible materials in wastes, and production of energy from resource recovery of organics;
- Market development and cost recovery potential for processing of residues, including ash and pollution control residues, including sludges and particulates, into usable products;
- Assessing whether the market development and cost recovery potential is adequate to support accepting selected categories of wastes from ships;
- Assessing whether the environmental impact issues of increasing waste quantities handled and expanding on the types of treatment processes added;
- Analysis and extensive dialogue with residents and the tourism enterprises is recommended to assess the extent to which waste systems can be further expanded beyond 2029; and
- A stakeholder-driven study is recommended to assess alternative futures and decide which one best suits the local population.

If the above studies/works result in an outcome that would alter straight-line continuation of the current DBOs it will be necessary to renegotiate the DBOs with the contractors. This could involve adding treatment techniques, or adding additional wastes from new waste

generators (such as cruise ships or the French Collectivity). It could involve altering tipping fees based on new sources of revenues, such as sale of energy to the electricity grid. This would also be the time to examine whether to bundle all tariffs from local waste generators into the electricity bill, as well as to have a segregated account and billing system for the additional waste generators.

To accommodate any changes, a revision of the solid waste entity and local solid waste regulations may be needed. Additional government oversight staff and specialized regulations for new treatment works and their emissions might be needed.

Detailed explanations, projections and concept designs, capacity calculations, and evaluations of the sub-project components of the system are given in Chapter 5 of this strategy. Therefore, it will not be repeated here. A list of sub-projects that are planned to be implemented for ISWMS are given below:

1. Construction of MSW Landfill Upgrade/Extension closure and after care activities and operation;
2. Removal of debris in IDDS;
3. Construction of ISWMF and operation, including optional WTE plant construction and operation;
4. Establishment of TDSR site and operation;
5. Construction and operation of New Landfill;
6. Establishment of C&D waste processing facility;
7. Establishment of port waste receiving facility
8. Collection system improvement;
9. Establishing and operating of Integrated Solid Waste Management Authority of Sint Maarten, and
10. All engineering and consultancies.

EVALUATION THE SWM SYSTEM SCENARIOS

The four system scenarios have been evaluated for establishing ISWMS for Sint Maarten.

Scenario 1:

This scenario would offer no achievement on the current system, and as is situation will continue.

Scenario 2:

This scenario would offer substantial improvements on the current system, and would suggest to:

- Conduct legal/regulatory and institutional reforms, establishing a separate integrated waste management authority (ISWMA) for the country;
- Improve MSW Landfill with upgrading and extension;
- Establish a new landfill as the current MSW landfill life would be at most 7-8 years with upgrading;
- Establish TDSR facility for processing the accumulated scrap tire, scrap glass, and wood waste;
- Establish a separate C&D waste processing facility for separately handling the C&D waste;
- Regulate the collection system and local recycling market;
- Set a tariff system, enforcing collection and disposal fee for a self-sustain SWM system, and develop financial framework;
- Regulate the incentives and disincentives, putting in place all financial and economic measures recommended in this strategy;
- Provide social inclusion in waste management, conducting activities for supporting the NGOs and CBOs for their involvement in SWM activities;
- Develop public awareness programs;
- Support the private sector for their involvement in solid waste management; and
- Take disaster response measure recommended in this strategy.

Scenario 3:

This scenario would offer substantial improvements as in Scenario 2 in the current system, and would suggest to establish additional integrated solid waste management facility (ISWMF) with only the MRF part.

Scenario 4:

This scenario would also offer substantial improvements as in Scenario 3 in the current system, and would suggest to add the WTE plant to integrated solid waste management facility (ISWMF) together with MRF facility.

Evaluation of the Scenarios

The scenarios are also evaluated based on their intrinsic advantages and disadvantages in the following traffic light rating comparison with a set of cost, sustainability, technical and enabling system criteria.

Although the comparative assessment below suggests that Scenario 3 presents most preferrable set of options, considering the local physical conditions, local and regional market demand, size of local economy which does not strongly support the circular economy for locally recycling the total recovered waste, Scenario 4 is determined as preferred scenario by the consultant.

Traffic Light Rating Comparison of the Scenarios					
Criteria		Scenario 1	Scenario 2	Scenario 3	Scenario 4
I.	**Cost Criteria**				
	Capital Investment Cost	🟢	🟢	🟡	🔴
	Recurrent cost affordability	🟢	🟡	🟡	🟡
	Cost Recovery	🔴	🔴	🟢	🟡
	Local & Regional Market demand for by-products	🟡	🟡	🟢	🟢
II.	**Sustainablity Criteria**				
	Compliance to Project's objectives	🔴	🟡	🟢	🟢
	Compliance to ISWMS Governance Principles	🔴	🟡	🟢	🟢
	Compliance to 4R's principles	🔴	🟡	🟢	🟢
	Provide Environmental Quality protection	🔴	🟡	🟢	🟢
	Provide Public Health protection	🔴	🟡	🟢	🟢
	Consider the Socio-cultural preferences	🔴	🟡	🟢	🟢
	Response to Existing Environmental & Social Impacts	🔴	🟡	🟢	🟢
	Resource Conservation	🟡	🟡	🟢	🟢
	Climate Change effect	🔴	🟡	🟢	🟢
	Disaster Response	🔴	🟡	🟢	🟢
II.	**Technical Criteria**				
II. i)	**Generation**				
	Source Reduction (waste minimization) measures	🔴	🟡	🟢	🟢
	Encouraging the reuse and upcycling	🔴	🟡	🟢	🟢
	Use of biodegradable packaging materials	🟡	🟡	🟢	🟢
	Encourage composting of organic (food waste) at source	🔴	🟡	🟢	🟢
II. ii)	**Collection & Transport**				
	Collection system optimization & Improvement	🔴	🟢	🟢	🟢
	Separate collection of recyclables	🟡	🟢	🟢	🟢
	Regulate the collection system	🔴	🟢	🟢	🟢
II. iii)	**Recycling , Recovery & Treatment**				
	Regulate the recycling market, developing a strategy to integrate them in the waste management system of the country	🔴	🟡	🟢	🟢
	Provide a central MRF with composting facilty to support the recycling market and other waste recycling, recovery and treatment activities	🔴	🔴	🟢	🟢
	Provide a facility for energy recovery from separated waste (WTE)	🔴	🔴	🔴	🟢
	Provide a separate C&D waste processing facility	🔴	🟢	🟢	🟢
	Establish coordination between collectors and recyclers	🔴	🟢	🟢	🟢
	Develop systems for bring back, buy-back, bring banks & drop-off centers	🔴	🟡	🟢	🟢
II. iv)	**Disposal**				
	Upgrade the existing MSW landfill with necessary machineries and equipment	🔴	🟢	🟢	🟢
	Remove the debris in IDDS, separating the recyclable fractions and soil that can be used for daily cover material in MSW landfill	🔴	🟢	🟢	🟢
	Establish a new landfill site for use after 2028 - 2029	🔴	🟢	🟢	🟢
III.	**Enabling Systems Criteria**				
III. i)	**Legal & Regulatory**				
	Provide improved and adequate legal infrastructure for SWM	🔴	🟢	🟢	🟢
III. ii)	**Institutional**				
	Provide institutional reform for SWM, establishing ISWMA	🔴	🟢	🟢	🟢
	Provide training for capacity building of SWM staff	🔴	🟢	🟢	🟢
III. iii)	**Financial & Economic**				
	Set a tariff system, including for collection/transport, treatment & disposal	🔴	🟡	🟢	🟢
	Establish a reliable accounting and billing system	🔴	🟢	🟢	🟢
	Establish a waste collection database, and provide access to the public	🔴	🟡	🟢	🟢
	Develop revenue generating, revenue providing and non-revenue instruments	🔴	🔴	🟢	🟢
III. iv)	**Social Inclusion, Public Awareness and Gender Mainstreaming**				
	Develop public awareness programmes, creating a web site	🔴	🟡	🟢	🟢
	Create a system for handling and tracking complaints and suggestions (GRM)	🔴	🟡	🟢	🟢
	Support collaborative efforts of CBOs and NGOs on SWM activities	🔴	🟡	🟢	🟢
	Provide policy support for waste management programmes and strategies	🔴	🟡	🟢	🟢
III. v)	**Private Sector Involvement**				
	Support, oversee, control, and regulate the private sector participation in SWM	🔴	🟡	🟢	🟢

FINANCIAL & ECONOMIC ANALYSIS

This section provides financial and economic analyses on project's financing, cost evaluation of the project elements in order to ensure the economic viability of the recommended options in this report. The section also analyzes the affordability of the services that will be provided by the project as a whole in financing and economic point of views.

FINANCING

CAPEX Financing

It is envisioned that initial major works for facilities and start up facility equipment, both mobile and stationary equipment, are considered CAPEX. For purposes of long-term contracts by DBO (i.e., design, build, transfer ownership, and operate), such as those for 20 years to implement a disposal or treatment facility, the initial works and goods would be financed as CAPEX.

CAPEX is commonly covered by a combination of grants and loans, provided by a combination of Government, Bi-lateral donors, and international development banks. To illustrate, potential CAPEX financing in Sint Maarten might come from a combination of Sint Maarten Government, the Netherlands, and the development banks of World Bank or other international financing institutions. Private sector financing is possible, and the Port Authority or a combined group of ship owners are possible contributors to CAPEX financing. If the facility appears to provide an improved base of renewable energy, possibly CAPEX financing from the electricity company is possible.

OPEX Financing

For a self-sustained SWM system, some economic instruments have considered to be in place for recovery of system operation costs, and those are mainly flat and variable user charges, tipping fees in Landfill and ISWMF, revenues from selling of recyclables sorted in ISWMF, and revenue from selling of energy from WTE to country's electricity grid.

Subsidies may also be needed for some services, rather than assuming full cost recovery. In initial 2-3 years of full system operation some costs, especially system management costs (ISWMA OPEX), cost of area cleaning, a part of collection cost such as cost of collection and transport of waste from schools would be subsidized by the government, using the fund obtained from municipal and utility fee, etc.

Unless and until the ship owners contribute waste and financing through related fees, subsidies should be anticipated.

Even though safe disposal and treatment is essential a public good, for the public protection of the environment, it is normal to link its cost recovery to waste generators through collection and tipping fees. However, such fees would normally be less for

households and small commercial establishments being served by contractors, and probably higher for large commercial establishments, airports, ports and ships.

Cost Recovery Mechanism

The costs of daily operations will be covered through the fee structures which would primarily would include:

- Tariffs to waste generators that receive door-to-door or curbside collection of wastes on a regular basis;
- Pick-up and haulage fees to waste generators that receive direct service to special wastes, such as construction/demolition debris, bulky waste, landscaping waste, and animal wastes;
- Tipping fees from waste collectors under contract and to licensed private haulers for wastes discharged at the official transfer, disposal, and treatment facilities;
- Special taxes or fees arranged for charging the shipping port, airport, and ships for their share of services related to the wastes of their customers; and
- Regular subsidies from Government related to the general clean-up of the streets and public areas, and for support of recycling and other activities that are related to the general public good.

Because of the unique nature of solid waste management as a largely public good, the cost recovery system is normally appropriately arranged to come from a wide range of sources. For example, some could come through property rates or other types of taxes, even environmental taxes. Some financing might come from climate change financing that is globally available or through emissions trading of carbon. Even though safe disposal and treatment is essential a public good, for the public protection of the environment, it is normal to link its cost recovery to waste generators through tipping fees. However, such fees would normally be less for households and small commercial establishments being served by contractors, and probably higher for large commercial establishments, airports, ports and ships.

A unique condition of waste collection costs, is that it costs much more to collect waste from small and poor households that it does from large and rich households. Access conditions, small quantities, less convenient containers, etc. affect the costs per tonne, making them much higher for service to the small and poor establishments. As a result, collection costs need to be graduated so that they take into consideration ability to pay, rather than estimated cost per tonne. Cross subsidies are expected to be arranged in the tariff system, so that larger and richer waste generators provide more revenue per tonne than the smaller and poorer waste generators. Subsidies may also be needed for some services, rather than assuming full cost recovery. Subsidies need to be carefully examined relative to the various costs that are public goods and also the various customers and their ability to pay. In general, in developing countries, full cost recovery is not expected. Unless and until the ship owners contribute waste and financing through related fees, subsidies should be anticipated.

Each of the recycling and resource recovery processing activities raise the costs, and are due to the lack of available land. They are due to the number of people that come to Sint Maarten and push the environment to handle waste quantities well beyond the limits of the island's natural resources. The tiny population of Sint Maarten would not have this issue of cost and cost recovery if it were not for the very large number of visitors, as it is in the COVID-19 situation. Therefore, it is reasonable and recommended that there be special dedicated revenues from the ports and airport that directly support the solid waste system, rather than simply go into the general revenues without being dedicated to support sustainable solid waste management.

If desired, tariff bundling is one way to expeditiously collect tariffs for waste collection and safe disposal. Bundling with a service that can be shut off is normally preferred, such as the water or electricity tariff. Both of these services usually have less demand from smaller and poorer establishments, so there is a built-in potential for cross-subsidy. It may be that the electricity tariff would be preferred, if the system is developed to create renewable energy from the waste.

The bundling partner would add the solid waste fee to their normal billing and collect the bundled fees. They would keep a commission, possible 2-5%, for their efforts and provide the remainder to the solid waste entity to help cover the costs.

COST EVALUATION

The evaluation covers Short, Medium, and Long Term plan period activities and sub-projects, including engineering and consultancies, works, purchasing of M&Es, and establishing of ISWMA on CAPEX and OPEX.

Total CAPEX

Below is the summary of system CAPEX, and detail CAPEX estimations are given in Chapter 6 and Annex 5 of this report. The total CAPEX of the system has been evaluated on 10 system components as shown in the following Table. The total CAPEX of the system would come true around US$ 97.25 million without WTE option, and US$ 170.25 million with WTE option with the proposed actions/activities for implementing ISWMS for Sint Maarten.

	Description of Activities	Total Cost	Phase 1 Short Term Plan Period	Phase 2 Mid Term Plan Period	Phase 3 Long Term Plan Period
			2020 - 2026	*2027 - 2029*	*2030 -2040*
		US$	*US$*	*US$*	*US$*
1	Establishing ISWMA	*348,500*	*348,500*		
2	Engineering & Consultancy	*3,135,000*	*3,135,000*		
3	MSW Landfill Upgrade/Extension, Closure and After Care	*40,426,539*	*30,042,946*	*7,883,593*	*2,500,000*
4	Irma Landfill Debris Removal Cost	*11,111,475*	*11,111,475*		
5	ISWMF with WTE	*23,926,750*	*23,926,750*		
	CAPEX - with WTE	*96,926,750*	*96,926,750*		
6	TDSR	*3,447,700*	*3,447,700*		
7	New Landfill Construction	*10,235,300*	*0*	*10,235,300*	
8	C&D Waste Processing Facility	*3,500,000*	*3,500,000*		
9	Port Waste Receiving F.	*500000*	*500000*		
10	Collection System Improvement	*620,000*	*620,000*		
Total CAPEX without WTE		***97,251,264***	***76,632,371***	***18,118,893***	***2,500,000***
Total CAPEX with WTE		***170,251,264***	***149,632,371***	***18,118,893***	***2,500,000***

Total OPEX

The OPEX evaluation of the system has been conducted on seven components as seen in the following Table, which are i) ISWMA, ii) MSW landfill in Pond Island, iii) ISWMF of Sint Maarten with WTE and No WTE options, iv) TDSR facility, v) New Landfill, vi) C&D waste processing facility, and vii) waste collection system. The OPEX analyses revealed that system total operating cost would be around US$ 202.49 million without WTE option from 2020 to 2040, and US$ 271.31 million with WTE option, respectively.

	Project Components	Total Cost	Phase 1 Short Term Plan Period, 7 Years	Phase 2 Mid Term Plan Period, 3 Years	Phase 3 Long Term Plan Period, 10 to 25 Years
			2020 - 2026	2027 - 2029	2030 - 2040
		US$	US$	US$	US$
1	System Management Cost through ISWMA	18,774,000	2,898,000	3,402,000	12,474,000
2	MSW Landfill in Pond Island	15,789,050	10,720,750	4,353,300	715,000
3	ISWMF with WTE	128,216,588	7,425,136	21,724,704	99,066,748
3a	*Operating Cost of ISWMF with No WTE*	**59,401,088**	**7,425,136**	**11,137,704**	**40,838,248**
4	TDSR	3,031,983	3,031,983	0	0
5	New Landfill Construction	17,799,650	0	0	17,799,650
6	C&D Waste Processing Facility	21,908,407	4,381,681	3,755,727	13,770,999
7	*Collection System*	65,787,632	17,723,288	9,473,341	38,591,003
Total OPEX of the SWM system without WTE		**202,491,810**	**46,180,838**	**32,122,072**	**124,188,900**
Total OPEX of the SWM system with WTE		**271,307,310**	**46,180,838**	**42,709,072**	**182,417,400**

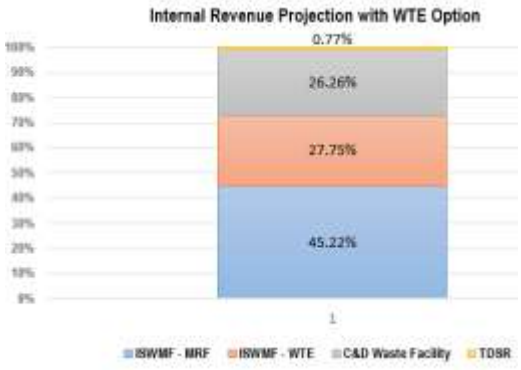
INTERNAL REVENUES THAT PROPOSED FACILITIES COULD GENERATE

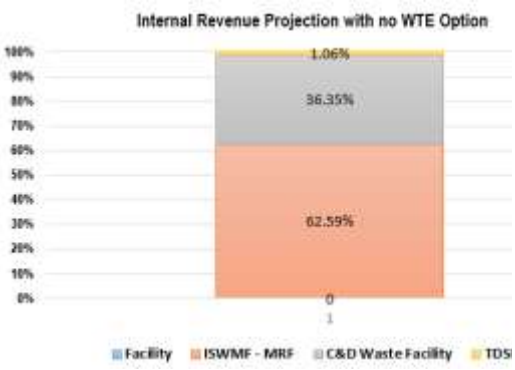
The projected SWM system would be capable to obtain internal revenue through selling of separation and pre-processing of a part of recyclables, mulch and wood briquette produced from wood waste, compost from bio-degradable waste, RDF, and selling the electricity to national power grid by producing energy from waste (EFW) during operation of ISWMF. The facilities that could generate internal revenue form their activities are mainly 1) ISWMF of Sint Maarten with WTE or without WTE, 2) C&D waste processing facility, and 3) TDSR for a short period. Internal revenue generation for other facilities such as MSW landfill, New Landfill, and collection system cannot be expected as they require the service fee or any other financial instrument in order to keep them operational.

The Consultant had a research on market prices of recyclables and other materials to be recovered, and the following internal revenue projection by phases has been conducted with WTE option and without WTE option for the project period of 2021 - 2040.

Estimated total internal revenue with no WTE option would come true around US$ 101.95 million, while it would be around US$ 141,11 million with WTE option. The following Figures also show the internal revenue percentages by facility with WTE and no WTE options.

	Short Term	Mid Term	Long Term	Total
Sale of Recyclables, form MRF - thsd. US$	*5,489*	*8,776*	*49,544*	***63,809***
Sale of electricity to national power grid - thsd. US$	*0*	*6,207*	*32,957*	***39,165***
C&D waste facility - thsd. US$	*5,877*	*6,146*	*25,035*	***37,058***
TDSR - thsd. US$	*1,080*	*0*	*0*	***1,080***
Total Internal Revenue with No WTE - US$	***12,447***	***14,921***	***74,579***	***101,948***
Total Internal Revenue with WTE - US$	***12,447***	***21,128***	***107,537***	***141,112***





EVALUATION OF THE SYSTEM SCENARIOS

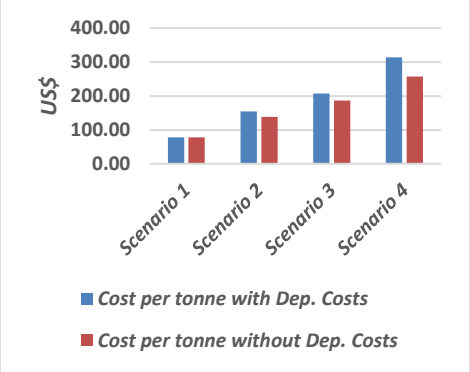
Four scenarios evaluated for SWM system above are also evaluated on full system financial and economic aspects. The advantages and disadvantages are compared in the following Table financial aspects of the scenarios.

Scenarios	Pros	Cons
Scenario 1 *(No Improvement)*	*It would suggest no investment cost, and therefore it requires no capital cost as it suggests no improvement on the current SWM system;* *It would suggest lowest operating cost per tonne.*	*Resource recovery would not be provided;* *It would suggest no financial sustainability;* *It would suggest no cost recovery;* *No internal income from recyclables;* *Suggest no sustainable SWM system from financial / economic and environmental points of view as it provides no cost recovery;* *The scenario would result in highest cash deficit, and government subsidy would continue to increase incrementally;*
Scenario 2 *(Substantial Improvement with no ISWMF)*	*It would suggest low investment cost;* *It would suggest moderate internal income from recyclables;* *It would suggest low operating cost;*	*It would suggest weak financial sustainability with little improvement;* *It would suggest high operating cost;* *It would suggest no full cost recovery;* *The scenario would result in high cash deficit, and user charges would be high;*

Scenarios	Pros	Cons
Scenario 3 *(Substantial improvement with ISWMF, but no WTE Option)*	*It would suggest high internal income from the waste management facilities for cost recovery;* *It would suggest strong financial sustainability;* *It would result in moderate cash deficit during operations, and would suggest low level of user charges;*	*It would suggest high investment cost;* *It would suggest higher operating cost than Scenario 2;*
Scenario 4 *(Substantial improvement with ISWMF, with WTE Option)*	*It would suggest highest internal income from waste management facilities;* *It would suggest strongest financial sustainability;* *It would suggest less cash deficit than other scenarios, and would suggest lowest level of user charges;*	*It would suggest highest investment cost;* *It would suggest highest operating cost;*

As discussed in Chapter 6, the financial evaluations on scenarios' operating cost revealed that the highest per tonne operating cost of the entire SWM system would result in Scenario 4, and the lowest in Scenario 1, see following Table and Figure.

Scenarios	Cost per tonne with Dep. Costs US$	Cost per tonne without Dep. Costs US$	Degree
Scenario 1	77.99	77.99	Lowest
Scenario 2	164.76	149.16	Low
Scenario 3	207.10	186.34	High
Scenario 4	341.20	257.03	Highest



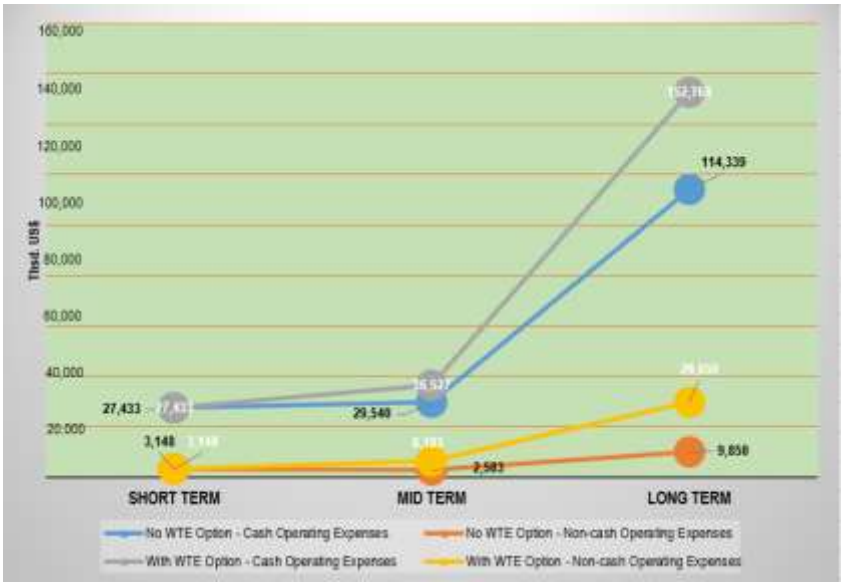
The cash deficit on four scenarios are also evaluated below.

CASH OUT AND CASH DEFICIT ANALSIS

Cash Out

As the most distinguished feature which shows and provides the system's sustainability is the cash flow produced by the system during the operations for sustainable management of any public utility system, and the current SWM system suffers from cash deficit continuously due to lack of adequate improvement and optimization within the operations with unregulated tariffs and generally no tariffs in Sint Maarten, cash deficit which will appear during operations within the scenarios established would be the main indicator. The following Figure also shows that cash out of the system will significantly increase within operation of WTE.

Cash Out of the Improved ISWM System, thsd. US$



SYSTEM FULL CASH DEFICIT ON SCENARIO 3 & 4

The system full cash deficit on Scenario 3 (no WTE Option) and 4 (with WTE Option) is evaluated, and the results are below. Net system cash deficit depicted in the following Table according to Scenario 3 & 4, assuming that the system would generate internal revenue approximately US$ 102 million in total by 2040 with no WTE option (Scenario 3), and US$ 141 million with WTE option (Scenario 4). System "Full Cash Deficit" shows the financial sustainability. The analysis also shows that per tonne average full cash deficit would come true around US$ 31 with no WTE option (Scenario 3), and US$ 42 with WTE option (Scenario 4).

	Short Term	Mid Term	Long Term	Total 20 Years
Full Cash Deficit with No WTE - thsd. US$	*18,134*	*17,201*	*49,610*	*84,945*
Full Cash Deficit with WTE - thsd. US$	*18,134*	*21,581*	*74,881*	*114,596*
Per tonne Full Cash Deficit with no WTE - US$	*25*	*44*	*31*	*31*
Per tonne Full Cash Deficit with WTE - US$	*25*	*55*	*47*	*42*
Per tonne Full Cash Deficit with mark up of 8% per tonne for No WTE Option - US$	27	48	34	34
Per tonne Full Cash Deficit with mark up of 8% per tonne for WTE Option - US$	*27*	*60*	*51*	*46*

GATE FEE ANALYSIS

Landfill Tipping Fee

In general, landfill tipping fee should cover the landfill operating cost and an appropriate margin for covering 8% of operating costs for contingencies and at least 8 - 10% of operating expenses for operational minor mistakes and modifications. As the current and new MSW landfill operation cost is around US$ 29 – 30 per tonne, two landfills' operating

costs (existing MSW and New Landfill) has been assumed to be US$ 30.00 per tonne in the calculations.

Within the planned integrated waste management system, landfills will not have any other revenue sources other than tipping fee, no internal revenue is assumed to be realized during landfills' operation, is assumed that operating costs of the landfills will be covered by tipping fee.

Cost items	Tipping Fee *US$/t*
O&M Cost	30.00
Contingency - 8% of operating cost	2.40
Margin - 10% of operating cost	3.00
Tipping Fee for Landfills – per tonne	**35.40**

Gate Fee for ISWMF without WTE (Scenario 3) and with WTE Option (Scenario 4)

Similar approach to calculate the gate fee for ISWMF is also applied for addition of the contingency (8% of gate fee) and operational margin (10% of gate fee), and 4.54% of operating cost of ISWMA to the gate fee, as the gate fee of ISWMF will cover only cash deficit and additional margins.

Scenarios	*Short Term*	*Mid Term*	*Long Term*
Scenario 3 - with No WTE option - US$ per tonne	*40*	*47*	*46*
Scenario 4 - with WTE option - US$ per tonne	*40*	*63*	*57*

AFFORDABILITY ASSESSMENT

The user charges should vary for households, small and large commercial and industrial waste generators, restaurants/bars, and hotel/resorts. The distribution of user charge between the waste generators by group will require special attention because 19% of waste disposed is households waste, 25% commercial waste, 19% mixed C&D waste, 35% yard waste, and 2% other waste respectively.

According to results of analyzed data of labor force survey of Sint Maarten Statistical Department by 2018, most decreases in the larger income brackets and increases in the smaller income brackets. For the purposes of user charge affordability assessment, including the first three income group in the first quintile, and the last group in above table in last quintile, households in Sint Maarten could be grouped in five income groups (quintiles), which are i) low income, ii) below median, iii) median, iv) above median, and v) upper income levels.

Analyses on statistical department data of household income by groups revealed that average monthly income varies between US$ 280 – 837 per month for poorest and US$ 4,740 - 5,298 for upper income group. Therefore, average monthly income can vary between US$ 0.00 and 2,000 for the low-income group, for median US$ 4,000, US$ 6,000 and for upper income US$ 8,000 and 10,000 plus, respectively.

Analyses also revealed that applying variable rate in accordance with electricity consumption will be more favorable than the flat rate for households in Sint Maarten, as

the electricity consumption will naturally correlate with the income levels and amount of waste generated by the households due to the fact that the more income, the more waste and more electricity consumption. Conversely, applying a flat rate according to 1 or 1.5% of mean average of median group would not be appropriate as the households generates approximately 19 – 20% of total waste in the country.

Households rates cannot be directly applied to commercial, institutional, and industrial waste generators. To correlate the waste fee rate for those, as mentioned before, more specific and comprehensive waste characterization generation analysis for commercial waste generators (restaurants/bars, hotels/resorts, and small retail shops/market) should be conducted in the later stages of the project.

In addition, calculation of total revenue of the system with user charges and other economic instruments (indirect revenue providing instruments) requires more data on central government revenue from municipal/environmental, utility fee, occupancy tax for hotels/resorts, and departure tax in the airport and port/marinas for stay over and cruise arrivals.

However, cash deficit analyses showed that cash deficit would appear approximately US$ 27.00 per tonne of waste received by the system in Phase 1 of the project with WTE option, US$ 60.00 per tonne in Phase 2, and US$ 51.00 per tonne in Phase 3, respectively. Although the deficit levels show the benchmark points for cost recovery, it will still strictly be bound with the application of the schedules recommended, and local and regional market conditions.

The results also suggest that direct revenue generating instruments of US$ 65 – 75 per tonne with WTE option, and US$ 55 – 65 per tonne in average for No-WTE option would provide for full cost recovery of the system. However, the results should be correlated and modified according to results of a new comprehensive waste characterization and detailed social survey within early stage of the project.

ECONOMIC INSTRUMENTS

There exist only two direct economic instruments used in Sint Maarten for providing solid waste management services, one of which is government budget support (subsidy) for waste collection from households, institutions and area cleaning, and disposal managing the landfill (MSW and Irma landfills), and second one is unregulated solid waste collection fee collected by private and unregulated waste collectors. Although the other indirect economic instruments (utility fee, environmental fee, etc.) support the government budget, it is unknown how the budget obtained through indirect economic instruments is allotted for SWM services.

Therefore, the indirect economic instruments are not benchmarked here as they require the legal and institutional infrastructure arrangements that do not exist in Sint Maarten.
A comparison has been conducted in Chapter 6 of this report with the user charge rates in 19 EU countries Vs. direct income generating instrument (user charges) proposed by the consultant with variations in phase basis. The user charges proposed by the consultant are approximately 15% lower than EU average with No WTE option (Scenario 3), and almost equal to EU average with WTE option Scenario 4).

However, roughly estimations on direct revenue instruments (user charges) showed that only user charges could not provide to cover the cash deficit within the new system for both alternative scenarios without contribution of indirect revenue instruments.

Sint Maarten is not capable alone to cope with the results of unusual conditions that will be arisen due to global economic downturns/shocks, and global unusual (COVID-19) and usual regional disaster events (hurricanes, tropical storms, etc.). Therefore, a resilient operational plan should be prepared for all SWM facilities in order to be ready for those situations.

IMPLEMENTATION PLAN (ACTION PLAN)

The project implementation period is planned to be realized in three phases, which are:

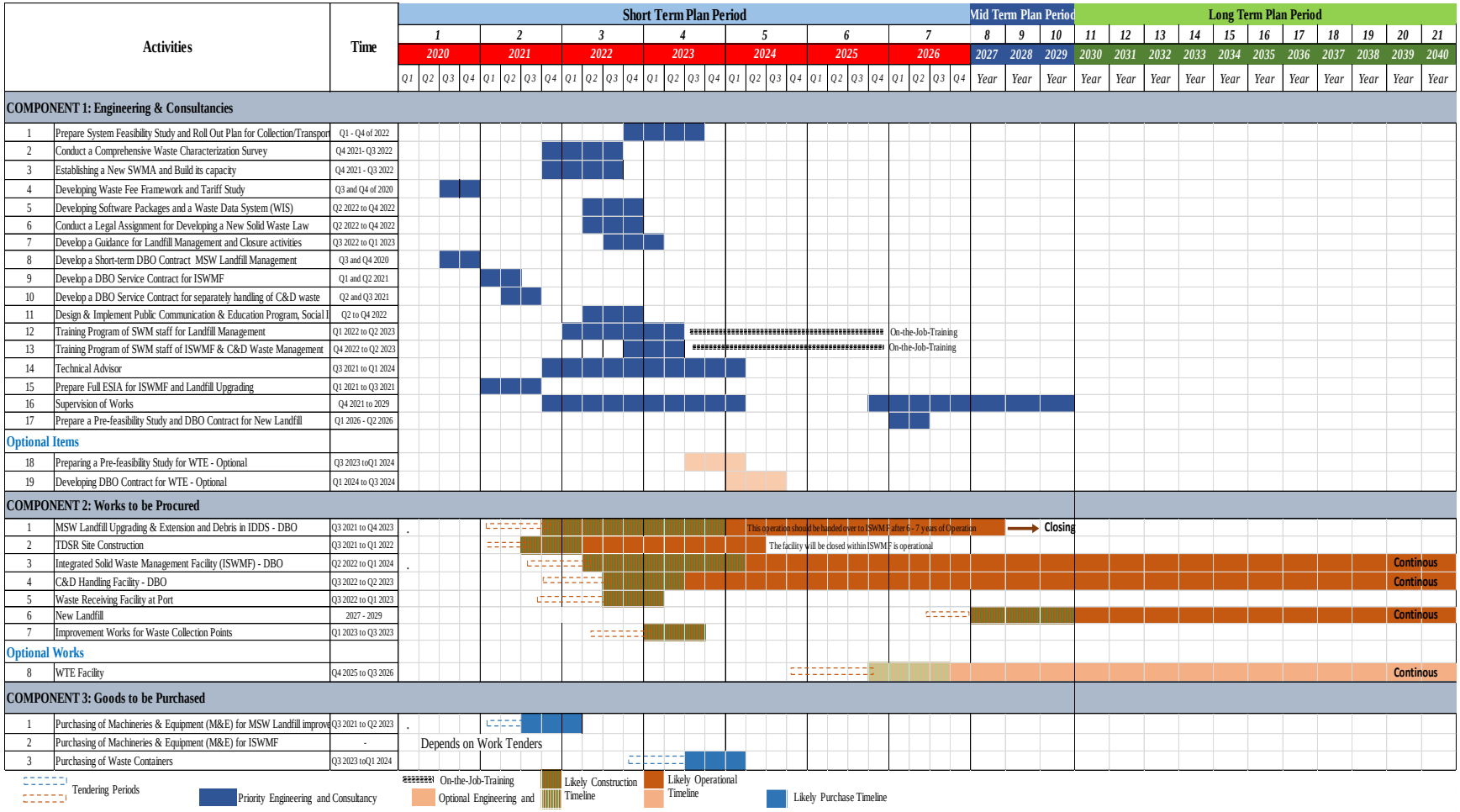
Phases of Implementation	Number of years covered	Expected calendar years to be covered
Short Term Plan Period - Phase 1	7	2020 - 2026
Mid Term Plan Period - Phase 2	3	2027 - 2029
Long Term Plan Period - Phase 3	11	2030 – 2040
Total Project Life	**21**	

It is assumed that all arrangements would be completed within the short and mid-term plan periods, including closure of existing MSW landfill, after care activities, and establishing new sanitary landfill for a projected project horizon of at least 20 years after closuring of existing MSW landfill in Pond Island. The long-term plan period would include operational activities of the system, including some fine tunings in the strategy and action plan updating them in every five (5) years in accordance with the waste capacity that may be changed in time, machinery and equipment renewals, and maintenance activities.

The project activities have been planned to be implemented under three components, which are:

1. Component 1: Engineering and Consultancy activities;
2. Component 2: Works to be procured; and
3. Component 3: Goods to be purchased.

The following is a detailed implementation schedule for all phases of the project.


Activities
Time
Short Term Plan Period
Mid Term Plan Period
Long Term Plan Period
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Q1 Q2 Q3 Q4 Year
COMPONENT 1: Engineering & Consultancies
1 Prepare System Feasibility Study and Roll Out Plan for Collection/Transport Q1 - Q4 of 2022
2 Conduct a Comprehensive Waste Characterization Survey Q4 2021- Q3 2022
3 Establishing a New SWMA and Build its capacity Q4 2021 - Q3 2022
4 Developing Waste Fee Framework and Tariff Study Q3 and Q4 of 2020
5 Developing Software Packages and a Waste Data System (WIS) Q2 2022 to Q4 2022
6 Conduct a Legal Assignment for Developing a New Solid Waste Law Q2 2022 to Q4 2022
7 Develop a Guidance for Landfill Management and Closure activities Q3 2022 to Q1 2023
8 Develop a Short-term DBO Contract MSW Landfill Management Q3 and Q4 2020
9 Develop a DBO Service Contract for ISWMF Q1 and Q2 2021
10 Develop a DBO Service Contract for separately handling of C&D waste Q2 and Q3 2021
11 Design & Implement Public Communication & Education Program, Social I Q2 to Q4 2022
12 Training Program of SWM staff for Landfill Management Q1 2022 to Q2 2023
On-the-Job-Training
13 Training Program of SWM staff of ISWMF & C&D Waste Management Q4 2022 to Q2 2023
On-the-Job-Training
14 Technical Advisor Q3 2021 to Q1 2024
15 Prepare Full ESIA for ISWMF and Landfill Upgrading Q1 2021 to Q3 2021
16 Supervision of Works Q4 2021 to 2029
17 Prepare a Pre-feasibility Study and DBO Contract for New Landfill Q1 2026 - Q2 2026
Optional Items
18 Preparing a Pre-feasibility Study for WTE - Optional Q3 2023 toQ1 2024
19 Developing DBO Contract for WTE - Optional Q1 2024 to Q3 2024
COMPONENT 2: Works to be Procured
1 MSW Landfill Upgrading & Extension and Debris in IDDS - DBO Q3 2021 to Q4 2023
This operation should be handed over to ISWMF after 6 - 7 years of Operation
Closing
2 TDSR Site Construction Q3 2021 to Q1 2022
The facility will be closed within ISWMF is operational
3 Integrated Solid Waste Management Facility (ISWMF) - DBO Q2 2022 to Q1 2024
Continous
4 C&D Handling Facility - DBO Q3 2022 to Q2 2023
Continous
5 Waste Receiving Facility at Port Q3 2022 to Q1 2023
6 New Landfill 2027 - 2029
Continous
7 Improvement Works for Waste Collection Points Q1 2023 to Q3 2023
Optional Works
8 WTE Facility Q4 2025 to Q3 2026
Continous
COMPONENT 3: Goods to be Purchased
1 Purchasing of Machineries & Equipment (M&E) for MSW Landfill improve Q3 2021 to Q2 2023
2 Purchasing of Machineries & Equipment (M&E) for ISWMF -
Depends on Work Tenders
3 Purchasing of Waste Containers Q3 2023 toQ1 2024
Tendering Periods
Priority Engineering and Consultancy
On-the-Job-Training
Optional Engineering and
Likely Construction Timeline
Likely Operational Timeline
Likely Purchase Timeline

STRATEGY MONITORING & REVIEW

This proposed Strategy for managing solid wastes in Sint Maarten represents only the initial stage in what is ultimately a long-term process (20 – 21 years). Needs and circumstances relating to wastes management can and almost certainly will change. It is therefore vital that the Strategy is continually monitored and periodically reviewed and updated to ensure that its objectives, actions for delivering change and underlying assumptions are still valid / appropriate, and that the timescales for achieving compliance with both European standards, and national legislation and targets, are still realistic.

Strategy Monitoring

In the context of Strategy implementation, the requirements for monitoring will arise in three main ways:

1. Policy implementation

The extent to which the various non-technical measures and policies set out in the Strategy are implemented in practice and / or included in other policy documents at national;

2. Development of waste management capacities

The extent to which the capacities of infrastructure and systems for the physical management of wastes needed to meet the objectives of the Strategy develop as planned;

3. Results

The results achieved in terms of the attainment of the qualitative objectives and quantitative targets in the Strategy.

Special attention should be given to monitoring progress in:

- Limiting growth in waste generation, particularly from institutional, commercial and industrial establishments which have many opportunities to reduce waste;
- Reducing environmental hazards and risks associated with waste management activities, particularly in the storage, collection, and disposal activities of the waste cycle;
- Increasing the levels of waste recovery and recycling, particularly in the large urban areas and cities where there is access to market development for the recycled and recovered materials developed;
- Developing and operating new waste management systems and facilities that increase waste collection containment and efficiency and minimize adverse disposal environmental consequences.

Various quantitative indicators will need to be used to measure and monitor progress with Strategy implementation. These should include:

- Waste production, overall and by waste type;

- Recovery and recycling rates, overall and by waste type;
- Recycling rates, by material;
- Quantities of specific hazardous wastes produced;
- Quantities of waste transferred to ISWMF;
- Quantities and types of waste landfilled.

STRATEGY REVIEW & UPDATING

With regard to Strategy review and updating, we propose that summary reports on the progress achieved in implementing the proposed Strategy should be prepared and published by the Government at 6-monthly intervals. The Strategy itself should be reviewed and updated biennially until 2030 in the short and mid plan periods, and thereafter quinquennially (5-year intervals) in the long term plan period.

RESPONSIBILITIES FOR STRATEGY IMPLEMENTATION

A number of Government Departments and Agencies will be responsible and play active roles to implement and monitor the strategy performance, track and overview the initial results in order to ensure the strategy is underway in accordance with the defined targets and objectives.

The following Government departments and Agencies will directly responsible to implement this strategy:

1. Ministry of Public Housing, Spatial Development, Environment & Infrastructure (VROMI);
2. Ministry of Public Health;
3. NRPB, and
4. ISWMA to be established.

Apart from the above Government departments and agencies, the following Government departments and agencies will be responsible in parallel to implement and achieve the objectives of this strategy.

1. Ministry of Tourism, Economic Affairs, Transport and Telecommunications;
2. Ministry of Education, Culture, Youth and Sports;
3. Ministry of Finance;
4. NGOs and CBOs

RISK ASSESSMENT

With any solid waste improvement plan, there are a number of potential risks that could slow or curtail the planned improvements. Some are minor risks potential and others are major. Based on the experience of many development projects by national governments and development agencies to implement solid waste improvements, the risks have occurred. Assessment of the risks is general, as it is impossible to know whether some or all of the following risks will occur. A detailed risk assessment is given in Chapter 8 of this Strategy paper.

Abdurrahim Tan

Team Leader, on behalf of the Strategy Development Team of Sint Maarten Integrated Solid Waste Management System

Aim Texas Trading, LLC
November, 2020
Revised in January, 2021

CH – 1
INTRODUCTION

Overview

This strategy provides an overview of the 2020 to 2035 strategy for actions and policies for the short and long-term of this time frame. For purposes of discussion, the short-term period is from 2020 to 2027, and the plan for that has been provided in the previous reports. The mid-term period is from 2028 to 2020, and is meant to build on the short-term activities planned and analyzed as operations proceed. It is anticipated that there would be a seamless transition from the short to long-term, with the short-term activities providing the foundation for the long-term activities.

1. Introduction

1.1 Project Background

Sint Maarten is an autonomous country within the Kingdom of the Netherlands, and is situated in the northeast Caribbean Sea and relies on tourism as its main industry. The country has a population of 40,614 by January 01, 2018[1], and enjoys rapid economic growth by receiving the tourists of approximately 1,7 million by 2018[2] from cruise and stay-over arrivals every year while struggling with a weak municipal solid waste (MSW) management system.

The country shares the same island with French part-Saint Martin with an area called “Collectivity of Saint Martin”. The Sint Maarten occupies the south part of the island. The area of island is 87 sq.km, and divided roughly 60/40 between French Republic (53 sq.km) and Kingdom of Netherlands (34 sq.km). Two parts of the island are roughly equal in population. The division dates to 1648.

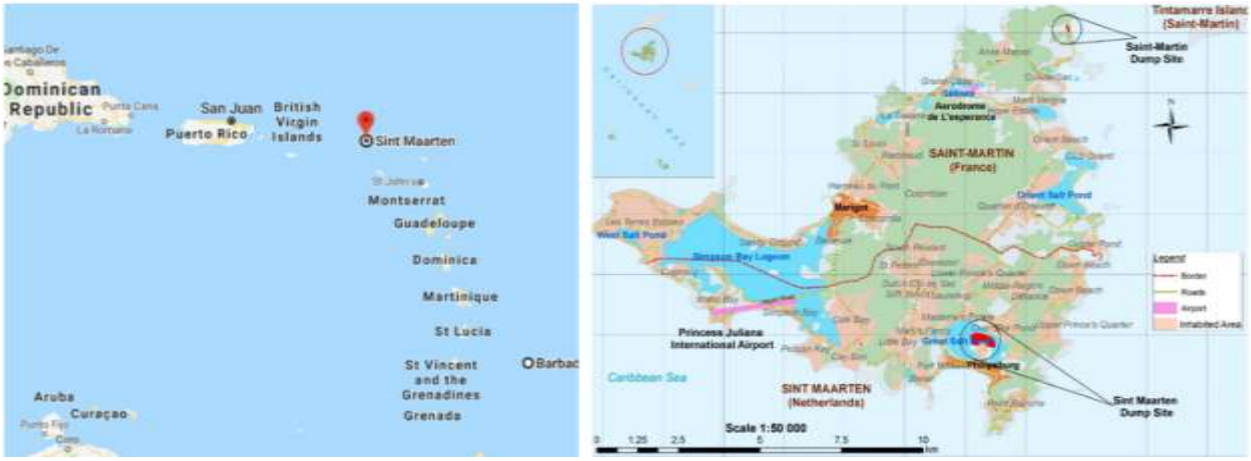


Figure 1.1: Lesser Antilles & Sint Maarten

Collectively, the two territories are also known as “St-Martin / St Maarten” and mostly “SXM”, and hereinafter called as “SXM” to refer the Sint Maarten. The capital of Sint Maarten is Philipsburg, and the largest city is Lower Princess Quarter.

According to weighbridge register of MSW landfill in Pond Island from 2009 to 2015, Sint Maarten generates an estimated 128 ths. tonnes per year of waste (about 350 tonnes per day), which is managed by the Ministry of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI). The situation has been exacerbated since the Hurricane Irma hit the island on September 6, 2017 and destructed over 90% of its main infrastructures.

After Hurricane Irma Sint Maarten government accepted the pre-conditions set by Dutch Government for financial support. The Netherlands contracted the International Bank for Reconstruction and Development (the World Bank) as an expert authority on redevelopment to manage the recovery via the “Reconstruction

[1] See SXM STAT; http://stat.gov.sx/
[2] See SXM STAT; http://stat.gov.sx/

and Resilience Trust Fund" (herein after called the "Trust Fund"), which is comprised of a grant of €470 million. But, according to the National Recovery and Resilience Plan (NRRP) the rebuilding of Sint Maarten would require funding of an estimated US$ 2.3 billion. The objective of the Netherlands' support to Sint Maarten's is to "support the material and non-material reconstruction and recovery of St Maarten wherever necessary, so as to restore vital infrastructure and sustainably boost the country's resilience to the effects of possible future disasters, natural and otherwise"[3].

Among other emergency recovery projects[4] that have been planned and currently being implemented, Emergency Debris Management Project with an estimated budget of US$ 25 million and Long-Term Waste Management Project (this project) with an estimated budget of US$ 35 million are programmed to be committed.

Accordingly, the World Bank has assigned Aim Texas Trading, LLC to conduct TA for establishing an Integrated Solid Waste Management System (ISWMS) in April, 2019 for Sint Maarten.

1.2 Vision & Mission

1.2.1 Vision

The visionary goal of this TA is to improve preparedness and develop a longer-term sustainable solution to municipal solid waste management in Sint Maarten. This would cover all forms of general non-hazardous residential, institutional, agricultural and commercial waste, and include normal construction/demolition waste, supporting the design of an Integrated Solid Waste Management (ISWMS) in Sint Maarten, through identifying quick-win solutions and long-team elements needed to develop the roadmap for establishing such a system.

1.2.2 Mission

The objective of the TA is to design an integrated solid waste management (SWM) system in St Maarten, to identify the key elements needed, and to develop the roadmap for establishing such a system.

This will be achieved by:

a) conducting a rapid assessment of the SWM sector;

b) providing recommendations on immediate technical and engineering solutions;

c) identifying mid to long term technical solutions and investment needs; and

d) assessing gaps and providing recommendations on legal, institutional, and financial frameworks, to create the needed enabling environment for operating the integrated SWM system sustainably.

Objective of this SWM strategy is to formulate a report that covers the strategies and actionable sector interventions for the transformation of the SWM of Sint Maarten into an Integrated Waste Management System (ISWMS), based on findings from the tasks previously conducted by the Consultant.

[3] Interim Report for Sint Maarten Trust Fund, April – November 2018, WBG.
[4] Emergency Recovery Project, Emergency Income Support & Training Project, and Hospital Resilience Preparadness Project, Enterprise Recovery project, and Airport Terminal Reconstruction Project..

The recommendations for actionable interventions will include areas of:

- Technological options and associated investment needs; and
- Legal, regulatory, institutional, and policy analyses, for reform and evolution of SWM sector in Sint Maarten.

1.3 Strategic Objectives

1.3.1 Scope

The scope of the TA will cover the whole value chain of municipal solid waste management, from generation, to collection, diversion, processing, disposal, and landfill operations. All the analyses and recommendations will be based on existing data and/or data to be collected, and technical and financial pre-feasibility studies conducted. However, this strategy will not cover the following waste types, although the relevant topics are addressed with the generic analysis and recommendations are covered in the strategy.

- Liquid wastes such as sewage;
- Gaseous wastes;
- Hazardous medical and industrial wastes; and
- Disaster wastes from natural events such as Hurricanes, storm surges, tsunamis, and earthquakes, and etc.;

1.3.2 Timeframe

This strategy will cover the 15-year period from 2020 to 2035. It will be reviewed, monitored and updated in every 5-year period by the Government of Sint Maarten.

1.4 Strategy Development Process

Waste management is now identified as one of the top priorities for the country. The government is keenly interested in establishing an integrated solid waste management system (ISWMS) that optimizes the holistic life-cycle sustainability of the overall system through the support of improved technical systems, optimized outsourcing, appropriate institutional arrangements, supportive legal/regulatory/policy frameworks, and financially sustainable cost recovery arrangements.

A series of studies which form the basis for this SWM strategy were required under the Consultant's contract, based on the start-up in April 25, 2019, and already the following reports, and studies were provided by the Consultant. The Consultant's team also attended at one workshop and numerous site visits and meetings with stakeholders, including with WB team, VROMI and NRPB. Enormous literature review and review of regional waste management practices are also conducted, as well as interviews with some waste management authorities/players.

- Task 1.1: Inception Report;

- Task 1.2: Solid Waste Questionnaires for Data Collection;
- Task 2.1: Potential Quick Wins List;
- Task 2.2: Solid Waste Sector Literature Review, Data Collection and Analysis, and Waste Data Report for Sint Maarten;
- Task 2.3: A Short Term Plan for Waste Management and Two Pre-feasibility Studies;
- Task 3.1: A Country Solid Waste Management (SWM) Sector Assessment Report, and
- Task 3.2: Waste Market Review Report for Caribbean Region.

Task 1.1 and 1.2 planned and programmed the Consultant's approach, work plan, and data collection efforts.

Task 2.1 involved considerable back and forth dialogue between the Consultant and the World Bank, resulting in several drafts of listed potential quick wins in July and August, 2019. The Task 2.2 Report enabled an adequate base of information for developing the Short Term plan and PFSs. Not only were issues of population, visitors, waste quantities and waste characteristics explored in detail, but the current legal, institutional, financial and service arrangements were also discussed in detail.

Thereafter, there followed a meeting in Sint Maarten between the World Bank and Sint Maarten Government to choose the most desired quick wins. Based on the results of those Bank/Country dialogues, the Consultant was given instruction and produced a proposal on September 3, 2019 outlining the work of Task 2.3, including the work that were done on preparation of a Short Term Plan and two Pre-feasibility studies (PFSs), which are on Improvement of the MSW Landfill analyzing the life extension options of the landfill and removing the debris in Irma Debris Disposal Site (IDDS), and development of and Integrated Solid Waste Management Facility (ISWMF).

The Task 2.3 report enabled efficient and focused dialogue between the Bank and Government for decision making regarding near term activities that could be executed expeditiously with the support and time-frame of the Trust Fund from the Netherlands for national recovery. The Short Term plan described the data, analysis, assessment, siting, land acquisition, and resettlement activities recommended and the packages that would be needed to prepare the investment project for consideration by the Bank's Board of Directors. Any detailed design, site studies, costing, land acquisition and ESIA work needed to satisfy Bank requirements will be done following the pre-feasibility stage and then the feasibility stage of work, and that the Short Term plan indicated the key activities that will be needed.

In conducting Task 2.2, the Consultant decided to develop as much of the needs for the sector data development and assessment as possible, in advance the Task 3.1 Report which provided all final solid waste data available during the study period.

Task 3.2 Report on Waste Market Review in Caribbean Region comprised the results of comprehensive review and research on waste management and waste management activities in and around Caribbean Small Island Developing States (Caribbean SIDS) reviewing their waste management mechanisms, including intra and inter islands and regional processed or semi-processed waste material trade links, and the connections with the international waste markets.

This SWM Strategy & Action Plan (SWM & AP of Sint Maarten) has arisen from the body of work that consisted of these aforementioned studies; as such this strategy is the culmination of the data, information, experience gathered, analyzed, and synthesized into findings through which this strategy correlates and utilizes.

1.4.1 Background of Short Term Plan and PFSs

As mentioned earlier, the choices for developing Integrated Solid Waste Management System (ISWMS) for Sint Maarten are long discussed with the WB team and Government in Summer and Fall of 2019 based on the Consultant's proposal produced on September 03, 2019, and this proposal has also been discussed in the meetings held in week of 15 September, 2019 in Sint Maarten. Accordingly, a Workshop was held in 29th and 30th of January, 2020 in Sint Maarten, to have comprehensive discussions on the Consultant's proposal and receiving the comments of the Government. Based on the comments and discussions on the topics evaluated in Short Term Plan and Pre-feasibility Studies (PFSs), the discussions evolved to a draft ISWMS proposal, and comprehensively discussed in the aforementioned Workshop.

1.4.2 Description of Short Term Plan and PFSs

1. Short Term Plan

The Short Term Plan provided "critical guidance to the design of the next waste management project", defining basic elements for a near-term investment project that the Bank will prepare. This will include pre-feasibility assessment of facility, equipment, and land elements needed to implement recommended solid waste improvements. In the meantime, it provided initial proposals for mid and long-term plans for developing ISWMS of Sint Maarten.

It described the data, analysis, assessment, siting, land acquisition, and resettlement activities recommended, and the packages that would be needed to prepare the investment project for consideration by the Bank's Board of Directors. Any detailed design, site studies, costing, land acquisition and ESIA work needed to satisfy Bank requirements will be done following the pre-feasibility stage and then the feasibility stage of work, and that the short-term plan indicated the key activities that will be needed.

The short-term plan has been supported by the work on the two pre-feasibility studies described below. For the short-term, landfill capacity must be assured, which means that every effort to improve and extend the existing landfill sites is needed. Also, weighbridge data is crucially needed for planning and design, and implementation of the weighbridge is urgently recommended.

At that time, it is not assumed that there are any potential new landfill sites available. If any sites could be found, it is assumed that all putrescible organics would have to be pre-processing within an enclosed facility, so that no bird-strike potential would existing within the international airport's required buffer zone. Ideally, enclosed pre-processing will be done nearby the current site to demonstrate that this concept could work to reduce attraction of the site to birds.

For the short-term, it is envisioned that there would be an integrated waste management facility (ISWMF) to handle all potentially recyclable and recoverable wastes. Therefore, such a facility could potentially include composting of appropriate food and green wastes, materials recovery of recyclable wastes, conversion of some dry combustibles to refuse derived fuel, and waste to energy conversion of other wastes directly to energy.

Because of the country's severe limitations for landfill, every effort needs to be made to process the wastes in a way that minimizes rejects, residuals, and pollution control residues. For the short term, it is also envisioned that a DBO contractor would handle only the country's municipal solid waste. Ownership of the facility would belong to the government upon payment for capital investment costs, after successful startup operations.

The Short Term Plan, like the Long Term Strategy and Action Plan (this report), addressed relevant sector conditions, projected sector conditions, technical realities and markets, legal/regulatory framework, institutional arrangements, and financial arrangements.

All technology and enabling framework proposals are expected to address sustainability, with special attention to the unique nature of Sint Maarten as a Small Island Developing State (SIDS), with a considerable tourism-based economy, which is subject to the growing issues of climate change, including rising oceans and increasing storm events. In addition, Sint Maarten has the additional unique issue of being part of the Kingdom of the Netherlands, with security and foreign relations obligations to the Kingdom, including obligations to foreign treaties signed by the Netherlands.

2. Pre-Feasibility Studies

Based on review of potential quick wins described in the Task 2.1 report, and on dialogue between the World Bank and Sint Maarten Government, two "top priority" quick wins are recommended by the Bank for purposes of conducting pre-feasibility studies, and those has been confirmed with Sint Maarten.

Pre-feasibility Study (PFS) 1 – Landfill Upgrading & Extension

Examination of the conditions and remaining space of the current MSW site and nearby lands used for storing scrap and other materials may have potential for extending the life of disposal in the Pond Island area of Sint Maarten. For purposes of this pre-feasibility study, the entire property available would be considered for potential disposal. The PFS 1 reviewed the available data and maps and indicated potential extension of life through practices that would improve landfill conditions and reduce space demands. Government efforts to stabilize slopes and curtail fires are considered, as they appear to be creating positive improvement.

Some incoming waste that do not require normal covered landfill might be diverted to other locations, such as construction/demolition debris, so that space for municipal solid waste could be optimized. Also, some incoming waste might be able to easily processed, such as landscaping wood and plant waste could be ground and composted at another location. Scrap metal could be crushed and exported. Some pre-processing of MSW might also be done to minimize volume demands and reduce soil cover requirements, such as aerobic decomposition of the putrescibles within the waste mix. Pre-sorting of recyclables could also be a way to minimize volume demands. Suggestions for source reduction of wastes could be briefly assessed.

As part of improving the site, slope stability and maintenance of fire suppression activities are considered as part of improved operational plan. The recent efforts of Government to address these issues are considered. The effort assessed how the various options proposed will extend life and how the combined implementation of the recommendations could extend the overall potential life, in terms of life-potential in years, volume and waste quantity.

It is important that the implementation of the weighbridge proceed without delay and that the landfill compactor already recommended be purchased. The Consultant provided a layout for the ideal location of the weighbridge and the staging of equipment.

The Consultant provided short descriptions of each package of work to be conducted with an estimated time frame and preliminary cost. These packages of work included any needed site investigations, stability analyses, follow-up feasibility level designs and costs, off-site work to remove the debris located in IDDS, and a construction/demolition debris location for the long term, as well as rejects, e.g., wastes that are not able to be processed. These packages of work are needed to enable the current disposal property to handle only MSW for the near term, and eventually provide space for an Integrated SWM Facility (ISWMF) and associated residuals from processing.

PFS 1 also included a preliminary assessment giving recommendations on project's environmental & social impact during the phases of the project. PFS 1 also included the costs of mitigation measures for project's negative impacts on environmental resources and social environment.

Pre-feasibility Study (PFS) 2 - Integrated SWM Facility (ISWMF)

Development of the framework for implementing an integrated solid waste management facility (ISWMF) which would conduct materials recovery, decomposition of putrescible organics and conversion of waste to energy. The framework for the facility examined the quantities and types of treatment to be conducted, as well as resulting by-products and markets. The various technical options have been reviewed and examined for potential applicability, risks, markets, and costs, at a pre-feasibility level. Spatial needs and potential disposal requirements for residues and rejects have also been examined. Potential cost recovery mechanisms, including tariff bundling concepts, have been outlined and discussed.

Packages outlining needed work are summarized, included estimated time frames and costs to conduct the work required to develop feasibility studies, site investigations, and preliminary costs. As noted above, it is assumed that the current disposal property for the above MSW and Irma landfills, and other site activities, are considered one property for potentially locating the ISWMF and the ancillary residuals disposal.

The ISWMF and its weighbridges would be the heart of Sint Maarten's solid waste system. All collection and any related source segregation activities would need to support the facility. Contracts, licenses, and regulations of both waste generators and collectors that are needed to be upgraded to enable the facility to be successful. Aside from describing the legal/regulatory/contractual requirements needed, packages are outlined with costs to describe the next work activities that would advance progress on this aspect.

The PFS 2 on ISWMF described the proposed works and contract arrangements, and the viability of locating all the needed operations at the current available properties owned by government at the Pond Island. The report discussed the initial capacity of the plant to handle MSW, and discussed the potential requirements if ship waste were later included in an expansion. For follow-up work, the Consultant provided short descriptions for each proposed package of work for the next steps of feasibility studies, costs, siting, and other activities needed to advance the development of ISWMF.

1.4.3 Choices Outlined in Short Term Plan & PFSs

Within the Short Term Plan, based on a comprehensive review of the Country's waste management programs and services, and the feedback received from the relevant Government Agency (VROMI), Aim Texas has generated the following conclusions:

- The Country has a clear decision to improve and enhance the solid waste management system into an Integrated Solid Waste Management System (ISWMS) with the help of World Bank, developing a comprehensive strategy for future 20 years, and this Short Term Plan will cover the time frame of 5 – 7 years as the first phase of ISWM strategy;
- A new solid waste ordinance needs to be developed in accord with the requirement of new ISWM Strategy;
- The Country requires main MSW landfill improvement, extension and adequate management, including continuous fire suppression activities during operation;
- Installing a weighbridge at the gate of MSW landfill with a suitable software is an urgent need to developing a waste record and information system;
- An Integrated Waste Management Agency (ISWMA) needs to be established with its charter and accounting framework in order to have a full transparent and accountable institution that is responsible from all solid waste management activities, including data collection, planning, procurement, and financial management of SWM system;
- A comprehensive waste collection and transport program study should be conducted, including conducting mapping to enable dedicated routes and service providers for key waste source categories and the potential for dedicated routes that would address wastes most ideally suited for resource recovery, for example:
    - Routes for waste that are high in paper, packaging, and other readily combustible materials, (such as offices, hotels, retail stores, schools, cruise ships);
    - Routes that are high in putrescible organics (such as restaurants, markets, and landscaping activities); and
    - Routes that are predominantly mixed wastes (e.g., households, cargo ships and yachts, airport and ship port).
- To develop Waste Fee Framework and Tariff Study (Financial Framework) and put in application is urgent, including developing software package for tracking the waste, revenues/expenditures, and billing operations;
- A public communication and education program, and a social inclusion program need to be designed and implemented, including complaint handling procedures and Web site for hearings on waste information and fee structures;
- Promotion and education efforts need to be focused and specifically designed to advance the waste reduction goals. The focused program should vary from year to year based on new program rollouts;

- To develop and apply a training program for SWM staff of relevant government agency and private companies that work on solid waste sector is also an urgent need.

The Short Term Plan period would include the following priority activities that could be implemented under three components, which are as follows:

Component 1: Engineering and Consultancy activities

Component 2: Procurement of Works

Component 3: Purchasing of Machineries and Equipment (M&E)

Component 1 of Short Term Plan would involve in procurement of engineering and consultancies that should take place as project preparatory works that outline and provide guidance for implementation of the mid and long term waste management activities and investments.

Component 2 of Short Term Plan would involve in procurement works that should be implemented within the Short Term Plan period, including procurement of construction works for MSW landfill upgrading and extension, construction of ISWMF and a separate C&D handling facility under DBO contracts. This component would also include procurement of works for construction of a waste receiving facility at port in Point Blanche of Philipsburg, and procurement of improvement works of waste collection points in all Country.

Component 3 of Short Term Plan would involve purchasing of machineries and equipment that would be required to operate the MSW landfill and ISWMF. This component would also contain purchasing of containers and bins to be used in the waste collection system.

The recommended activities in the short term period of 5-7 years are described in the Table below:

Table 1.1: Short Term Plan Recommendations for ISWMS of Sint Maarten

Area of Intervention	Arrangements
Institutional Arrangements	• Create improved staffing within a dedicated government unit or authority – Integrated Solid Waste Management Authority – ISWMA (see Annex 1) - for all types and activities within the solid waste sector, including: i) data collection and planning, ii) operations, iii) inspection, iv) complaint management, v) accounting, vi) social inclusion, and vii) public education.
Legal & Regulatory Arrangements	- **Legal Arrangements:** • Finalize development of a country solid waste law to include, for example: o govern the behavior of waste generators and waste handlers; • Define the potential involvement of the private sector; • Describe issues of social inclusion, labor protection, health, safety and environmental protection; • Arrange for sustainable financial resources; • Establish incentives; • Define disincentives and potential for sanctions under the law. - **Regulatory Arrangements:** • Develop related regulations under the solid waste law, and create appropriate institutional arrangements; • Legally organize improved control over waste generator behavior, solid waste collection, including commercial waste collection.
Financial Arrangements	• Develop a tariff cost recovery mechanism, tied to the framework of the new solid waste law; • Examine the potential for tariff bundling in a manner that cross subsidies appropriately established, addressing ability to pay and the principle of polluter pays, and • Develop a fully accountable system for tracking expenses and revenues, consistent with government systems.
Public Information	• Hire staff to be community liaison specialists who conduct public information as part of the new institutional structure; • Provide public education of the changes in the legal and regulatory arrangements and the system for managing waste collection and treatment/disposal, in order to clarify roles and responsibilities of all parties, including all waste generators and informal sector recyclers; • Create a system for handling and tracking complaints and suggestions, and all related responses, and • Create a website for the public to know all requirements, contact points, system schedules and deliverables, fees, and also see the public licensing and contracting arrangements.

Area of Intervention	Arrangements
Data Generation & Analysis	• Have staff in the new institutional structure that are dedicated to data development and planning; • Implement a new weighbridge at the disposal site, including all related computer management information systems, and • Conduct a comprehensive sorting and waste characterization study.
Social Inclusion & Gender Mainstreaming	• Hire a specialist to be responsible for social inclusion and gender mainstreaming within the new institutional structure; • Create policies for social inclusion and gender mainstreaming, making it inclusive for recipients of service; • Arrange that all providers of service comply with the policies created, whether through their licensing or contracts for service provision; • In contracts, assure that there are specifications for performance focused on inclusion and gender mainstreaming.
Recycling Market Development	• Create a special unit within ISWMA to study marketing activities for recyclables, improve networking between recyclers and buyers, and support the recyclers and contractors to improve their success in cost recovery from recycling; • Based on the needs of the recycling community and availability of markets, develop systems of bring back, buy banks, drop off centers, bring banks, etc., as needed to facilitate and encourage recycling; • Create incentives for waste generators to recycle and also reduce their wastes; • Coordinate with the waste collectors to improve their cooperation with the recycling agenda, and • Provide public education to children, adults, and commercial establishments on the need for and value of recycling.
Waste Collection	• Study and recommend improvements to existing waste collection contractual instruments where appropriate; • Address the potential for recycling to be enhanced as part of the collection system, and • Develop and implement comprehensive, transparent, equitable, and inclusive contracting and licensing arrangements for all waste collectors of domestic and commercial wastes, where needed to supplement systems already existing.
Interim Municipal Works & Operation	• Develop a short term Service Contract Tender Document to implement operational arrangements for the landfill that will optimize extending its life and assuring its stability and acceptability; • Hire the Contract to properly operate the landfill and provide pre-processing of all organic materials to minimize site attraction to birds, reduce the potential for methane and related fires, and reduce the need for landfill cover; • Continue the fire suppression activities that are currently improving the site; • All works and use of contractor equipment would be covered under the service agreement; • Once the long-term ISWMF is contracted through DBOT, this Service Contract would end and the DBOT contractor would take over all disposal operations as well implementation of the new facility.

Area of Intervention	Arrangements
Construction & Demolition Waste Facility	• Develop a short term Service Contract Tender Document to implement operational arrangements for the facility for separately handling of C&D waste in another place other than MSW landfill; • Hire the Contract to properly operate the facility and provide pre-processing of all inert recyclable materials; • All works and use of Contractor equipment would be covered under the service agreement.
Removal of Debris in Irma Landfill	• Provide budget for removal of debris in Irma landfill and conduct a tender for hiring a contractor for this activity, screening and separating the inert and other recyclable materials; • Haul the separated materials to new C&D waste handling facility area, except the fines and sands that are by-product from this activity; • Re-use the fines and sands in the MSW landfill operation.
Integrated Solid Waste Management Facility (ISWMF)	• Develop a 20-year DBO Contract Tender Document to implement and operate integrated waste management facility (ISWMF) sized to address local municipal wastes only, to be built at a location close to MSW landfill, and also provide treatment for the residuals so that landfill requirements would be largely minimized (as in Japan); • The facility operator would take over the landfill operation activities from the interim service contractor as part of this DBO contract; • All land and works would be owned by Government, after commissioning and transfer. Investment financing would cover the cost of initial works through the period of commissioning operations and tipping fees would cover the remainder of the any works costs, including any renewal and expansion during the contract period; • The DBO contract would handle all municipal waste during the initial 7 years, with an option to expand and extend capacity for the longer term if the results indicate that cost recovery potential expansion of the facility beyond meeting only local municipal waste needs.
Long Term Expansion Potential of Ship Waste	• Monitor the progress in the solid waste sector, coordinate with ISWMF DBO contractor to assess and advise Government regarding cost recovery potential if the solid waste facilities were expanded to accommodate enabling ships to off-load wastes; • While MARPOL requires ports to provide solid waste management arrangements, it may be that Sint Maarten is too limited in land and financial resources to meet the requirements of the international treaty; • Expansion should be done only if internationally acceptable waste-to-energy net revenues are able to offset the costs of importing fossil fuel for the country's national electrical grid, markets for other potential by-products of waste treatment would cover the costs, and only if all of the residuals and pollution control residues could be safely managed on-site or though recycling to meet international standards.
Cooperation Possibilities of Two Parts of the Island	• Short term plan recommends that the cooperation between two parts of the island would be one of the most desirable as it support the economies-of-scale in sizing of the facilities. However, because of the complexity of the international treaty of the BASEL Convention, which prohibits wastes being transported across national boundaries, and also because of the different standards and financial arrangements of its French status, there would be complexities of a combined system. • One suggestion is to allow only refuse derived fuel (RDF) created from waste to be transported from one side to the other, as RDF is not considered a waste.

1.5 Report Structure

Chapter 2 provides detailed information on country background setting, including on governing administrative structures, land use, demography, economic, and physical & environmental settings in the country.

Chapter 3 outlines detailed information of country setting on SWM, including the technical and policy frameworks on solid waste management, giving comprehensive information on solid waste management, legal/regulatory and institutional structure of waste management, solid waste generation, waste composition, and waste character.

Chapter 4 provides an overview on ISWM approach and process of Sint Maarten SWM Strategy and Action Plan (Sint Maarten SWMS &AP) during the TA for Establishing Integrated Solid Waste Management System (ISWMS) under the Sint Maarten Sustainable Solid Waste Management Project supported by World Bank and Sint Maarten Government.

Chapter 5 conducts projections on scheduling and planning the system elements, facilities, facility capacities for the prospective ISWMS of Sint Maarten, conducting projections and analyses considering the local and market demand.

Chapter 6 provides financial and economic analyses on project's financing, cost evaluation of the project elements in order to ensure the economic viability of the recommended options in this report.

Chapter 7 provides a complete schedule and action plan to be implemented throughout the strategy implementation on 20 – 21 years from 2020 to 2040.

Chapter 8 Assesses the risks that can be arisen during this strategy implementation, giving recommendations to cope with them.

Annex 1 summarizes the Short Term Plan and two Pre-feasibility studies.

Annex 2 analyzes the country setting on SWM.

Annex 3 summarizes the Caribbean Waste Market Assessment conducted by the Consultant.

Annex 4 provides an assessment on current legal/regulatory and institutional structure on SWM system of the country, giving recommendations on improving the legal/regulatory and institutional structures, and on currently being drafted new waste management law analyzing the gaps on it.

Annex 5 provides comprehensive analyses on project's CAPEX, OPEX, and including financial and economic, and affordability assessment of SWM system to be implemented.

Annex 6 outlines the project implementation plan and action plan.

Annex 7 analyzes the cruise ship waste and its effects on country's waste generation.

Annex 8 provides assessment on Extended Producer Responsibility, giving the recommendations for Sint Maarten.

Annex 9 provides detailed definitions on waste management sector.

Annex 10 is references.

CH – 2

COUNTRY BACKGROUND SETTING

Overview

This Chapter provides detailed information on country background setting, including on governing administrative structures, land use, demography, economic, and physical & environmental settings in the country.

2.1 Governing Setting

As mentioned in Chapter 1, the country shares the same island with "French Collectivity of Saint Martin" in North part of the island with an area of 53 hectares, and Sint Maarten occupies the South part of the island with an area of 34 hectares. See Figure 1.1. Collectively, the two territories are also known as "St-Martin / St Maarten" and mostly "SXM".

Sint Maarten is in the Caribbean Sea, within an area commonly called the Dutch Caribbean or Netherlands Antilles. This area was made a separate autonomous country in 1954 with the name of Netherlands Antilles. The constituent country of Netherlands Antilles was dissolved in 2010, after several years of negotiations and agreements with each island. Sint Maarten became an autonomous country within the Kingdom of the Netherlands, as did Aruba and Curaçao. Saba, Sint Eustatius and Bonaire became special municipalities within the country of the Netherlands.

The Sint Maarten is located about 250 km north from Continental – Guadeloupe, and belongs to the so-called Northern Archipelago. The Atlantic Ocean lies to the island's East, to the West is the Caribbean Sea. To the South, Sint Maarten is predominantly dotted with salt pans and lagoons.

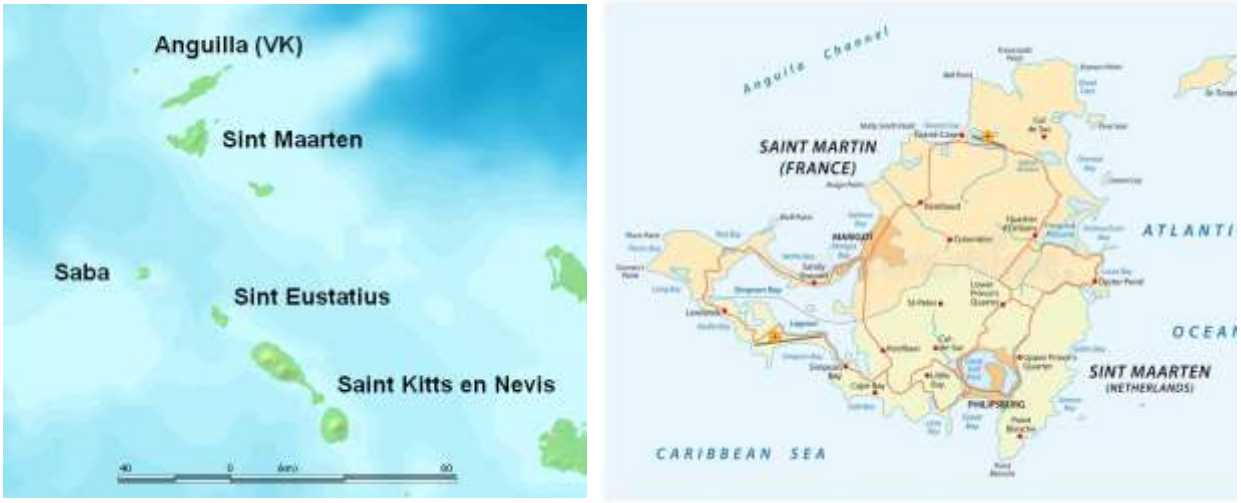


Figure 2.1: Maps Showing the Location of Sint Maarten

The capital of Sint Maarten is Philipsburg, and the largest city is Lower Princess Quarter. The land breakdown of the two political jurisdictions is indicated below.

Table 2.1: Breakdown of the Two Political Jurisdictions in the Island

	Total Area		Inhabited Area		Lakes & Ponds & Lagoons	
	ha	*% -of Total Area*	*ha*	*% -of Total Area*	*ha*	*%-of Total Area*
Saint-Martin	5,300.00	100%	1,311.00	24.74%	648.00	12.23%
Sint Maarten	3,400.00	100%	1,362.00	40.06%	448.00	13.17%
Total	8,700.00	100%	2,673.00	30.72%	1,096.00	25.40%

Source: Consultant's own assessment based on data provided by VROMI.

2.1.1 Governing Structure

UN listed 59 SIDS worldwide, including Least Developed Countries (LDCs), 20 of which are Non-UN SIDS that are not a member of UN. Of 13 Non-UN SIDS are located in Caribbean region. 29 SIDS that are located in Caribbean region are the Member and Associate Member Countries of the Caribbean Development and Cooperation Committee (CDCC) under UN. Sint Maarten, as an Overseas Country under the Kingdom of Netherlands, that is located in Netherlands Antilles is one of Non-UN SIDS, but it is a SIDS which is an associate member of CDCC. It is ISO Country code is "MAF".

Aruba, Curacao, and Sint Maarten are dependent on the Netherlands for matters like foreign policy and defense, but are autonomous to a certain degree with their own parliaments in their internal affairs, international trade, and to establish relations with some international establishments and trade organizations. They, with own constitution, are representative parliamentary democracy organized as unitary states. Their administrations consist of the Governors, who represent the Kingdom of the Netherlands. They have own central banks and currency, which is Netherlands Antillean Guilder (NAG) linked to US Dollars.

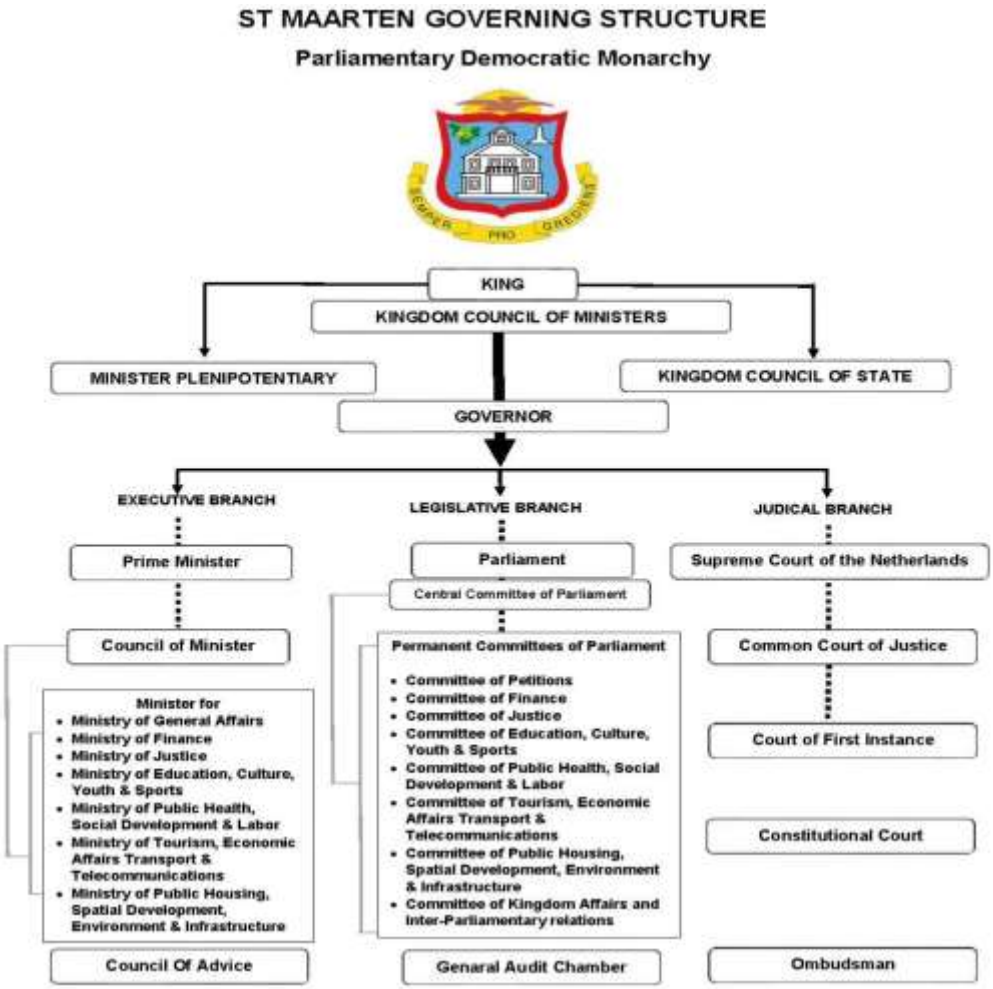


Figure 2.2: Governing Structure of Sint Maarten (VROMI)

2.1.2 Land Use in Sint Maarten

Over the last decades, the island has undergone a tremendous economic boom, with a resulting spatial development that the government has been challenged to manage. As a result, there have been many positive developments in terms of buildings and land use, but also many developments that have had adverse spatial effects that are difficult to reverse.

This can be seen for example in many inadequately planned developments in the hillsides, in the occurrence of incompatible developments competing for space such as commercial and industrial functions in close proximity to residential neighborhoods, and in inadequate road infrastructure.

A View from Sentry Hill

A View from Cay Hill

Figure 2.3: Diverse Residential Development in Sint Maarten

Common land use designations that can be found in development plans include residential use, business use, industrial use, recreational use, public facilities, as well as designation of land for environment and nature conservation.

A View from Illidge Road

Simpson Bay – Airport Road

Figure 2.4: Concentrate Commercial and Retail Development

2.1.3 Land Tenure

A private individual or a legal entity can be an owner of real estate property in St. Maarten. The owner of real estate property has the absolute right to that property, i.e. the right to freely enjoy and dispose of that particular property.

Ownership of real estate in St. Maarten must be recorded in the public register for real estate property, also referred to as the land registry (*Kadaster*). The land registry also provides an overview of encumbrances, mortgages and liens (if any).

2.1.4 Housing Stock in Sint Maarten

According to Households Budget Survey 2017[1] of Sint Maarten, housing stock of Sint Maarten is 14,000 by 2017. Household size is approximately 2.9 by 2018.

2.2 Demography

According to population fact sheet of Sint Maarten Statistics Department (STAT), the static population (permanent residence) in January 2017 was slightly higher than 40,000, and at the beginning of 2018 it was 40,614. At the same period, 49% of the population was male and 51% was female. The following Figure shows the population growth in Sin Maarten between 1914 and 2018 (SXM STAT). However, no information has been found in SXM STAT on how many households exist in the country. The country's zoning plan divides the country into 13 zones, which are shown in the following map.

[1] Sint Maarten Households Budget Survey Results, 2017, SXM STAT (http://stat.gov.sx/press_release/Household_Budget_Survey/2017/HBS_Results.pdf)

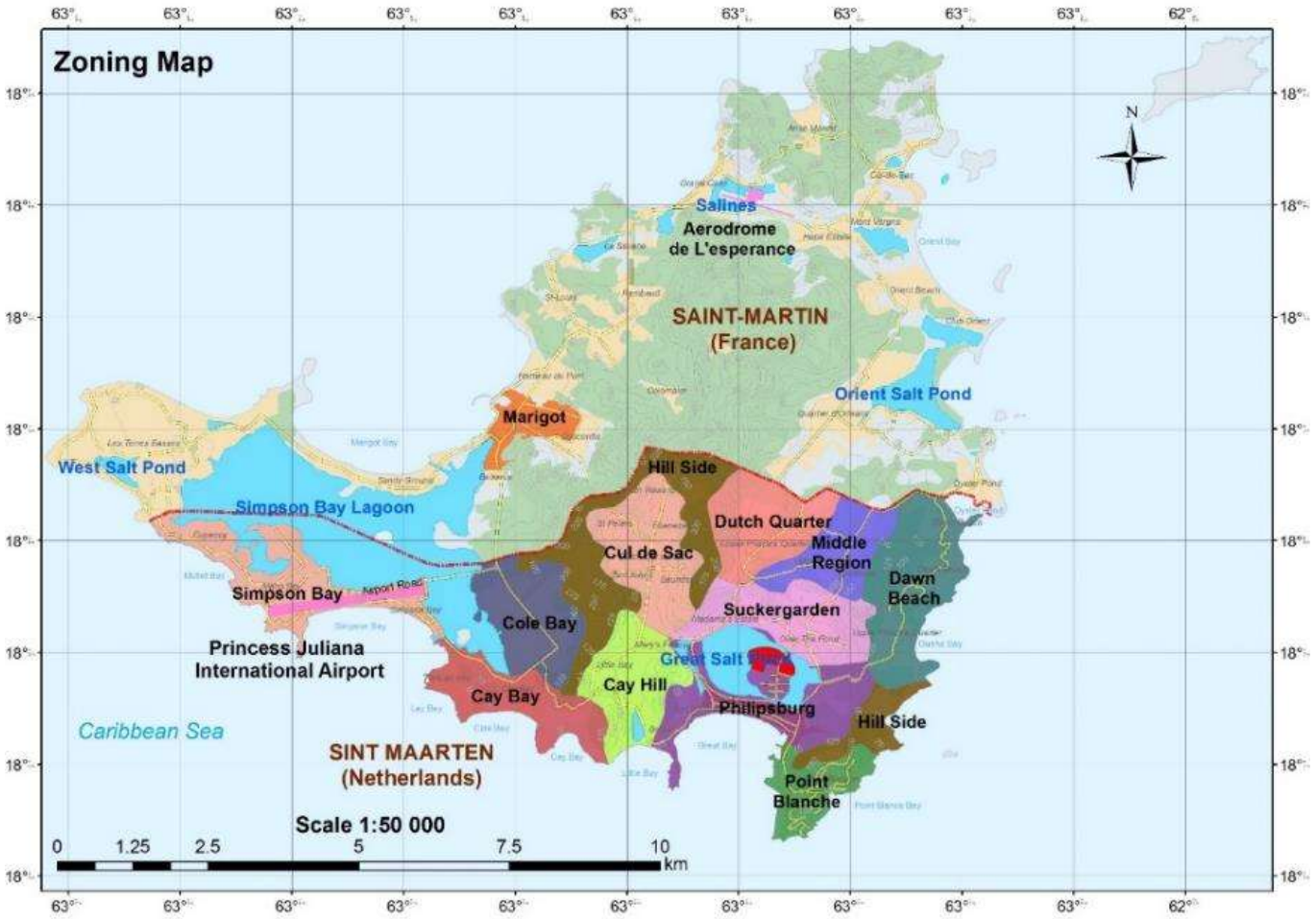


Figure 2.5: Zoning Plan of Sint Maarten

The population density in Sint Maarten is 1,194 sq.km by 2018. According to the 2011 Census, the population was distributed as follows:

Table 2.2: Population Distribution by Zones (Districts)

Zone (District)	Population Distribution %
Simpson Bay	2.1
Lower Pricess Quarter	25.7
Cul-de-Sac	24.4
Cole Bay	21.3
Little Bay	9
Upper Princess Quarter	11.4
Lowlands	1.4
Philipsburg	4.8

Source: AZ STAT (http://stat.gov.sx/)

The next Figure also shows that the permanent residence increased dramatically after 1960 due to up growth of tourism activities and developing of tourism infrastructure. So, the island became one of the islands most visited among the Windward Islands after 1990.

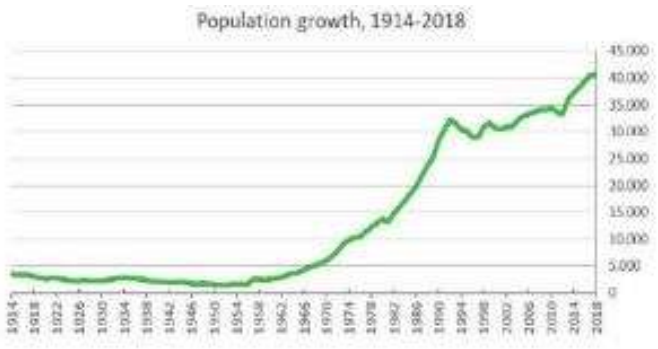


Figure 2.5: Population Growth between 1914 and 2018

The population change from 2017 to 2018 is less than 1.1%[2]. This is largely due to the fact that net migration for 2017 was negative, meaning that more persons emigrated out of St. Maarten than immigrated into St. Maarten. Most immigrants came from the Dominican Republic. Other important sending countries are the Netherlands, France and Jamaica. Most emigrants left to the Netherlands. In the months July and August 280 persons left to the Netherlands. Other important destinations were the other islands of the former Dutch Antilles and the United States of America.

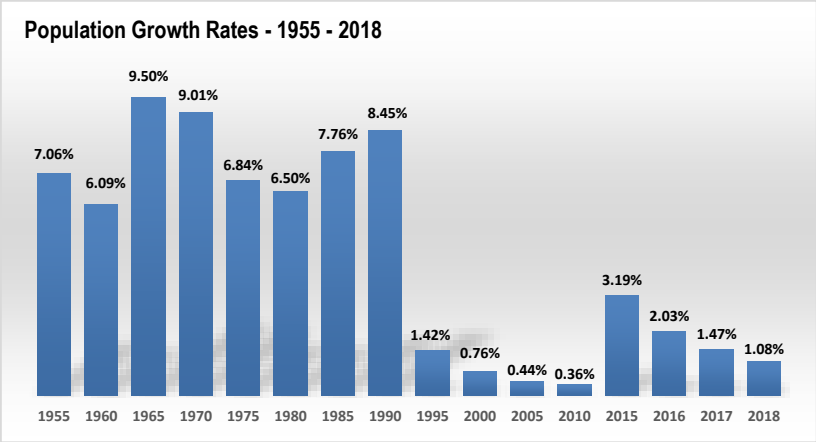


Figure 2.6: Population Growth Trend in Sint Maarten

According to SXM STAT, the number of deaths also fluctuates every year. In 2017, 111 males and 61 females died, an overall total of 172 persons. Of every 1000 inhabitants 4.2 persons died. Because of high life expectancies the number of older persons is rising. This is especially notable for females.

The Figure 2.7 also shows that permanent residence population growth trend in the last 25 years, and stabilization the population growth after 1995.

The average population growth rate in the last 23 years is realized 1.34% per year. Therefore, the consultant has accepted an average 1.5% (base case scenario) population growth rate per year for base case scenario will be rationale for Sint Maarten during projections for the next 20 years as this assumption is supported by the scarcity of the land resources of Sint Maarten.

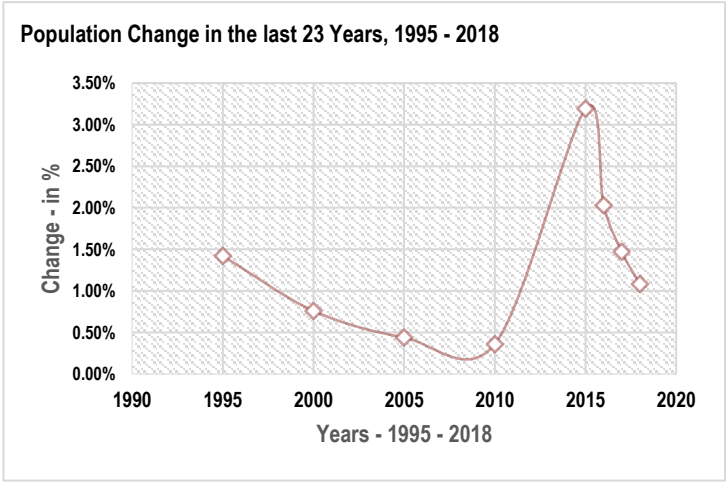


Figure 2.7: Population Change in the last 23 Years, 1995 – 2018

[2] Waste Data Report, Aim Texas, October, 2019.

The growth rate is assumed as 1.00 for low case scenario, and 2.00 for high case scenario. Daily dynamic population of Sint Maarten is much higher than the static population, which affects waste generation significantly in the Country because of the daily excursion organizations of the cruise passengers and stayover tourism.

According to Sint Maarten STAT, stayover tourist population in the first six months of 2018 is 74,474, and number of cruise passengers who visit Sint Maarten in the first two quarters of 2018 is 733,666. The following Figure shows the stay-over and cruise passenger arrival to Sint Maarten in the last 10 years. As seen in the Figure below, both stay-over and cruise arrivals have decreased considerably in 2017 due to Irma Hurricane damages, but, the country seems to reach its touristic potential before Irma in the next couple of years as the number of cruise arrivals have reached to 733k passengers within the first two quarters of 2018.

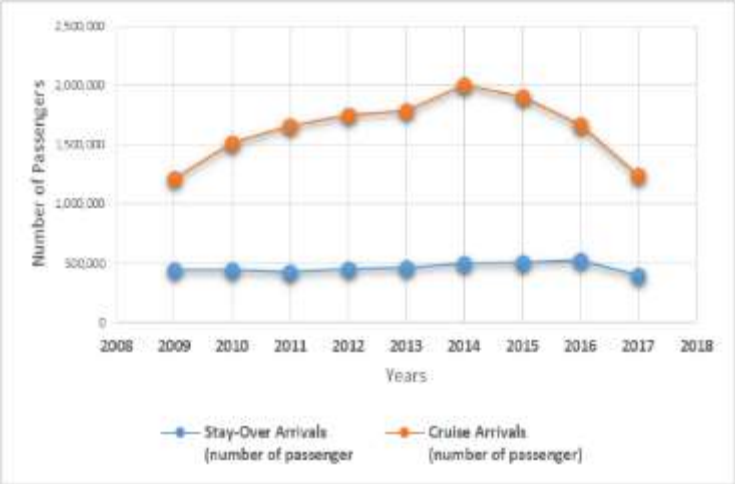


Figure 2.8: Stay-Over and Cruise Arrivals (Passengers)
(Waste Data Report, Aim Texas, October, 2019)

As there is no uncertainty on the number of tourists both from cruise ships arrivals and stayover arrivals to the country, which is around 2.5 million in any high tourism year when we look at the statistics. This transposes that, with a conservative approach, the contribution of tourist population to the daily dynamic population can only be around 6,000. This figure can also be correlated with the number of hotel and timeshare rooms in the country, which is around 4,115, with an occupancy rate of 70%. This also transposes that the contribution of stayover tourists to the daily dynamic population can only be around 3,000. Contribution of undocumented residents to the daily dynamic population is obvious in the country, and it may be around 12,000 (following analysis).

Table 2.3: Estimated Dynamic Daily Population by 2020

Indicators	**Dynamic Daily Population**
Static population – high case, see Table 2.4	42,225
Contribution from Cruise arrivals (2 million / 365), high tourism	5,479
Contribution from Stayover (4117 * 70%), high tourism	2,882
Contribution of undocumented residents (as much as half of the employed population)	12,000
Total Daily Dynamic Population	**62,586**

Source: SXM STAT Statistics and Labor Force Survey, 2019[3], and Consultant's estimations (Waste Data Report, Oct, 2019).

[3] SXM STAT, *Statistics and Labour Force Survey, 2019 (http://stat.gov.sx/downloads/LFS/Results_STAT_Labour_Force_Survey_2018.pdf)*

Considering the high number of tourist arrivals by cruise ships and stayover arrivals, significant illegal residents, following static and dynamic population estimation is developed by the consultant.

Table 2.4: Population Projection, 2020 - 2038

Years	Base case scenario - GR - 1.5% per year		Low case scenario - GR - 1.0% per year		High case scenario - GR - 2.0% per year	
	Static	*Dynamic*	*Static*	*Dynamic*	*Static*	*Dynamic*
2020	41,842	63,000	41,430	63,000	42,255	63,000
2025	45,075	67,869	43,544	66,214	46,653	69,557
2030	48,559	73,114	45,765	69,591	51,508	76,797
2035	52,312	78,765	48,099	73,141	56,869	84,790
2038	54,701	82,362	49,557	75,357	60,350	89,980

Source: Waste Data Report, Aim Texas, October, 2019.

Employed population consists of 20,850 persons, which is around 51% of the total static population. The male – female split of the Employed population is 53% to 47%, almost half-half.

The labour force development is shown in the following Table. The increase in the labour force is seen over the last seven years. The increase in the economically active population mimics the decrease in the economically inactive population, but also an increase in the employed population.

Table 2.5: Labour Force Development in Sint Maarten – 2011 -2018

Indicators	***2011***	***2013***	***2017***	***2018***	**Change 2017 - 2018**
Population	33,609.00	36,175.00	40,120.00	40,614.00	1.20%
Labour Force	19,337.00	21,071.00	22,342.00	23,146.00	3.60%
Economically inactive	6,867.00	7,482.00	9,846.00	9,429.00	-4.23%
Employed	17,108.00	19,137.00	20,954.00	20,850.00	-0.50%
Unemployed	2,229.00	1,934.00	1,388.00	2,296.00	65.48%
Unemployment Rate	11.50%	9.20%	6.20%	9.90%	3.71%

Source: Labour Force Survey by SXM STAT, 2019

Employed population consists of 20,850 persons, which is around 51% of the total static population. The male – female split of the Employed population is 53% to 47%, almost half-half.

A majority of the population aged 15 to 74 years on the Dutch Caribbean Islands are in paid work. The labor participation rate is highest on Bonaire (70 percent), followed by St. Maarten and St. Eustatius (both 66 percent) and lowest on Curaçao (53 percent). Employed population consists of 20,850 persons, which is around 51% of the total static population. The male – female split of the Employed population is 53% to 47%, almost half-half.

Urbanization process in Sint Maarten mimics some other Caribbean SIDS which their economies heavily rely on tourism, tourism related activities, and off-shore finance. Few SIDS in Caribbean region are almost completely urban; e.g., Cayman Islands and Anguilla – 100%, and Bermuda 99%; Sint Maarten, Puerto Rico, and US Virgin Islands are urbanized over 94%, and Bahamas 83%, while many have over from 40 to 70% of their population living in rural areas (i.e., Antigua and Barbuda, Barbados, Belize, Grenada, Guyana,

St. Kitts and Nevis, Haiti, Jamaica, St. Lucia, St. Vincent and Grenadines, Suriname, Trinidad and Tobago, Aruba, and British Virgin Islands).

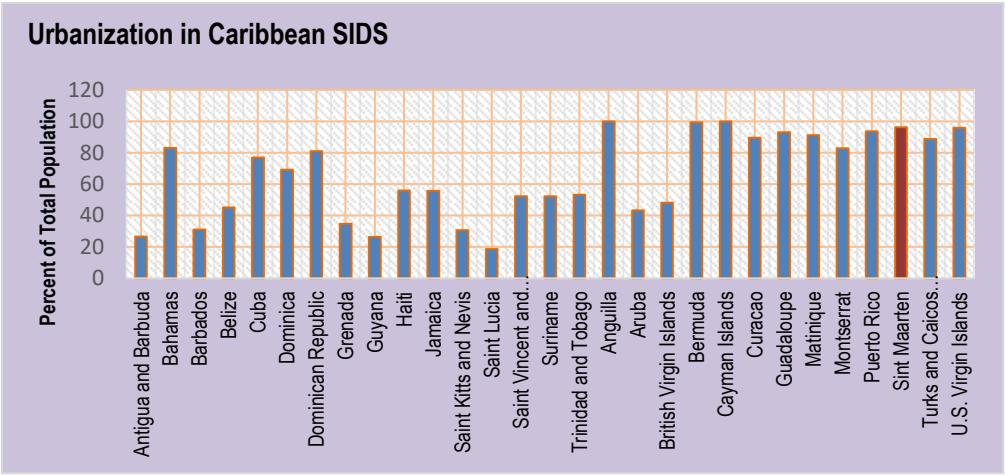


Figure 2.9: Urbanization in Caribbean SIDS

2.3 Economic Setting

Sint Maarten is classified as high-income country by UN and World Bank with nominal per capita GDP of US$ 26,500, which is slightly higher than regional average (US$ 20,000). However, GDP doesn't reflect the true economic capacity of the population. Many of the residents are simply employees in the tourist facilities that are owned offshore and often managed by special staff brought in by the owner. Many of the tourist book packages with hotels and cruise ships, and those bookings are commonly done in other countries, and much of the ownership of the hotels and ships is in other countries, with the income accruing to the companies in those countries. Main economic drivers in the country are:

- Tourism and tourism related activities
- Ports and Airports
- Offshore Finance
- International trade, marine transport, import/export
- Small scale local industries, mostly are light industries, and
- Weak cultural industries

As one of the largest sources of foreign exchange, tourism is a life-blood for the country as in many SIDS' economies in Caribbean region. The tourism sector also has strong linkages with other sectors such as financial services and international commerce and trades. The following Figure depicts the sectorial distibution by major GDP sources of the Country.

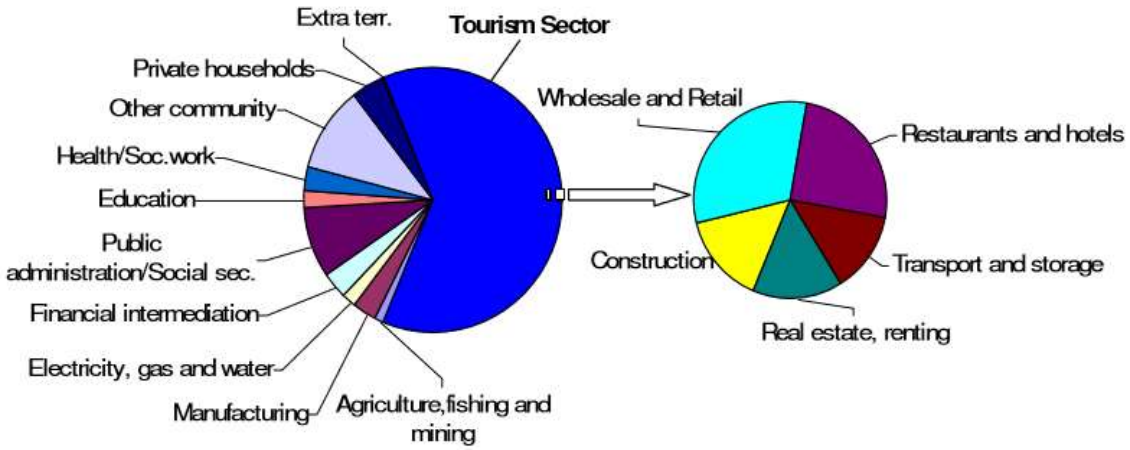


Figure 2.10: GDP Sources and Sectorial Distribution

GNI per capita in the country is around US$ 29,002, which is almost 50% higher than the regional average (US$ 19,322). Only 14% of GNI is sourced from industry in Sint Maarten, and 85% form service sector. This creates a very strong fragility on the country's economy, and high dependency to international market. From this perspective the country's economy is more vulnerable to economic shocks and natural hazards than the continental countries and some SIDS and OCTs in Caribbean region such as Dominican Republic, Haiti, Trinidad and Tobago, Cuba, Belize, Aruba, Puerto Rico, Guadeloupe, Grenada, and Guyana, see following Figure. The increased frequency and intensity of the storm events that may result from climate change will also have effects on both the economy and the environment of Sint Maarten as seen in the periods after Hurricanes and during COVID-19 outbreak.

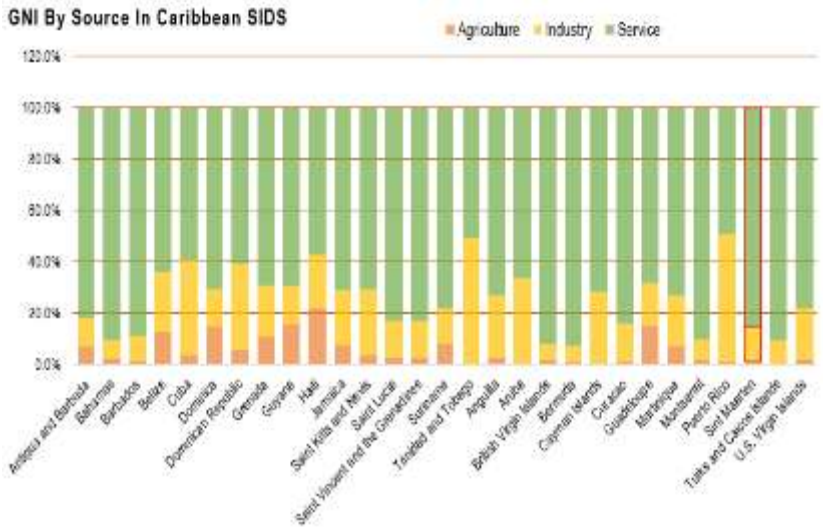


Figure 2.11: GNI by Source in Caribbean SIDS
(Aim Texas, Regional Waste Market Review Report, June, 2020)

The nominal per capita GDP in Sint Maarten is slightly higher than regional average.

Openness and high trade dependence of the country is one of the most important factors, which poses a challenge to waste management. In addition to growing rates of solid waste generation per capita, stop-over tourists are reported to generate at least twice the amount of waste as local residents, while cruise ship passengers generate up to four times the amount generated by local residents.

Before the hurricanes there were a total of 4,115 hotel and timeshare rooms on the Dutch side.

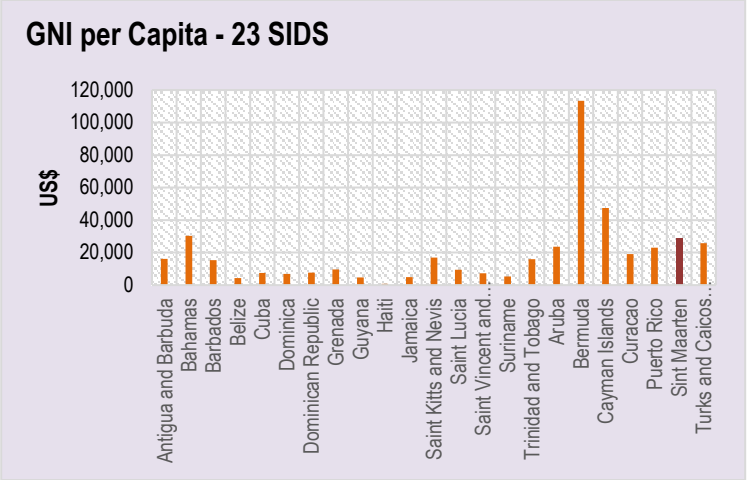


Figure 2.12: Comparison of Per Capita GNI in Sint Maarten

As of October 2018, the occupancy rate approached 65 percent in the first half of 2019. Damages to the main airport and hotels have significantly reduced the number of overnight tourist arrivals and the airport is running at 60 percent throughput of the pre-hurricane levels (for both landing slots and passenger throughput) in the first half of 2019, though cruise arrivals are now resuming to pre-hurricane levels. However, the island and the similar SIDS in Caribbean Region are experiencing second economic shock after Hurricane Irma with COVID-19 outbreak and limitations applied since March, 2020.

There is no agricultural activity in the island. It remained the most important economic activity until around 1960. Many areas in the valleys, which have historically been used for agriculture, have recently been released for housing construction. More recently, construction projects have been encroaching on the remaining mountain forest. See Figure 2.3.

In the absence of a national poverty line for Sint Maarten, a UNDP benchmark for poverty based on minimum wage[4] indicates that 26.87 percent of households (approximately 3,762 households) are poor and live on revenues at or below the minimum wage (NAF 1.530.53 or approximately US$850 per month in 2017). Although little is known about the distribution of disaster impacts and their effect on vulnerable groups in Sint Maarten, international experience indicates that the poorest and most vulnerable groups are likely disproportionately affected by the disaster, including Sint Maarten's large number of female-headed households (38.7 percent of all households), who depend on the income of women post hurricane.

The 12-month average of consumer prices in October 2017 is 1.9%. This represents an increase of 2.0 percent when compared to average prices in the same period.

According to 2015 Households Budget Survey (HBS) of SXM STAT, the 2015 HBS collected information on household expenditure in 12 categories derived from the International Standard of the Classification of Individual Consumption according to Purpose (COICOP). In the updated classification, the largest expenditure category is the Housing, water, electricity, gas and other fuels division, with an expenditure of NAF 431,058,531.62 (US$ 242,167,813) annually and NAF 2,565.82 (US$ 1,441.47) monthly per household, accounting for 37.4% of total expenditure as seen in Table 1 above and in Figure 2 below.

[4] Developed by UNDP in 2015.

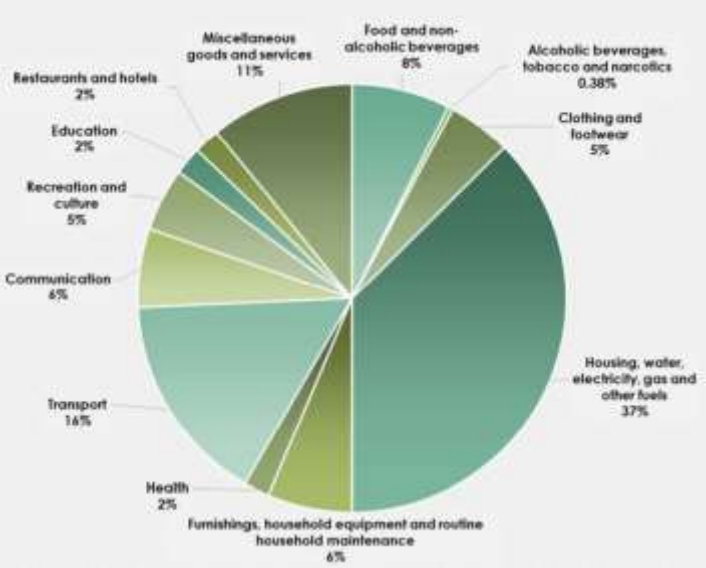


Figure 2.13: Percentage shares of the 12 COICOP Divisions

However, in 2015, the two largest divisions, housing, water, electricity, gas and other fuels and transport, account for over half (50%) of total household expenditure (NAF 1,293.41 – US$ 726,63 per month). See Footnote 1. The following Table shows the breakdown of household expenditures of housing, water, electricity, gas and other fuels.

2.3.1 Transport

As in almost all Caribbean SIDS, transport for every activity for tourism, intra and inter-island and inter-continental transport are provided by air and marine routes and means to Sint Maarten. Therefore, the ports and airports have utmost importance on economy, transportation and daily life for the country.
There is only one international airport (Princess Juliana International Airport - PJIA) in the Island. It is located on the Sint Maarten side, and viewed as a major contributor to the Sint Maarten economy. In 2014 the airport and its users accounted for 60% of Sint Maarten's GDP and 52% of total employment. The airport itself had revenues over USD 59 million in 2014. Yearly average passenger capacity of PJIA is around 1.8 million passengers.

However, Sint Maarten government has decided to stop the cruise arrivals in Sint Maarten ports until the end of 2020, while it allows landing of aircrafts of few air travels companies such as KLM and Air France during this period, to provide limited travel to both parts of the island.

Sint Maarten Harbor Group of Companies, a government-owned group of 12 companies responsible for most of the island's maritime activities. The Group operates and has responsibility for the Dr. A.C. Wathey Cruise & Cargo Facility at Point Blanche, the Harbor Pointe Village, the Captain Hodge Pier in Philipsburg, the fuel station at Great Bay and the Simpson Bay Lagoon Authority, which is responsible for the Simpson Bay Bridge. The Group has diversified its activities into real estate ownership and port consultancy as well as owning and operating the port's two mobile harbor cranes.

The cruise port now accommodates six cruise ships through its two piers, with the terminal handling anything from 6,000 to more than 20,000 passengers in a single day. The cruise port also has a cruise village for this purpose. The cruise industry in Sint Maarten is one of the fastest growing sector, but not uniformly seasonal.

Sint Maarten's cargo handling facilities have grown with the shipping lines calling at the island and it was a natural progression to expand the existing quay. The Captain David Cargo Quay was extended from 270 to 540 meters in 2009 and protection from the sea was achieved with a new breakwater at the southern end of the quay.

The Cruise Port has no appropriate waste receiving facility which meets the MARPOL's requirements for accepting the waste from the cruise ships. However, waste oil and black water removal and glass recycling services are available in the port[5]. At a regional scale the Port of Philipsburg is a service port which connects with both intra-regional hub-ports as well as other service ports in the region, and global hub-ports in Caribbean region.

However, the port of Philipsburg in Sint Maarten is a transshipment hub for CMA-CGM. As OECS ports are looking to add cargo, the transshipment volumes in Philipsburg are a target[6].

2.3.2 Energy

The N.V. GEBE[7] is officially owned by the Government of Sint Maarten, which is responsible for electricity generation and distribution in the country. The approximately 20,000 customers of N.V. GEBE are as an average consuming around 1,500 kWh monthly, which is one of the highest consumption figures in the region. When looking at the average peak demand of around 50 MW during the weekdays the average peak is 3 kW per customer, the average load at the evening hours is 43 MW, which is 2.5 kW per customer.

N.V. GEBE has 3 categories of customers: domestic, commercial and large consumers: the average electricity bill for domestic consumers is ± USD 200 per month per household. The electricity at N.V. GEBE is produced by diesel-generator sets by use of mainly fossil fuel, using mainly Heavy Fuel Oil (HFO). The GEBE power plant is located in Cay Bay.

The N.V. GEBE is also single provider for drinking water to all Sint Maarten through its desalination plants from sea water in Cay Bay, Point Blanche and Lowlands with reverse osmosis water plants to meet the daily demands of water consumption in the country.

Energy challenges constrain sustainable economic development in Sint Maarten as in most Caribbean SIDS as the country heavily depends on imported fossil fuels. However, the government is aware of importance of identifying energy-system resilience and renewable energy deployment as the key goals in energy transition, and this issue has already taken the first place in energy policy of Sint Maarten as CARICOM has set a regional target of 47% renewable energy contribution to total electricity generation by 2027.

[5] Sint Maarten Harbour Group of Companies publication, 2012.
[6] Caribbean Ports Services Industry, Towards the Efficiency Frontier, CDB, 2019.
[7] Gemeenschappelijk Elektriciteitsbedrijf Bovenwindse Eilanden (GEBE)

While regional average of domestic electricity tariffs is around US$ 0.32 in CARICOM region, it is US$ 0.18 for households in Sint Maarten. The following Figure compares the electricity tariffs in the CARICOM region.

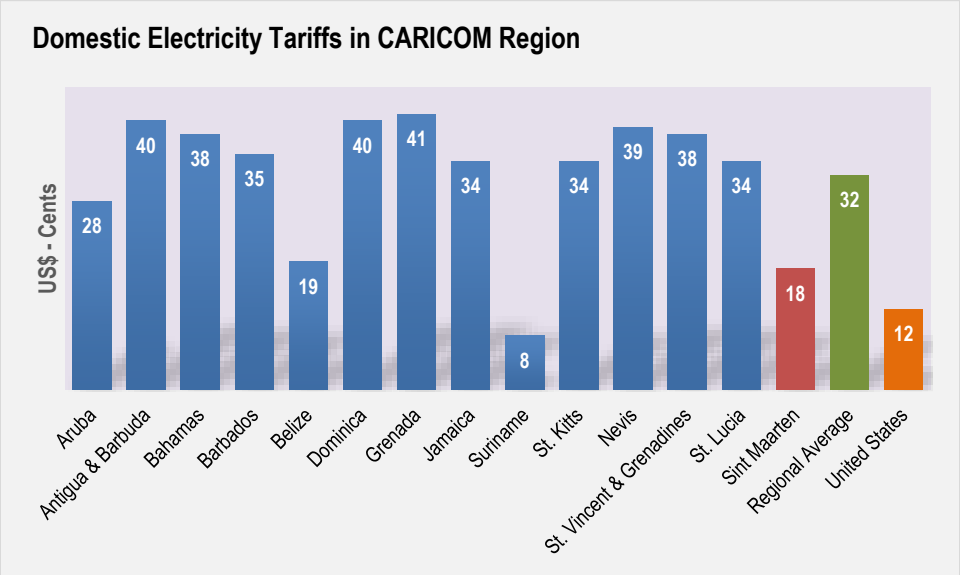


Figure 2.14: Domestic Electricity Tariffs – United States and 13 CARICOM Countries – US$

(Based on Consultant's own investigation and IMF Working Paper, No. WP/16/53. Washington, D.C., International Monetary Fund (IMF), 2016.)

2.3.3 Hotels and Resorts

Before the hurricanes there were a total of 4,115 hotel and timeshare rooms on the Dutch side. As of October 2018, the capacity approached 65 percent of this level. Damages to the main airport and hotels have significantly reduced the number of overnight tourist arrivals and the airport is running at 60 percent throughput of the pre-hurricane levels (for both landing slots and passenger throughput), though cruise arrivals are now resuming to pre-hurricane levels.

However, COVID-19 outbreak is also heavily affected the tourism sector of the country since March, 2020.

2.3.4 Major Industries in Sint Maarten

Apart from GEBE power plant, the major light industries in Sint Maarten primarily focused on rum and bear production and fish products. There are three rum, three brewery factories, and one water distilling and bottling company which also produces sparkling water. Yacht repair and maintenance firms also take important place in industrial activities in Sint Maarten.

Table 2.6: Major Light Industrial Companies in Sint Maarten

Companies	Productions
Caribbean Brewing Company	Beer production since 2019
SXM Beer	Beer Production since 1996
Pelikan Brewery	Beer Production since 2017

Topper's Rhum Distillery	Rhum Production since 2008
Sint Maarten Guavaberry	Rhum Production
Sint Maarten Distillery	Rhum Production
Heavenly Water	Distilled Water, Sparkling Water
Sint Maarten Concrete	Crushed Material and Batching Concrete production
FKG - Yact rigging, marine fabricating	Yacht Repair, rebuild, and manufacture new parts, rigging and redesign
Ship XM Boat Repair	Catamaran, Yacht and Boat Repair
IMM	Yacht refit and repair
Polypat Caraibs	Boat Repair Maintenance
Sint Maarten Shipyard N.V.	Yacht refit and repair
Maintec	Yacht refit and repair
J. M. C. Marina & Boatyard	Yacht refit and repair
Bobby's Airport Road Shipyard	Yacht refit and repair
Mega Yard	Yacht refit and repair

2.3.5 Major Macro-economic Developments

The country's economy is tourism-based. The restaurants, hotels, and other tourism-related sectors, account for approximately 45 percent of Sint Maarten's gross domestic product (GDP). Transport, storage and communication sectors, accounting for 11 percent of GDP, are also related to the tourism sector. The tourism sector contributed 73 percent to the country's total foreign exchange income in 2016. Sint Maarten's harbor is a significant port for cruise tourism in the Caribbean, with 1.7 million cruise passengers visiting per year. The airport is a hub for regional travel with a large network of connecting flights across the Caribbean.

However, in the recent 3 years the country experienced two shocks on its economy due to the devastating effects of Irma hurricane and recession effects of COVID-19 outbreak. The tourism and tourism related activities in the country now almost zero since March, 2020.

Though there are no figures on hand about the effects of COVID-19 outbreak on Sint Maarten economy in this early stage, significant decrease should be expected on country's GNI and GDP at least until the end of 2020. Throughout the outbreak, the CARICOM collaborative framework has been used by national governments as an experience-sharing and problem-solving platform. The Caribbean Disaster Emergency Management Agency and the Caribbean Public Health Agency have provided key resources and expertise, in particular in outbreak response logistics and to bolster the regional testing capacity. Other regional entities (e.g., Pan American Health Organization, and Caribbean Development Bank have contributed additional technical and funding assistance, each working through this infrastructure.

However, in SWM context, while the Irma caused increase effect on solid waste generation due to huge amount of disaster debris created in the country, the COVID-19 outbreak caused adverse effect on solid

waste generation, except the increase on medical waste generation in the country, which is bound with the early border controls that stopped the stay-over and cruise arrivals to the country.

2.4 Physical & Ecological Setting

2.4.1 Physical Setting

Topography

Sint Maarten is low, hilly terrain of volcanic origin geologically. The total area of the country is 3,400 hectares, approximately 33% of which is inhabited, 11% of which is occupied by lakes, ponds and lagoons, and 10% land parks which are nature conservative areas. The highest point is Mount Flagstaff at 383 masl, but the island's highest point is in French side, which is Paradise Hill at 424 masl, see following map.

Figure 2.15: Topography of the Island

Climate & Wind

The climate of St. Maarten is humid tropical; the average rainfall is 1008 mm per year. The average yearly temperature is 26.8 ºC. Yearly variations in rainfall can be considerable, for example, in 1992 there was 1273 mm of rain, yet in 1994 there was 658 mm. The majority of the rain falls in August – November, though on a monthly basis clear wet or dry seasons are difficult to distinguish July 2005 saw the highest monthly rainfall with 211.6mm; August 24th 2005 saw the greatest daily maximum with 80.4mm falling in 24 hours. The majority of the rainfall on St. Maarten is caused by convection (the air heating up and rising – thus causing rainfall), although the hilly areas in the center of the island receive more rainfall suggesting they are high enough to cause orographic rainfall (air forced up by the height of the land causing rainfall).

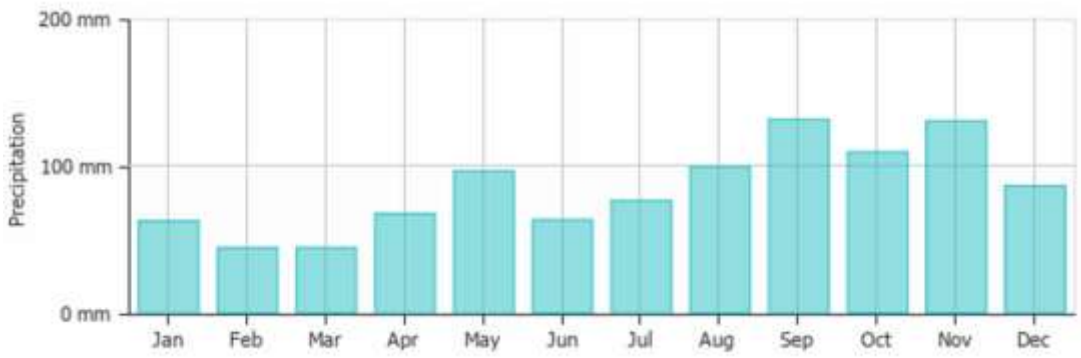


Figure 2.16: Average Precipitation in Sint Maarten

(Weather-and-Climate.com)

There is very little variation in temperature over the year, with December to March being the cooler months at around 25ºC on average, and April to November being the warmer months on average with temperatures between 27ºC and 29ºC. The coldest temperatures recorded are around 18ºC; the hottest temperatures are around 33ºC. The precipitation/temperature graph below shows the average rainfall and temperatures from 1970 to 2005.

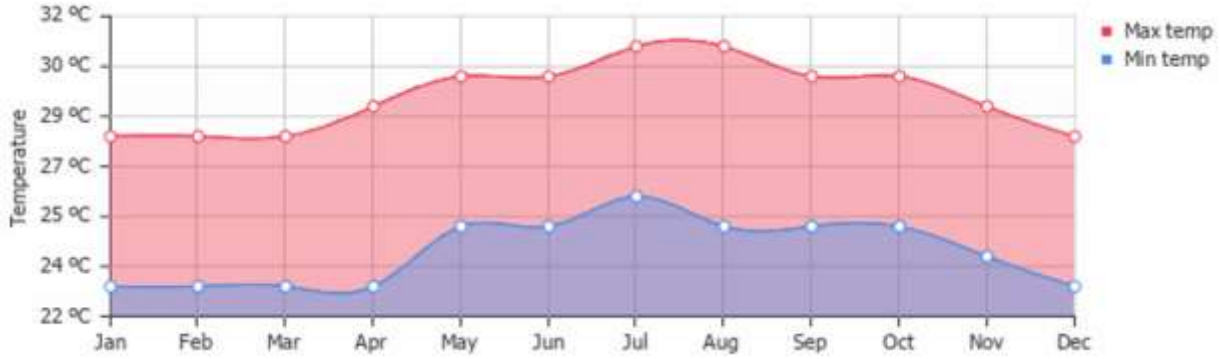


Figure 2.17: Average Temperature in Sint Maarten

(Weather-and-Climate.com)

The monthly average sea surface temperature ranges from 25°C in January-March to 29°C in August-November. Visibility ranges from 15m to 30+m. There are usually two high tides and two low tides every day in St. Martin/St. Maarten, with about six hours between high tide and low tide. The average tidal range is around 45cm.

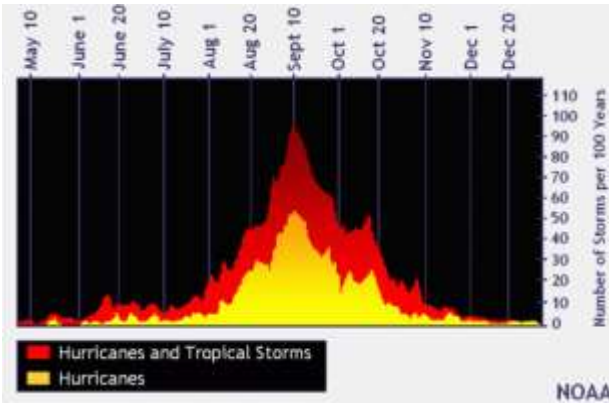
St. Maarten is located in the Northeast Trade Wind zone. 78% of the wind comes from the east, and 22% from east-south-east, with average wind speeds of 6 - 7 m per second. The Wind is a significant, reliable natural resource on St. Maarten.

The area is active tectonically and seismically. Hurricanes are also risk in this territory such as Hurricane Georges - 09/21/1999 (110mph), Hurricane Lenny – 1999 (95mph), Hurricane Debby -2000 (75mph), Hurricane Omar – 2008 (130mph), Hurricane Earl - 2010 (110mph), Hurricane Rafael - 2012 (90mph), Hurricane Gonzalo - 2014 (85mph), and Hurricane Irma - 09/06/2017 (185mph). Hurricanes are expected to become more intense in future as a result of climate change.

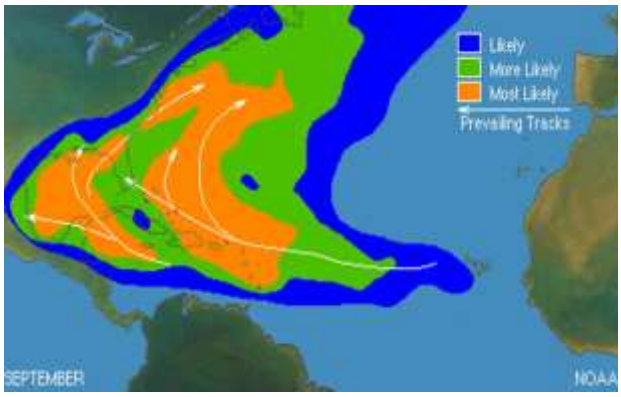
Figure 2.18: Average Wind Speed in Sint Maarten

(Weather-and-Climate.com)

The official hurricane season for the Atlantic basin, Caribbean Sea, and Gulf of Mexico is from June 01 to November 30. Assen in the following Figure, the peak season is from mid-August to late October, deadly hurricanes can occur anytime in the hurricane season.



Hurricane Season & Frequency per 100 Years



Probabability of Tropical Cyclon in Caribbean Sea

Figure 2.19: Hurricane Season, Frequency per 100 Years & Probability in Caribbean Sea

(National Oceanic and Atmospheric Administration (NOAA) of US)

However, flood prevention, preparedness and mitigations on the island have not been sufficiently developed to cope with potential disasters. Addressing and minimizing the risk of flood-related disasters is a major challenge for the government.

Hydrology

Physically, the west end is an atoll of low land surrounding a lagoon, while the east end is a range of conical hills. The island has white sandy beaches and numerous bays. The island has very scarce fresh surface and ground water resources. A lagoon and three brackish ponds are home to all four species of mangrove.

The fresh water sources in the island are mostly seasonal creeks fed by rainfall, see following map.

Figure 2.20: Fresh Surface Water Sources in the Island

Geology and Geomorphology

St. Martin/St. Maarten forms part of the non-volcanic arc of the Lesser Antilles. The oldest layers of rock date back approximately 50 million years. These older rocks are sedimentary – and made of marine deposits that were once on the ocean floor. More recently these layers were folded by tectonic forces, then pushed above the water surface.

A second period of tectonic activity brought the area above sea level. Throughout the Pleistocene Era (1.8 million to 12,000 years before present) there was an ice age which locked up much of the earth's water on land. At the end of the Pleistocene glaciation, ice melted and the sea level rose. The large, single island flooded and only the highest parts remained above sea level – forming the islands of St. Martin/St. Maarten, Anguilla and St. Barthélemy as they are known today. The Simpson Bay Lagoon, Great Salt Pond, Great Bay and other bays and lagoons are drowned valleys. The plateau the neighboring islands sit on has a maximum depth of 36 m and is known as the Anguilla Bank.

A number of geomorphological landforms exist on St. Maarten - including sand bars, and spits which are formed by water movement and sand deposition around the bays and coastline. Soils on the hill slopes are not very well developed due to the comparatively high rainfall and associated high rates of erosion. In the valleys, on the less porous rock, soils are generally well developed where they have not been removed for building foundations and other infrastructure development.

2.4.2 Ecological Resources

Coral reefs, seagrass beds, mangrove and salt pond habitats are apparent around the coastline of St. Maarten. The coral reefs have spur and groove formations (coral ridges divided by sand channels) and boulders at the dive sites 'The Maze' and 'Hen and Chicks' are encrusted with numerous species of corals, sponges and anemones. Seagrasses are found mainly along the southern and south western shores,

although they are on the brink of total destruction due to damage caused by conch fisherfolk and coastal development. Mangroves can be found around Simpson Bay Lagoon, and around the salt ponds, which provide a perfect habitat for roosting, nesting and migrating birds as well as a wealth of other species. The salt ponds provide important foraging areas for many birds and the brackish and sometimes hypersaline conditions give rise to a unique wildlife community that includes several fish species, snails and insects.

The hills of Sint Maarten show hibiscus, orange sage, flamboyant, mahogany and cactus. In coastal areas there are palm trees, sea grapes and aloe. Tropical birds (including the nation bird, the brown pelican) and lizards abound.

Snowy Egret ***Black Necked Stilts*** ***Brown Pelican***

Figure 2.21: Birds in Great Salt Pond

Sint Maarten has patch reefs and barrier reefs and some mangrove stands. The Man of War Shoal Marine Park was established in 2010. It is located off the southern shore of the island and is home to varied reef fish, sea turtles, lobsters and the rare queen conch. It also is a stopover point for many marine mammals. It includes the island's most valuable ecological and economic marine habitat. It provides a safe haven for whales, sharks, sea turtles and hundreds of species of fish. It includes not only a range of habitats from coral reefs to sea grass beds and open water, but also the Proselyte Reef.

As the waters around St. Maarten are relatively shallow, without much exchange between coastal and deep-water currents, corals and other organisms on reefs are exposed to any terrestrial influences. This includes freshwater runoff, sediments, nutrients and any form of pollution, which all stress and eventually kill marine organisms.

The coastline includes bays, lagoons, steep rocky coasts, and sandy beaches. Old plantations removed the natural habitat and today, the high population density and expanding tourism industry of St. Maarten continues to threaten terrestrial environments. As a consequence, St. Maarten's vegetation is almost entirely secondary or degraded.

The types of vegetation that characterize Sint Maarten have evolved due to the island terrain, distinct climate and years of human activity. Sint Maarten has varied topography with large hills forming three main ridges in the center and east, aligned in a north-south direction. Only the Lowlands in the west are flat.

Figure 2.22: Red Mangrove *(Rhizophora Mangel),* **Flying Gurnard** *(Dactylopterus volitans)* **over seagrass, Pillar Coral** *(Dendrogyra cylindrica)* **on a reef** *(source NAFSXM)*

CH – 3
COUNTRY SETTING ON SWM

Overview

This Chapter provides detailed information of country setting on SWM, including the technical and policy frameworks on solid waste management, giving comprehensive information on solid waste management, legal/regulatory and institutional structure of waste management, solid waste generation, waste composition, and waste character. The Chapter also assesses the regional waste market in Caribbean Region, comparing the Sint Maarten SWM context with the countries in Caribbean Region.

3.1 Legal/Regulatory and Institutional Setting

The summary assessment on legal/regulatory and institutional settings in the country is given in the following chapters, and detailed assessment and comments are given in Annex 1.

3.1.1 Legal/Regulatory Setting

There is no comprehensive solid waste institutional arrangement or regulatory framework at the moment, but the government is aware of this need and has expressed its desire to address it within their SWM Roadmap. Some norms from pre-independence time are still being used and there are piecemeal decrees to address some needs, as well as a draft environmental policy.

However, VROMI has organized recently to be prepared a new draft waste ordinance. It is currently circulated for comments and revisions. The consultant's comments and recommendations for re-arranging the law are presented in Annex 4.

Although Sint Maarten is not bound to comply with solid waste regulation in the European Union, it is generally required to comply with the following treaties that Netherlands enters into.

- MARPOL Annex V: It covers all wastes from ship…any kind and size of ships. It has been in force since 1988. It prohibits discharge of waste to the see, except for certain allowable releases of food wastes in some waters, cleaning fluids and animal carcasses.
- The Basel Convention: It controls movement of wastes and makes special arrangements for how hazardous wastes shall be handled along with related manifest systems.
- The Hong Kong International Convention adopted in 2009: It requires that ships being salvaged or recycled following their operational life have all potentially hazardous materials properly handled to not pose any risk to workers or adverse impacts to the environment. Also, all ships are to have emergency preparedness procedures, training, and plans to avoid incidents, including fires and spills.
- ICAO's Standards: One aspect of these standards requires the management of waste so that it does not encourage bird strike within the aerodrome or wildlife on the runway.

3.1.2 Institutional Setting

There is no separate Waste Management Authority (WMA) in the country. Almost all solid waste collection and disposal management and operations, except the hazardous medical waste, are under the management of Ministry of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI), which also handles infrastructure planning and development. VROMI also operates two landfills (MSW landfill and IDDS in Pond Island) with its own staff, however, all machineries and equipment used in the landfills are hired from contractors with rates set by government.

The government is also conducting studies for future disposal and treatment. For purposes of the financial support from external entities for emergency response to the Hurricane Irma disaster, a special government body called the National Recovery Program Bureau (NRPB) reports directly to the office of the Prime Minister. The NRPB coordinates the government agencies and also arranges for the accountable, transparent management of the procurements and actions financed for the recovery activities. See following Chapter. The following Table and Figure depicts the institutional arrangements for all waste management activities in Sint Maarten.

Table 3.1: Institutional Arrangements of Waste Management in the Country

Waste Type	Regulatory Body	Collection & Transport	Treatment / Disposal
Householdls waste, including HHW	VROMI	VROMI outsources the collection & transport services to collection service companies	VROMI
Institutional Waste, including schools	VROMI	VROMI outsources the collection & transport services to collection service companies	VROMI
Commercial Waste, including airport waste, waste from marinas	VROMI	Unregulated Private Collectors with open subscription	VROMI
Hazardous Medical Waste	Ministry of Public Health and Social Development and Labor (VSA)	Medical Facilities under control of VSA	Medical Facilities under control of VSA
Hazardous & Non-hazardous industrial waste	VROMI	Collected and transported commingled with other municipal waste types	VROMI
Marine and coastal litters	VROMI	VROMI in cooperation with local or regional NGOs and CBOs	VROMI
Car wrecks and tires	- Regular situation by VROMI - Disaster situation by NRPB	VROMI	VROMI
Disaster waste	NRPB, VROMI, ESFs	NRPB VROMI ESFs	NRPB VROMI

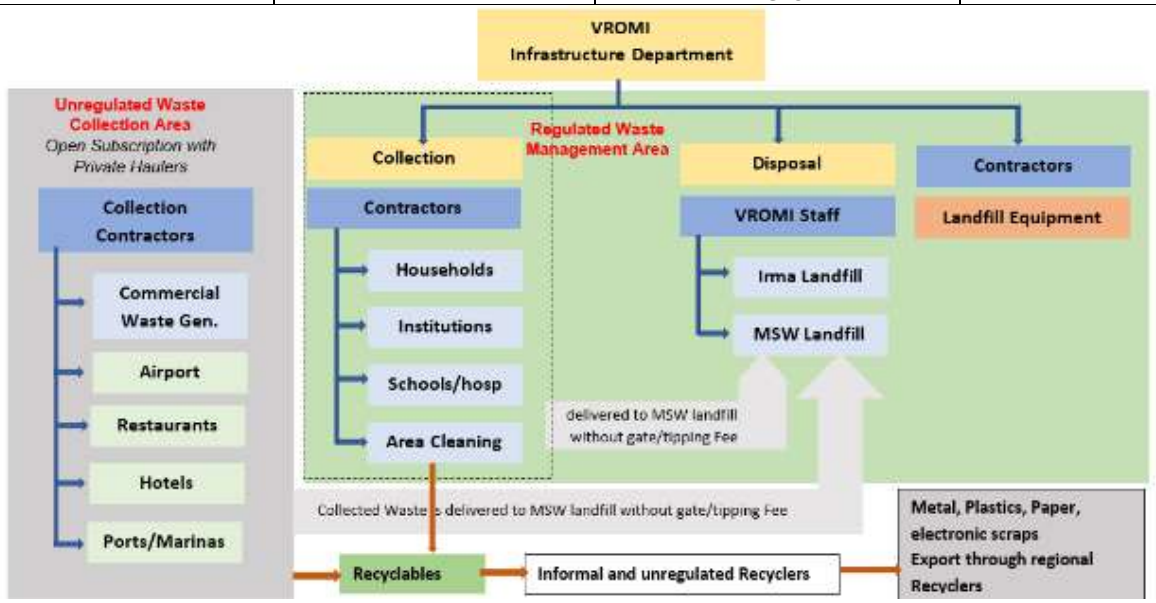


Figure 3.1: Sint Maarten Current Waste Management System

Within the current waste management system, VROMI is not able to control the SWM system wholly because it does not have sufficient resources such as budget, human resource and legal infrastructure. Therefore, SWM components of collection/transport and disposal as well as recycling activities remain uncontrolled. The current system does also not support to secure the full-cost recovery of SWM operations.

Although there is no comprehensive solid waste institutional arrangement or regulatory framework at the moment in Sint Maarten, the government is aware of this need and has expressed its desire to address it within their SWM Roadmap. Some norms from pre-independence time are still being used and there are piecemeal decrees to address some needs, as well as a draft environmental policy.

3.1.3 Disaster Risk Management Context

Disaster Governance

Sint Maarten's disaster management plan was designed to provide both a technical and organizational plan which could deal with the first recovery processes of multiple disaster events in an efficient way. It has been created as a reaction to hurricane Luis between 1995 and 2000, as the previous system in place did not function during the preparation and aftermath phases.

The disaster plan provides an organizational plan on how Sint Maarten should prepare for and respond to a possible disaster, see Figure 2 of Annex 2. The PM has the supreme command and is both responsible for the cohesion between the different actions plans present within the different Emergency Support Function (ESF) groups and for the training of the staff members involved in the disaster management process.

As indicated in Figure of Annex 2, the different ESFs form the tactical level of the disaster management plan. There is however also an operational level within the structure. This consists of three ESFs; the Fire Department, Police Department and the Ministry of Public Health, Social Development and Labor (VSA). These three ESFs are together forming the COPI (in Dutch Commando Plaats Incident). Thus, the COPI is responsible for operationalizing the disaster management practices in the case of a disaster or major accident.

Response After IRMA

National Recovery Plan

Shortly after Irma (14th of September) a workgroup has been formed for establishing A National Recovery Plan (NRP). Within this report an analysis was made of the economic impact and actions required for the recovery of the communities and economy.

The NRP estimated that the budget of the government would have a shortfall, and this would be catastrophic for the funds needed for the recovery processes necessary to restore and rebuild the island again, especially as the estimated total damage was around US$2.7 billion (Government of Sint Maarten, 2018).

As a response to help and speed up the recovery on Sint Maarten the Dutch government made available a budget of €550 million. Of this budget seven million was made available to finance projects in the first phase of the recovery. These projects were executed by local and international organizations such as the United Nations Development Program, the Red Cross and UNICEF.

Long Term Response

As a response to Irma the Dutch Government made available a budget of €470 million to assist Sint Maarten.

Simultaneously the Netherlands started negotiating with the World Bank if they could be able to play a role within the rebuilding processes on Sint Maarten. The agreement between the Netherlands, Sint Maarten and the World Bank was signed on the 16th of April, 2018. A steering committee, consisting of representatives of the World Bank, Sint Maarten and the Netherlands, would decide in consensus if these projects will be executed. The World Bank also provided their expertise regarding the rebuilding and recovery processes, even before the actual grand agreement was signed. Accordingly, a National Recovery and Resilience Plan (NRRP) is developed by the Government. According to NRRP, the rebuilding of Sint Maarten would require funding of an estimated US$ 2.3 billion. The objective of the Netherlands' support to Sint Maarten is to "support the material and non-material reconstruction and recovery of St Maarten wherever necessary, so as to restore vital infrastructure and sustainably boost the country's resilience to the effects of possible future disasters, natural and otherwise"[1].

An Interim Recovery Committee (IRC) was focusing on issues such as project management, the financial state, and the legal status all in order to make sure that the current different activities and projects are executed 'smoothly'. It can therefore be seen as a sort of 'intermediary' between the ministries and the World Bank, focusing on facilitating the collaboration between the two. The IRC consisted of eight to ten different members, who previously worked for different ministries, and it eventually developed itself into a National Recovery Program Bureau (NRPB). See Figure 3 of Annex 2 for the Trust Fund Governance Structure.

3.2 Financial & Economic Setting

Currently, the reports reviewed included the operational expenditure budget of VROMI as VROMI is the responsible government body from the solid waste services and management of the Pond Island Landfills (MSW and Irma). The Ministry plan 2015 – 2018 shows that the finances needed to realize the strategic objectives of the Ministry are secured from various sources. According to current VROMI Ministry plans, capital investments are realized through the support of External Donor Funding, which can comprise local donors as well as international donors.

A governing program has been developed by the government in 2018. The goal of the government is to act swiftly to improve the quality of life for the people, rebuild a vibrant economy, restore a robust social fabric and promote a resilient sense of community. This governing program addresses the economic and infrastructural reality that the Country is facing. It reflects the objectives and plans of the government to restore and redevelop Sint Maarten [2].

The national budget of the Government of Sint Maarten allocates funds to the various ministries and organizational units as Operational Expenditure Budget to be used for recurring expenses, and as Capital Investment Budget to be used for larger scale 'one-time' project investments. The national budget 2018 of Sint Maarten had a deficit of ANG 197 million (US$ 110 million) and had a capital investment of ANG 22 million (US$ 12 million). But, the deficit in the national budget lowered up to ANG 67.2 million (US$ 37.3 million), having a capital investment of ANG 132.3 million (US$ 73.5 million).

The key characteristics of central government budget is i) annuity, ii) unity, and iii) universality. As the SWM operations in the country is government operation partly, there is no standard budget dedication methodology from the government budget specifically for SWM system, which will provide adequately

[1] Interim Report for Sint Maarten Trust Fund, April – November 2018, WBG.
[2] Governing Program 2018 – 2022.

splitting the budget collected as environmental and utility fees. Therefore, the budget provided to VROMI is not a resource allocation type budget, but only annual authorization type budget dedication method is applied according to next fiscal year requirements of VROMI, based on its contracts related to SWM and staff work in SWM department as there is no precise financial management framework for SWM operations.

As mentioned earlier in this report, among other emergency recovery projects[3] that have been planned and currently being implemented, Emergency Debris Management Project with an estimated budget of US$ 25 million and Long-Term Waste Management Project (this project) with an estimated budget of US$ 35 million are programmed to be committed.

3.2.1 Current Economic Instruments as SWM Budget Sources in Sint Maarten

Currently, revenues for solid waste management activities in Sint Maarten comprise of the direct and indirect revenue sources. Indirect revenues are collected directly by the central government. However, it is unknown which the percentage of the budget obtained from these sources is transferred from central government budget to SWM budget as no government budget statistics are obtained.

Table 3.2: Indirect Revenue Sources

Indirect Economic Instruments	Rate *US$*
Environmental fee, per person per day through hotels, resorts and room-share apartments	1.50
Utility Fee, per person per day through hotels, resorts and room-share apartments	3.00
Occupancy Tax, per week at hotels & resorts	50.00
Departure tax, for one-off entry payable at the airport	30.00

Source: Based on Hotel Bills and Airport information.

User charges that are applied by private unregulated waste collectors for waste collection from commercial and industrial waste generators are direct revenue sources as summarized in Table 3.3.

There is also no waste collection and disposal tariff set by the government, no user charge for households and institutions (government departments and schools) in the country. There is also no billing system for SWM services. Except commercial waste collection and transport budget, all SWM budget is provided by the government, including collection and transport budget of household and institutional waste, area cleaning waste, and the budget for disposal and treatment.

Waste collectors of household/institutional and area cleaning waste are paid by VROMI from the central government budget through the contracts. VROMI has no revenue from the waste management activities as there are no tariffs set by the Government as user charges and tipping or gate fee at the entrance of the Pond Island MSW landfill for all waste types collected and delivered, including commercial waste collectors. Government's revenue from commercial waste collectors is only by direct and indirect taxes accrued for their commercial activities.

Table 3.3: Direct Revenue Sources

Waste Generator	Rate *US$*
Small shops & retail business, including industrial workshops per month (est.)	30.00 - 50.00
Restaurants and bars, per month (est.)	80.00 - 150.00
Hotels and resorts, per room per month (est.)	10.00

Source: Consultant's own investigation.

[3] Emergency Recovery Project, Emergency Income Support & Training Project, and Hospital Resilience Preparadness Project, Enterprise Recovery project, and Airport Terminal Reconstruction Project..

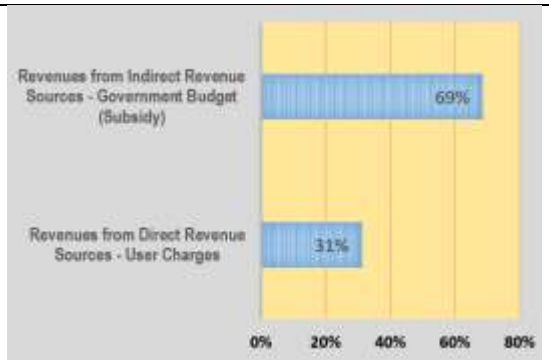
Current SWM System Operational Costs

As seen in Table 3.4 and Figure 3.2, almost 69% of total SWM budget is government subsidy (from government budget based on environmental fee, utility fee and occupancy tax from the hotels, resorts and time-share apartments), and estimated 31.32% is provided by commercial waste generators through unregulated waste collectors. Almost 68% of SWM budget goes to collection services, and 32% to disposal and treatment services.

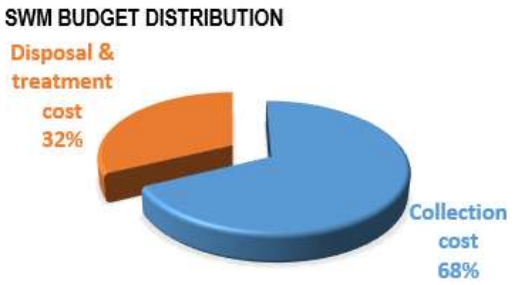
Table 3.4: Total SWM Budget of Sint Maarten by 2018

Cost Item	Cost *thsd. US$ (*)*	Budget Source	Percent of Total SWM budget
Collection and transport budget for household/institutional and area cleaning waste	3,733	Government	36.54%
Disposal and Treatment budget	3,284	Government	32.14%
Sub-total SWM budget (provided by the govt.)	**7,017**		68.68%
Commercial waste collection & transport budget	3,200	Commercial waste generators	31.32%
Total SWM budget	**10,217**		

Source: VROMI, and Consultant's own estimation based on waste market review.



Current SWM Budget Structure



SWM Budget Distribution between Collection and Disposal Services

Figure 3.2 Current SWM Budget Structure and Distribution

It should be noted that the government subsidy does not imply that 69% of the SWM budget is fully government subsidy as the government collects funds through different economic instruments such as environmental fee charged through hotels/resorts and room-share apartments, and also occupancy tax charged per room per week at the hotels and resorts.

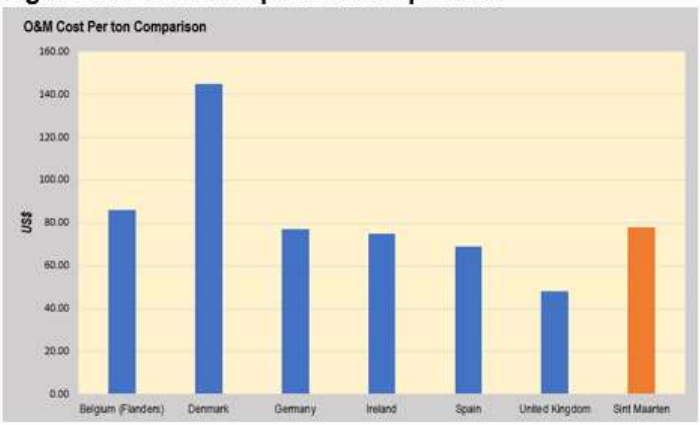
The analyses on current O&M cost based on VROMI data and consultant's market surveys showed that estimated O&M cost per ton of full SWM system by 2018 is US$ 77,98. SWM cost per person per year and month are US$ 162,16 and US$ 13.51 respectively. See Table 4 of Annex 2.

The results of this limited O&M cost assessment are compared with the cost per ton O&M rates in few European countries. Per ton O&M cost in Sint Maarten seems too high as it is almost equal to SWM system O&M cost per ton in Germany, Belgium, Ireland and Spain[4]. If the service level in those countries is considered as a cost level function, it is apparently seen that cost per ton O&M cost of SWM services in

[4] Costs for Municipal Waste Management in the EU, Final report to Directorate General Environment, European Commission, Eunomia on behalf of ECOTEC.

Sint Maarten is too high or there is no liable data on SWM budget. The latter is more possible than the first assessment because of the fact that there is no functional weighbridge at the gate of main MSW landfill; VROMI does not have sufficient staff and infrastructure to measure and keep under control the SWM system performance, and suffers from lack of capital for enhancing the performance of the system components; almost half of the collection system is unregulated, and recycling market revenues are not included into the SWM system as it is also unregulated market.

Figure 3.3: O&M cost per ton Comparison



3.2.2 Other Economic Instruments, Incentives/Disincentives

There is no environmental levy in Sint Maarten. There is only environmental fee and utility fee per person per day, charged through hotels, resorts and room-share apartments. Apart from these, there is also a Government occupancy tax per unit (room) per week at the hotels and resorts, and a departure tax per person for one-off entry payable at the airport, see Table 3.2.

There also exist no incentives which encourage the waste minimization, reuse and source separation in the country. No deposit refund system or other revenue instruments imposed by the Government for covering the external costs of environmental implications, as well as no recycling policy, and other policies which cover the components of an Extended Producer Responsibility (EPR policy).

Unlike any other SIDS in the region, Sint Maarten enjoys a Duty-Free status with no import or export taxes. This allows for the tariff free importation of raw materials for construction and manufacturing as well as tax free exportation of finished goods to be sold in foreign markets.

3.2.3 Cost Recovery

No cost recovery is secured within the current financial model, which is not a self-financed system and economically viable, and can no longer sustain the SWM system in Sint Maarten. Assessment of the issue of cost recovery depends on whether ship waste will be included in the plan or not, and whether additional tariffs can be generated from such inclusion. Ideally, tariffs from the ships would more than cover their direct costs to receive service, and provide enough to cover the additional costs of municipal service that includes cleaning up after the disembark from the ships.

3.3 Waste Sources and Characteristics

Waste types in Sint Maarten are classified under 11 categories based on their sources. All studies since almost 10 years on waste generation in Sint Maarten show that this small island country has one of the highest per capita solid waste generation rates (WGR – 3.53 kg/capita/day) in Caribbean SIDS as it is one of the most favorable destination by cruise ships and stayover tourists.

Table 3.5: Waste Types Generated in Sint Maarten

Waste Type	
1	Household Waste (residential)
2	Commercial Waste (including restaurants, touristic facilities and resorts, and small and large retail markets, grocery stores, entertainment facilities, airport, port facilities and cruise ship wastes)
3	Marine and coastal litters from land-based and sea-based sources, i.e., ocean dumping by boats, accidental container spillages, wind blown solid waste, (paper, plastic, etc) from urban areas and waste landfills, and tourism activities in beaches and coastal zones
4	Institutional Waste (schools, government offices and medical facilities)
5	Industrial Waste (non-process and non-hazardous waste from the human activities)
6	Mixed Construction and Demolition Waste – Mixed C&D Waste
7	Car wrecks/tires
8	Medical Waste (non-hazardous waste from the human activities
9	Hazardous Medical Waste
10	Hazardous Industrial Waste
11	Disaster Waste

There are two authority disposal facilities in Sint Maarten, MSW landfill and Irma Debris Disposal Site (IDDS). Both are located in Pond Island of Philipsburg. MSW landfill is accepting all waste types along with municipal waste types. IDDS occupies some 6.5 hectares of land. The MSW landfill occupies approximately 16 hectares of land in northwestern part of the Pond Island, and is in service for some 50 years. Its operable life time is almost finished. The current total fill in MSW landfill is around 1.85 million cubic meters by the end of 2019. Approximately 215,000 cubic meter debris (disaster waste) are placed in IDDS since October, 2017.

Figure 3.4: MSW Landfill & IDDS in Pond Island

Both of them are not equipped with a functional weighbridge that records the weight and other source information on the waste delivered to the landfills. Adequate compaction and placement are not performed in both landfills as VROMI has no sufficient M&E, staff and budget. Nevertheless, VROMI has achieved little improvements in 2019 in MSW landfill with its own possibilities, carrying out partly compaction by bulldozer and ADC application for covering the waste.

Analyses on waste data from 2009 to the end of 2015 showed averagely 19% of waste disposed has come from households and institutions, 25% commercial sources, 35% from area cleaning activities as yard waste, 19% from construction sector as C&D waste, respectively. Averaged yearly waste generation is around 127.4 ths. tonnes in the period of 2009-2015.

Waste from mooring yachts, fishing boats, and regional ferries are all treated as domestic waste, and assumed that they are included into household and commercial waste categories. In the weighbridge register belongs to the period from 2009 to 2015 it is noticed that very small amount of cruise ship waste (0.36%) has been accepted for disposal in the landfill.

Similarly, hazardous industrial waste is possibly included in industrial waste category in the weighbridge register of VROMI because there is no other landfill in island for disposal of them. All waste collected from industrial facilities in the island are currently accepted by Pond Island MSW landfill. There is no legal enforcement which inhibits to dispose of hazardous industrial waste to MSW landfill with other waste types.

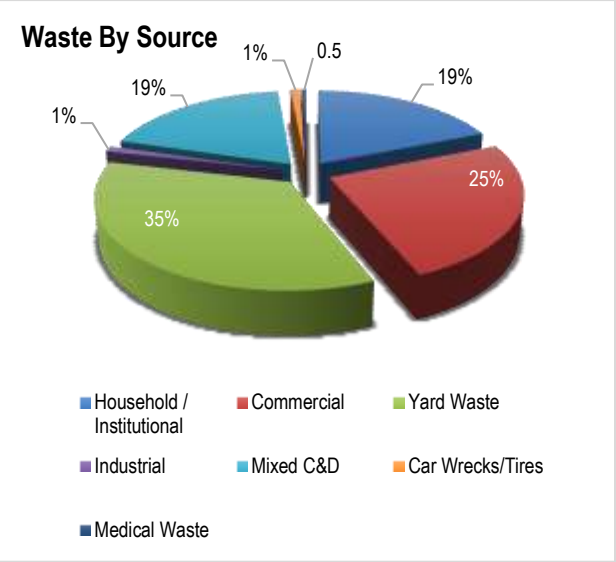


Figure 3.5: Waste Generation by Source

This situation shows that VROMI has also no sufficient resources for improving the adequate waste management as well as financial resources as there is no financial framework specifically arranged and designed for waste management.

Household and institutional waste are mainly coming from households, small scale commercial retail businesses among the neighborhoods, and government institutions/departments, schools and universities, and only 29-30% of this waste type is composed of organic waste. Some hotels and resorts compact their waste in a special container (excluding construction and some small fractions that cannot be compacted), and delivered to waste collectors. Yard waste contains mostly tree trimmings, grass clippings, and in part bush and tree brunches. Significant part of the yard waste is coming from area cleaning activities that are organized by VROMI, outsourcing the private service contractors.The household and institutional waste is collected and transported to the Pond Island MSW landfill by five private collectors contracted by VROMI.

All commercial and industrial waste are collected by unregulated private collectors with tariffs agreed mutually by private collectors and customers, and they deliver the waste to the landfill without any fee. Some big waste generators such as big commodity stores and industrial waste generators haul directly their waste to the landfill with their vehicles without paying any tipping fee.

3.3.1 Waste Composition

Figure 3.6 and 3.7 show the waste composition in the country, including and excluding C&D waste by fraction groups, based on waste characterization survey conducted in 2009[5]. Of the total waste generated, 41% is C&D waste, 9% paper, 15% organic waste,12% yard waste, 7% glass, and 7% plastics, respectively.

If C&D waste would be separated from the municipal solid waste stream as a separate category assuming that it will be handled and treated separately, the waste composition would be as follows: 16% of the generated waste would be paper & cardboard, 12% plastics, 12% glass, 10% metals, 26% organics, and 20% yard waste, respectively.

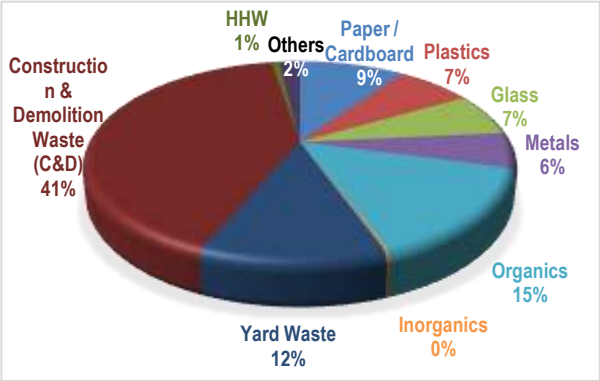


Figure 3.6: Waste Composition, including C&D Waste

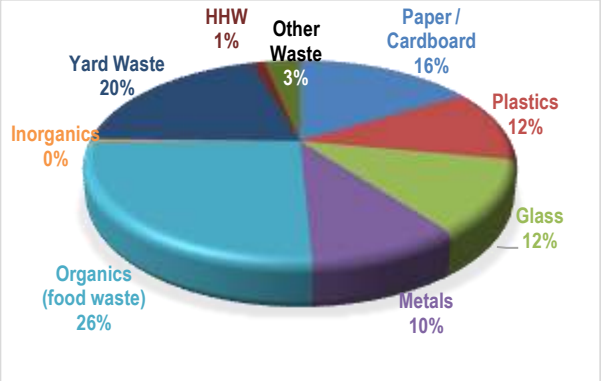


Figure 3.7: Waste Composition, excluding C&D Waste

Waste types are categorized as Municipal Solid Waste and Special Waste Types for the purposes of this project as special waste types require special attention during collection/transport, and disposal/treatment. C&D waste can contain hazardous construction chemicals which require special care, and industrial waste also requires special treatment techniques according to its industrial processes. WEEE and durables also require different collection and treatment/disposal processes. So that those should be handled separately out of the municipal waste stream. Obsolete car batteries also contain hazardous materials, and therefore, they should separately be collected, stored and handled by different techniques, even if they are sold out of island. Similarly, hazardous medical waste should be handled separately under oversee and control of the Ministry of Health.

Table 3.6: Municipal Waste and Special Waste Categories

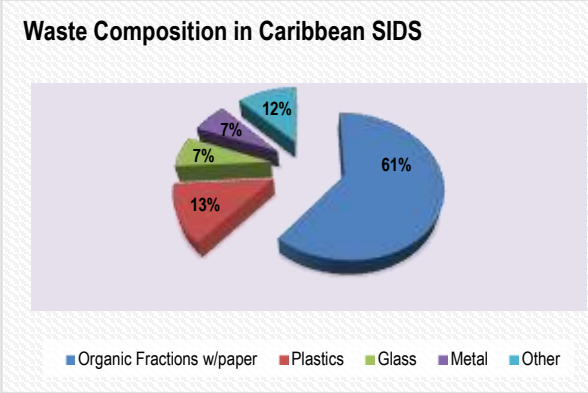
Mixed Municipal	Special Waste
Paper/cardboards	C&D Waste
Plastics	Hazardous Medical Waste
Metals	WEEE and Durables
Organic Waste (food)	Car Batteries
Textile	Hazardous industrial waste
Tire & Rubber	
Inorganic Fractions	
Yard Waste	
HHW	
Other waste	

Waste Composition – MSW Vs. Special Waste

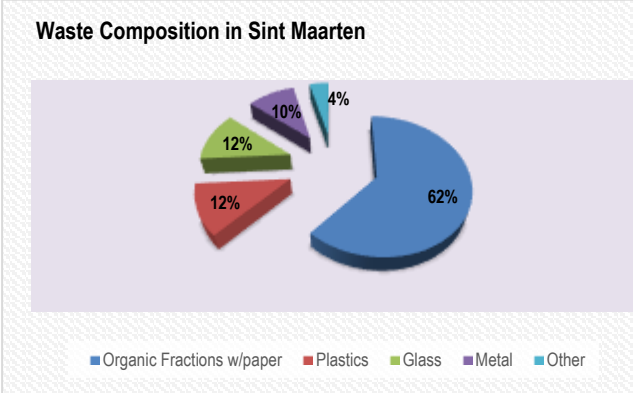
[5] Waste Chracterization Survey Results, R.W. Beck, 2010.

Comparison of Waste Composition of Sint Maarten with the One in Caribbean SIDS

The similarity of MSW composition of Sint Maarten with Caribbean SIDS is remarkable. The following comparison shows that MSW composition in Sint Maarten almost mimics the character of waste generated in Caribbean SIDS.



MSW Composition in Caribbean SIDS
(Data generated based on data in the report by Romeela Mohee, Sumayya Mauthoor, Zumar M.A. Bundhoo, Geeta D. Somaroo, Nuhaa Soobhany, Sanjana Gunasee, 2015)



MSW Composition in Sint Maarten (see Figure 3.7)
(Data generated based on Waste Data Report of Sint Maarten)

Figure 3.8: Comparison of Waste Composition with Caribbean SIDS
(Re-development of Waste Composition Data in Regional Waste Market Review Report of Aim Texas)

3.3.2 Waste Generation

Based on analysis of historical data on waste generation, it is assumed that waste generation (including C&D waste) by 2016 in Sint Maarten was around 127.4 thousand tonnes. Accordingly, the following waste generation projection has been conducted by the Consultant. Projected waste generation capacity from 2016 to 2040 is given below, assuming that the incremental increase per year will be in parallel with the population growth rate of 1.5% for base case scenario, 1.00% for low case scenario, and 2.0% for high case scenario. It seems that Sint Maarten could have waste generation capacity of 182,103 tonnes per annum by 2040 in case the base case scenario would be realized, including C&D and other special waste types.

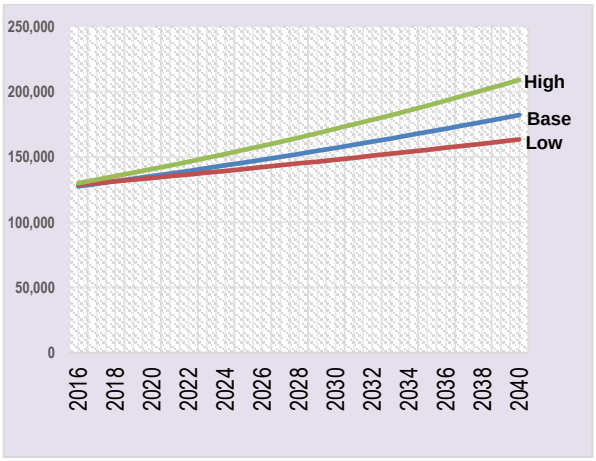
The projections did not take into account the COVID-19 lowering impact on waste generation rates for 2020 and 2021, considering the fact that the waste generation rate will rise up to the projected figures gradually following the future end of COVID-19 pandemic, and low capacity of waste generation in 2020 and 2021 would create very little effect on the end capacity of waste generation of the country, projected for 2040.

Table 3.7: Waste Generation Projections by Base – Low – High Case Scenarios, 2016 – 2040

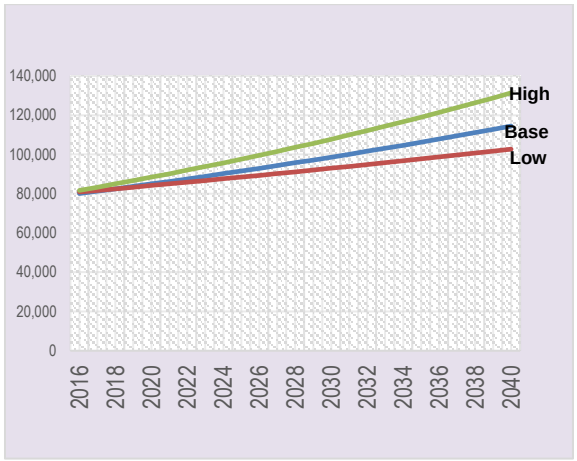
Years	Base Case Scenario		Low Case Scenario		High Case Scenario	
	C&D Waste included	C&D Waste Excluded	C&D Waste included	C&D Waste Excluded	C&D Waste included	C&D Waste Excluded
	t/a	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*
2016	127,389	80,083	128,663	80,884	129,937	81,685
2020	135,206	84,997	133,887	84,168	140,648	88,418
2025	145,656	91,566	140,717	88,462	155,287	97,621

2030	156,912	98,643	147,895	92,974	171,449	107,781
2035	169,039	106,267	155,439	97,717	189,294	118,999
2040	182,103	114,479	163,368	102,701	208,995	131,385

Source: Consultant's own estimations based on historical data provided by VROMI.



Waste Projection – C&D Waste Encluded



Waste Projection – C&D Waste Excluded

Figure 3.9: Waste Generation Projection by Base – Low – High Case Scenarios, 2016 – 2040

Waste generated by stayover tourism activity is included in this projection, but no ship waste is projected in this projection, except the boats moored in the marinas. Consultant's team observed that the tourists coming by own boats are using the communal containers for disposing their waste. Waste from commercial establishments and households are collected as mixed waste, and transported to the Pond Island landfill. Therefore, no separate category is considered to be assessed for the waste from the boats moored in the marinas. The following assessment on waste generation by source is also conducted based on VROMI weighbridge register from 2009 to the end of 2015. This analysis shows that averagely 18.54% of waste disposed has come from households and institutions; 24.52% form commercial sources; 34.89% is yard waste from different waste streams, and 19.42% from construction sector.

Table 3.8: Averaged waste disposed by source between 2009 and 2015

Waste Source	**Generation**	
	ths. tonnes	*%*
Household / Institutional	23.62	18.54%
Commercial	31.24	24.52%
Yard Waste	44.45	34.89%
Industrial	1.46	1.14%
Mixed C&D	24.74	19.42%
Car Wrecks/Tires	1.50	1.18%
Medical Waste	0.06	0.05%
Other	0.33	0.26%
Total	**127.40**	**100.00%**

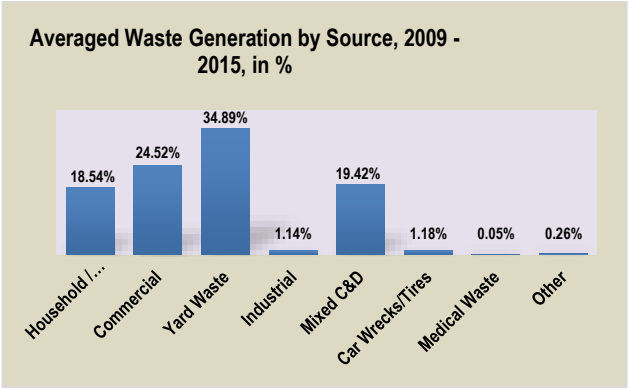


Figure 3.10: Averaged waste tonnages disposed by source between 2009-2015 *(VROMI)*

COVID-19 Effect in Waste Generation in Sint Maarten

However, a sharp decrease is expected on waste generation due to COVID-19 implications from March, 2020 to present. Based on research to date, the waste value chain does not appear to spread COVID-19. However, the SWM sector has felt impacts.

Waste production has shifted from industry and commercial centers to residential areas. According to IFC report[6]:

- The volume of medical waste may increase by up to 40 percent;
- Industrial and commercial waste production may fall drastically due to the slowdown in manufacturing activity and absence of tourism activities in the island;
- Hazardous waste production may grow with higher production from the pharmaceutical and medical sectors. Existing hazardous waste treatment capacity in developing countries (such as in Sint Maarten) is likely to be overwhelmed, leading to stockpiling and potentially inadequate disposal; and
- Municipal waste, except from commercial and industrial waste, may increase in volume, effectively overwhelming existing waste collection and disposal systems. A reduction in recycling activities further compound challenges in the collection and disposal of municipal waste.

However, we will not truly know the answers without systems modeling of waste management data. The goal of this perspective is to bring attention to the need for better real-time waste management data and systems thinking in the context of the COVID-19 pandemic and beyond.

3.3.3 Waste Generation Rate (WGR)

Waste Generation Rate (WGR) has been evaluated for two cases of C&D waste is included or excluded. The WGR in Sint Maarten is one of the highest rates among the Caribbean SIDS.

Table 3.9: Waste Generation Rates by Dynamic Population

C&D Waste Included	C&D Waste Excluded
kg/capita/day	*kg/capita/day*
5.99	**3.53**

Many of the highest waste generators are the active tourist economies in SIDS like Sint Maarten in Caribbean region. The following Figure shows the regional comparison overview of WGRs in the Small Island States that have high tourist economies. The WGR in OCT SIDS in Caribbean region is almost 50% higher than the world average (1.19 kg/capita/day), and more than two folds in LAC (1.07 kg/capita/day).

[6] COVID-19's Impact on the Waste Sector, IFC, 2020.

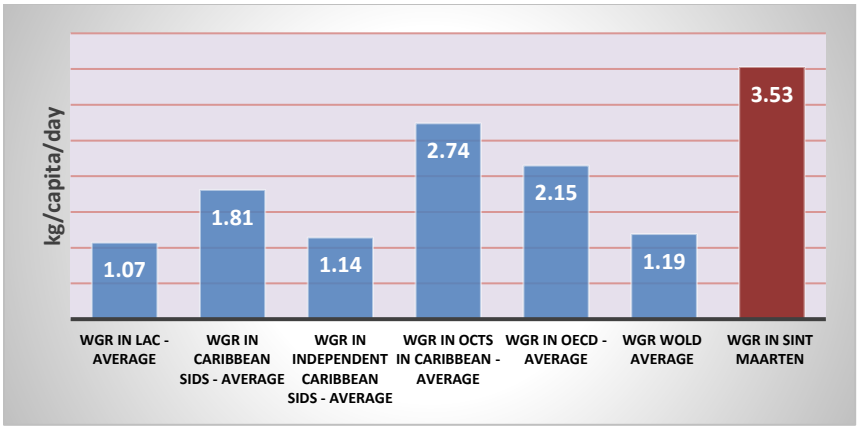


Figure 3.11: Comparison of Average WGRs in Independent Caribbean SIDS, OECD & World Average *(Consultant's own assessment).*

In addition to growing rates of solid waste generation per capita, stop-over tourists are reported to generate at least twice the amount of waste as local residents, while cruise ship passengers generate up to four times the amount generated by local residents.

However, it is expected that WGR in Sint Maarten with COVID-19 effects may drop down to level of average WGR in the independent Caribbean SIDS (1.14 kg per capita per day). Nevertheless, it should be noted that this Strategy is a planning instrument for the future waste management in the country, all projections in this report have been conducted according to waste generation rate of 3.53 kg per capita day for MSW generation without C&D waste and the rate of 5.99 kg per capita per day including C&D waste, considering the fact that the waste generation rate will rise up to the projected figure gradually following the future end of COVID-19 pandemic. Because of this reason, the total waste generation in the country using the average WGR rate in the independent Caribbean SIDS, has been adjusted to start relatively low and gradually rise for the periods of 2020 – 2021 due to lowering impact of COVID-19.

3.3.4 Waste Flow

Current waste collection and transport practice are only comprised of collection/transport of all types of the waste generated, and hauling them to the MSW landfill. There is no formal material recovery facility or activity programmed by the government for separating and classified the waste fractions during waste flow. Informal collection and diversion of recyclables from the main stream makes up less than 10% of total waste collected.

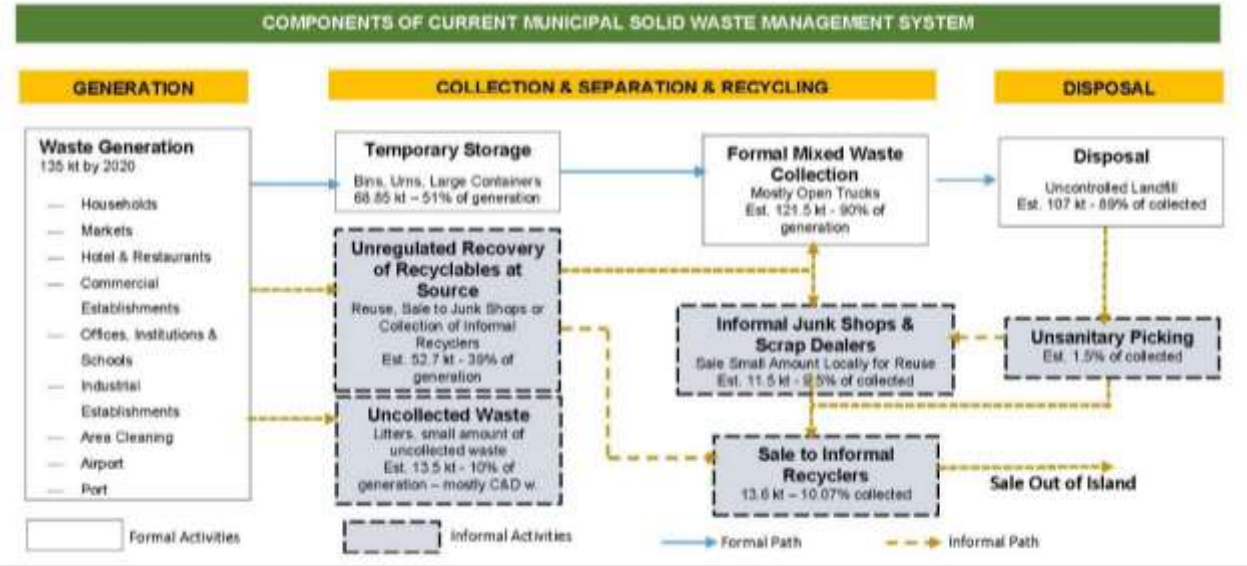


Figure 3.12: Current Waste Flow Components in Sint Maarten

The current waste flow scheme cannot be used conveniently to identify visually and to record where, how and when the wastes are generated.

3.3.5 Waste Character

According to the results of waste characterization survey conducted in 2009, 41% of the total waste (including C&D waste) generated in the country is C&D waste. However, 47.83%% of C&D waste is formed from wooden fractures. This waste composition suggests that the topological distribution of waste generated is 55.70% organic fractions, 21.60% inorganic and inert materials, 7% plastics, 6.90% glass, 5.70% metals. Other small fractions make up 2.80% of total waste generated.

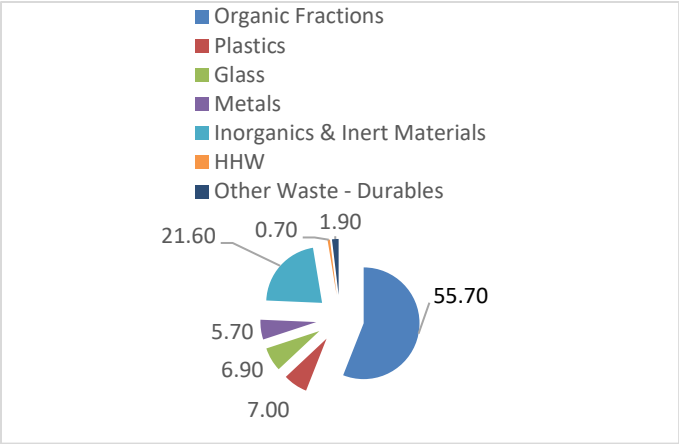


Figure 3.13: Topological Distribution of Waste

Waste Density

As there is no reliable waste density measurements or surveys previously conducted for Sint Maarten, based on the consultant's experience worldwide and the literature review, the average MSW densities depending on where it is placed are given below for referencing.

Consultant's assumptions for planning level waste densities are given below.

Table 3.10: Compacted and Un-compacted Waste densities for Hauling and Landfilling Purposes

Waste Compacted / Un-compacted	Density
	kg/m³
Mixed MSW in container	280 - 300
Messy waste in open truck	350 - 400
Compacted mixed waste in truck	650

Waste in skid containers for hook lift trucks - 3 - 4 m^3	350
Compacted waste in landfill	1,200
Suitably uncompacted waste in landfill	800 - 850

Source: Consultant's own experience.

Calorific (Heat) Value

The overall high heat value (HHV) for the projected waste stream in the waste characterization survey report (2009) is 2,534 kcal/kg. However, no laboratory test has been conducted for determining the average high and low heat value of mix waste generated in Sint Maarten during the survey. Besides, few inert and non-combustible materials (other C&D waste, durables, misc. inorganics, etc.) are included in the estimation, which in turn affects the level of calorific value significantly. The calorific value of overall waste stream will also fluctuate throughout the course of the year depending upon the amount of precipitation, variations in the composition of incoming waste, and future changes in the waste stream.

An approximate average calorific value on potential for incineration alternative has been conducted with the sector specific caloric values of combustible fractions for overall waste stream, assuming that all wood fractions from C&D waste will go to the incinerator. The assessment has been conducted on 21 waste fractions. The resulting wet weight low and high calorific value may be around 2,803 and 3,514 kcal/kg, respectively. However, the consultant recommend that a detailed analysis should be conducted on low and high calorific values, programming a comprehensive and seasonal waste characterization survey.

3.3.6 Potential for Recycling, Resource Recovery, Biodegradation (composting) and Waste to Energy Production

The topological dynamics of waste deposited is given in the following Figure. Approximately 55.70% of waste disposed is putrescible organics, including paper/cardboard, organic waste (food waste, wooden fractions, tire and rubber, and yard waste. 54.20% of it is biodegradable, 46.60% recyclable, 63.90% combustible, and 57.10% can be converted into RDF for use as secondary fuel.

Figure 3.14: Topological Dynamics of Waste Disposed in Sint Maarten
Source: Consultant's assessment based on waste characterization survey conducted in 2009.

Potential for Recycling, Biodegradation and Waste to Energy (divided into potential for waste incineration and RDF - secondary fuel) production is assessed in the following Figure based on following assumptions;

- Evaluated waste composition;
- Population Growth rate is 1,5% per base case;
- Waste generation Rate is 3.53 kg per capita per day, excluding C&D waste and cruise ship waste;

Out of the total waste stream the following Figure below shows the percentages for recycling and resource recovery. See Annex 2 for details.

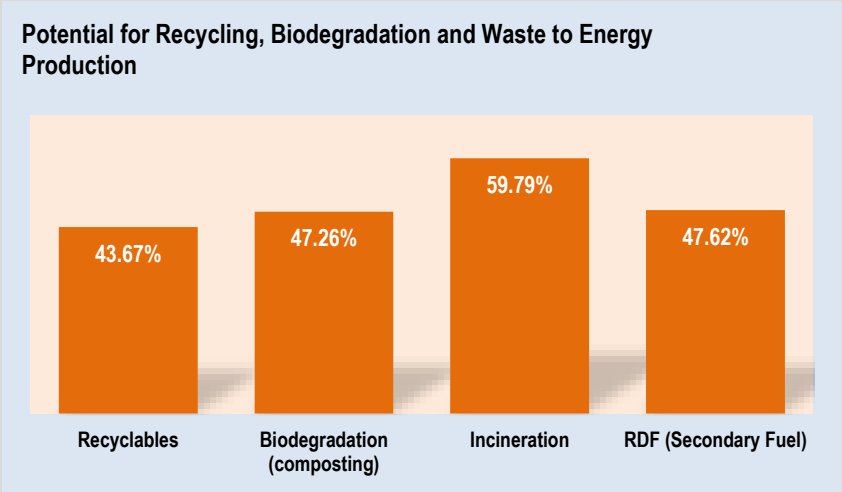


Figure 3.15: Recycling, Biodegradation, WTE and RDF Potential

(Consultant's own development, based on the results of last waste characterization survey conducted in 2009)

It should be noted that the last waste characterization survey does not represent seasonal variations, and conducted 10 years ago. A more comprehensive waste characterization survey should be conducted to ensure the updated waster character and seasonal variations in the waste generation.

3.4 Waste Market of Sint Maarten

3.4.1 Market Size

Based on the historical waste records, and results of consultant's projections from 2016 to 2040, the waste market in Sint Maarten can generate estimated 100 tonnes per annum recyclable waste, including wood fractions in C&D waste and yard waste) in a normal tourism season. However, any fluctuation on tourist capacity of the country can heavily affect the size of waste market. The packages of imported materials increase the amount of recyclable waste generation in Sint Maarten. Almost 64% of the generated waste (approx. 100 tonnes per annum MSW) in total is recyclables with 85% separation & collection efficiency, including wood fractions in C&D waste. See Annex 2, Table 15.

It is seen that packaging waste (paper – 11.81%, plastics - 7.88%, glass – 8.86%, and wood pallets) plays important role on amount of recyclable waste generated. Sint Maarten together with sister islands (Saba and St. Estatius) consume over 30 million bottles of beer in a normal tourism season.

3.4.2 Analysis of Waste Market

Aim Texas consultants have reviewed and examined the waste market in Caribbean SIDS, and its connections to international markets, specifically on final destinations of recyclable fractions, their transportation routes to regional and worldwide recycling market, and major recyclers that play important roles in waste market of Caribbean Region.

Sint Maarten shows many similarities to other SIDS in the region from the perspective of demographics, economic drivers and economic dependency on tourism, tourism related activities and tourism dependent industries, dependence or connections to regional and global market, transport capability and difficulties to haul their processed or semi-processed waste to the regional and global market, dependency on use of fossil fuel for energy, and being exposed to natural disasters such as tropical storms.

Currently, the major players in Sint Maarten waste market are the waste management authority (VROMI), relevant government agencies/authorities, the waste generators, waste recyclers/processors, general public, and non-governmental organizations (NGOs). The airport authority, port authority, and big hotels and resorts should also count as major players in waste management because they are major waste generators in the country.

Because of the fact that these stakeholders act independently from the main waste management authority (VROMI), and in a disorganized manner, the overall waste management in Sint Maarten is unfortunately unable to be perceived as a cohesive and holistic waste management scheme. As a result, VROMI is solely relegated to performing collection of the solid waste from households/institutions and area cleaning as well as managing landfills within their own limited resources, leaving the collection and transport of commercial waste unregulated.

This situation enables local recyclers to opportunistically seek out the international markets through regional recyclers, bypassing regulations and best practices all the while selling the recyclable fractions in the main waste stream as semi-processed recyclables, since there is no robust enough industrial infrastructure to support a circular economy which revolves around these local recyclers, and also there is no industrial and agricultural base for sustaining material reuse & internal processing of recyclables. Thus, these local recyclers are compelled to respond to the existing demand within the Caribbean waste market, and they conform their scrap recycling procedures according to hub areas around the Caribbean.

According to Aim Texas consultants' research on regional waste market, estimated 350 – 400 recyclable materials shipments per year leaving Port Philipsburg and arriving of Port Everglades in Florida exclusively, through local and regional Scrap Collectors/Dealers; They accept only scrap metal, car batteries, small amount of plastics and electronic waste, and very small amount of scrap paper. Recovered Paper supply in the region is in fact much lower than either Metal or Plastic Scrap Supply, and no scrap wood and glass demand in regional market.

3.4.3 Recyclers in the Market

There are more than 13-14 active recyclers in the island, including the ones located in French part. Although exact number of local recyclers is not known as no official records are available, the major ones are determined by the consultant during surveys and site visits. The list of the prominent local recyclers is given in Annex 2, Table 16.

Some of them hire 8-10 cu.m dumpsters to large waste generators, to collect both the recyclable fractions separately from the main waste stream and bulky waste. They also had direct connections to the regional recycler companies in the region and in US, to export the recyclables.

Few local NGOs are also providing recycling bins for separate collection recyclables in few points. They also provide the regular collection of single use plastics deposited in recycling bins, which will be processed in Sint Maarten. They are also supported by few CBOs (i.e., St Peters Emergency Organization Group – SPEOG). This initiative seems to be spread to other communities in the country. Few of them are also operating scrap yards in different location of the country, to store, pre-process, and bale the recyclable materials such as ELV or wrecked cars, scrap metals, plastics, paper and scrap electronics.

Dumpsters of Meadowlands

Meadowlands pre-processing facility in Cool Bay

Caribbean Scrap's Scrap Yard in Pond Island

Recycling Bins for separate collection of recyclables – Waste Factory

Figure 3.16: Dumpsters and two bins side-by-side for separate collection of bulky waste and recyclables

Waste2Work (NGO) started in January 2018 as an initiative from 'Startup Solutions for Sint Maarten', a coalition of Netherlands Red Cross, Ministry of Internal Affairs (BZK), Stichting Open House, Innofest, Start-up Delta, Dutch Coalition for Humanitarian Innovation and Ministry of Defense. It works on reuse of scrap woods and lumbers, producing garden furniture and some wood decorative wood stuff from the scrap

woods. It also produces some souvenirs from tins and cans, and plastics. However, they have small capacity.

Some restaurants apply a discount for their customers who bring their own to-go containers or cup such as the Dinghy Dock, Mark's Place, Subway, Joga and Market Garden Cafe. Along with these restaurants more than two dozen of bar & restaurants[7] support the waste minimization efforts, switching to environmentally friendly products instead of single-use plastics. Their leadership in being an environmentally friendly business inspires other businesses and their customers to care more about the environment and creates a chain reaction of additional businesses and people who will refuse the use of single-use plastics in Sint Maarten. However, no monitoring is conducted by a government department over all these waste minimization and recycling activities as there is no government policy, which regulates the recycling market.

3.4.4 Current Recycling Rate

According to the resullts of Aim Texas consultants' Caribbean waste market research, estimated amount of collected and exported recyclables from Sint Maarten is 13,667 tonnes by 2019, breakdown of which is given in Annex 2: The estimated recycling rate in the country is around 11%, which is slightly below the regional average of 12%, see following Figure. However, regional average is probably higher than 12% as the data and information on recycling in Haiti and Dominic Republic are very scarce.

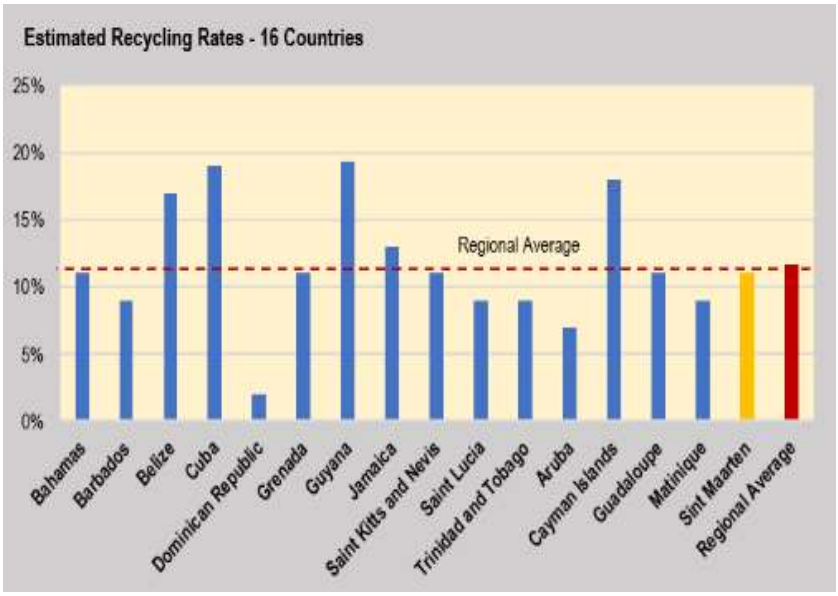


Figure 3.17: Estimated Recycling Rates – 16 Countries

The analyses above showed that the CARICOM countries like in Sint Maarten, have not sufficient industrial infrastructures which support processing the recyclables in-house or in the region, rather they rely on export of the recyclables as secondary material to the markets/countries that have more developed industrial infrastructures such as USA, China, India, Taiwan, and for small amounts to Canada and European countries. This also means that approximately 85 - 88% of waste ends up in landfills in CARICOM region as in Sint Maarten.

3.5 Gaps Assessment for the Sint Maarten Current Waste Management System

The Sint Maarten solid waste management system is accommodating both "technical" and "policy level (enabling systems)" gaps according to an Integrated Solid Waste Management System (ISWMS), and naturally needs to fill the gaps. So that the gaps within the current waste management system are summarized under following two categories:

[7] Nature Foundation of Sint Maarten (https://naturefoundationsxm.org/2019/08/29/nature-foundation-st-maarten-expresses-appreciation-to-businesses-that-have-reduced-use-of-single-use-plastics/)

A. Technical Systems, and Physical Resources, and
B. Enabling Systems.

The following Tables highlighted the apparent gaps in SWM system of Sint Maarten.

A. Technical Systems' Gaps

1. Waste Collection

1. Waste collection system is vested with some lackings in the extent of accountabilities of the parties involved.
2. Only waste collection system for households, institutions, and area cleaning is regulated.
3. Waste collection form commercial & industrial premises is unregulated.
4. An open subscription system is in place for collection and transport of waste from the commercial and industrial waste generators.
5. Significant amount of C&D waste is collected with the municipal waste.
6. All waste types collected mixedly, and transport to the Pond Island MSW landfill.
7. Waste collection system is not arranged in a holistic approach, and not integrated with other components of waste management system.
8. Although the TORs announced by VROMI for waste collection are very comprehensive in content, the waste category definition is very complicated and creates confusing. The categories/waste types are not complied with the general concept of waste industry, and waste categoreies in EU regulations;
9. Informal diversion recyclables by waste collectors.
10. No public awareness of residential waste generator responsibilities in the waste collection system.
11. No standardization on number of communal containers, and their locations
12. Waste accumulations in waste collection and communal container locations.
13. Increased litter in non-tourist residential areas.
14. The current waste collection and disposal scheme does not contain any measure or application to provide separate collection of different waste types.
15. No weighing and recording the waste collected.
16. EHS measures are not observed within the waste collection scheme,
17. No policy level support for engagement of NGOs and CBOs in waste collection.
18. No policy and program support by waste management authority/government for efforts of CBOs, NGOs, and commercial community for separate collection of waste.

2. Waste Disposal & Treatment

1. Access control is not provided at the entrance of both landfills;
2. Both landfills are not equipped with a functional weighbridge; so that actual waste tonnage is unknown;
3. No lining at the bottom, and no adequately graded slopes in both landfills; so that slopes are very steep, and they have potential risks for slope failure;
4. No adequate compaction and grading equipment; so that no adequate compaction and grading in both landfills;
5. The waste density of about 800 -850 kg per cubic meter in the landfill indicates spaces that contain no waste inside the waste pile;
6. LFG can easily accumulate in these spaces, and oxygen contact with LFG (mainly methane) triggers deep seated fires or shallow sub-surface fires;

7. Crevasses, fissures close to slopes suggest that there are unstable areas on the landfill slopes;
8. No leachate collection, treatment and disposal system also exist in both landfills, all leachate is seeping to water table under the landfill;
9. Absence of land adjacent to the landfill suitable for lateral expansion creates problem for MSW landfill operational life;
10. No guidance and/or method statements for measuring the performances of the contractors;
11. Perimeter fence is inadequate;
12. No EHS measures in place in disposal & pre-treatment activities;
13. No measures on avoiding of environmental and social impacts of both landfills' daily operations, and monitoring:
    - No traffic control at the intersection of Soualiga road with landfill access roads;
    - No environmental monitoring on leachate seeping or littering to the Great Salt Pond;
    - Residential/commercial area adjacent to landfill in south and south-east is heavily impacted by daily operation of MSW landfill with dispersing of fugitive dust.
14. People living in residential and commercial area south and south-east of MSW landfill are under slope failure risks that can cause significant physical damage.

3. Waste minimization, Reuse, Recycling & Recovery

1. All recycling market in Sint Maarten is unregulated by a specific resource conservation and recovery policy or ordinance;
2. There is no robust enough industrial infrastructure to support a circular economy which revolves around these local recyclers, and also there is no industrial and agricultural base for sustaining material reuse & internal processing of recyclables;
3. There are no incentives and disincentives officially arranged or government programme on waste prevention, minimization and reuse by government ordinance, although few hotels/resorts, bars and restaurants support the waste minimization efforts,
4. There is no ban on import and use of single-use plastic containers and bags to the island, although there are civil initiatives by few non-governmental organizations on banning of imports and use of single-use plastic bags and food packaging;
5. There is no regulation on arrangements of separation at source, and separate collection of the recyclables as well as arranging color-coded recyclable bins in public areas, which are important resource conservation measures;
6. VROMI, as single waste management authority of the country, has no sufficient trained staff and financial resources to enable to control, manage and/or oversee the recycling market in the country as well as to improve networking between recyclers;
7. No public education and awareness programmes that are applied by the government or waste management authority (VROMI) on waste management;
8. No energy recovery from the Waste.

4. Physical Resources

1. Natural Resources

- Land scarcity for expansion of exisiting facilities.
- Scarce soil resources for daily cover and top soil.
- scarce raw materials (gravel and rocks for crushed aggregate) for different applications in SWM system facility improvements.
- Absence of natural water resources.
- Energy dependency of the country to fossil fuels.

2. Geographic Positioning

- Natural events which cause frequent extensive destruction in the island such as tropical storms and hurricanes with torrential rains, storm surge, tsunamis, earthquakes due to volcanic activities and plate-tectonics.
- These events bring additional burden to overcome by the waste management department and service providers.
- No resiliency to overcome the problems caused by the natural events. So that waste management in the island is vulnerable to consequences of the natural events.

- Vulnerable to the effects of climate change due to extreme weather events, sea level rise, habitat degradation, etc.
- Difficulties to connect to transport grid in Caribbean region and sub-regional marine transport routes.
- So that transshipment services are more costly.
- Remoteness from global markets also leads to high production and trading costs, limiting investment, competitiveness and the scope for integrating global value chains of pre-processed or processed recyclables.

3. Economic Resources

- No industrial infrastructure to support the internal recycling, which will support a circular economy in the island.
- This creates a strong dependency to the regional waste recyclers, and the demand of regional and global recycling market.
- Small domestic market and a narrow natural resource base result in undiversified economy, limits for achieving economies of scale, and reduced scope for private sector development with attendant impacts on economic growth and job creation in the country.
- The country's economy is highly open, and thus are quickly and strongly affected by global trade and financial volatility and economic downturns.
- Infrastructure costs, particularly for sustainable energy, communications and transport, are high in the country.
- Small scale economy and absence of economies of scale are major impediments for attracting domestic and global capital in SWM investments for exploring waste management techniques other than traditional ones.

4. Human Resources

- Lack of human resources and expertise for SWM in the island is a common concern as other small island SIDS in Caribbean region.
- This creates stresses on waste governance as in other SIDS in Lesser Antilles.
- This situation is an impediment on effective use of the resources dedicated for waste management.

B. Enabling Systems' Gaps

1. Legal & Regulatory

1. Sint Maarten drafted a new comprehensive national law, which is significantly more robust than the previous law. AIM TEXAS provided review and comment on this draft law, through the team Attorney, in October 2019. In summary, the comments suggested Gap Analysis to address of the draft law relative to existing laws and systems, to be sure that they are compatible;
2. Once the solid waste national law is finalized and enacted, there may need to be some changes in municipal ordinances, where they may exist, to make them fully compatible with the new national law. In any case, the new solid waste law would supersede municipal ordinances or codes.

2. Institutional

1. The major conflict on institutional and regulatory side is that regulatory and operational body are the same institution – VROMI. Along with this major gap, the following gaps are identified within the current institutional arrangements;
2. VROMI has no sufficient staff for adequately managing the SWM system in the country;
3. Department of Infrastructure Management (DOIM) of VROMI is not only responsible for solid waste management in the country, but also it is responsible to manage the wastewater system and road networks and related activities, although it has separate, but in insufficient number of staff for SWM;
4. Therefore, DOIM suffers from lack of staff capacity and capability in overall for SWM.

3. Financial & Economic

1. No tariff set by the government and/or waste management authority (VROMI) for waste management activities in the country, including waste collection disposal (tipping fee);
2. There are only two direct economic instruments in Sint Maarten, which are:
    - User charge for only commercial waste generators, and
    - Government Subsidy.
3. There are also 4 tpyes indirect economic instruments, those are: 1) Environmental fee, 2) Municipal (utility) fee, 3) occupancy tax, and 4) Departure tax.
4. However, it is unclear that the fund provided by the indirect economic intruments is used for SWM system's cost recovery as Sint Maarten does not have clear financial policies; The fund provided by these instruments is also used for recovering of street lighting and other communal services. This in turn, cause to financial shortage for full cost recovery of SWM services, and no cost recovery could be made secur;
5. An unregulated open subscription fee collection mechanism exists for the commercial waste generators;
6. Current economic instruments are far from providing a sustainable cost recovery.
7. The regulations for revenue providing are not directly related to specific services of solid waste management, and billing system exists;
8. No revenue is transferred to the waste management budget from the recycling activities;
9. No full cost accounting approach in the financial policies for solid waste management;
10. No cost recovery is secured within the current financial model;
11. The other generalized problems are:
    - Insufficient financial resources to cover the SWM cost;
    - No specific SWM spending and budgeting accounts;
    - SWM Revenue and Costs are not clearly known;
    - Absence of a SWM Cost Calculation methodology;
    - Absence of SWM economic and financial performance Indicators;
12. Absence or low investment in education & communication and in planning & control.

4. Social Inclusion & Public Awareness

1. Lack of public and private cooperation and awareness are serious concerns in Sint Maarten as the government does currently not support them fully (except few of them such as Nature Foundation of SM, and etc.) with a government policy and programme, though few civil initiatives listed above are in keen interest to create a clean community in the country;
2. Although in order to put in effect the public awareness and social inclusion programmes was set forth in recent government programmes, there is no significant achievements for providing environmental consciousness;
3. Collaborative efforts between VROMI and CBOs/NGOs in waste management are weak;
4. However, the community organizations and NGOs, which support the recycling activities and waste management, are collaborate mostly formal private companies and other Ministries;

5. Private Sector Involvement

1. Private sector involvement in waste management system is partly organized by VROMI in waste collection and transport;
2. However, there is no policy and program support to involved private sector in waste;
3. They involve in waste management sector for the sake of having clean Sint Maarten by using some rule of thumbs related to waste management, but they are disconnected to a holistically prepared programme.

CH 4
ISWM APPROACH

Overview

This Chapter provides an overview on ISWM approach and process of Sint Maarten SWM Strategy and Action Plan (Sint Maarten SWMS &AP) during the TA for Establishing Integrated Solid Waste Management System (ISWMS) under the Sint Maarten Sustainable Solid Waste Management Project supported by World Bank and Sint Maarten Government.

4.1 Integrated Solid Waste Management (ISWM) Approach

The main purpose of waste management is to supply a service, specifically to remove waste from the human habitat to ensure hygienic living conditions. Today, waste management meets hygienic requirements so well and as a matter of course that the public does not perceive the need for this service except in emergencies. In parallel with increasing production and consumption, the growing need and role for waste management as a "filter" between human activities and the environment became apparent, resulting in the development of safe and reliable technologies such as modern collection systems, incinerators, and sanitary landfills.

An integrative regulatory approach is needed that encompasses not only the technical and environmental but also the political, social, financial, economic, and institutional elements (enabling framework options) of waste management if environmental protection is to be realized.

Three overarching principles guides the preparation of this integrated waste management strategy, which are:

1. Sustainability;
2. Regional Cooperation and integration to regional waste market; and
3. Fiscal Responsibility (FR).

1. Sustainability: solid waste as a resource that should be managed to promote economic vitality, ecological integrity, and improved quality of life in a way that fosters sustainability. The primary aim of sustainable solid waste management is to address concerns related to public health, environmental pollution, land use, resource management and socio-economic impacts associated with improper disposal and treatment of waste.

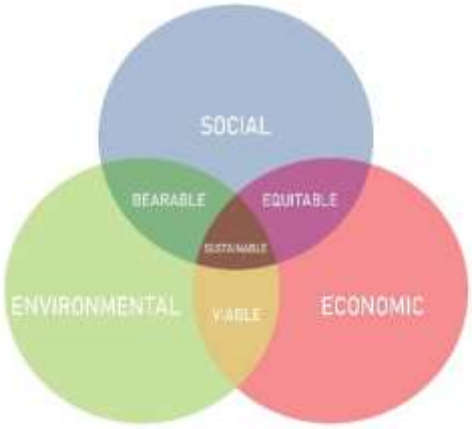


Figure 4.1: Interconnection of Elements Affected Sustainability

2. Regional Cooperation and integration to regional waste market: is vital for Sint Maarten as the lack of economies of scale and local industrial infrastructure are a reality. This corresponds to inter-island and regional cooperation that seeks cooperation opportunities with the islands in immediate

vicinity and Caribbean region in similar size in order to provide integration to regional waste market, and intra-island cooperation that will seek cooperation opportunities with French part of the island.

3. Fiscal Responsibility: Fiscal policy is one of the instruments for the achievement of sustainable solid waste management. Taxes, environmental/municipal fees, service fees (user charges), and subsidies are the key elements of the fiscal policy. Policy instruments based on economic incentives also influence the behaviour of producers and consumers towards a more sustainable waste management.

ISWM theory recognizes three key components: the stakeholders affected by or engaged in waste management, physical or practical elements of the waste management system and an array of the aspects that directly affect waste management including political and cultural influences, see following Figure.

Figure 4.2: Integrated Sustainable Waste Management Model
(Source: Putting Integrated Sustainable Waste Management into Practice, 2004)

In the strategic planning process of ISWMS of Sint Maarten, the consultant used a model to transform the SWM organization in the country from its present position to the desired position as described by the objectives, subject to the constraints of the capabilities and the potential of the organization. The model specifically stresses on two concepts, which are:

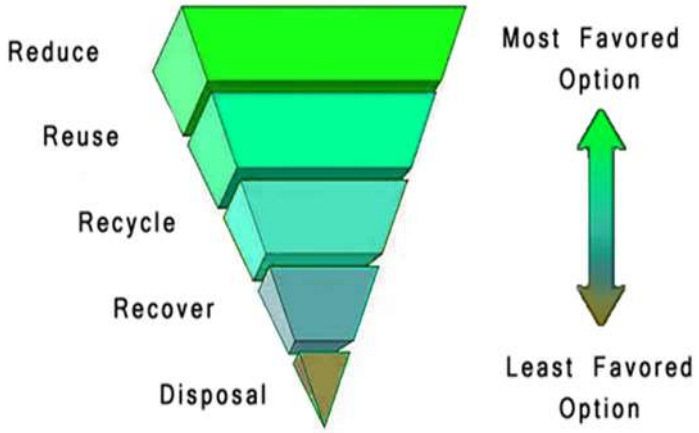
- Evaluation of the differences (gaps) between the current position of the system and its objectives; and
- The idea that the system must seek a centrally organized product-market posture and market diversification in waste management with a capability-based participatory approach, the combined performance of which is greater than the sum of its parts.

4.1.1 The Waste Hierarchy

Globally, most countries of the world have adopted the waste hierarchy as a key principle for their solid waste systems. The focus of the waste hierarchy is to prioritize activities that eventually lead to minimizing the need for land disposal. Most often the Waste Hierarchy is shown by using a pyramid (as shown in Figure 2.3 depicting the 4 R's, in their sequence of priority, as follows:

- Reduce – reduction of the amount of waste being generated at the source of possible waste generation and reduction of the hazardous content of waste, by improved principles of "green" manufacturing by industries.

- Reuse – reuse of a material or product at the source of possible waste generation, rather than wasting it, by concepts such a product stewardship by manufacturers, waste exchanges between manufacturers, and industrial use of recyclables as manufacturing feedstock.



- Recycling – processing waste commodity materials, such as paper, plastic and metal, by mechanical techniques such as sorting belts, screens, magnetic separators, air classifiers.

- Resource Recovery – making new resources from waste, by techniques such as: gasification to synthetic fuel, biological digestion to biogas, aerobic decomposition to compost and incineration to electricity.

Recycling, the most preferred technical option environmentally, leads to substantial natural resource savings. This includes conserving petroleum, as recycling saves on the inherent energy of a material that has become produced through mining, planting, processing, transporting, and/or manufacturing. Some examples of the natural resource savings include:

- Recycling 1 ton of paper saves 16 trees, 2 barrels of oil, 4100 kW of electricity, 1 cubic meter of land disposal space, and 27 kg of air pollution. Recycling half the world's paper could save 9 million hectares of forest.

- Recycling 1 ton of aluminum saves about 40 barrels of oil, thereby conserving 95% of the energy needed to make aluminum cans from virgin bauxite ore, and produces 97% less water pollution.
- Producing 1 ton of recycled rubber requires only 29% of the energy required to produce a ton of rubber from virgin materials.
- Recycling glass reduces silica mining waste by 70%, water use by 50%, and air pollution by 20%.
- Producing steel cans from recycled steel requires only 25% of the energy needed to produce it from virgin steel, and results in only 25% of the water and air pollution.
- Recycling 1 million cell phones recovers 16,000 kg of copper, 320 kg of silver, 34 kg of gold, and 15 kg of palladium.

4.1.2 Overarching Principles of the Integrated Solid Waste Management (ISWM)

The key principles for development of the strategy are:

- Using an integrated waste management approach that seeks to optimize the cost-effectiveness of the solid waste activities as an integrated system from collection to disposal;
- Using a holistic perspective that looks at the whole life of equipment and facilities and total costs to maintain, operate and use them, and also looks at closure and post-closure costs. In this holistic perspective, natural resource consumption, emissions, and energy demand for every activity along the chain of solid waste activities are considered;
- Accepting the waste hierarchy and its 4 R's of waste reduction, reuse, recycling and resource recovery as priority steps to minimize land disposal;
- Adopting the polluter-pays-principle coupled with an appreciation for the ability-to-pay of various waste generators in developing cost recovery concepts;
- Optimizing economies-of-scale through defining waste processing and landfilling systems;
- Outlining enabling frameworks of supportive laws, institutions, financing, economic instruments, social inclusion, and private sector participation; and
- Assessing the full array of possible environmental, social, and health impacts for optimization of choices and inclusion of mitigation measures.

4.2 Technical and Enabling Framework

Choices were separated into two categories of solid waste improvement, namely:

- Technical choices, and
- Enabling Framework choices.

Technical Arrangements directly involve investment in infrastructure and new services. The benefits that result are specified in the designs and contracts for the goods, civil works, and operations.

On the other hand, the Enabling Framework Arrangements create the support systems, incentives and disincentives that encourage a change in behavior. Enabling Framework Arrangements are meant to result in significant public cooperation, private sector investment, and more environmentally/socially conscientious activities. Without the Enabling Framework Arrangements, the Technical Arrangements would not be likely to be successful. But, even with Technical Arrangements, the Enabling Framework Arrangements would lead to solid waste improvements. Together, the speed and cost-effectiveness of upgrading the solid waste system would be optimized.

Within these two categories for decision-making about the future of solid waste in Sint Maarten.

4.2.1 Technical Options

1. Collection Options

Collection is conducted by a wide arrange of mobile equipment selected to match neighborhood conditions of access and waste storage. As there is no unpaved road, use of simple hand carts, tricycle carts or animal drawn carts is not the case for Sint Maarten. But, most often, compaction trucks are used as they enable the work of loading the vehicle to be less strenuous for workers. While Sint Maarten's waste is relatively low dense due to high amount of packaging waste, compaction trucks still can offer some value because they push the waste up from a low loading height into the high body of the truck, thus enabling easy loading of a large volume of waste. Compaction trucks can be filled from a wide range of containers, ranging from plastic bags to metal liftable containers.

Compacted waste containers that are used by some resort hotels can be hauled with roll of low bed trucks. Bulky waste, part of the area cleaning and yard waste are generally hauled with open trucks as currently is the case in Sint Maarten.

Attractive covered containers at safe lighted collection points, coupled with attractive enclosed modern vehicles and polite crews in proper uniforms give the consumer a sense of appreciation for the services being provided. Since it is the consumer who has to pay for the service and who sees only the collection part of the service, efforts to make it pleasant, reliable, clean, and modern have value beyond simply the provision of services.

Door-to-door (or building-to-building or compound-to-compound for resorts and hotels) and curbside collection for residential and central business districts, and on-site pick up for large commercial and industrial districts will be preferred for planning of the collection points.

2. Transfer Options

There are two options for transferring the waste collected to the disposal site or a processing site:

- Direct haul to disposal site; and
- Transfer station option.

However, as a waste transfer station is not the case for Sint Maarten due to the fact that any direct hauling distance to disposal or treatment site does not exceed 25 - 30 km from the collection area.

3. Recycling and Resource Recovery Options

Recycling processing involves mechanical systems to sort, screen, clean, air classify, and magnetically separate commodity materials from mixed wastes. The output of processing municipal waste includes: paper, cardboard, glass, metal, rubber, and plastics. If the recycling process is established to focus on construction and demolition debris, the output of processing is concrete aggregate, asphalt aggregate and metal.

Resource recovery processing involves three basic approaches for converting organics in waste to a new resource, as follows:

- biological conversion,
- thermal conversion, and
- mechanical conversion.

a) Biological Conversion

Biological conversion involves micro-organisms that convert putrescible organic material under either aerobic or anaerobic processing conditions to end products of compost or biogas. The two common biological conversion methods are composting and anaerobic digestion. There are many vendor variations, but they all fall under these two methods. Typically, the micro-organisms that work in the aerobic process of composting are more robust and less sensitive than those that work in anaerobic systems. However, both systems require careful attention to the safety of the environment for the micro-organisms and the conditions that support their growth. Biological conversion facilities are dealing with putrescible organics and thus attract insects and birds. As a result, it is best if they are enclosed. The main pollutions of importance are fine particulates and bioaerosols, because these can trigger respiratory disease.

b) Thermal conversion

Thermal conversion involves the use of heat and possibly pressure to convert any type of organic material to either syngas, synfuel, or steam for electricity generation. The common thermal conversion methods are combustion and gasification. Under gasification, there are variations, such as gasification to syngas, pyrolytic gasification to oils and gas, and plasma arc extremely high temperature gasification. Under incineration, the variations offer different feeding and furnace designs. All of the thermal conversion processes have similar types and levels of emissions and all are subject to similar economies-of-scale benefits.

Because of the potential for hazardous emissions, the EU's 2000 emission standards are considered to be the minimum necessary to safeguard the public against cancer risk. The emissions of greatest concern with incineration and gasification are volatilized heavy metals, volatile refractory organics, and dioxins and furans, and these are emitted as air emissions that can be transported a long distance if discharged from the stack. Fine particulates can also be emitted from the stack and can trigger respiratory disease. A key factor in the implementation of thermal conversion systems is that the air pollution controls that are recommended for these technologies have a cost and land area requirement that is roughly equal to the thermal conversion facilities alone.

c) Mechanical conversion

Mechanical conversion involves the use of simple mechanical sorting, screening, processing and pelletizing to process dry organic materials into refuse-derived fuel, or the more quality-controlled secondary recovered fuel that is able to meet EU import standards. As with any handling systems for solid waste, localized air emission of fine particulates and dusts are possible. However, there are no high temperatures to create volatilized emissions and no stacks to discharge air emissions to a high elevation. An important aspect of creating RDF is that the country needs to have special emission requirements for any industrial burners or kilns that are using these fuels, as the emissions are significant and unique from the coal or other solid fuels for which their furnaces have been designed, if the RDF will be used in country.

4. Landfill Options

Landfill is a technique that involves a series of steps to build cells of waste, covered by layers of soil, and contained such that infiltration of rain water and ground water is minimized, drainage from the waste cells is captured (this drainage is called leachate, and is heavily contaminated with dissolved organics, refractory organics, salts and heavy metals), and gases of decomposition are collected (these gases are called biogas or landfill gas - LFG, and include large amounts of methane).

There are three options for landfilling of wastes, which are as follows;

- Controlled Landfill (CLF);
- Sanitary Landfill (SLF); and
- Sanitary Landfill with Pre-processing (SLF w/PP).

As the Sint Maarten already has controlled dumpsite without leachate collection, gasification, and appropriate daily cover and final capping, and there is a decision for improving it to be a Controlled Landfill, other options are not the case for the country. However, in the future if a new landfill land should be dedicated, the Consultant recommends that the new landfill should be a Sanitary Landfill (SLF) with leachate collection, gasification and other necessary facilities.

Sanitary Landfill with pre-processing is not outlined below as they are not the case for this project in accordance with the choices outlined within the Short Term Plan, and pre-processing activities would be achieved in Sint Maarten planned. Only, Controlled Landfill and Sanitary Landfill are outlined below as existing MSW landfill is a “Controlled Dumpsite”, and it will be upgraded to a “Controlled Landfill” that is improved with the measures outlined in Short Term Plan and Pre-feasibility Studies (PFSs) prepared within this TA. Hence a Sanitary Landfill, even with a small capacity, would be required for Sint Maarten after closuring of the upgraded MSW “Controlled Landfill”, Sanitary Landfill is included into this assessment.

a) Controlled Landfill (CLF)

Controlled landfill provides equipment to spread, grade, compact and cover the wastes, but it is not engineered to provide full containment and management of leachate and landfill gas to the same extent as sanitary landfill. Operations at existing “Controlled Dumpsite” are able to be improved to meet a “Controlled Landfill” standards within the Short Term Plan period (7 years from 2020 to 2026).

b) Sanitary Landfill (SLF)

Sanitary landfill is the internationally accepted method of handling wastes that remain after efforts of recycling and resource recovery. A sanitary landfill is underlined with impermeable material to protect groundwater resources and enable the collection of the contaminated drainage (leachate). That impermeable material could be indigenous impermeable clay, or an imported clay material, and/or a plastic liner. Usually a network of perforated underdrainage piping is created below the initial waste cells and protected with gravel and a layer of permeable geotextile.

The landfill gases must be ventilated from the landfill cells, or they could travel underground and create explosions in nearby tunnels, culverts or basements. Because of the high methane content of the landfill gases, recent gas management systems capture these gases and either flare them or use a generator to convert them to electricity. Landfill gases additionally have volatilized refractory organics that are toxic and include carbon monoxide; therefore, ventilation to the atmosphere is not recommended.

5. Economies of Scale of Technical Options

The solid waste sector has very few system components that have major economies-of-scale. Therefore, large service areas for waste collection and some processing techniques are not required. But, for sanitary landfill and waste-to-energy (WTE), economies-of-scale are necessary and must be carefully considered. Economies-of-scale always require local cost analysis to be determined accurately. For Sint Maarten, economies-of-scale are indicated below:

- Primary collection in neighborhoods where access to large trucks is limited is commonly conducted by mini vehicles. The service zones need to be large enough only for a small number of one mini vehicle, such as 5 tonnes/day.
- Secondary collection of wastes brought from the periphery of primary collection zones is done by equipment to load the wastes into vehicles. The service zones for secondary collection need to be large enough to fully use the loader and trucks, or at least 50 tons/day.
- Door-to-door or curbside collection in laid out areas is commonly collected by large trucks that can reach all households and other establishments. The service zones need only to be large enough to fully utilize several waste collection vehicles that would make at least 2 trips/day, or at least 50 tonnes/day.
- Manually conducted composting facilities, except in future MRF can be very small and decentralized at a neighborhoods scale. There is no economy-of-scale requirement.
- For mechanized composting with trommel screens, conveyance belts, mechanical windrow turning and vibrating screens, the plant would need to be large enough to fully occupy the equipment economically. Wheeled loaders and windrow turning machines are probably the key size determinants in a mechanized compost plant. Windrow turning machine vendors have product lines that handle as little as 100 tonnes/hour. For economies-of-scale, assuming compost pile turning at least once a week for 6 weeks, therefore 100 tons/day could be economic.
- Waste-to-energy facilities can be bio-conversion or thermal-conversion types, and all of these operate on a 24-hour basis. These plants would need to be large enough to reach

temperatures and retention times to fully comply with internationally accepted dioxin and furan emission standards. Waste-to-energy facility vendors have product lines that handle as little as 50 tons/day in gasifiers or 120 tonnes/day in incinerators. It used to be necessary to have at least two processing lines per plant for reliability, but recent product improvements have reliabilities that now allow for single lines in a facility.

- Upgrading dumpsites to controlled landfill does not have to have full-time on-site equipment. Wheeled loaders, graders, bull-dozers and other equipment to grade, spread, compact and cover the wastes can be sent to the controlled landfill sites on a periodic and regular basis and hired when needed from local contractors.

- Engineered sanitary landfills need heavy machinery that is strong enough to push and spread the waste, and ideally to compact the waste. Bulldozers are used at small landfills, but specially designed landfill compactors are preferable if there are enough wastes. The smallest viable size for a landfill bulldozer is the equivalent of a CAT D-6, which could readily handle up to tonness/day; while the smallest viable landfill compactor could handle about 400 tonnes/day. Landfill access roads and landfill base/underdrains/liner development are significant cost elements. Given that slopes are limited for purposes of stability, larger landfill areas allow greater heights and more waste/area. Thus, large landfills allow cost/ton to be significantly lowered thereby creating an economy of scale.

However, given that Sint Maarten has limited waste generation capacity, while the economies-of-scale for WTE facility would be assumed that 150 - 175 tonnes/day (with 20 years horizon), new sanitary landfill capacity would be around 80 - 100 tonnes/day, that this indicates the importance of recycling and recovery measures in waste management in Sint Maarten. While, economies-of-scale for composting facility would be assumed around 100 tonnes/day,due to market condition this capacity in Sint Maarten would be around 15 – 20 tonnes/day, which indicates no economies-of-scale. Also, economies-of-scale for landfill machineries and equipment would not be provided, that this invokes to outsource of these services to private sector. However, considering that the private sector in the country has also limited capacity, the WB team in consultation with the government has decided to include the purchase of the equipment within priority activities for urgent improving the situation in MSW landfill, and use of these machineries and equipment[1] in the future facilities within the improved SWM system in Sint Maarten. See also Chapter 5.

6. Comparison of Technical Options

a) Economic Life of Facilities

To compare technical options involves understanding how their capital and recurrent costs vary. Each unit of waste handling equipment and each facility for waste processing have an economic life, which is the period where preventative maintenance and repairs are economically feasible versus replacement with a new unit or facility. These economic life periods are commonly used as the depreciation periods for the capital investment. These periods are also used to determine the minimum cost-effective periods for contracts that provide economic pay-back periods for the investments made. For various components of the solid waste system, economic pay-back periods for investment are commonly:

[1] A Landfill compactor, etc., see TDSR list.

- 4 - 6 years - small collection equipment systems for primary collection that is labor-intensive.
- 8 - 10 years - Collection trucks of 3-20 cubic meters for secondary collection, or door-to-door or curbside collection in laid out areas, which is modern and not labor-intensive.
- 10 -15 years - Transfer trucks of 20-40 cubic meters for transfer, including any mechanized loading systems.
- 25 - 30 years – Buildings and other civil works, as well as key stationary equipment, which comprise the facilities for transfer, processing, or sanitary landfill.

b) Cost/Benefit Analysis of Options

For purposes of this strategic planning effort, we will examine direct costs quantitatively through preliminary estimates using local unit cost factors, and compare our preliminary estimates with cost data widely available in the literature.

c) Qualitative View of Life Cycle Costs

There are numerous research efforts that have reported in the literature about the comparative life cycle analysis of technologies. Life cycle costing provides examples of all costs and quantifiable externalities of equipment units or individual facilities over the economic life of the main components. This includes full capital, operating, maintenance, and renewal costs over the economic life. It also includes consumption of all required natural resources to manufacture, build, and operate these units or facilities, including any of consumption for the mining, processing, transporting, and manufacturing of materials and goods used in production or construction. Life cycle analysis of equipment units or individual facilities reports such outputs as cost, emissions, carbon footprint, land use, and energy demand for the units analyzed.

d) Qualitative View of Holistic Costs

Comprehensive decision models are available for life cycle analysis of various options. Interestingly, when the costs of externalities are quantified, processing options that achieve significant recycling and resource recovery have such a large savings in natural resource consumption that they are very cost competitive with seemingly inexpensive options such as sanitary landfill. These computerized methods of modeling costs have altered significantly the way the technical options are able to be compared. A number of articles and reports array life cycle modeling results comparing technologies, providing insight to analyses that previously were not possible to do readily.

Comparison of options can be further enhanced by examining holistic costs. Holistic decision support tools analyze the entire cycle of a waste management system, taking into consideration such things as special source segregation and recyclables collection systems that are required to support a waste processing facility, and the ultimate disposal requirements of the processing residuals. Holistic model analysis of the full range of connecting systems for a given processing or disposal technology reports outputs such as cost, emissions, carbon footprint, land area demand, and energy demand for the full system analyzed. Our team has been involved in the use of holistic

models for solid waste decision modeling in a number of cities[2]. The reports on cities that have been assessed using holistic modes provide a sense of the relative holistic costs of the different collection, transfer, processing, and disposal components of a city's solid waste system.

e) Comparison of Options

Various technical options discussed above relative to the key considerations of capital cost, recurrent operating and maintenance cost, revenue prospects, skill requirements, and land area requirements. The comparison also shows whether facilities derived from each technology choice are likely to be developed locally or regionally where an appropriate economy of scale becomes important in determining cost effectiveness and economic sustainability. It is expected that all of the technical options will be designed and sited to meet internationally accepted standards for environment, health and safety, and so it is not necessary to compare them from that perspective.

While the Consultant's previous studies and other studies conducted by other help to identify the technical choices that are available to improve solid waste management conditions in Sint Maarten, the selection of the best technical applications and enabling framework arrangements will be a function of a number of development factors that may be local or regional in nature. For example, the availability of sufficient waste to justify the selection of complex and costly technologies may provide the required economy of scale necessary to make such facilities cost effective and sustainable. In addition, the availability and capacity of markets that may be available for outputs (materials, energy, etc.) from the technology application will have a significant impact on the economic and technical viability of individual technical choices. Development of investment plan (and the feasibility analyses that may accompany them) must closely consider the technical and economic viability of the various technology choices to assure that the investment results are capable of successfully meeting the objectives of this strategy in an effective and sustainable. This Strategy will, likely, focus on the creation of conditions that support the development of effective facilities and processes that have been successful in other countries.

This Strategy also seeks to gain input from key stakeholders relative to the basis and manner by which supporting conditions and enabling arrangements can be created since they will play an important role in their implementation.

4.2.2 Enabling Framework Options

Enabling frameworks provide the support systems that enable solid waste technical activities to be successful and sustainable. Enabling frameworks lay out the laws, regulations, policies, institutional structures, enforcement systems, financial systems, cost recovery mechanisms, market incentives, private sector incentives and other support systems. Through these frameworks, an approach to capacity building at every level of government is implemented. The choices are many and it is up to Government to decide among the options and create the enabling framework that best fits Sint Maarten needs and conditions.

Even without any efforts by government to directly implement new technical systems, government effort to build strong enabling frameworks could gradually lead to solid waste improvements. Through creating clear requirements and authority for solid waste improvements, coupled with arrangements to enable competition and provide business climates with minimized risk, solid waste services would gradually improve. At a minimum, such independent improvements would have more economic sustainability if government

[2] Including cities in the USA, United Arab Emirates, Argentina, China, Pakistan, Azerbaijan, Japan and Jordan.

demonstrated good interventions in the sector with well-done design, siting, procurement, utility connections, access roads, etc. Also, government investment in the sector and support through viability gap financing would enable systems to be affordable to the waste generators and to be implemented on a fast track schedule.

For all of the enabling framework topics we have outlined proposed arrangements within this report. Because the legal and institutional frameworks are the foundation of support for the solid waste system, we have given particular attention to discussing these in detail in Annex 4. The legal and institutional efforts highlight the urgent need for the country's solid waste law to be upgraded and for a new national institutional entity to be created to guide and manage solid waste improvements.

We propose that the national entity be a national authority (ISWMA) which has overall powers of regulation and knowledge development, as well as supervision and monitoring. Including another mission within the ISWMA which would separately be able to focus on knowledge development, capacity building, data compilation and planning, would be a center of excellence. Separating these functions under the national authority allows them to focus on their respective activities, avoid conflict of interest between operations and regulation, and function with optimized accountability to government.

Enabling Framework options are examined under the following five (5) spheres:

1. Legal/regulatory and Institutional options;
2. Financial options;
3. Economic Instruments options;
4. Social Inclusion options; and
5. Private Sector Participation options.

1. Legal/Regulatory and Institutional Options

Legal/Regulatory

Laws and regulations for the solid waste sector stipulate the requirements that all waste generators need to meet. They elaborate on the roles, responsibilities, and authorities that each level of government has relative to the solid waste system. They also establish how the private sector can participate as an agent of government to build, own, and/or operate solid waste systems. The laws and regulations define the types of wastes and how each type needs to be managed, and how best to protect the environment and public health within the context of the waste management systems.

Sint Maarten has many gaps in its legislative coverage for the solid waste sector. Also, the laws are not accompanied with regulations that spell out standards and requirements in detail. Annex 4 on Legal/Regulatory and Institutional Arrangements discusses the points of clarity in the main solid waste law, as well as the other legal issues needing resolution.

Sint Maarten should decide to harmonize its laws with those of the European Union and internationally acceptable best practices worldwide. This means that there would be some consistency and compatibility with EU laws, internationally acceptable best practices and that the overarching goals would be comparable. However, the harmonization does not mean duplication, as Sint Maarten's needs and finances are not the same as Europe's and the countries that have advanced solid waste practices. The legal options considered most important to develop and harmonize are discussed in Annex 4.

Aside from specific law for the solid waste sector, laws that provide clarity on private investor's rights, establish clear rules for contract arbitration, establish the rights of association and contracting at different levels of government, create government rules for raising infrastructure bonds, and define liability coverage are part of the general legal framework for doing business that could support the solid waste sector.

Institutional

Currently, Sint Maarten does not have an institutional arrangement that could seamlessly implement the solid waste management systems that the country needs. The structures and entities are not established and the capacity is not available. Therefore, various options need to be studied for purposes of this planning effort.

To implement the national strategic plan, different government entities will be assigned separate activities. New entity for solid waste management will need to be created. Some activities will need to be done at the district level, others at the national level. Some of the institutional entities will be directly involved in the implementation of works and operations (such as VSA involves the collection and treatment of medical waste), while others will have oversight and monitoring roles (VROMI and VSA). Annex 4 of this report on institutional arrangements describes the possible types of institutional entities that are being considered and their relative merits.

2. Financial Options

Financing of investments and operations can come from many sources, whether loans, bonds, private sector funds, government's general revenues, waste generator user charges, gate fees to use solid waste facilities, environmental taxes on trade licenses, private hauler and service provider license, penalties for those not addressing legal requirements, carbon credits, and/or waste processing by-product sales.

Solid waste management is a private good only to the waste generators that directly benefit from waste collection service at their door or from permission to discharge wastes directly at facilities. But for those that indirectly benefit from communal collection, street cleaning, safe disposal, and recycling that conserves the global natural resources, solid waste management is a public good. Therefore, it is a matter of choice whether government elects to cover most of its costs as a public good from public funds, or whether it chooses to raise awareness by making the polluter pay through user charges for at least a portion, if not all of the system. Additionally, there are financial options for how government would choose to disburse viability gap financing.

Some possibilities are:

- Construction grants to help cover capital costs of service providers over the construction period;
- Minimum revenue grants to compensate service providers for shortfalls in projected revenue;
- Operational grants to address the expenditure and revenue gap, when user charges and tipping fees are not able to be adequate to cover operating costs;
- Annuity payment mechanism paid periodically by government to the service providers for specified expenditures.

- Guarantees to service providers for credit, market demand for services, market demand for processing by-products, revenues from users and sales of by-products, and rate adjustments related to changes in government legal or contractual requirements.

Probably, there will be a gradual increase in cost recovery over the years to cover some portion of both capital and operating costs. We anticipate that new financial arrangements will include building capacity at the local government levels and improving overall financial transparency and accountability at all levels through improved digitalized systems that are linked to one umbrella system.

3. Economic Instruments Options

Economic instruments are market-based incentives and disincentives that mobilize the self-interest of consumers, producers, recyclers, and service providers to improve solid waste management. These incentives and disincentives embrace the polluter-pays principle of covering the costs of environmental externalities from the combined population of waste generators – not necessarily from each waste generator based on quantity and pollution hazard per generator. They also embrace the 4 Rs of reduce, reuse, recycle and recover as priorities in the waste hierarchy over disposal. Many economic instruments are focused on developing revenues, with examples such as:

- Developing industrial demand for waste-derived by-products of waste processing (e.g., paper, metal, glass, plastic, rubber, used oil, recycled concrete aggregate, recycled asphalt aggregate, wood, and compost);
- Carbon trading (e.g., offsets of fossil fuel energy generation by waste-to-energy facility, landfill gas avoidance by biological conversion and thermal conversion, landfill gas capture and recovery or flaring, offsets of inherent energy in materials by recycling);
- Renewable energy preferential pricing (e.g., biological digestion of waste to methane gas, incineration to steam and electricity, gasification or pyrolysis to synthetic fuel, refuse derived fuel for direct co-burning in industrial boilers or cement kilns);
- Preferential procurements of products with recycled content and products that are taken back for refurbishing after use;
- Deposit refunds programs for recyclables (e.g., lubricating oil, tires, car batteries, beverage containers);
- User charges that influence waste generators to reduce their waste production;
- Disposal gate fees and/or landfill taxes that influence waste generators and industries to minimize disposal.

Economic instruments have potential for providing incentives to the most desired solid waste actions and providing disincentives to the least desired solid waste actions. Incentives include special pricing policies for renewables to be purchased for power grids at higher rates than fossil fuels. Disincentives include landfill taxes on the quantity of total waste received at landfills. The various categories of economic instruments are briefly outlined below.

A) <u>Revenue generating instruments</u> generate income from consumers, producers and service providers from:

- Charges (e.g., tipping fees - gate fees, waste generation fees, waste service user charges, contractor and waste generator business licensing fees),
- Taxes (e.g., landfill taxes, municipal taxes/fees, product taxes on packaging and plastic bags, taxes on nonrenewable fuels).

B) Revenue providing instruments enable producers and service providers to obtain income from government through:

- Tax reduction to investors (e.g., customs duties, corporate income taxes),
- Fiscal incentives including accelerated depreciation (e.g., to investments in equipment that enables use of recycled feedstock in industry, to investments in resource recovery facilities),
- Development rights (e.g., to developers mitigating the environmental & health impacts),
- Concessions for processing wastes (e.g., marketing rights to recovered materials or resources from wastes), and
- Funds (e.g., ozone funds, carbon funds, priority organic pollutant funds).

C) Non-revenue instruments motivate without generating or providing revenues, using means such as:

- Emission trade-off arrangements (e.g., sulfur dioxide, nitrous oxide, carbon),
- Deposit-refund systems (e.g., tires, aluminum cans, glass beverage bottles, lubricating oil),
- Product stewardship and take-back systems (also called extended producer responsibility - EPR, and including take back of computers, printer cartridges, cell phones, used car batteries, farm produce crates),
- Production and product change incentives (e.g., to enable use of recycled material as manufacturing feedstock, or use of refuse-derived fuel in industrial boiler or cement kiln systems),
- Convenient collection points (e.g. supermarket collection of recyclable cans, bottles, plastic bags and batteries; vehicle gas and repair station collection of tires and used oil)
- Bans on certain projects (e.g., thin plastic film bags, incandescent light bulbs)
- Performance disclosure in contracts (e.g., use of recycled materials in construction, use of energy from waste, use of equipment with refurbished/recycled components),
- Performance disclosure in industrial waste reduction (e.g., internet lists of company reduction and stewardship, government list of industrial polluters and industrial successes, recognized certification of green companies),

- Liability law (e.g., reduction of hazards by use of goods with minimal hazard content, liability projection to contractors using recycled construction/demolition aggregates approved for use), and

- Preferential procurement policies (e.g., products with recycled content, minimal hazard content or refurbished component content, construction materials from recycled demolition wastes, products with take-back arrangements).

4. Social Inclusion Options

Social Inclusion provides opportunities for all people be included in the solid waste services and livelihood opportunities created, and also seeks to protect people whose livelihood and residence could be at risk by a new solid waste facilities or services (e.g., the livelihood of existing informal sector waste recyclers).

Special measures could seek to include certain groups, such as women or displaced people (if a case in Sint Maarten), in solid waste system's opportunities. Groups of women could be organized to monitor that waste collection is well done, or they could even be organized into micro-enterprises to establish private collection service in return for payment.

Social inclusion also provides opportunities for all people to have a voice in the process of planning, siting, design, and operation of solid waste activities. Types of public involvement include: surveys of public needs and willingness to pay, consideration of affordability, discussion of public preferences, siting criteria discussions, public review of facility siting and planning at various stages, public information of tendering processes and schedule, public comment on environmental impact assessments and public input to mitigative measures. One approach for long term public involvement could be a citizen task force representative of key stakeholders that could meet regularly with government to help guide government's public involvement activities.

5. Private Sector Participation Options

For purposes of this document, we use the term Private Sector Participation (PSP) as the overarching term. PSP in government infrastructure and services can take many forms, as discussed below.

Private Sector Outsourcing (PSO) is conducted through service contracts, management contracts, concessions, and leasing are traditional methods where government pays for solid waste activities to be conducted. It is also possible to arrange contracts that do not involve payment by government, such as licensed open competition or giving the private sector a franchise to handle the activities and obtain the user fees for a zone.

Public-private partnership (PPP) involves setting up a long-term joint venture or contract arrangements where a private-sector party invests in a facility to provide public service to or on behalf of the public sector. In a PPP the public sector may provide major assets or significant capital investment.

However, most private sector participation in Sint Maarten should be done through private sector outsourcing methods. The wide array of these options is outlined below:

- <u>Licensed Open Competition (also called Private Subscription):</u>

- An open competition agreement provides a license and the service requirements for the specialized service providers, allowing them to compete openly for customers within a zone or larger area.
- Services are charged according to market demand according to customer needs.
- Government monitors user charges, especially to be sure that there is not collusion among the service providers to control pricing. As needed, government may advise customers on ranges of appropriate prices.
- Government monitors labor, EHS, and service delivery for conformance with license conditions.
- Open competition activities include collection door-to-door for any specific waste or recyclable, operating processing facility, or a drop-off center where waste haulers can unload after signing an agreement to meet waste quality, quantity and tipping fee requirements of the facility operator.

- Franchise Agreement:
  - A franchise agreement awards the franchisee with an exclusive zonal monopoly to be the only service provider within the zone.
  - The service provider has the rights to collect user charges to cover its costs, based on the tariff structure agreed with government.
  - No fees from government are provided.
  - Franchise service can be defined as exclusive collection of residential waste, mixed municipal waste, green waste, construction/demolition debris, corporate establishment waste, medical waste or recyclables.
  - Franchise services are awarded only in zones and for service types that can generate the revenues for the service provider to be sustainable financially.
  - Franchises are commonly awarded for door-to-door collection services, which could be on a small scale, such as primary collection by women's associations, or could be on a large scale, such as zonal collection from commercial and industrial establishments.

- Service Contract:
  - A service contract specifies the details of service provision and payment on a unit of service basis or within a specified zone of service.
  - Unlike the franchise agreement, government fully pays for services rendered.
  - Contract service can be street cleaning or waste collection done with the contractor's equipment, or it could involve services provided at a government-owned transfer, processing or disposal facility.

- Payment is provided by government on a unit of work basis, such as per household served or tonne collected, per unit length of street cleaned, or per tonne of waste landfilled or delivered to MRF.

- Service contracts are commonly awarded for communal collection, street cleaning, drain cleaning, and waste disposal services.

- <u>Lease or Divestiture Agreement coupled with Service Agreement:</u>
  - A lease or divestiture agreement enables government to allocate its own facilities or equipment for use by the private sector while providing services.

  - The lease or divestiture could be for government equipment parking, workshops, processing facilities, landfills, or waste collection and transport fleets.

  - The service agreement would take into consideration requirements for the service provider to regularly conduct preventative maintenance, repair, and renewal of all goods and works allocated for use under the lease or divestiture agreement.

- <u>Management Contract:</u>
  - A management contract enables having optimum management of the overall SWM system, which can be a combination of public and private service providers working in a wide array of agreements.

  - The management contractor is given a fixed fee type of contract for a specific set of team skills and a set of performance-based bonus payments for showing improvements to service delivery, customer satisfaction, user fee payment, market development, cost recovery, system expansion and renewal.

  - Government pays the management contract and the performance-based bonus payments.

- <u>Concession Contract:</u>
  - A concession enables government to allow the private sector to utilize a resource owned by government for purposes for profit-making purposes. Logging, drilling, mining, and water concessions are common examples. Because government owns MSW that has been put out to public streets for waste collection, and some of these wastes have resources of value, government concessions for MSW typically involve recycling commodity or recovery of resources in the MSW.

  - A concession contractor is allowed build new facilities to process and freely market recyclables, compost, synfuel, biofuel, RDF, and other resources obtained from waste processing, as well as landfill gas from waste disposal. In return, the concessionaire operates the facilities to meet the concession standards.

  - In concessions, the concessionaire conducts cost recovery through user charges.

- As these agreements involve private sector capital investment in facilities, they are usually long term and require careful specification of preventative maintenance, repair, and renewal.

- Waste flow control, waste quality control, and freedom to implement user charges are typical parts of the agreement.

- If the facility is fully financed by the private sector, ownership may remain forever in the hands of the private sector, as in DBFOO concessions (i.e., design, build, finance, operate and own). If the facility transfers to the public sector at the end of the concession period, it would be a DBOT concession (i.e., design, build, operate, transfer).

None of the private sector participation methods discussed above are “privatization”, which is defined as the full transfer of former public infrastructure and service responsibility to the private sector. In general, privatization is not done for the solid waste sector, because it is not a natural monopoly as you would see for managing a water supply watershed, sewerage piping network, electricity grid, telecom network, or air traffic control system. The system is largely based on facilities that have modest economies-of-scale and on collection by a fleet of vehicles that have no economies-of-scale.

4.3 Sint Maarten ISWM Topics Arrangement

Any strategic planning process on upgrading the SWM system creates alternative scenarios for stakeholders and decision makers to consider in choosing a path forward. To have a manageable set of alternative scenarios to consider, the process needed to be simplified, and the topics of scenarios that will be evaluated should be arranged in accord with the applicable criteria that consider local and regional conditions, addressing appropriately the gaps of the current system.

Therefore, the criteria for ambition levels of strategically determined topics is created complying with the following local and regional conditions:

- Scarce land and soil resources for developing the required facilities for upgrading the system;
- Scarce skilled staff on managing solid waste system, which would affect the effective operation of upgraded system elements;
- Lack of industrial infrastructure that support processing the waste locally, and hence circular economy;
- Remote location to capable recycling markets, but existence of the recyclers that integrated into the regional waste market, although they are unregulated;
- Existence of relatively experienced formal and informal waste collectors and recyclers, even though they have weak technical and financial capacity;
- Weak financial capacity of the Government to support the investments for upgrading the SWM system, but existence of keen interest of the Government to upgrade and improve the SWM system in the country;

- Existence of relatively weak, but aspirant local NGOs and CBOs to participate in waste management in the whole island.

As outlined in Chapter 4.2, technical and enabling framework topics are arranged in the following Table in accordance with system gaps identified in Country Solid Waste Management Sector Assessment Report, recommendations given in Short Term Plan (see Table 1.1 Chapter 1), and the overarching principles given in this Chapter, to essentially establish a bridge between the past and the future with a far-sighted approach for managing the solid wastes in the country.

Accordingly, the scenarios for ISWM system of Sint Maarten are developed in Chapter 5.

Table 4.1: Strategy Topics Development

Topics	Activity Arrangements
TECHNICAL OPTIONS	
Collection & Transport	- Regulate the unregulated current commercial and industrial waste collection system, conducting collection system mapping in order to enable the dedicated routes and service providers for key waste source categories and the potential for dedicated routes that would address wastes most ideally suited for resource recovery; So that collection and transport system can support the Integrated Waste Management Facility (ISWMF) of Sint Maarten; - Examine and draft contracts for commercial waste collectors according to the results of collection routing and system configuration analysis; - Examine and draft suggested improvements to the existing household/institutional and area cleaning waste collection contracts for future contracting; - Develop Waste Fee Framework and Tariff Study for waste collection and transport/transfer. - Establish a waste collection database, and provide access to the public. - Conduct collection route optimization and system configuration analysis according to sector specific best practices, to determine the system needs for urgent improvement; - Analyze the possible locations of the color-coded containers that will be placed at different points as a mid-term measure for separate collection of the recyclables at source; - Develop and implement comprehensive, transparent, equitable, and inclusive contracting and licensing arrangements for all waste collectors of domestic and commercial wastes, where needed to supplement systems already existing; - Study and recommend improvements to existing waste collection contractual instruments where appropriate; - Provide policy support by waste management authority/government for efforts of CBOs, NGOs, and commercial community for separate collection of waste. - Provide policy support for EHS measures in waste collection and transport. - Conduct emergency measures to collect separately with special measures the hazardous waste (gloves, masks, etc.) sourced from COVID-19 implication.
Waste Disposal & Treatment	- Provide and install a mobile weighbridge for the landfill with a suitable software in order to start recording the waste delivered to the landfill; - Conduct a comprehensive geotechnical site investigation in MSW landfill in order to have necessary data on characteristics of the landfill, in order to make correct decisions about the behavior of the landfill waste; - Procure the landfill equipment for compaction, spreading, earth moving, excavation and fire suppression;

Topics	Activity Arrangements
	- Establish a temporary MRF like waste pre-processing facility (TDSR) to pre-process the accumulated scrap tire, wood waste, scrap glass, and yard waste, in order to reduce the volume of these waste types as those occupy lots of space in the landfill; - Procure other TDSR equipment for pre-processing the scrap tire accumulated in MSW landfill, wood waste (wood pallets, scarp woods from Irma debris and C&D waste), yard waste, scrap glass, and removing the debris in IDDS; - Start the landfill improvement activities, including fire suppression activities according to requirements of Landfill Improvement PFS; - Establish a separate C&D waste handling facility; - Establish an Integrated Waste Management Facility (ISWMF) in accordance with PFS, which includes an MRF and optional WTE facility; - Take emergency measures for protecting the residential/commercial community south and southeast of the landfill from the potential slope failure during the landfill operation and improvement activities, including resettlement of the people reside in residential/ commercial area; - Take measures for mitigating the environmental and social impacts of daily operation of the landfills, including EHS measures; - Do not involve any construction, regrading, or interim capping activity in the landfill before completing a detailed geotechnical site investigation and engineering design based on data obtained from the investigation; - Provide budget for removal of debris in Irma landfill; - Prepare a guidance that complies with best practice applications and EU regulations for landfill management and closure activities; - Develop Waste Fee Framework and Tariff Study for waste disposal and treatment; - Developing Software Package for Tracking the Waste, Revenues/Expenditures, and Billing, in order to provide cost recovery; - Develop a DBO contract prequalification documents with initial contract performance standards adequate to obtain a shortlist of 3 to 5 qualified consortiums to implement the improvement and operation of the MSW landfill initially during Shor-Term Plan period (5-7 years); - Hire the Contract to properly improve and operate the MSW landfill initially during Short Term Plan period (5-7 years); - Develop a short-term Service Contract Tender Document to implement operational arrangements for the facility for separately handling of C&D waste in another place other than MSW landfill; - Hire the Contract to properly operate the C&D waste facility and provide pre-processing of all inert recyclable materials; All works and use of Contractor equipment would be covered under the service agreement; - Conduct a tender for hiring a contractor for removal of Irma debris; Haul the separated materials to new C&D waste handling facility area, except the fines and sands that are by-product from this activity; Re-use the fines and sands in the MSW landfill operation; - Develop a 20-year DBO contract prequalification documents to implement and operate ISWMF sized to address local municipal wastes only, to be built at a location close to MSW landfill; - Develop a DBO contract for New Sanitary Landfill, preparing a pre-feasibility study and ESIA; - Put in effect a programme and schedule immediately to avoid the hazardous waste disposal into both landfills as a result of COVID-19.
Waste Minimization, Reuse, and Recycling & Recovery	- Regulate the recycling market centrally, setting up by a government institution largely as an organization that does data collection, planning, procurement, and financial management;

Topics	Activity Arrangements
	- Develop strategy to promote informal private recyclers to integrate in main waste management scheme with analytical framework/typology of interventions as informal private recycling market provides a chain of formal employment opportunities, and their engaging is vital in converting recovered materials into secondary raw materials for the industrial sector, and dealing with exportable secondary raw materials to neighboring/regional countries which earn them foreign exchange, linking to regional and worldwide recycling network; - Based on the needs of the recycling community and availability of markets, develop systems of bring back, buy banks, drop off centers, bring banks, or civic amenity centers, etc., as needed to facilitate and encourage recycling; - Create a special unit within current or prospective waste management authority (ISWMA) to study marketing activities for recyclables, and improve networking between recyclers and buyers, and support the recyclers and contractors to improve their success in cost recovery from recycling; - Enforce the import of food and other materials that are packed with PLA (bioplastics-Polylactic Acid) to the island, and regulate it by policy and ordinance; - Improve networking between recyclers and buyers, and support the recyclers and contractors to improve their success in cost recovery from recycling; - Create incentives for waste generators to recycle and also reduce their wastes, and give supports to the current initiatives on waste minimization, reuse and recovery activities, including composting activities; - Provide policy support, preparing ordinances for energy recovery from the waste in order to regulate the energy recovery from the waste in the country. - Coordinate with the waste collectors to improve their cooperation with the recycling agenda; - Provide public education to children, adults, and commercial establishments on the need for and value of recycling;
Disaster Response	- Commission an emergency debris site for accumulating the disaster waste when it occurs, such as waste from hurricanes and tropical storms, storm surge, etc.; - Prepare the emergency debris site in accordance with the lessons learned from previous disaster situations experienced, including measures for avoiding any fires (either surface fires and deep-seated fires), and fire suppression in site;
ENABLING FRAMEWORK OPTIONS	
Legal & Regulatory	- Define the potential involvement of the private sector as agents of government in meeting service needs; - Describe issues of social inclusion, labor protection, health, safety and environmental protection; arrange for sustainable financial resources; - Establish incentives; - Define disincentives and potential for sanctions under the law; - Legally organize improved control over waste generator behavior, solid waste collection, including commercial waste collection in addition to domestic waste, recycling, and treatment/disposal;

Topics	Activity Arrangements
	- Finalize development of a country solid waste law to include, for example: o govern the behavior of waste generators and waste handlers; - Develop related regulations under the solid waste law, and create appropriate institutional arrangements with adequate empowerment and free from conflicts of interest to provide regulatory control and enforcement related to the solid waste system; - Create legally developed standards and regulations on separate collection of recyclables, pre-processing and processing; - The regulations should define the related provisions regarding activities that are not subject to the transfer / processing regulatory requirements (i.e., *''Residual'', ''Reuse'', ''Separation for Reuse'', ''Source Separation''*, etc); - As the current Solid Waste Law has the narrow identifications on the waste classification, an enumerated waste catalogue similar to the system in the European Waste Catalogue (EWC) would itemize the waste classes comprehensively; - A detailed Recovery Policy Framework should be developed to amend to the enhanced Solid waste Law . This Framework should be extended to cover all consumer products, including construction materials and relevant commodities cycled in the consumer sector. This Framework should also identify the hazardous contents that may be used in the manufacturing of the materials as virgin material; - Rules and Regulations should be developed to achieve the goals of Recovery Policy Framework for at least next 20 years period; - The criteria should provide the basis for enforcing the prohibition on *''Open Dumps''* and enable them to be used by citizens' suits in the State Courts; - New Regulations should have comprehensive environmental response, compensation and liabilities, which establish a framework for responding to releases of hazardous substances, pollutants, or contaminants in all media at all installations; - New Regulations should govern most of the environmental mission/operational related and closure-related compliance activities; - Comprehensive Life Cycle and End-of-Life criteria should be established in accordance with the Country's Standard Industrial Codes; - A generic carbon credit system which belongs to emission factors should be a part of the waste management strategy on reuse or recycle of the recovered materials; - A Legal Framework should be conducted for Management of WEEE e-waste in the Country; - A safequard policy should be prepared specifically for management and movement of WEEE e-waste, which addresses Basel Convention and ILO rules; - Prepare more robust "Disaster Response and Recovery Plan (DRRP)" which addresses the response and recovery phases activities in accodance with the major SWM phases of "i) Generation, ii) Collection, iii) Transportation, iv) recovery/recycling and v) disposal", and include in DRRP the principles in "Waste Management Guidelines of Joint UNEP/OCHA Environment Unit[3].

[3] Disaster Waste Management Guidelines, Waste Management Guidelines of Joint UNEP/OCHA Environment Unit, March, 2013 (https://www.eecentre.org/wp-content/uploads/2019/05/Disaster-Waste-Management-Guidelines-6.pdf).

Topics	Activity Arrangements
	- Comprehensive WEEE e-waste definitions should take place in the relevant environmental and Solid Waste legislation / regulations with an amendment. EU Directive 75/442/EEC (Eu, 2002a) can be employed for defining the categories of EEE. The following words and their definitions should be interpreted in the relevant legislation / regulations of the Country; o Electrical and Electronic equipment, o Electrical assemblies / Components / Products, o Discarded / Disposal, o Used Goods / Scrap EEE, - Legislation / Regulations of the Country should specify the roles and responsibility of the following stakeholder in the Waste Management Sector; o Generator / Producer o Exporter / Importer o Collector / Transporter o Treatment operator o Regulatory Agencies (Local / National).
Institutional	- Separate assessment is needed for the capability and capacity of Department of Infrastructure Management (DOIM) of VROMI for management of solid waste system in the Country, and discuss challenges to increase its capacity to achieve the quick-win, emergency and short-term measures; - Train VROMI staff and Waste Management Operators both in collection and disposal sides; - Implement the activities on developing the proposed government owned waste management authority (ISWMA), its capacity building activities, and support the government in draft arrangements for institutional set up, and organizational and staffing arrangements; - Actively examine the creation of a new solid waste authority (ISWMA) that would be fully government owned and operate much like the current electricity authority; - Create improved staffing within a dedicated government unit or authority – Integrated Solid Waste Management Authority – ISWMA - for all types and activities within the solid waste sector.
Financial & Economic	***Financial*** - When conducting cost analysis, all phases must be considered, e.g., collection, transportation, landfilling, illegal dumping, area cleaning, street sweeping, material recycling, composting, administration costs, and public education/social inclusion costs, etc.; - Ensure that distribution of the fund be clearly stated between the solid waste management components; - Define clearly the accountability and transparency in the implementation of SWM programmes in the relevant regulations; - Tariffs set should be reviewed in every five (5) years, and updated, if necessary, and willingness-to-pay surveys should be iterated once a 5 year; - Make arrangements to ensure all financial reports be complied with international financing standards; - Consider the budget for development of real-time data for planning, research, policy development in SWM budget calculation;

Topics	Activity Arrangements
	- Develop a tariff cost recovery mechanism, tied to the framework of the new solid waste law, to enable improved financial support for collection, recycling, and safe treatment/disposal; - Develop a fully accountable system for tracking expenses and revenues, consistent with government systems planned or being developed for financial management; - Develop a tool to calculate SWM costs, taking into account the financial sustainability and performance indicators; - Review and update the relevant financial regulations in accordance with full-cost accounting principles to support financial mechanisms; - The fees collected for solid waste management should be kept separate from the funds of other services, and should be used only for the development of the sector; ***Economic*** - Examine the potential for tariff bundling in a manner that cross subsidies are appropriately established addressing ability to pay and the principle of polluter pays; - Establish tariffs by an independent authority; - Develop revenue, generating, revenue providing and non-revenue instruments outlined in Chapter 4.2.2. ***Data Availability & Updating*** - Provide data availability by ensuring access and updating regularly;
Social Inclusion, Public Awareness and Gender Mainstreaming	- Conduct robust research on the informal waste sector in the country; - Develop corporate awareness programmes, which take some training and perhaps some incentives; - Hire staff to be community liaison specialists who conduct public information as part of both the VROMI's waste management staff and the new institutional structure for waste management; - Provide public education of the changes in the legal and regulatory arrangements and the system for managing waste collection and treatment/disposal, in order to clarify roles and responsibilities of all parties, including all waste generators and informal sector recyclers; - Create a system for handling and tracking complaints and suggestions, and all related responses (Grievance Redress Mechanism - GRM); - Create a website for the public to know all requirements, contact points, system schedules and deliverables, fees, and also see the public licensing and contracting arrangements in DIOM of VROMI, and be handed over it to new waste management authority in the future, if it is established; - Provide public education to children, adults, and commercial establishments on the need for and value of recycling; - Support collaborative efforts of CBOs and NGOs which involve in waste management activities through the main waste management authority (WMA); - Provide policy support be in place in accordance with the waste management programmes and strategies prepared and applied by VROMI or new ISWMA; - In contracts, assure that there are specifications for performance focused on inclusion and gender mainstreaming; - Conduct awareness programme to enlighten the public on disposing the contaminated PPE materials at haphazard due to COVID-19.

Topics	Activity Arrangements
Private Sector Involvement	- Support, oversee, control, and regulate the private sector participation and their activities in solid waste management without reducing their involvement by a holistically prepared government programme;
Disaster Response	- Create more specific disaster response plan for handling the disaster waste in accordance the local conditions in order to provide handling the disaster waste does not degrade the municipal waste management programmes to be improved; - Review the current disaster response plan, and revise it, taking into account the vulnerable and fragile Sint Maarten economy against disaster situations and worldwide economic shocks, which will heavily affect the Sint Maarten response to disaster situations; - Pepare a training manual for handling of disaster waste, and apply continuous training programmes for the SWM staff on disaster response programmes for early and adequatly handling of disaster waste;

CH – 5

SCHEDULING OF THE PLANS

Overview

This Chapter provides projections on scheduling and planning the system elements, facilities, facility capacities for the prospective ISWMS of Sint Maarten, conducting projections and analyses considering the local and market demand. Comprehensive waste flow projections and alternative scenarios are also developed and analyzed in this Chapter in order to constitute detailed informative data for decision-maker.

5. Scheduling of the Plans

Significant efforts have been conducted to develop this Strategy in consultation with WB team and Sint Maarten Government since April, 2019 until now. Detailed information and data on country SWM and SWM in Caribbean region are given in previous Chapter and Annex 1, 2 and 3.

The following is an assessment which portrays the current waste management activities globally, and global and regional recycling markets. The recent developments within recent years, especially COVID-19 outbreak significantly affect the plans on waste management and recycling. For example, global recycling markets have been very constrained in recent years, especially with the reduction of oil prices undercutting plastics recycling. Processing the waste into energy is also being affected by the reduction of oil and gas prices, given that local utilities obtain most of their energy from fossil fuels. The same issue of oil and gas pricing is affecting the cement industry's market demand for refuse derived fuel; because increased coal production is reducing global prices and having an adverse impact on market demand for refuse derived fuel.

Sint Maarten does not have an industrial base, unlike some of the Caribbean Islands that have local recycling markets with manufacturing enterprises, for example, Cuba, Dominican Republic and Puerto Rico have significant industrialization. Even in the industrialized islands, the recycling activities are low, and barely reach 20% of the recyclable materials within their wastes. Therefore, the majority of wastes still require disposal or treatment in even these countries. For Sint Maarten, recycling has to depend on the global demand, and that is not good in recent years. There currently is no indication that demand for recyclables will improve. Stockpiles of recyclables are present in most of the industrialized countries, in hopes of a market demand improvement. Despite low market demand, their regulatory frameworks require they segregate and collect recyclables, and they do it at a cost to them. Recycling, resource recovery and disposal minimization activities in various countries are being paid for by the residents of those countries, either directly or through special taxes and subsidies. By-product revenues are not driving decisions about which systems to implement; but rather disposal minimization is the key driver.

Recycling significantly has also been affected by the COVID-19 Pandemic. Factories that normally are major players in the global demand were shut down in some areas and production activities were reduced. Worldwide, cargo vessels had disruptions and freight charges per container were increased by up to 3 times. Rail and trucking activities also have been reduced, as the infection has spread. Lock-down activities lead to non-essential factories being closed, globally affecting demand for recycled materials as feedstock. Concerns about controlling infection lead to the closure of some USA materials recovery plants.[1] Some USA states curtailed the bottle bill deposit refund program, to minimize the handling of potentially infected used bottles.[2] Stores returned to using clean plastic film bags, rather than allowing customers to bring their own containers, as a measure to minimize the spread of infection to the store employees packing the bought goods.

According to the IMF, economic recession due to the Pandemic is anticipated to occur globally, as nearly all countries lock-down non-essential establishments and struggle with the costs of minimizing their cases and deaths. Depressed economic conditions reduced consumer consumption and purchasing, and these will further affect demand for recyclables, as one overview of the impacts of the Pandemic describes.[3]

[1] https://www.wastedive.com/news/mrf-operations-closure-coronavirus-waste-management-republic-services/575629/
[2] https://www.wastedive.com/news/coronavirus-state-bottle-bill-enforcement-recycling/574593/
[3]https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwjEprjs-_roAhVoAZ0JHUzKA_oQFjAAegQIBRAB&url=https%3A%2F%2Fresource-

Sint Maarten's economy is heavily dependent on the cruise business and the visitors and crew members that come on these cruises. The cruise business has been increasingly pressed to become more environmentally sound, and customers have become more discerning about the environmental responsibility of the cruise companies that they support. After this recent year of Pandemic and the issues regarding the cruise companies handling of disease cases at various ports, there is anticipated to be more oversight of their practices onboard, and also in discharging diseased passengers. As of mid-April 2020, over 20 cruise ships had reported COVID-19 cases on board. As early as mid-January 2020, passengers from China on cruises to other Asian countries were found to be have been infected. A number of cruise vessels with infected passengers went to various ports trying to disembark infected passengers and were forced to remain at sea with their sick passengers. An overview is available of all the known infected cruise vessels, as well as a listing of those suspected but not confirmed.[4]

There already have been questions raised about whether the cruise companies were paying their way adequately in terms of extra costs to the port countries for issues such as waste management, but now the impact from the Pandemic raises more concerns. Sint Maarten responded quickly to the cases that arrived with airport and port visitors.

So long as theCOVID-19 case continues, it should be assumed that most recurrent costs of SWM system will have to be covered by local residents and incoming visitors as the cruise ship arrivals have been stopped until the end of 2020 in Sint Maarten, and stay-over arrivals will be limited.

The waste management industry has been hit with significant risk of infection from its work. It is well known from past occupational health studies that bioaerosols at the hopper of rear loading waste collection trucks are a hazard. Increasingly, some companies have transitioned to curbside liftable containers that are lifted curbside and discharged into a roof-top hopper. The extreme aerosol mobility and infectious nature of COVID-19's corona virus has increased the risks, especially as the waste from infected family homes now may be containing sputum, fecal matter, and food wastes to waste management workers. Significant investments and time requirements of Pandemic-related safety protocols are driving up business costs, along with absenteeism from employees. Meanwhile, the economic recession limits the waste management companies from being able to increase fees in the near term to cover these increased costs.

However, in all cases a waste management strategy is a long-term planning instrument, plans in this strategy will consider the applications in long-term within the normal conditions as well as considering extraordinary, but temporary conditions despite the fact that it cannot be predictable how many times those will continue.

5.1 Planned Activities and Implementation by Phases

The project comprises the following sub-projects and activities by phases based on discussions conducted form the project's early stages until now with Government of Sint Maarten and WB team.

recycling.com%2Frecycling%2F2020%2F03%2F17%2Fcoronavirus-pandemic-disrupts-recycling-sector%2F&usg=AOvVaw1j5FVuEBh6V0WqF20endOI

[4] http://www.sintmaartengov.org/government/VSA/Health-Updates/NOVELCORONAVIRUS/Pages/lockdown.aspx

1. Phase 1: Short term plan period activities, and related sub-projects;
2. Phase 2: Mid term plan period activities and related sub-projects; and
3. Phase 3: Long term plan period activities and related sub-projects.

Short term plan period activities and related sub-projects also comprise the priority activities, and the related sub-projects that will be delivered in the Short Term plan period from 2020 until end of 2026. Mid term plan period activities is planned to be completed until the end of 2029. The long term plan period activities will comprise only running of the facilities and some studies for modification of the projections according to technical, environmental and social requirements that will be emerged during lon term period. See following Figure.

Table 5.1: Project Plan Periods

Activities	Phase 1							Phase 2			Phase 3										
	Short Term Plan Period - 7 Years							Mid Term Plan Period - 3 years			Long Term Plan Period - 10 years (2039) and beyond										
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Procurement of Engineering/Consultancies																					
Procurement of Works																					
Procurement of M&E																					
Operation of the facilities																					

5.1.1 Phase 1: Short Term Plan Period Activities and Related Sub-projects

As listed in Annex1, Table 2, the following activities indicated as priorities within the seven (7 from 2020 to the end of 2026) years of this Short Term plan period by Aim Texas as a result of all efforts spent for identifying the needs of the Sint Maarten to have a long term sustainable solid waste management system. These activities and sub-projects would support the medium and long term integrated solid waste management activities.

The Short Term Plan period activities and sub-projects could be implemented under three components, which are as follows:

Component 1: Engineering and Consultancy activities

Component 2: Procurement of Works

Component 3: Purchasing of Machineries and Equipment (M&E)

Component 1 of Short Term Plan period would involve in procurement of engineering and consultancies that should take place as project preparatory works that outline and provide guidance for implementation of the mid and long term waste management activities and investments.

Component 2 of Short Term Plan period would involve in procurement works that should be implemented within the Short Term Plan period, including procurement of construction works for MSW landfill upgrading and extension, construction of ISWMF and a separate C&D handling facility under DBO contracts. This component would also include procurement of works for construction of a waste receiving facility at port in Point Blanche of Philipsburg, and procurement of improvement works of waste collection points in all Country.

Component 3 of Short Term Plan period would involve purchasing of machineries and equipment that would be required to operate the MSW landfill and ISWMF. This component would also contain purchasing of containers and bins to be used in the waste collection system.

Table 5.2: Short Term Plan Period Activities and Sub-projects, 2020 -2026

1	**COMPONENT 1: Engineering & Consultancies to be Procured**
1.1	Prepare System Feasibility Study and Roll Out Plan for Collection/Transport
1.2	Conduct a Geo-technical Survey at MSW Landfill Location
1.3	Conduct a Comprehensive Waste Characterization Survey
1.4	Establish a New SWMA and Capacity Building, including Developing its Charter and Accounting Framework
1.5	Develop Waste Fee Framework and Tariff Study (Financial Framework), including Developing Software Package for Tracking the Waste, Revenues/Expenditures, and Billing
1.6	Developing Software Packages and a Waste Data System (WIS)
1.7	Conduct a Legal Assignment for Developing a New Solid Waste Law
1.8	Develop a Guidance for Landfill Management and Closure activities
1.9	Develop a Short-term DBO Contract for MSW Landfill Management
1.10	Develop a DBO Service Contract for ISWMF
1.11	Develop a DBO Service Contract for separately handling of C&D waste in another place other than MSW landfill
1.12	Design & Implement Public Communication & Education Program, Social Inclusion Program and Outreach, including complaint handling procedures and Web site for hearings on waste information and fee structures
1.13	Conduct Training Program of SWM staff for Landfill Management
1.14	Conduct Training Program of SWM staff of ISWMF Management and C&D Waste Management Contractor
1.15	Hire a Technical Advisor
1.16	Prepare Full ESIA for ISWMF and Landfill Upgrading
1.17	Supervision of Works
Optional Items	
1.15	Preparing a Pre-feasibility Study for WTE Part of ISWMF- Optional
1.16	Developing DBO Contract for WTE part of ISWMF - Optional
2	**COMPONENT 2: Works to be Procured**
2.1	MSW Landfill Upgrading & Extension - DBO
2.2	Integrated Solid Waste Management Facility (ISWMF), except Optional WTE Part - DBO
2.3	Removal of Debris in Irma Landfill
2.4	Separate C&D Handling Facility - DBO
2.5	Waste Receiving Facility at Port
2.6	Improvement Works for Waste Collection Points
Optional Works	
2.5	WTE Part of ISWMF
3	**COMPONENT 3: Goods to be Purchased**
3.1	Purchasing of Machineries & Equipment (M&E) for Landfill, including TDSR list
3.2	Purchasing of Machineries & Equipment (M&E) for ISWMF
3.3	Purchasing the Machineries & Equipment for Removal of Debris in Irma Landfill
3.4	Purchasing of Waste Containers

5.1.2 Phase 2: Mid Term Plan Period Activities and Related Sub-projects

Apart from the following additional activities and sub-projects, this period comprises of the continuation of the activities and sub-projects that may be uncompleted in the short term plan period.

Design and preparation of new sanitary landfill site for landfilling of residuals from operation of the ISWMF as the current MSW landfill life is projected to be ended at the end of 2028. So that design and construction of a new sanitary landfill with appropriate capacity is included in the mid term period activities. Closuring activities of MSW Landfill in Pond Island is also included in the mid term activities. The main sub-projects that are projected to be implemented in the mid term plan period from 2027 to the end of 2029 are given in the following Table.

The Mid Term Plan period activities and sub-projects could also be implemented under three components, which are as follows:

Component 1: Engineering and Consultancy activities

Component 2: Procurement of Works

Component 3: Purchasing of Machineries and Equipment (M&E)

Table 5.3: Mid Term Plan Period Activities and Sub-projects, 2027 -2029

1	**COMPONENT 1: Engineering & Consultancies to be Procured**
1.1	Prepare Feasibility Study, and develop a DBO contract for New Sanitary Landfill
1.2	Prepare Full ESIA for New Sanitary Landfill
1.3	Prepare Feasibility Study and a DBO contract for closuring the current MSW landfill in Pond Island
1.4	Prepare Full ESIA for Closuring of Existing MSW landfill in Pond Island
1.5	Supervision of Works
2	**COMPONENT 2: Works to be Procured**
2.1	Construction works of New Sanitary Landfill - DBO
2.2	Construction works of Existing MSW Landfill Closure – Continuation of Existing DBO Contract for Improving of MSW landfill
3	**COMPONENT 3: Goods to be Purchased**
3.1	Purchasing of Machineries & Equipment (M&E) for New Sanitary Landfill

5.1.3 Phase 3: Long Term Plan Period Activities and Related Sub-projects

The major studies, works, and procurement activities will likely be completed to the end of 2029, so that by theend of 2029 the whole SWM system would be fully operational. After care activities of MSW Landfill in Pond Island after closuring, and review of performance of the DBO Contractors will continue in the Long Term Plan period.

In addition, the following studies/activities would be needed to determine whether to increase design capacity and/or treatment facilities based on the studies/works conducted/procured above, regarding:

- Market development and cost recovery potential for recycling of secondary commodity materials, such as paper, cardboard, plastic, metal, glass, textile, and rubber;

- Market development and cost recovery potential for resource recovery, such as production of compost from resource recovery of putrescible organics, production of refuse derived fuel from resource recovery of combustible materials in wastes, and production of energy from resource recovery of organics;
- Market development and cost recovery potential for processing of residues, including ash and pollution control residues, including sludges and particulates, into usable products;
- Assessing whether the market development and cost recovery potential is adequate to support accepting selected categories of wastes from ships;
- Assessing whether the environmental impact issues of increasing waste quantities handled and expanding on the types of treatment processes added;
- Analysis and extensive dialogue with residents and the tourism enterprises is recommended to assess the extent to which waste systems can be further expanded beyond 2029; and
- A stakeholder-driven study is recommended to assess alternative futures and decide which one best suits the local population.

If the above studies/works result in an outcome that would alter straight-line continuation of the current DBOs it will be necessary to renegotiate the DBOs with the contractors. This could involve adding treatment techniques, or adding additional wastes from new waste generators (such as cruise ships or the French Collectivity). It could involve altering tipping fees based on new sources of revenues, such as sale of energy to the electricity grid. This would also be the time to examine whether to bundle all tariffs from local waste generators into the electricity bill, as well as to have a segregated account and billing system for the additional waste generators.

To accommodate any changes, a revision of the solid waste entity and local solid waste regulations may be needed. Additional government oversight staff and specialized regulations for new treatment works and their emissions might be needed.

5.2 Scheduling of Collection System Improvement

In all solid waste systems world-wide, the first priority is given to improving the basic system of waste collection. To improve the collection system the activities that should be planned, conducted and implemented in the short and medium plan period are listed in Chapter 4 of this report. Although current waste collection efficiency rate is almost 95% in Sint Maarten, the waste collection system is vested with some lacks in the extent of accountabilities of the parties involved. Waste collection in commercial and industrial part is totally unregulated, which leaves this part of the collection system uncontrolled and irresponsible against the basic technical, environmental and social requirements.

While a part of recyclables is diverted during collection cycles by the informal recyclers in both collection of households/institutional and area cleaning waste, and commercial and industrial waste, it is unknown the amount of diverted recyclables from the main waste stream. Incomplete or mis-characterization of waste can lead to improper waste management, inaccurate modeling outputs, or erroneous decisions concerning the type of unit to be used. The pivotal parameter in waste management is mass (and not volume). Volume is often misleading because different waste fractions have different density and this skews the statistics.

The following prerequisites are considered to be in place:

- Collection system should be fully regulated, kept under control, and overseen by the central waste management authority of the country such as by ISWMA of Sint Maarten;
- Regulation measures should contain the environmental & social safeguards compliance measures;
- Daily registration of daily collected waste with final destination district by district, each individual collection route and service provider basis should be provided, so that waste database would have detailed data and information on daily collected waste, separately collected or separated recyclables;
- Any activity should be planned according to economies of scale criteria that will be determined and established specifically for Sint Maarten scale;
- All system should be designed by weight, i.e., kilogram (kg), tonnes (t), kilotonnes (kt), etc.;
- More comprehensive determinations are required on the solid waste composition and Waste Generation Rate; For this a comprehensive waste characterization survey is included in the short term period activities;
- Special waste types (such as C&D waste, hazardous medical waste, hazardous industrial waste, WEEE) should separately collected from the mainstream, and each should have different collection and disposal system because collection of special waste types commingled with municipal waste degrade significantly the general waste collection scheme;
- A number of different systems can be implemented to collect recyclables from the general waste stream. These systems lie along the spectrum of trade-off between public convenience and government ease and expense. The three main categories of collection are "drop-off centers or civic amenity centers" and "buy-back centers" that may be operated by formal local recycler companies, and "curbside collection".
- Cruise ship waste should not be included in the general Sint Maarten waste collection scheme, even if Sint Maarten were to implement safe disposal, it is not possible to know the quantity of wastes that would be off-loaded, as that would depend on pricing competition relative to other nearby Caribbean ports.

Since other measures recommended for improving the collection system have been detailed in Chapter 4, Table 4.1, they will not be repeated here.

All activities for improving the collection system have been planned to be implemented and completed before the end of 2026. The following activities for improving the waste collection system in Sint Maarten have been included in the short and mid-term plan period.

- Prepare Waste Collection System Feasibility Study and Roll Out Plan for Collection/Transport; this will also provide mapping to enable dedicated routes and service providers for key waste source categories and the potential for dedicated routes that would address wastes most ideally suited for resource recovery, for example:
    - Routes for waste that are high in paper, packaging, and other readily combustible materials, (such as offices, hotels, retail stores, schools, cruise ships);

  - Routes that are high in putrescible organics (such as restaurants, markets, and landscaping activities); and
  - Routes that are predominantly mixed wastes (e.g., households, cargo ships and yachts, airport and ship port).
  - Conduct collection route optimization and system configuration analysis, to determine the system needs for urgent improvement

- A comprehensive Waste Characterization Survey;
- Improvement works for waste collection points;
- Establishing color-coded container points for separate collection of clean recyclables;
- Apply two bin system in few pilot districts, to promote and encourage the separate collection at source gradually;
- Purchasing waste containers in accordance with the collection system configuration recommended in the collection system feasibility study;
- Waste receiving facility at Philipsburg cruise port.

5.2.1 Source Separation During Collection of Waste

Diversion of recyclables by the unregulated recyclers during collection cycle without control and registering is an important a drawback for a holistic planning of the mass-balance of waste flow in the country. So that the consultant has planned the following technical measures that should be in place along with the measures recommended in Chapter 4 for fully integration of the waste collection system into the country's Integrated Waste Management System (ISWMS).

1. Establishing color-coded container points with different containers (for glass, newspaper, and tin/aluminum cans) in the capacity of 2 -2.5 cubic meter per 1000 capita along the central business districts and densely populated neighborhoods for separate collection of recyclables, to increase the culture of the voluntary separation of recyclable fractions from the main waste stream; This would organize oversee by central waste management authority (such as ISWMA of Sint Maarten) through voluntarily involved NGOs, CBOs, private waste collectors, but with the provision of control and registry of separately collected recyclables by this way.

2. Applying at least two bin system within the curbside collection in some pilot districts until the end of mid term plan period, one for recyclables and one for organic and other waste; This would also promote and encourage the separate collection at source gradually in the country, and by this way three bin system could be developed in the long term plan period.

The other measures for separate collection of the clean recyclables are evaluated in Chapter 5.4.

5.2.2 Economies of Scale for Waste Collection System

The economics literature in municipal solid waste (MSW) markets is concerned primarily with demand-side issues and the associated policy implications. The major driver for economies of scale in waste collection are costs of the services, mainly O&M costs as the capital cost is a one-time cost. Although capital cost is

a one-time cost, depreciation cost is directly related to capital cost despite the fact that it is generally included in O&M costs components as non-cash recurrent expense. The amortization period of machineries and equipment varies country by country depending on tax legislations. The life cycle of a refuse collection vehicle (RCV) is relatively shorter than the one in other sectors such as life cycle of an RCV – a compactor truck or an open truck – is shorter than a truck used for non-stop transportation as an RCV has more stop and start under heavy load with low speed during collection cycle, which in turn causes to rapid aging on vehicle. Labour cost is also second O&M cost component in waste collection, which is constant per day while O&M cost of an RCV is variable due to RCV's number of sorties per day. Sector specific experiences suggest that higher number of sorties per day the low O&M cost of RCV, and smaller number of sorties per day the higher O&M cost of RCV per day.

Economies of scale that depends on number of sorties of an RCV per day is to have two sorties per day as a collection cycle requires four hours in average for 30 – 35 collection points with 55 – 65 km travel per tour (30 – 33 km for collection cycle and 25 – 30 km for hauling the waste to disposal site).

Economies of scale for payload of an RCV for each tour is 3 tonnes per tour for an RCV with 12 cubic meter hopper volume, and 5 tonnes per tour for an RCV with 16 cubic meter hopper volume, depending on service zone size.

Table 5.4: Economies of Scale Criteria for Collection & Transport

Indicator	Value
Number tour - per day for RCVs	
Compactor Truck	2
Open Truck	2
Minimu payload per sortie for RCVs - tonne	
Compactor Truck - 12 cum hopper	3 - 3.5
Compactor Truck - 16 cum hopper	5 - 5.5
Open Truck - 12 cum	2.4
Open Truck - 8 cum	1.6
Primary service zone in neighborhoods - tonne per day	50
Secondary collection zone from the periphery of primary collection zones - tonne per day	50
Distance between collection points - m	100 - 120

Source: Consultant's own evaluation.

5.3 Scheduling of Waste Disposal System

Currently, all solid waste collected in Sint Maarten are ended in MSW landfill in Pond Island without any segregation or pre-processing or treating any waste types, except diversion of recyclables (estimated 11% of collected waste) by the local recyclers during the collection cycles.

For the purposes of this project the enhanced and sustainable waste disposal system has planned under following components in or der to create an integrated and improved waste management system for Sint Maarten.

- Component 1: Enhancing existing waste disposal site in Pond Island in accordance with the sector specific best practices and design of environmentally acceptable waste disposal site, upgrading the "controlled dumpsite" to "controlled landfill" with its life extension. This facility will also be integrated with the new Integrated Waste Management Facility (ISWMF) of Sint Maarten. This component will also include the closure of existing MSW Landfill and after care activities.
- Component 2: Removing debris in IDDS with environmentally sound practices, and
- Component 3: Planning to establish a new Sanitary Landfill for future waste disposal operations.

5.3.1 Component 1: Existing MSW Disposal Site Upgrading and Life Extension

This strategy assumes that all activities for upgrading the MSW landfill in Pond Island will depend on completion of resettlement issues for the residential/commercial area located South and South-East of the MSW landfill. Scheduling of removing debris in IDD site would partly depend on completion of the resettlement issue and the preparation of new C&D waste handling facility site as the main activities for removing debris will be in IDD site, i.e., screening of debris by a trommel screen, and hauling of screened debris fractions to a separate dedicated C&D waste handling site.

The Pre-feasibility Study (PFS 1) prepared previously by the Consultant examined the design, operations management, improvement, re-contouring, and eventual closure and aftercare of the existing MSW landfill including fire suppression activities during management of the main MSW landfill, and available area as part of the government-owned property allocated to solid waste at Pond Island of Sint Maarten.

The PFS 1 reviewed the available data and maps and indicated potential extension of life through practices that would improve landfill conditions and reduce space demands. Government efforts to stabilize slopes and curtail fires are considered, as they appear to be creating positive improvement. For purposes of FPS 1, the entire property of MSW landfill available in Pond Island is considered for potential disposal. The following satellite map shows the location of MSW landfill in Pond Island.

Figure 5.1: Satellite Image of MSW Landfill Location

The PFS 1 has also assessed the characteristics of the landfill site with regard to historical development of the site, Pond Island and Great Salt Pond, ecological environment of the site, climatic conditions of the area, adjacent land use practice, and existing waste disposal practices in the MSW landfill and IDD site. It also assessed the required and remaining volume projection in MSW landfill site with a required volume projection.

According to projection model 100% of waste collected will be landfilled until third quarter of 2020 (latest). Within the fourth quarter of 2020 all special waste types will be diverted to another area to be dedicated by the government, and MSW landfill will not accept the special waste types to reduce the volume demand in the landfill, as the landfill capacity is limited. The PFS 1 also assumed that the MSW landfill will be closed at the end of 2027. However, this target should apparently be revised according to effects of COVID-19 pandemic. Nevertheless, no projection for waste to be disposed at MSW landfill could be conducted for effects of COVID-19 pandemic on waste generation for 2020, 2021, and 2022, to include the variations due to COVID-19 effect as no data exist for doing estimations on waste amount that can be disposed during COVID-19 pandemic, and it is unknown that how much time the period of COVID-19 would last.

Therefore, the remaining volume projection conducted by PFS 1 for MSW landfill in Pond Island has not been changed for now. However, it is almost certain that the calculated remaining volume will increase due to COVID-19 lowering effect on waste generation and disposal in the next 2-3 years. The calculated remaining volume seems to extend the life time of the landfill by 7-8 years (approx. to the 2028) with all measures recommended within the PFS 1 would be implemented within the next 1 -2 years, as the remaining volume calculation revealed that the MSW landfill can accommodate approximately 568,433 cubic meter waste after 2020 to 2028 see following Table).

Table 5.5: Computation Results for Landfill Additional Volume with 3-D Model for Slope 3:1 (H:V)

Indicator	Unit	Value
Landfill total Area -	m^2	159,499.00
Current Total Fill	m^3	1,834,533.00

Total Volume with Aim Texas 3-D Model	m^3	2,608,994.00
Difference between Current Total Fill & 3-D Model	m^3	793,461.00
Ney Waste pile Volume with 3-D Model	m^3	2,449,210.00
Loss of Volume for Ring Road from Drainage and Riparian Defense Structures	m^3	165,878.00
Loss of Volume from Daily Cover	m^3	65,000.00
Total Net Volume gained with 3-D Model (Net Landfill Capacity)	**m^3**	**549,583.00**

Source: PFS 1 for MSW landfill life extension and improvement, Aim Texas, February, 2020.

The calculated remaining volume may also increase in time as the waste to be placed will be compacted adequately with suitable and sufficient equipment, and re-placing of the waste during re-contouring activities and compaction of new waste will rise the compaction efficiency of the waste pile already placed. The results of the projection for volume of waste that can be disposed in the MSW landfill from 2020 are summarized in the following Table. The projection assumes that C&D waste and other special waste types (i.e., C&D waste, hazardous medical waste, and hazardous industrial waste and WEEE) will not be accepted by the Landfill.

Table 5.6: Volume Calculation of Waste Planned to be landfilled

Years	Waste collected - on Truck		Volume of Waste with Compaction Factor of 3.2	Assumed percentage for landfilling	Airspace to be consumed
	t/a	*m^3/a*	*m^3/a*	*%*	*m^3/a*
2020	91,263	246,657	82,219	100%	82,219
2021	73,762	199,357	66,452	100%	66,452
2022	74,869	202,349	67,450	100%	67,450
2023	75,992	205,384	68,461	100%	68,461
2024	77,132	208,465	69,488	100%	69,488
2025	78,288	211,589	70,530	100%	70,530
2026	79,000	213,514	71,171	100%	71,171
2027	80,655	217,986	72,662	100%	72,662
Total	**630,961**	**1,705,300**	**568,433**		**568,433**

Source: Consultant's own assessment, PFS 1 for MSW landfill life extension and improvement, Aim Texas February, 2020)

Accordingly, the following activities for upgrading and life extension of the current MSW landfill in Pond Island are planned through PFS 1 by the Consultant. The closure of the landfill and after care activities are also included in improvement of the landfill.

Landfill would require site and facility upgrades as no ring road and emergency entrance, appropriately designed landfill entrance with required facilities, storm water collection, interim and final capping exist, all these facilities should be constructed. A new leachate collection and treatment system could not be planned although there is also no leachate collection system due to the fact that high amount of waste is already placed (in some parts), and re-excavating and re-placement of waste for constructing of a new leachate collection system would be very costly.

Table 5.7: Activities Planned for MSW Landfill Improvement and Removing the Debris in IDDS

Activities Planned	
1	Re-contouring and Regrading

Activities Planned	
2	Track Road for Managing the Waste Deposits and the Development of the Landfill
3	Landfill Side Defense Facility – Concrete Retaining Wall and Fencing
4	Landfill Perimeter Drainage Structure
5	Interim Perimeter Capping & Construction of Ring Road
6	Sediment Trap & Water Treatment Facility
7	Emergency Pump House
8	Landfill Main Entrance Facilities
9	Daily Waste Fill, Daily Cover
10	Interim Capping, Interim Storm Water Facilities
11	Interim Gasification System Installation
12	Fire Suppression and Preventing Activities
13	Restoration, Landfill Closure, Final Gasification
14	After Care
15	Manitenance of Environmental Pollution Control
16	Removal Activities of Debris in IDDS

Source: PFS 1 for MSW landfill life extension and improvement, Aim Texas February, 2020)

The Figure below also shows the concept plan for improvement of the MSW landfill.

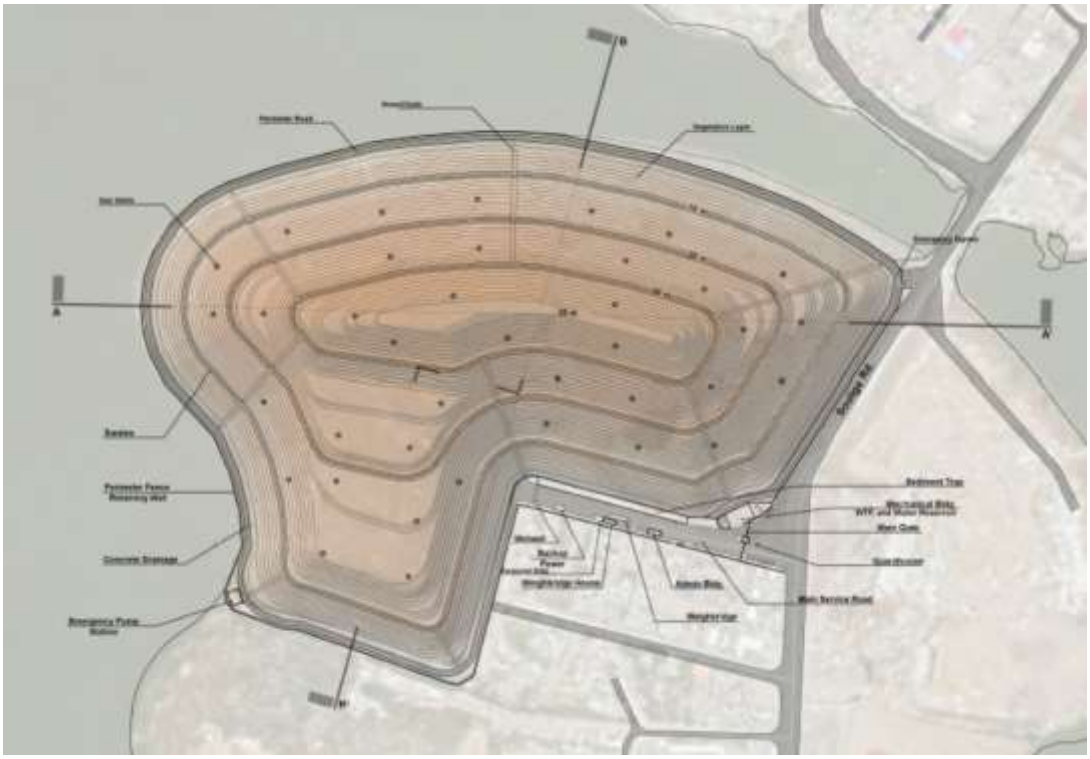


Figure 5.2: Concept Plan for Improved MSW Landfill

(PFS 1, Aim Texas, February, 2020)

Machineries and Equipment (M&E) for MSW Landfill Improvement and Operation

The following equipment is, therefore, planned to be in place for operation of the landfill regardless the economies of scale, and their costs are included in the capital cost of landfill improvement.

Table 5.8: Machineries and Equipment Planned to be in Place for MSW Landfill Improvement & Operation

Machineries and Equipment (M&E)	Type	Nos	Capacity/Power
Weighbridge with software	Portable Steel Deck Type	1	Deck width 10', Length without ramps 50', Optional (10*40 or 10*60) feet 45 Mtons
Emergency Pumps	Radial centrifugal	2	Min. head – 50-m atmosphere
Emergency Stand-by Generator - 110 kVA	Diesel	1	110 kVA
Pumps for wet wells and storm water treatment facility	Submersible	1 Set	Min. head – 20-m atmosphere
Track Type Tractor	Chain	1	200 HP 150 kW
Compactor for both spreading and compaction of waste	Lightweight	1	Operating Weight 50 – 55 thsd. Lbs.
Versatile Back Hoe Loader w/ripper attachment	w/Ripper Attachment	1	220 HP, 40 m^3/hour
Motor Grader - 140 HP	-	1	140 HP
Water Truck	w/spray attachment for dust control	1	5 m^3
Truck Mounted Hydro Seeder	-	1	-
Fire Fighting Equipment, welding equipment and other repair tools	Set	1	Set
Dump Trucks	-	2	8 m^3
Trailer Truck	-	1	Low Bed
Small pick-up Truck - supervision vehicle	4 Wheel Drive	1	1 m^3 (2 m^3 soil/hour)
Portable Trommel Screen	Mobile Trommel Drum Screen	1	18 tonnes/hour

5.3.2 Component 2: Removing debris in IDDS with Environmentally Sound Practices

Removing the debris in IDDS is also included in the Waste Disposal activities in consultation with WB team and Government as the Irma debris is temporarily deposited in IDDS. Currently, approximately 225,000 cubic meters of debris are deposited in IDDS.

M&E for Removal of Debris in IDDS

The Consultant also planned the following M&E would be in place for debris removal activities in IDDS, and their capital costs are included in the capital cost of landfill improvement activities.

Table 5.9: Machineries and Equipment Planned to be in Place for Debris Removal in IDDS

Machineries and Equipment (M&E)	Type	Nos	Capacity/Power
Generator -	Diesel, Mobile Stand-by	1	50 kVA

Versatile Back Hoe Loader	Back Hoe Loader	1	220 HP, 40 m3/hour
Small pick-up Truck -	4 Wheel Drive	1	1 m3 (2 m3 soil/hour)
Water Truck	w/spray attachment for dust control	1	5 m^3
Portable Trommel Screen - 18 tonnes/hour	Mobile Trommel Drum Screen	1	18 tonnes/hour
Fire Fighting Equipment, welding equipment and other tools	Set	1	Set
Dump Trucks - 8 m3	-	2	8 m^3

5.3.3 Component 3: Planning to Establish a New Sanitary Landfill for Future Waste Disposal Operations

Establishing a new Sanitary Landfill for future waste disposal operations will be required as the current MSW landfill in Pond Island has limited life span, even if it will have 7 - 8 years extended life after improvement. Although the planned ISWMF will significantly reduce landfilling requirement, in any case 20 - 25% of waste to be collected waste (residues form ISWMF operation – contaminated sand/soil and inert materials) need to be landfilled. Projections for a new Sanitary landfill resulted in the requirement of a 600,000 cubic meters airspace for landfilling of the residual waste for 25 years operation of this landfill from 2028 to 2052. This new landfill should be ready to operation latest at the end of 2028. A concept layout for new sanitary landfill is given below. An area of approximately 6 -9 hectares would be sufficient for this facility.

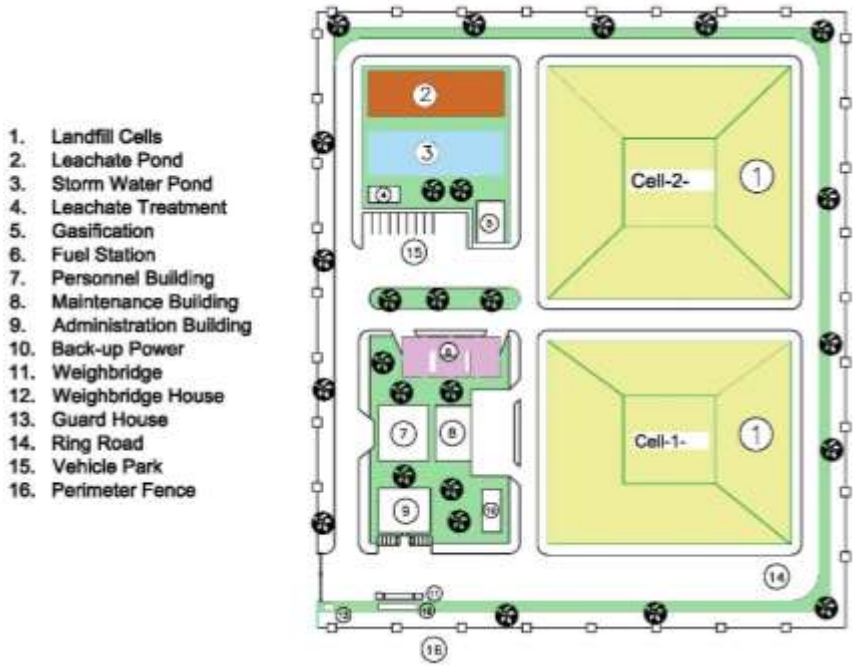


Figure 5.3: Concept Layout of Prospective New Sanitary Landfill

The facility would handle disposing of residual waste from ISWMF of Sint Maarten from 2028 to 2052. The following Projection has been conducted, assuming that 25% of the waste to be treated in ISWMF of Sint Maarten will be disposed this landfill in 25 years period. According to the following projection, the first cell of the facility would accommodate the residual waste until about 2039 with providing an airspace capacity

of about 260,000 cubic meters. Second cell would need to be established after 2039, and could accommodate the residual waste until 2052.

Table 5.10: Required Airspace Calculation for Future New Sanitary Landfill

Years	Waste Generation (Special Waste Excluded)	Estimated Residual Waste to be landfilled		Density of Compacted Waste Landfilled	Airspace to be consumed for Landfilling of Residual Waste	Cumulative Airspace to be consumed for Landfilling of Residual Waste
	t/a	*%*	*t/a*	*m^3/t*	*m^3/a*	*m^3/a*
2028	81,865	25%	20,466	1.20	17,055	17,055
2029	83,093	25%	20,773	1.20	17,311	34,366
2030	84,339	25%	21,085	1.20	17,571	51,937
2031	85,605	25%	21,401	1.20	17,834	69,771
2032	86,888	25%	21,722	1.20	18,102	87,873
2033	88,192	25%	22,048	1.20	18,373	106,246
2034	89,514	25%	22,379	1.20	18,649	124,895
2035	90,858	25%	22,714	1.20	18,929	143,824
2036	92,220	25%	23,055	1.20	19,212	163,036
2037	93,603	25%	23,401	1.20	19,501	182,537
2038	95,008	25%	23,752	1.20	19,793	202,330
2039	96,432	25%	24,108	1.20	20,090	222,420
2040	97,879	25%	24,470	1.20	20,391	242,811
2041	99,347	25%	24,837	1.20	20,697	263,509
2042	100,837	25%	25,209	1.20	21,008	284,516
2043	102,350	25%	25,587	1.20	21,323	305,839
2044	103,885	25%	25,971	1.20	21,643	327,482
2045	105,443	25%	26,361	1.20	21,967	349,449
2046	107,025	25%	26,756	1.20	22,297	371,746
2047	108,630	25%	27,158	1.20	22,631	394,378
2048	110,260	25%	27,565	1.20	22,971	417,348
2049	111,914	25%	27,978	1.20	23,315	440,664
2050	113,592	25%	28,398	1.20	23,665	464,329
2051	115,296	25%	28,824	1.20	24,020	488,349
2052	117,026	25%	29,256	1.20	24,380	512,729
Total	**2,461,101**		**615,275**		**512,729**	

Source: Consultant's own assessment.

As seen above analysis, the future new Sanitary Landfill would handle approximately 615 thsd. tonnes of residual waste until 2052. No landfill machineries and equipment (M&E) have planned to be purchased for the new Sanitary Landfill as M&E of upgraded MSW landfill in Pond Island would be transferred to this landfill after closuring.

5.3.4 Economies of Scale for Waste Disposal System

Economies-of-scale for waste disposal systems is always bound with capacities of the machineries and equipment to be used. Upgrading dumpsites to controlled landfill does not have to have full-time on-site equipment. Wheeled loaders, graders, bull-dozers and other equipment to grade, spread, compact and cover the wastes can be sent to the controlled landfill sites on a periodic and regular basis and hired when needed from local contractors.

However, in Sint Maarten case, since the private sector has weak financial capacity, and the country has only one landfill, there is no base to hire the equipment for daily operation of the landfill from the private contractors. The smallest viable size for a landfill bulldozer is the equivalent of a CAT D-6, which could readily handle up to 500 tonnes/day; while the smallest viable landfill compactor could handle about 400 tonnes/day. Bulldozers may be used at small landfills, but specially designed landfill compactors are preferable for Sint Maarten Landfill.

5.4 Scheduling of Waste Treatment System

5.4.1 Main Waste Treatment Concept

An integrated waste treatment system for Sint Maarten has planned mainly by PFS 2 (Feasibility Study for establishing Integrated Solid Waste Management Facility – ISWMF). The concept of the PSF 2 is long discussed with WB team and Government from September, 2019 to February, 2020. The concept of this centralized waste treatment facility is based on a modular approach could have separate lines that recover commodity materials for recycling, others that convert putrescible organics into compost or biogas, and others that produce energy through thermal or chemical means. The concept also foresees that the MSW landfill will not accept itself any waste delivery, and only the residual materials from the operation of ISWMF will be delivered to upgraded MSW landfill.

As mentioned in Chapter 1 and Annex 1, this centralized waste treatment facility is expected to have three basic modules of operation, namely:

1 A materials recovery sorting and pre-processing module (MRF) – Module -1;

2 A putrescible organics decomposition module – Module – 2;

3 An optional waste to energy module (WTE) – Module – 3; and

4 A disposal facility for residual disposal from ISWMF operation

However, the upgraded MSW landfill in Pond Island will be 4th module of this facility for disposal of residuals from the facility operation. The amounts of residuals to be disposed at the landfill can vary according to technology of waste to energy module of the facility, although waste to energy typically reduces volume by 85-90% and weight by 20-25%...which means there is residue that could require disposal space if not further processed. The residual ash, slag, and/or pollution control residues would ideally be processed to the extent possible to minimize disposal. This comes at a relatively high cost, but the cost needs to be

weighed relative to the lack of suitable land for disposal. The following waste material groups need to be rejected by ISWMF of Sint Maarten.

1. Construction and Demolition Waste (C&D Waste)
2. Waste Electrical and Electronic Equipment (WEEE - eWaste) and Durables
3. Car Batteries (Lead Acid Batteries – LAB)
4. Hazardous Medical Waste
5. Hazardous Industrial Waste
6. Disaster Debris

The waste treatment facility is expected to have multiple lines to process multiple waste streams. The facility would need to be flexible to adjust the quantity of waste processed through each line in response to market demand for each line's outputs as well as seasonal variations in waste flows.

The recommended technologies for the facility include:

- Sorting and materials recovery of recyclable commodity materials;
- Aerobic decomposition by composting of putrescible organics; and
- Waste-to-energy by incineration or gasification of combustible organics, with a possible step for refuse-derived fuel.

In a "performance based" procurement instrument, it isn't necessary to specify the technology precisely. Instead, the procurement specifies all of the performance measures to be met, including the emission standards and reliability requirements.

The facility initially would handle an average of 250 - 300 tonnes/day of waste with seasonal fluctuations, of which 10-15% by volume and 20-25% by weight would require residuals management. It would need to be flexible to handle daily and monthly fluctuations in the quantity. For now, and based on the estimated waste characterization shown in the Short Term Plan, it is estimated that the lines of treatment would include the following:

- Commodity materials recovery for recycling through various human and mechanized sorting of 25% to 35% of the wastes received;
- Biodegradation through aerobic microbial systems for resource recovery of compost from 7% to 15% of the wastes received;
- Thermal or chemical conversion through incineration or gasification for resource recovery of energy from 30%-50% of the wastes received;
- Combustible materials recovery for refuse derived fuel through human and mechanized sorting of 0% to 20% of the wastes received, depending on market availability; and
- Conversion of ash and slag to usable products.

5.4.2 Capacity Projection of ISWMF of Sint Maarten

As MRF part of ISWMF will be a centralized waste hub for the whole Integrated Solid Waste Management System (ISWMS) of Sint Maarten, its conceptual capacity should be planned to handle the waste amount around 100,000 tons per year by 2040 with daily waste handling capacity of around 274 tonnes per day, see following Table. All waste collected will be accepted by this facility, and processed by it for distribution to other waste treatment and disposal facilities, including future WTE.

Assuming that the first part (MRF part) of ISWMF would be operational until end of 2024, the following waste projection is conducted, which shows the amount of waste to be accepted by ISWMF.

Table 5.11: Waste Projection through ISWMF, from 2025 to 2040

Projected Years	Waste Amount Projected to be accepted by ISWMF
	t/a
2025	*78,288*
2026	*79,000*
2027	*80,655*
2028	*81,864*
2029	*83,093*
2030	*84,339*
2031	*85,605*
2032	*86,888*
2033	*88,192*
2034	*89,514*
2035	*90,858*
2036	*92,220*
2037	*93,603*
2038	*95,008*
2039	*96,432*
2040	*97,879*
Total	***1,403,438***

Source: Consultant's own assessment based on re-evaluation of the results of 2009 waste characterization survey.

As seen in above analysis, the ISWMF of Sint Maarten will handle 1.4 million tonnes of waste for its operational time of 17 years.

The waste material group-based projection is conducted for planning of facility sections that will provide sufficient area for their functions. This projection assumes that 90% of MSW generated (except special waste and C&D waste) will be collected, and 5% of collected MSW will be diverted informally during collection cycle in Sint Maarten. Thus, only 85.55 percent of MSW collected could be delivered to ISWMF.

The following Table gives the amounts of waste that will be handled in ISWMF of Sint Maarten by three phases, which are i) Phase 1 (Short Term Plan Period) covering from 2025 to the end of 2026, ii) Phase 2 (Mid Term Plan Period) from 2027 to the end of 2029, and iii) Phase 3 (Long Term Plan Period) from 2030 to the end of 2040 respectively.

Table 5.12: Implementation and Projected Operation Phases of Sint Maarten ISWMF

Phases of Implementation	Number of years covered	Expected calendar years to be covered
ISWMF Implementation period	5	2020 - 2024
Short Term Plan Period - Phase 1	2	2025 - 2026
Mid Term Plan Period - Phase 2	3	2027 - 2029
Long Term Plan Period - Phase 3	10 (15)	2030 – 2039 and beyond
Total Project Life	**20 (25)**	

The analysis on waste projection by material group also shows that 16.29% of the waste would be paper and cardboard, 11.67% plastics, 11.70% glass, 9.58% metals, 22.10% organics (food), 2.51% textiles, 1.10% tire and rubber, and 20.23%-yard waste. See also following Table.

Table 5.13: Material Flow through ISWMF by 2040, based on Material Group

Material Group		**Waste Amount**	***Waste Amount by 2040***
		%	*Thsd. tons*
1	Paper / Cardboard	16.29%	16
2	Plastics	11.67%	11
3	Glass	11.70%	11
4	Metals	9.58%	9
5	Organics	22.10%	22
6	Textiles	2.51%	2
7	Tire & Rubber	1.10%	1
8	Inorganics	0.40%	0
9	Yard Waste	20.23%	20
10	HHW	1.14%	1
11	Other Waste	3.27%	3
TOTAL		**100.0%**	98

Source: PFS 2, consultant's own projection based on the results of waste characterization survey of 2019.

5.4.3 Siting Process of ISWMF

According to conceptual layout of the facility, approximately 4.24 hectares of land would be required for the facility. The probable locations of the facility are evaluated and assessed by the PFS 2, see following Figure. Mainly two locations are assessed, and compared.

Initial discussions are held with VROMI for location alternatives of the facility during performance of this pre-feasibility study. The following figure discuss the alternative locations. The vacant area south-west of the current MSW landfill is proposed by VROMI for location of both MRF and prospective WTE.

Alternative Location 1: Located south-west of the current MSW landfill.

Alternative Location 2: A part of the area where current Irma debris site is located.

Although both areas proposed provide sufficient land, as indicated in the following Table which compares the pros and cons of both locations, the Alternative Location 2 is considered by AIM TEXAS to be the superior alternative for facility location because of the following reasons:

- The location provides good access from a main transportation route;
- Suggests resettlement of only one commercial lease holder on Government owned land;
- Suggests no significant environmental and social public health impacts during operation by heavy vehicle traffic;
- No vehicle which hauls the waste will travel through residential or commercial area with a narrow road;
- It does not suggest any volume lost in MSW landfill; and
- The area provides 6.2 hectares of land. It will still be possible to spare a sufficient area for a new soccer field as ISWMF requires only 4.24 hectares area.

The following Map also shows the Alternative Locations.

Figure 5.4: Alternative Locations for Sint Maarten ISWMF

Pros and Cons of two alternative locations are given in the following Table:

Table 5.14: Comparative Evaluation of Alternative Locations for the ISWMF Facility

Alternative Locations	PROS	CONS
Location Alternative 1:	- Location is currently vacant - The area is a Government owned land, thus it will not raise any resettlement issue. - Provides almost sufficient area	- No good access from a main transportation route. - Foresees that main access to the facility will be available through main landfill entrance, replacing the waste in the south-east of MSW landfill, secondary service road through residential and commercial area with a very narrow road. - Creates significant/major environmental and social and public health impacts during operation period by heavy vehicle traffic. - Suggest volume lost in MSW landfill. - Suggests relocation huge volume of waste in the MSW landfill - Suggests urgent resettlement of the residential and commercial premises which locate along the border of the MSW landfill in south-eastern part of MSW landfill. This would be a major impact.
Location Alternative 2:	- Provides sufficient land. - The area is a Government owned land. - Provides good access from a main transportation route - Create no significant environmental and social public health impacts during operation by heavy vehicle traffic. - No vehicle which hauls the waste will travel through residential or commercial area with a narrow road. - It does not suggest a volume loss in MSW landfill	- It will cause to increase the traffic on Soualiga road. - The area is currently not a vacant area. - It suggest resettlement of one commercial lease holder nearby the Irma landfill, which deal with car wrecks processing. This would be major social impact.

On account of the evaluation above the consultant proposed Alternative Location 2 for ISWMF location. Nevertheless, the prospective location of ISWMF may be re-evaluated in the further steps of the project, in case the Government proposes another location(s) as it is a long-term facility.

5.4.4 Design of the ISWMF of Sint Maarten

A conceptual lay out of the facility is provided by PFS 2, and summarized in Annex 1 of this Strategy Report. The layout will depend on the final property boundaries that the Government is able to set aside for construction of the treatment facility and related residuals disposal. It would have a planted buffer zone around the security wall. Each bidder will present a separate and unique layout of their technical works. No design specifications will be provided in the DBO contract, only precise performance specifications.

ISWMF will have two parts and will be implemented in two phases. The first part will be material recovery parts (MRF) for separation and pre-processing the waste accepted, and second part of it will be the Waste to Energy (WTE) facility for thermal processing the waste separated for energy recovery, but implementing of this part will be optional in Short Term Plan period. The project proponents (Government and World

Bank) will possibly make a decision for implementation time of the second part (WTE). However, it should be operational at latest until beginning of 2028 as the current MSW landfill is planned to be closed in 2028, and it is unknown that a suitable land will be provided for a new Sanitary Landfill (see Chapter 5.2.3) as the land scarcity for a new Sanitary Landfill is one of the main concerns for Sint Maarten.

The Sint Maarten ISWMF would comprise of three modules, one of which is MRF part, second putrescible organics decomposition (composting) module, and third WTE module.

1. Functional Description of MRF Part of ISMF

The MRF of ISWMF would have the waste handling capacity of approximately 100,000 tonnes per annum by 2040 (see Table 5.8 and 5.9), and would have the following abilities to achieve the expected functions:

- Administrative and personnel facilities;
- Scaling and recording abilities;
- Abilities for managing of full MSW system, including full accounting and billing operations;
- Waste separation, pre and post processing abilities such as compost production, crumb rubber production, etc.;
- Pre-processed and processed waste baling and storing abilities;
- Maintenance, repair, fire-fighting and dust suppression abilities;
- Ability for vehicle parking and maneuvering area;
- Emergency medical treatment ability against unexpected physical injuries during operation; and
- The means for avoiding the environmental and social impacts, and mitigating them.

To perform its functions the facility requires at least two weighbridges (one for ingress and one for egress), internal roads which allow easy maneuvering for vehicles, closed warehouse for tipping and separating the mixed/semi-separated clean/dirt waste, washing, baling and temporary storing the recyclables, shredding compartments for wood, metal, plastics and tires, separate loading decks for residues to be landfilled and other materials. A concept design is given below for MRF part of ISWMF with putrescible organics decomposition (composting) module:

1. Sufficient Parking space
2. Administration building
3. Personnel building
4. Storage area
5. Main MRF building
6. Composting building (ISWMF Module 2)
7. Wood processing building
8. Tire shredding
9. Maintenance building
10. Car wash building
11. Two weighbridges

12 & 13 Drop-off Center

14. Fire-fighting Station
15. Power Back-up Facility

Figure 5.5: Concept Design of MRF Part of ISWMF

An approximately 2 hectares of land would be required for MRF part and composting module of ISWMF of Sint Maarten.

Structural Design

All facility, including module 1 and 2 of ISWMF MRF part, is considered to be built by structurally engineered materials (metal) with sufficient ventilation system, except administrative and personnel sections. Administrative and personnel building could be constructed with conventional materials with necessary furniture and equipment. All receiving areas, processing areas, and storage areas will be fully enclosed inside of well-ventilated buildings. The facility will have separate buildings for offices, worker changing and sanitation facilities, training and public visitor education. Only the weighbridges, access road, internal road, parking, and vehicle workshops will be outside of the buildings. No waste piles will be allowed outside of the buildings. All works and buildings will be protected by a security wall and gates.

Environmental and Social Considerations

During operation of the facility the most relevant emissions could be dust and emissions from heavy equipment and machineries. These create air pollution and health hazards (respiratory) and nuisance form the high for the employees, if there will be no means and measures within the facility to suppress, mitigate and avoid these negative effects during operation. So that all machineries and equipment to be selected should be environmentally friendly, and the facility should have the ability to take all measures for avoiding the negative impacts. Eventually all the dust should be collected in big bags and disposed of at the MSW landfill.

2. Functional Design of Putrescible Organics Decomposition (Compositing) Module of ISWMF

The consultant has verified the country's capacity of compost use by putrescible organic decomposition. There is currently very little capacity for compost use in the agriculture as almost no agricultural activity exists in the country. Agricultural activity is confined with small scale gardening in homestead lands. Efforts of few NGOs on promoting of home-scale compost production and use in the agricultural activities affect very little to develop the compost use in the country as also the lack of land for agriculture is a main obstacle.

Resource recovery of organics by composting or anaerobic digestion of putrescible wastes, such as food and yard wastes, could be desirable to improve soils in Sint Maarten and make them potentially productive. Currently, there is minimal agricultural activity because of poor soils and limited fresh water. The country also extensively imports flowers for the many hotels and restaurants. However, some of these products could be grown in green houses in small lands using quality compost and water saving techniques. Taking into account this potential, the compost production is included in projections of resource recovery by a scenario which assumes only 5% of putrescible organics should be decomposed during short term plan period, gradually increasing this amount up to 10% in the mid and long term plan period.

3. Functional Description of WTE Module of ISWMF of Sint Maarten (Optional in Short Term Plan Period)

The WTE part of the ISWMF of Sint Maarten would be to thermal processing the waste separated for energy recovery, but implementing of this part will be optional in Short Term Plan period. Project proponents (Government and World Bank) will possibly make a decision for implementation time of the second part (WTE). However, it should be operational latest until beginning of 2028 as the current MSW landfill is planned to be closed in 2028.

According to results of the Consultant's projection, the WTE part of ISWMF of Sint Maarten would be in the capacity of approximately 5 – 5.5 MWh electricity generation capacity, incinerating at least 55 – 65,000 tonnes of waste per year by 2040, converting of ash and slag to usable products depending on WTE technology to be employed. This capacity could be re-arranged according to RDF demand in regional market.

Mass burn incineration is the most proven and reliable system, able to handle a wide range of wastes and directly produce electricity for the grid. There appears to be enough waste for economic development as technical advances in the last year have led to equipment that can economically handle smaller quantities. Gasification systems are less proven and less robust, potentially requiring more careful management of inputs or limitation to handling only refuse-derived fuel. Gasification can either create syngas only, or subsequently process the syngas into electricity for the grid. Usually, gasification systems are more costly.

5.4.5 Reject List of ISWMF

The ISWMF of Sint Maarten would be expected to handle all typical municipal waste categories that are not hazardous, including paper, cardboard, food wastes, plastics, textiles, bottles and cans, etc. Landscaping wastes, crop residues, and animal manures could be safely handled at the waste treatment facility, or separately, whichever is preferred, depending on markets. These wastes potentially could be co-processed with food wastes.

The following waste material groups will be rejected by ISWMF of Sint Maarten.

1. Construction and Demolition Waste (C&D Waste)
2. Waste Electrical and Electronic Equipment (WEEE - eWaste) and Durables
3. Car Batteries (Lead Acid Batteries – LAB)
4. Hazardous Medical Waste
5. Hazardous Industrial Waste
6. Disaster Debris

The exceptions for rejection from the waste treatment facility are discussed below.

Construction and Demolition Waste (C&D Waste)

Most inert wastes such as construction/demolition debris generally would not be considered suitable for co-processing with municipal wastes. Many of the major components of construction/demolition debris can be recycled, including wood, glass, metal, concrete, brick, and asphalt. To facilitate this requires contractors doing works to follow a government-prescribed protocol of separation of materials as the works are done. For Sint Maarten, some of these materials (such as the crushed and sized concrete, brick and asphalt) could find good local markets. But, for others (such as plaster board), a special disposal site would be needed. Ideally, a private contractor would be engaged to manage these wastes for a tipping fee and be partially compensated through local revenues from marketing. For this purpose, establishing of a separate C&D waste processing facility in included in Short term plan period activities. See Chapter 5.4.7

Waste Electrical and Electronic Equipment (WEEE - eWaste) and Durables

The country, given its small size and limited land for disposal, shoul want to consider a take-back legal framework of product stewardship for key items like electronics and appliances. If not, an import deposit could help to defray the costs of their export to externally located recyclers.

WEEE and durable materials can also be hazardous. Electronic devices form a complex mixture of materials and components, often containing several hundreds of different substances, many of which are toxic and create serious pollution upon disposal. These include heavy metals such as mercury, lead, cadmium, chromium and flame retardants such as poly-brominated biphenyls (PBB) and poly-brominated diphenylethers (PBDEs). Large household appliance like refrigerator may consist of electric motor, a circuit board, a transformer, capacitor, thermal insulation, switches, wiring, plastic casing (containing flame retardants) etc. A typical washing machine may consist of the metal casing, concrete ballast, inner and outer drums, a motor, a pump, washing cycle controller unit, switches and other components.

In the most recent trends, discarded electronics are described as ‘resource’ instead of ‘waste’. Electronic product ‘takeback legislation’ has been proposed in a number of European countries, and the issue is discussed in several Asian countries.

Such appliances and obsolete white goods generally would not be considered suitable for co-processing with municipal waste.

The EU Directive 75/442/EEC (Eu, 2002a) categorizes the EEE as follows;

1. Large household appliances,

2. Small household appliances,
3. IT and telecommunications equipment,
4. Consumer equipment,
5. Lighting equipment,
6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools),
7. Toys, leisure and sports equipment,
8. Medical devices (with the exception of all implanted and infected products),
9. Monitoring and control instruments,
10. Automatic dispensers.

Therefore, WEEE and durables will be rejected by ISWMF.

Car Batteries (Lead Acid Batteries – LAB)

Lead-acid batteries contain components that have the ability to cause serious environmental contamination. Lead-acid batteries contain sulphuric acid and large amounts of lead (Pb), which is dangerous trace metal. The acid is extremely corrosive, and also a good carrier for soluble lead and lead particulate.

Therefore, car batteries will be rejected by ISWMF.

Hazardous Medical Waste

The ISWMF will accept only non-hazardous waste that is generated by human activities such as food left-overs, and other typical municipal waste, but not hazardous medical waste such as left medicines, syringes, needles that are used for medical treatment. This type of waste should be disposed by medical facilities itself under control of the Ministry of Public Health, Social Development and Labor (VSA) of Sint Maarten.

Therefore, hazardous medical waste will be rejected by ISWMF.

Hazardous Industrial Waste

The ISWMF will reject any hazardous waste from the industrial facilities that should be responsible to treat their hazardous waste at their own facility and expense.

Disaster Debris

Disaster debris management and disposal facilities are recommended, so that the waste treatment facility is not hindered by unexpected disaster events and related wastes they create. Disaster planning would cover the full range of potential events and how the wastes would be handled, including: earthquakes, fires, hurricanes, floods, epidemics and even dirty bombs. A disaster response and debris plan is needed for all types of wastes and incidents. US EPA created a natural disaster decision guidance for debris management, published in 2019[5]. The US EPA also worked with US Homeland Security for other types of disasters, and provides a full range of tools and guidance for managing those special security incident wastes[6].
The consultant strongly recommend that Sint Maarten should prepare a separate "Disaster Debris Disposal Site – DDDS" for use when any disaster event occurs as the island and surrounding area is located in zone of disaster-prone area.

Therefore, ISWMF will reject any disaster debris.

[5] US EPA Natural Disaster Debris Guidance: https://www.epa.gov/sites/production/files/2019-05/documents/final_pndd_guidance_0.pdf
[6] US EPA and Homeland Security Disaster Debris Guidance: https://www.epa.gov/homeland-security-waste

5.4.6 Combined Concept Layout of ISWMF

The facility initially would handle an average of 250 - 300 tonnes/day of waste with seasonal fluctuations, of which 10-15% by volume and 20-25% by weight would require residuals management, see Table 5.7. It would need to be flexible to handle daily and monthly fluctuations in the quantity. it is estimated that the lines of treatment would include the following:

- Recyclable materials recovery for recycling through various human and mechanized sorting of 15% to 20% of the wastes received;
- Biodegradation through aerobic microbial systems for resource recovery of compost from 3% to 5% of the wastes received;
- Wood chip production for use as mulch in landscaping from 2% to 5% of the waste received;
- Wood dust for production of charcoal briquette to be locally consumed from 1% to 3% of the waste received;
- Thermal or chemical conversion through incineration or gasification for resource recovery of energy from 400% - 600% of the wastes received;
- Combustible materials recovery for refuse derived fuel (RDF) through human and mechanized sorting of 0% to 20% of the wastes received, depending on market availability; and
- Conversion of ash and slag to usable products.

The Consultant has developed a Concept layout for a “Combined ISWMF of Sint Maarten” with three modules. See following Figure.

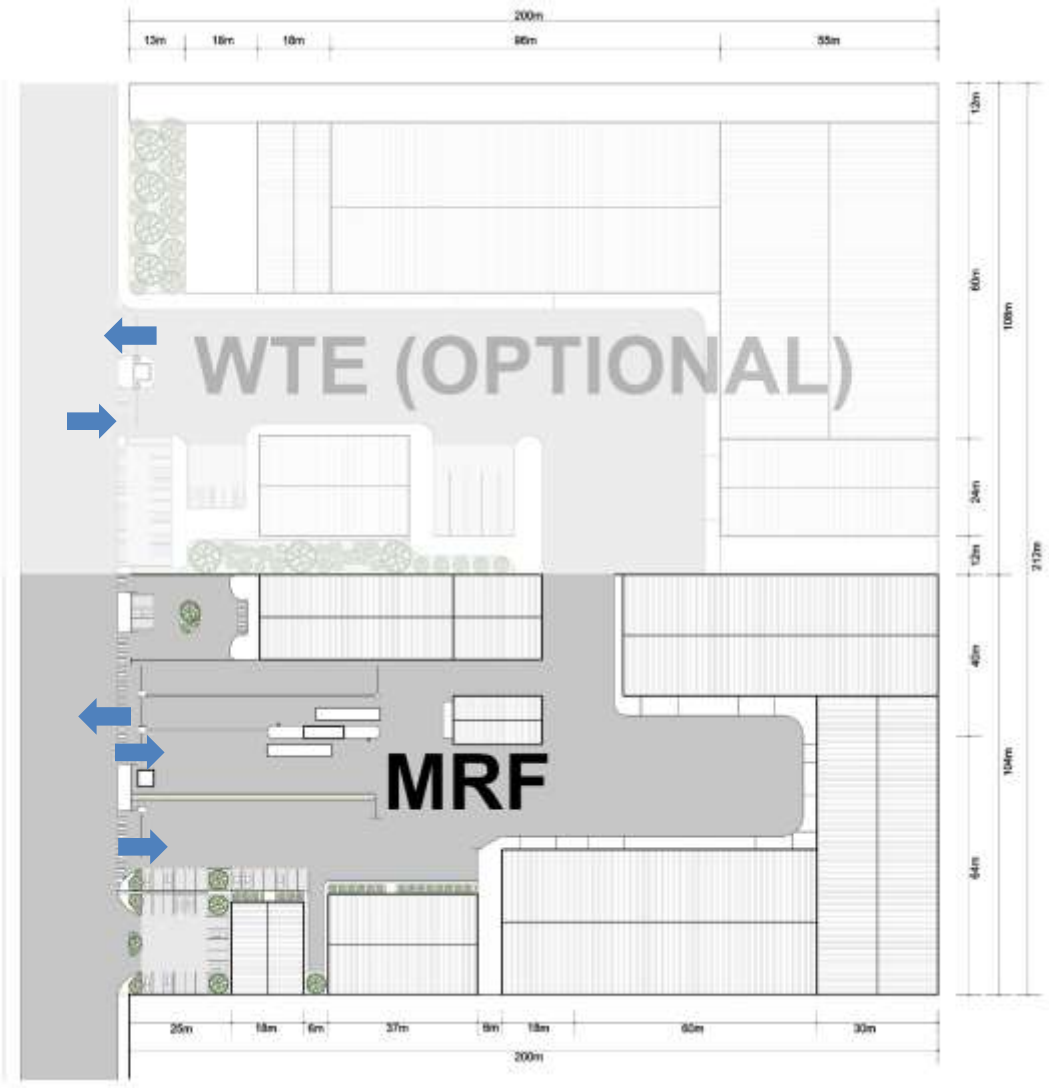


Figure 5.6: Concept Layout of ISWMF
(Illustrated by Aim Texas Design Team, December, 2019)

In addition, resource recovery of energy by incineration or gasification of combustibles (i.e., organics that are relatively dry, such as wood, textile, paper, cardboard, rubber and plastic) has potential for Sint Maarten because all fossil fuel for electricity production is imported. The grid buying price for electricity is very sufficiently high...almost two (2) times higher than the grid price in the US. So that establishing of an optional WTE as part of ISWMF of Sint Maarten is included in the resource recovery planning process.

However, although the interest of major cement producers in Caribbean Region for RDF use in cement kilns is currently rising, many of the cement production giants are in planning phase for use RDF and other alternative pre-processed waste originated materials in their cement kilns.

5.4.7 C&D Waste Processing Facility

Construction and demolition activities should make efficient use of resources while minimizing any adverse impacts on the environment. Several of these classes of materials, such as concrete, masonry, bricks, cubic stones, CMUs, and ceramics are considered inert by solid waste authorities, because they will not degrade by bacterial activity once landfilled. There are many components of C&D waste that are not inert in nature and, therefore, are putrescible such as wood fractions. There are also several types of materials that can be considered chemically reactive, such as paint, paint thinner, etc., and must be handled in a special manner.

However, as mentioned in FPS 1, C&D waste fines from small screen size (50-mm minus) could be used as an alternative daily cover (ADC) material instead of fine gran soil, which will be produced during processing of C&D waste in C&D processing facility. This type of fines is also currently being used largely in land application for soil amendment.

Approximately two hectares area would enough for such a facility.

As mentioned in the Short Term Plan all C&D waste should be directed to other processing facilities other than the main MSW landfill and ISWMF. For this purpose, two-line items are included in the priority activity program within the Short Term plan in order to facilitate a separate C&D waste landfill for operating it under a DBO contract. WB standard DBO contract type could be used for this purpose.

Therefore, C&D waste will be rejected by ISWMF and MSW landfill. This will also provide significant volume reduction in MSW landfill as almost 40% of the total waste generated waste in Sint Maarten is C&D waste.

5.5 Scheduling of Recycling & Resource Recovery System

5.5.1 Market Demand in Sint Maarten and Caribbean Region

The recycling market in Sint Maarten and Caribbean Region have been analyzed by Aim Texas consultants during waste market review in Caribbean Region, see Annex 3. In general, scrap market in region is composed in the form of which doesn't allow competitiveness of the small SIDS such like Sint Maarten within the Windward and Leeward islands on the scrap market due to pre-formed hub areas and ports in Caribbean. These small island SIDS are simply trying to sell their small amount of scraps through regional scrap dealers with the price which is determined by the regional scrap dealers because regional intermediate stops of the scraps are mostly in Haiti, Dominican Republic, Puerto Rico, Trinidad & Tobago, and Jamaica, as most of them are heavily urbanized and has no industrial infrastructure and human resource, which will support the circular economy.

As mentioned in Chapter 3.4 and Annex 3, the exact number of local recyclers is not known as there is no official records, however, the Aim Texas consultants determined the major ones during surveys and site visits, and they act independently from the main waste management authority (VROMI), and in a disorganized manner. As a result, VROMI is solely relegated to performing collection of the solid waste from households/institutions and area cleaning as well as managing landfills within their own limited resources, leaving the collection and transport of commercial waste unregulated.

This situation enables the local recyclers to opportunistically seek out the international markets through regional recyclers, bypassing regulations and best practices all the while selling the recyclable fractions in the main waste stream as semi-processed recyclables. So that the market demand for recyclables is strictly

bound with regional and global waste market. Thus, these local recyclers are compelled to respond to the existing demand within the Caribbean waste market, and they conform their scrap recycling procedures according to hub areas around the Caribbean.

Estimated 350 – 400 recyclable materials shipments per year are leaving Port Philipsburg and arriving of Port Everglades in Florida exclusively, through local and regional Scrap Collectors/Dealers; Regional recyclers accept only scrap metal, car batteries, small amount of plastics and electronic waste, and very small amount of scrap paper. Recovered Paper supply in the region is in fact much lower than either Metal or Plastic Scrap Supply, and no scrap wood and glass demand in regional market.

Synergizing with scrap metal collection and shipping, plastic scrap collection is similarly congregated around the Dominican Republic and Haiti, each of which supplying over 1,000 individual shipments annually, while smaller Island Nations in the region not exceeding 100 individual shipments per year. Sint Maarten's Plastic Scrap Collectors, mainly focused on plastic bottle scrap and some electronics scrap, produces less than 50 individual shipments to Port Everglades in Florida per year.

Recovered Paper supply in the region is in fact much lower than either Metal or Plastic Scrap Supply, as the biggest suppliers of note appear to have congregated around Jamaica and the Dominican Republic, who, even then, only supply just over 100 individual shipments per year, almost exclusively to Florida, as with all other Scrap Collection and Supply Routes.

5.5.2 Limitations that Affect Recycling Market in the Country

The following constraints that are common in Caribbean SIDS also create stress on processing the recyclables locally in the country;

- Absence of robust enough industrial infrastructure to support a circular economy which revolves around the local recyclers in the country;
- Absence of industrial and agricultural base for sustaining material reuse & internal processing of recyclables;
- Land availibility for the facilities in oder to adequately processing of the recyclables;
- Lack of skilled staff to support the range of technical skills necessary to plan, implement and monitor waste management systems;
- Unavailability of scale-efficient technologies for processing the recyclables locally due to domestic market is small, and state capacity is limited, thus limiting economies of scale;
- High transport cost from the country to the regional and global market creates additional stress on exporting of semi-processed recyclables. A large part of the trade between service ports is moved either by chartered vessels, or on regular shipping lines that connect to other lines via transshipment services;
- Openness and high trade dependence of Caribbean economies are other factors which pose a challenge to waste management in the country as in other Caribbean SIDS. This does not create any incentive to reduce packaging content in international source markets.

5.5.3 Current Recycling Rate in Sint Maarten

The activities of local and regional recyclers connected to regional recyclers result in only the estimated recycling rate of 11% of total waste collected. As seen in the following analyses (Table 5.12 and 5.13), almost 47 of total recovered waste materials through recycling activities are processed or recycled/reused in the country, while 53% of them are exported by local and regional recyclers. However, significant amount of waste materials (78.23%) recovered are coming from collecting and pre-processing of special waste types such as car batteries, electrical/electronic scraps, scrap metal (50%) and woods (90%) from C&D waste. Currently, only 21.77% of recovered waste materials are coming from MSW. Scrap metal and wood recovered make up almost 50% of the waste recovered as almost 100% of recovered scrap wood are used for repair of the roofs and other parts (door, window, etc.) of the damaged houses by Irma.

Almost 80% of scrap metal recovered is exported, while 100% of scrap wood is being locally recovered/recycled or reused as there exist no demand for scrap wood in the regional waste market. However, significant amount of scrap metal recovered and exported is coming from recovered car wrecks, although its exact percentage of scrap metal in exported is not known. Almost 90% of plastics recovered is exported, while 100% of scrap glass recovered is being locally recycled as also there exist no demand for scrap glass in the regional waste market.

Table 5.15: Estimated Current Recycling Rate in Sint Maarten by 2019

Waste Fractions	**t/a**	**Percentage of total Recycled %**
Scrap metal & car batteries – exported (bill of ladings) -t/a	6,225.00	42.45%
Plastics & electronic scrap – exported (bill of ladings) - t/a	1,435.00	9.79%
Wood – in house recycled or reused (estimated) - t/a	6,000.00	40.91%
Glass - in house recycled (estimated) - t/a	5.00	0.03%
Paper - in house reuse and exported (estimated) - t/a	1,000.00	6.82%
Total recycled waste amount - t/a	**14,665.00**	100.00%
Collected and disposed waste in total by 2019 - t/a	135,000.00	
Estimated recycling rate by 2019 -%	**11**	
Estimated recycling rate by in-house recycling and processing	***6,904.00***	***47.08%***
Estimated recycling rate by exporting	***7,762.00***	***52.93%***
Estimated recyclables recovered from MSW	***3,993.00***	***27%***
Estimated Recyclables recovered from Special Waste	***10,672.00***	***73%***

Source: Consultant's own estimation based on data and information reviewed during Caribbean Waste Market Review.

The following breakdown is the estimate of the consultant based on its local and regional waste market review and analysis.

Table 5.16: Breakdown of Waste Materials Recovered based on Consultant's Estimations by 2019

Breakdown	Total Recycled by 2019		From MSW	From Special Waste	Exported		Locally Recycled	
	t/a	%	t/a	t/a	t/a	%	t/a	%
Scrap Metal	4,000.00	27.28%	2,000	2,000	3,200	80%	800	20%
Car Batteries	2,225.00	15.17%	0	2,225	2,225	100%	0	0%
Electronic scrap	950.00	6.48%	0	950	950	100%	0	0%
Plastics	485.00	3.31%	388	97	437	90%	49	10%
Paper	1,000.00	6.82%	1,000	0	950	95%	50	5%
Glass	5.00	0.03%	5	0	0	0%	5	100%
Wood	6,000.00	40.91%	600	5,400	0	0%	6,000	100%
Total	**14,665.00**	**100.00%**	**3,993**	**10,672**	**7,762**	**53%**	**6,904**	**47%**
Percent of Recycled by source			***27%***	***73%***				

Source: Consultant's own estimations, based on local and regional waste market review and analysis.

However, it is seen that exporting 20-25% of recyclables to the regional processors through regional wholesale scrap dealers in Caribbean Waste Market is possible with more methodical arrangements, supportive programmes and arrangements for local recyclers. Converting into RDF of scrap wood and a part of yard waste together with a part of scrap papers also appears a potential to increase the resource recovery in the country.

Increased synergy in the recent years by local NGOs and CBOs on saving the resources in both parts of the island, will provide public inclusion and awareness as well as greatly bolstering the resource recovery and recycling programmes, which will be established centrally by the Government. Incorporating regulated local recycler companies (or waste pickers) into country's resource recovery and recycling programs could also be socially desirable, economically viable, and environmentally sound in Sint Maarten, using their experiences, connections, and their infrastructures.

To do so, however, decision maker needs to recognize those could be an asset, and needs to engage with them as potential partners because of the fact that they have already started to organize themselves using different business models and opportunities to connect to the regional and worldwide recycler companies. Similarly, international donors are increasingly integrating those companies/waste pickers into programs to foster urban development, promote a cleaner environment, and increase recycling activities. So that this opportunity should be used in Sint Maarten, formalizing them by regulating and supporting as almost 60% of the current recycling rate is provided by them.

5.5.4 Projections on Development and Arrangement of Recycling Market of Sint Maarten

Projection for Recovery of Recyclables

As regional market focused on scrap metal, car batteries, small amount of plastics and electronic waste, and very small amount of scrap paper, any plan on development of the recycling market of Sint Maarten should also reflect these existing trends. Accordingly, the following projection on MSW (except CD waste and other special waste types) has been developed with the existing market demand as well as the limitations aforementioned, assuming that commodity materials (scrap metal, glass, paper and plastics) recovery for recycling through various human and mechanized sorting of 15% of the wastes received by

ISWMF between 2025 and 2030, 20% between 2030 and 2035, and 25% between 2035 and 2040 respectively.

The plan also assumed that C&D waste will be processed in a separate facility (see Chapter 5.4.6), and ISWMF of Sint Maarten will be operational within 2025. Recycling of scrap paper, plastics, metals, glass, and rubber would be included in the following projection.

Table 5.17: Projection for Recovery of Recyclables through ISWMF

Indicators	***2025***	***2030***	***2035***	***2040***
Projected total waste received by ISWMF - t/a	*78,288*	*84,338*	*90,856*	*97,878*
Total recyclable materials in total waste received by ISWMF - t/a	36,482	39,302	42,339	45,611
Projected Recycling rate - % of total recyclables	20%	25%	30%	30%
Projected recovered recyclables - t/a	7,296	9,825	12,702	13,683
Projected Recycling rate - % of total waste received by ISWMF	9%	12%	14%	14%

Source: Consultant's own projection based on the results of recent waste characterization survey, 2019.

However, the actual recycling rate in the country will be higher as the private sector participation will continue through their formally registered activities. Their current contribution to Sint Maarten recycling market is seen almost 7-9% of total waste collected.

5.5.5 Projection of Compost Production in ISWMF

Currently, 54.2% of municipal waste (except special waste) is compostable (see Table 3.18), that means approximately 39,839 tonnes per year waste is suitable for composting by 2020, assuming that 90% of MSW generated (except special waste) will be collected, and 5% of collected MSW will be diverted informally during collection cycle. However, the consultant projected that only 5% of the putrescible organics should be composted until 2030 as there is currently no demand of the regional market in Caribbean for compost. So that the following production is conducted, assuming that compost production can begin within 2025, then increasing this rate gradually up to 8% after 2030 until 2035, and up to 10% after 2035 until 2040 respectively, see following Table.

Table 5.18: Compost Production Projection in ISWMF

Indicators	***2025***	***2030***	***2035***	***2040***
Total MSW to be collected and received by ISWMF- t/a	*78,288*	*84,338*	*90,856*	*97,878*
Compostable waste in total waste received by ISWMF - t/a	42,432	45,711	49,244	53,050
Projected Compost production - % of compostable waste	5%	8%	10%	10%
Projected recovered waste through compost production - t/a	2,122	3,657	4,924	5,305
Projected Recovery rate % of total waste received by ISWMF through composting	3%	4%	5%	5%

Source: Consultant's own projection based on the results of recent waste characterization survey, 2019.

Therefore, a compost production unit in the capacity of 5,305 tonnes per year by 2040 is planned to be operational by 2025 for Sint Maarten ISWMF. This unit could produce compost approximately 60,449 tonnes in total until 2040.

5.5.6 Projection for Refuse Derived Fuel Production (RDF)

Analysis on topological dynamics of the waste collected in Sint Maarten shows that 57.10% of the municipal waste is suitable for RDF production. However, currently there is no market for use of RDF for energy recovery in local waste market. RDF use for energy recovery from waste in Caribbean waste market depends on first market demand, and second the price of RDF with transportation cost, although the regional energy market is in keen interest to use RDF in cement kilns mainly focusing on RDF from scrap tire as it has high calorific value. But, the high cost of transportation of RDF from Sint Maarten is one of main concerns in projection of RDF production for marketing it in Caribbean waste market, including USA.

The choice of RDF production using scrap paper, yard waste and scrap wood also depends on regional market demand, which is very narrow and requires extensive marketing efforts, and also incentive or subsidy due to high transportation cost and lower calorific value of these types of waste fractions.

However, especially accumulated high amount of scrap wood (mainly wooden pallets and scrap wood from Irma debris and C&D waste) and tire is serious concern for Sint Maarten. The WB team has already envisaged to establish a TDSR site in order to both reduce the volume of these waste types, and convert them into a marketable commodity increasing the calorific value of particularly scrap woods, to prevent the disposal of them in MSW landfill. See Chapter 5.5.

Apart from the planned RDF production activity planned for the accumulated scrap wood and tire through TDSR, the consultant has projected that a part of scrap wood, yard waste and a part of scrap paper would be converted into RDF with gradually increased percentage within the implementation of ISWMF of Sint Maarten at or after 2025. RDF preparation planned in TDSR is not included in the short, medium, and long-term plan as it is an emergency measure to reduce the volume of scrap tire and wooden fractures accumulated in hand.

The following projection is conducted for RDF production through ISWMF in the short, medium and long term plan periods, considering the local and regional market demands.

Table 5.19: Projection for Recovery of Combustible Waste through Converting into RDF

Indicators	***2025***	***2030***	***2035***	***2040***
Projected total waste accepted by ISWMF - t/a	78,288	84,338	90,856	97,878
Estimated combustible waste that may be convertible into RDF in total waste received by ISWMF - %	57%	57%	57%	57%
Estimated combustible waste that may be convertible into RDF in total waste received by ISWMF - t/a	44,702	48,157	51,879	55,888
Projected recovery rate - % of combustible waste in total waste received - %	20%	25%	30%	30%
Projected recovered waste through converting into RDF - t/a	8,940	12,039	15,564	16,767
Projected recovery rate - % of total waste received by ISWMF through converting into RDF - %	11%	14%	17%	17%

Source: Consultant's own projection based on the results of recent waste characterization survey, 2019.

5.5.7 Projections for Production and Marketing Potential of Mulch and Charcoal Briquette from Wood Waste for Energy Recovery of Combustible Waste

Recovery of Wood Dust through Charcoal Briquette Production

Sint Maarten has more than 400 restaurants and bars, which consume charcoal briquette imported abroad. It is well-known that charcoal briquette is produced from wood dust and small chips of scrap woods with a simple technology. However, the local retail price for this type of charcoal briquette varies between US$ 1,800 and US$ 2,650 (depending on the quality) in Sint Maarten, which is almost 300% of global market price. As almost 20% of waste that will be accepted by ISWMF will be made up from scrap wood and yard waste, there is a potential demand in Sint Maarten market for charcoal briquette locally produced. So that the consultant has planned to include the production of wood dust for the charcoal briquette production in Sint Maarten ISWMF for supporting and encouraging the local and/or private investors who wish to put small capital in this business in order to create an opportunity for them providing wood dust from ISWMF for the charcoal briquette production to be locally consumed. In fact, the charcoal briquette market is small, but the raw material (wood dust) can be produced locally by ISWMF. The consultant's local market research showed that approximately 3 – 3.5 tonnes per year of charcoal briquettes are consumed in Sint Maarten. Accordingly, the following projection is conducted by the consultant, to determine what percentage of wood scrap would be converted into wood dust in ISWMF of Sint Maarten for production of charcoal briquette that can be locally sold. This target would be achieved gradually increasing the charcoal briquette production up to 10% of wood scrap until 2030, up to 20% between 2030 and 2035, and up to 25% after 2035.

Table 5.20: Projection for Recovery of Wood Waste through Production of Charcoal Briquette from Wood Dust

Indicators	*2025*	*2026*	*2027*	*2028*	*2029*	*2030*	*2035*	*2040*
Projected total waste received by ISWMF - t/a	78,288	79,462	80,654	81,864	83,092	84,338	90,856	97,878
Estimated wood waste in total waste received by ISWMF - %	12%	12%	12%	12%	12%	12%	12%	12%
Estimated wood waste in total waste received by ISWMF - t/a	9,395	9,535	9,679	9,824	9,971	10,121	10,903	11,745
Projected recovery rate through wood dust production for charcoal briquette - % of wood waste in total waste received - %	0%	5%	5%	8%	10%	20%	25%	25%
Projected recovered wood waste through wood dust production for charcoal briquette - t/a	0	477	484	786	997	2,024	2,726	2,936
Projected recovery rate - % of total waste received by ISWMF through wood dust production for charcoal briquette	0%	1%	1%	1%	1%	2%	3%	3%

Source: Consultant's own estimation based on local market research.

Recovery of Wood Waste through Wood Chip Production for Use of Mulch

Sint Maarten has approximately 35 – 40 hectares of public parks and traffic islands, except the greenery areas in hotels and resorts. This area would be around 75 -80 hectares including greenery areas in hotels and resorts. A part wood chip to be produced in ISWMF of Sint Maarten would be used as mulch in different colors for soil amendment and landscaping purposes in these lands. Approximately 6,400 tonnes of wood waste for chip production would be required biannually for this purpose by 2025. Approximately 35% of

wood waste could be recovered with use of colored wood chips produced in ISWMF as mulch. See following Table.

Table 5.21: Projection for Recovery of Wood Waste through Production of Wood Chip for Mulch

Indicators	*2025*	*2030*	*2035*	*2040*
Projected total waste received by ISWMF - t/a	78,288	84,338	90,856	97,878
Estimated wood waste in total waste received by ISWMF - %	12%	12%	12%	12%
Estimated wood waste in total waste received by ISWMF - t/a	9,395	10,121	10,903	11,745
Projected recovery rate - % of wood waste in total waste received for mulch production - %	35%	35%	35%	35%
Projected recovered wood waste through mulch production - t/a	3,288	3,542	3,816	4,111
Projected recovery rate - % of total waste received by ISWMF through mulching	4.20%	4.20%	4.20%	4.20%

Source: Consultant's own estimation based on local market research.

5.5.8 Projections for Recovery of Waste with Waste-to-Energy (WTE) Part of ISWMF

As mentioned in Chapter 5.3.4, ISWMF of Sint Maarten will comprise of two parts, the second part of it will be an Optional part for establishing a WTE facility for recovering the energy from remaining waste pre-processed in MRF part after separating. Approximately 55-60% of waste received by ISWMF, including remaining recyclables (mainly a mix of plastics, paper, rubber, textiles), wood and yard waste, organic waste, would be incinerated in the Optional WTE Part for energy recovery (mainly electricity generation). Mainly, two technical options would be possible depending on WTE technology that will be used. While the first option for WTE technology would suggest the mass burning of the mix waste producing 25% bottom ash and 5% fly ash of the waste received, the second option would suggest the mass burning re-incinerating the bottom ash and fly ash as they are pure carbon.

Within the first option approximately 30% of waste received by WTE would be converted into bottom and fly ash, and those should be landfilled after appropriate treatment or could be used in construction roads as base material or for any other constructional applications such as CMU block production and etc. This option would also require more land for post treatment of bottom and fly as they will contain heavy metals and other hazardous contents.

Second option would be more profitable providing more cost-effective results re-burning the bottom and fly ash as they are pure carbon, and could increase the energy production of WTE. The WTEs that use of this type of technology are currently operational, especially in Japan.

The following projection show the recovery of waste for energy production in the ISWMF WTE part for two optional technologies. See following Table. As seen in the following analysis, WTE Option 1 would recover approximately 642,500 tonnes of waste from 2028 to 2040 with net recovery rate of 70%, WTE Option 2 would recover the same amount of waste with net recovery rate of 95%.

Table 5.22: Projections for Recovery of Waste in Optional WTE Part of ISWMF

Indicators	***2028***	***2030***	***2035***	***2040***
WTE Option 1 - projected waste amount to be incinerated, assuming that bottom and fly ash will be landfilled after treatment				

Waste received - t/a	50,000	48,000	46,000	50,000
Incineration bottom ash - 25% of incinerated waste - t/a	12,500	12,000	11,500	12,500
Incineration fly ash - 5% of incinerated waste - t/a	2,500	2,400	2,300	2,500
Waste amount to be landfilled - t/a	15,000	14,400	13,800	15,000
Waste amount to be landfilled- % of waste received by WTE	30%	30%	30%	30%
Net total of waste amount to be recovered - t/a	35,000	33,600	32,200	35,000
Net recovery rate - % of waste received	70%	70%	70%	70%
WTE Option 2 - projected waste amount to be incinerated, assuming that bottom and fly ash will be re-burned				
Waste received - t/a	50,000	48,000	46,000	50,000
Incineration bottom ash - 5% of incinerated waste - t/a	2500	2400	2300	2500
Waste amount to be landfilled - t/a	2500	2400	2300	2500
Waste amount to be landfilled - % of waste received	5%	5%	5%	5%
Net total of waste amount to be recovered - t/a	47,500	45,600	43,700	47,500
Net recovery rate - % of waste received	95%	95%	95%	95%

Source: Consultant's own evaluation.

5.5.9 Drop-off Centers

Few drop-off centers to be established by registered private recyclers/companies with modular and portable sea containers would also give significant contribution for recovery of recyclable materials from bulky waste or house wares. These may also encourage the reuse of the leftover and used materials in Sint Maarten as they can also sell some reusable materials such as left-over paints or other materials, clean plastic containers, and etc. So that drop-off centers are included in planning of resource recovery scheme. However, no projection is conducted for recovery rate through drop-off centers as no comprehensive waste characterization survey could be conducted recently.

5.5.10 Summary Recovery Projection through ISWMF

Waste recovery projection through ISWMF of Sint Maarten revealed that average 42% of the waste received by ISWMF would be recovered through recycling, RDF and composting by 2040., and 58% would be landfilled without WTE option. However, recovery rates with thermal treatment of remaining waste after recycling would be 74% with WTE Option 1, and 85% with WTE Option 2 respectively. See following Table and Figure. Waste amount to be landfilled would be 371,285 tonnes per annum with WTE Option 1, while it is 210,660 tonnes per annum with WTE Option 2.

Table 5.23: Summary Recovery Projection with WTE Option, 2025 - 2040

	2025	2030	2035	2040	Total/Average 2025 - 2040
Total Waste received - t/a	*78,288*	*84,338*	*90,856*	*97,878*	1,403,889
Recovered through recycling, RDF, composting - t/a	**25,295**	**35,018**	**43,965**	**47,363**	**587,377**
Recovery Rate through recycling, RDF, composting - % of waste received	**32%**	**42%**	**48%**	**48%**	**42%**
Remaining Waste after recovery (landfill) - t/a	**52,993**	**49,320**	**46,891**	**50,515**	**816,512**
Remaining Waste after recovery - % of total waste received by ISWMF	68%	58%	52%	52%	58%
With WTE Option 1 - projected waste amount to be incinerated (bottom and fly ash will be landfilled after treatment) - t/a	**0**	**48,000**	**46,000**	**50,000**	**642,500**
Waste amount to be landfilled with WTE Option 1 - t/a and tonnes in total	**52,993**	**16,024**	**15,100**	**15,955**	**371,285**
Waste amount to be landfilled with WTE Option 1- % of waste received	**68%**	**19%**	**17%**	**16%**	**26%**
Total of waste amount to be recovered with WTE Option 1- t/a	25,295	68,315	75,757	81,923	1,032,604
Net recovery rate with WTE Option 1 - % of waste received	**32%**	**81%**	**83%**	**84%**	**74%**
With WTE Option 2 - projected waste amount to be incinerated (assuming that bottom and fly ash will be re-burned) - t/a	**0**	**48,000**	**46,000**	**50,000**	**642,500**
Waste amount to be landfilled with WTE Option 2 - t/a and tonnes in total	**52,993**	**4,024**	**3,600**	**3,455**	**210,660**
Waste amount to be landfilled with WTE Option 2- % of waste received	**68%**	**5%**	**4%**	**4%**	**15%**
Net total of waste amount to be recovered with WTE Option 2- t/a	25,295	80,315	87,257	94,423	1,193,229
Net recovery rate with WTE Option 2 - % of waste received	**32%**	**95%**	**96%**	**96%**	**85%**

Source: Consultant's own evaluation results.

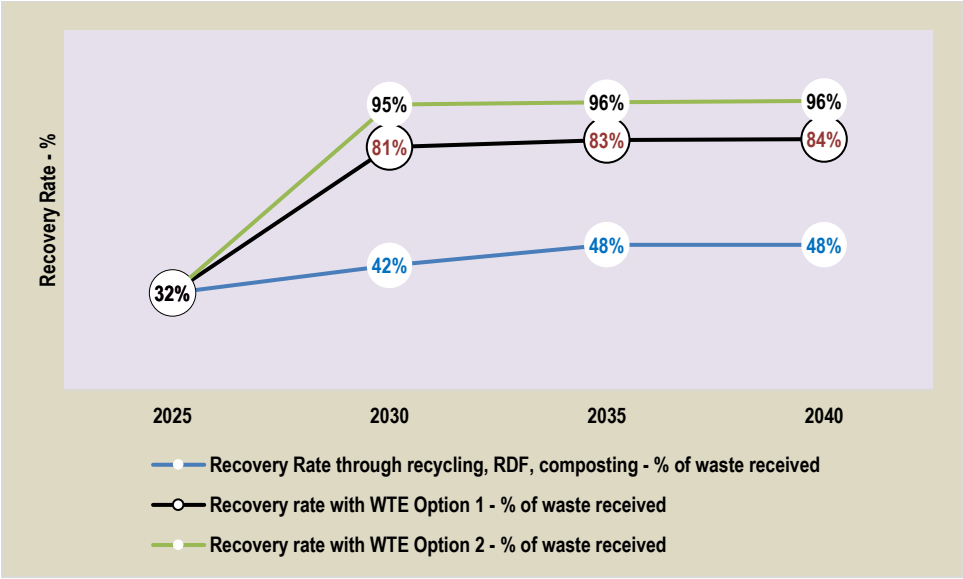


Figure 5.7: Recovery Rates Only Recycling Vs. WTE Options

5.6 Temporary Debris Storage and Reduction (TDSR) Facility

The WB team and NRPB have planned to establish a Temporary Debris Storage and Reduction (TDSR) facility under Sint Maarten Emergency Debris Management Project (EDMP) of Sint Maarten in order to initially reduction of the waste fractions from Irma through separating, shredding, briquetting the wood pallets and other wooden fractions, shredding the scrap tires, separating and baling the metal fractions from the dismantled white goods and scrap metals in the debris, and production the glass cullet in different size crushing the scrap glass. This facility will also handle the HHW separating and storing them in secure containers that are properly ventilated and are of sufficient size to contain liquid chemicals and keep rain off the waste.

For this purpose, a set of machineries and equipment (M&E) is intended to be purchased by WB team and NRPB. The M&E list is long discussed by WB team, NRPB and the consultants, and following M&E are intended to be purchased. Purchasing mobile truck scale for existing MSW landfill and mobile trommel drum screen for removal of debris in current IDDS have been included in M&E list.

Table 5.24: M&E to be Purchased within the TDSR List

M&E	Quantity	Capacity	Purpose
Mobile Trommel Drum Screen	1	40 t/h	Removal of debris in IDDS
Mobile Truck Scale with suitable software – Deck Pitless type	1	45 Mtons	Existing MSW Landfill in Pond Island
Tire Shredder	1	1 t/h	For Shredding the scrap tires
Scrap Glass Crushing and Grading System	1 Set	6 t/h	For TDSR - producing glass cullet and sand for different applications
Wood Shredder	1	10 – 12 t/h	For TDSR – producing wood chips
Wood Briquetting Machine	1	6 t/h	For TDSR – producing wood briquettes form wood dust and chips

The following concept layout and sections depicts the facility.

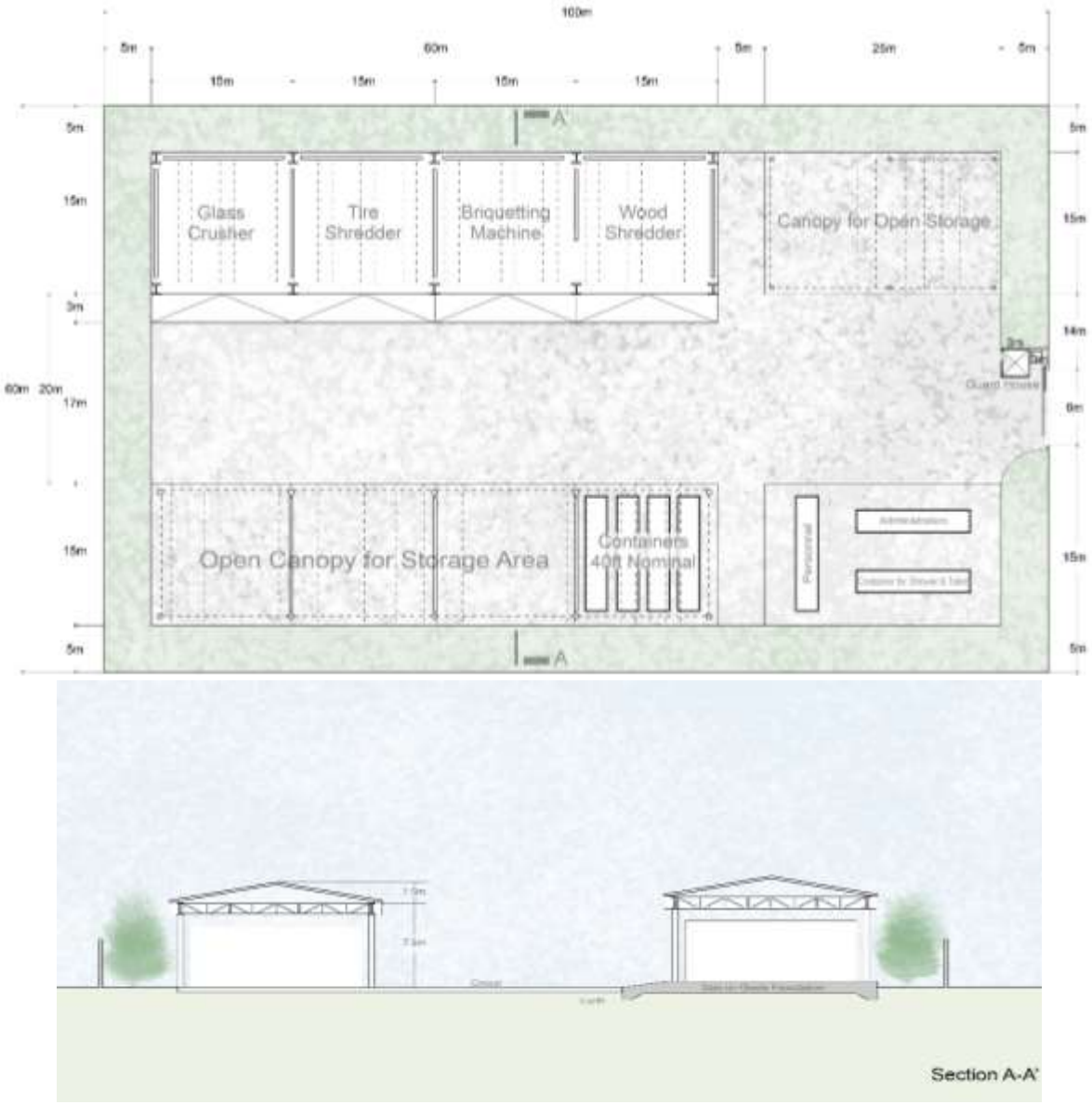


Figure 5.8: TDSR Facility Concept Layout and Sections

5.7 Waste Flow Projections

MSW flow control is the main mechanism that the Government can use to foster development of in-country capacity to manage municipal solid waste in Sint Maarten, by making it easier to adequately size and finance waste management facilities. Similarly, control of the waste will ensure that waste management facilities will be fully utilized in the country, which should result in cost-efficient operations.

For the purposes of this project, the Consultant developed the following MSW flow management scenarios.

5.7.1 MSW Flow Scenarios

Two alternative scenarios appear for the municipal waste flow projection (except C&D waste) in Sint Maarten.

Alternative Scenario 1 for MSW Flow – No WTE Option

The first alternative offers separating the recyclables in ISWMF and selling to the local and regional recyclers, small amount of compost, mulch and wood dust and chip production for production for locally consumed charcoal briquette production, and certain amount of RDF production according to local and regional market demand. See following Figure.

Approximately 68% of waste received by ISWMF would be landfilled in 2025, 60% in 2030 and 53% in 2035 respectively. Although a gradual decrease on the amount of waste to be landfilled appears within this scenario, it suggests landfilling of more than 50% of the waste received.

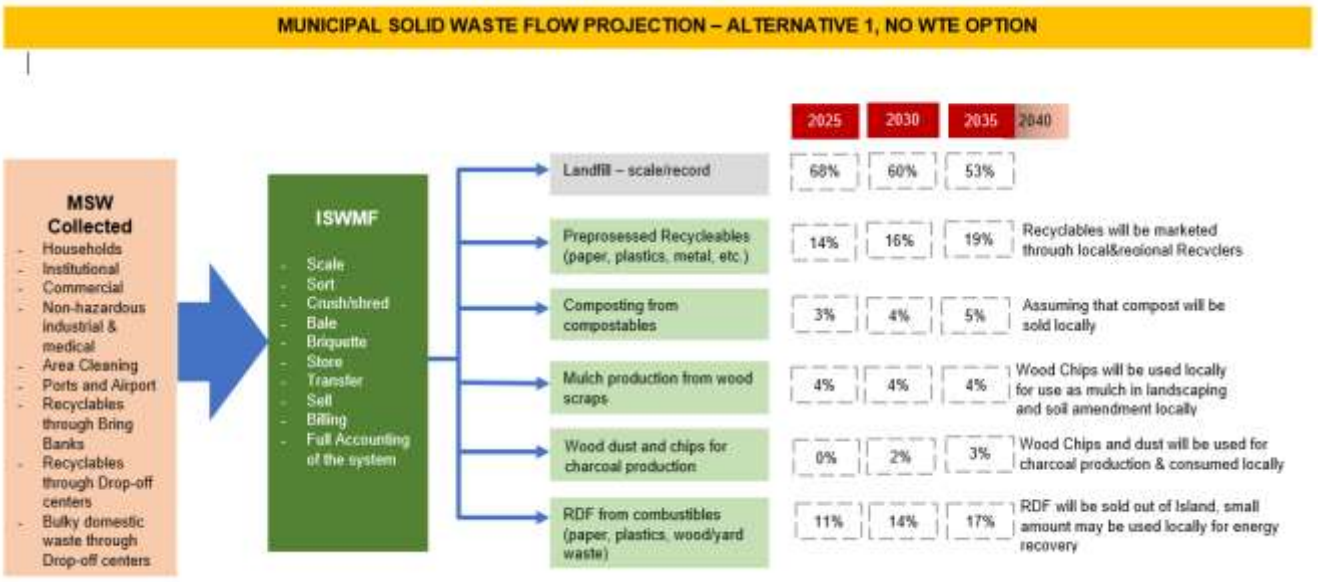


Figure 5.9: Waste Flow Projection Alternative Scenario 1 – No WTE Option

Alternative Scenario 2 for MSW Flow – with WTE Option

This scenario would suggest two optional sub-scenarios depending of WTE technology (see Table 5.22 and 5.23, and Figure 5.7), which are:

a) Alternative Waste Flow Scenario 2a: Mass burn technology suggesting bottom ash and fly ash from incineration operation would be landfilled after treating (WTE Option 1); and

b) Alternative Waste Flow Scenario 2b: Mass burn technology suggesting bottom ash and fly ash would be re-burned as they are pure carbon (WTE Option 2).

Figure 5.10: Waste Flow Projection - Alternative Scenario 2a – with WTE Option 1

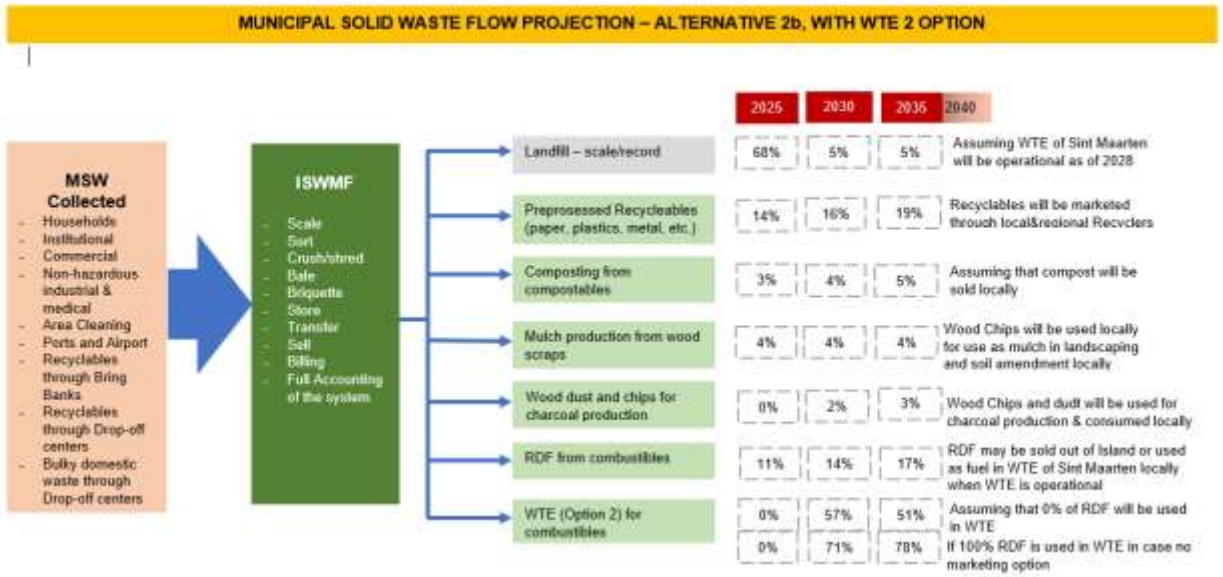


Figure 5.11: Waste Flow Projection - Alternative Scenario 2b – with WTE Option 2

5.7.2 Evaluation of MSW Flow Scenarios

The MSW flow scenarios are evaluated in pros and cons table below.

Table 5.25: Pros and Cons of MSW Flow Scenarios

Waste Flow Scenarios	PROS	CONS
Alternative Scenario 1 (No WTE Option)	- Suggests average 42% of waste received could be recovered during project life time. - Takes into account the local and regional waste market demand. - Provides strict control on MSW flow. - Would suggest lowest tipping fee. - Would suggest lowest investment and capital cost. - .	- Suggests average 58% of waste received will be landfilled during project life time - Highest space requirement for landfill. - Would not consider the land scarcity in the country. - Provides lowest recovery rate. - Would suggest lowest energy recovery.
Alternative Scenario 2a (with WTE Option 1)	- Suggests average 74% of waste received could be recovered through recycling and energy recovery. - Takes into account the local and regional waste market demand. - Would consider the land scarcity in the country. - Provides strict control on MSW flow. - Provides high recovery rate. - Low space requirement for landfill.	- Suggests average 26% of waste received will be landfilled during project life time. - Would suggest high investment and capital cost. - Would suggest high tipping Fee.
Alternative Scenario 2b (with WTE Option 2)	- Suggests average 85% of waste received could be recovered - Takes into account the local and regional waste market demand. - Would consider the land scarcity in the country. - Provides strict control on MSW flow. - Provides highest recovery rate - Lowest space requirement for landfill.	- Suggests average 15% of waste received will be landfilled during project life time. - Would suggest high investment and capital cost. - Would suggest high tipping fee.

Although the Alternative Waste Flow Scenario 1 seems more preferrable from the perspective of environmental soundness and climate change effects as it suggests no incineration of waste, it is not recommended as a long-term solution for Sint Maarten, as it requires highest space for landfilling and suggests lowest recovery rate. One of the most important constraints in Sint Maarten is scarcity of land for establishing a landfill large enough for deposition of the waste amount suggested by this alternative.

Although Alternative Waste Flow Scenarios 2a and 2b suggest high investment and capital cost, they would help to overcome the land scarcity factor in the country, providing the highest rate of energy recovery rate from waste.

So that Alternative Waste Flow Scenarios 2a and 2b are more preferable than Alternative Waste Flow Scenario 1 for Sint Maarten. However, considering the lowest requirement of landfill space Alternative Waste Flow Scenario 2b is more preferrable then Alternative 2a.

5.8 Climate Change

CH – 6

FINANCIAL & ECONOMIC ANALYSES

Overview

This Chapter provides financial and economic analyses on project's financing, cost evaluation of the project elements in order to ensure the economic viability of the recommended options in this report. The Chapter also analyzes the affordability of the services that will be provided by the project as a whole in financing and economic point of views.

6.1 Financing

This section discusses the categories of costs for the solid waste system and how they could be sustainably financed. The material discusses capital expense (CAPEX), operating expense (OPEX) financing, principles of private versus public goods and how they are financed, issues of cross subsidy to address ability to pay versus the polluter pays concept, and various mechanisms of tariffing, including tariff bundling.

The new solid waste entity will need to develop a business plan to discuss how it will conduct and finance capital works that are needed, generate operational revenues, and make progress on reducing the subsidies and grants that will initially be needed.

Once operational, the new solid waste entity will need to provide a balanced budget each year to Government and provide duly accountable and transparent financial records. For purposes of accounting, costs related to long term investments are called capital expenditures (CAPEX), while costs related to operational activities are called operational expenses (OPEX), even if they include some routine periodic replacement, renewal and expansion expenditures.

6.1.1 CAPEX Financing

It is envisioned that initial major works for facilities and start up facility equipment, both mobile and stationary equipment, will be considered CAPEX. For purposes of long-term contracts by DBO (i.e., design, build, transfer ownership, and operate), such as those for 20 years to implement a disposal or treatment facility, the initial works and goods would be financed as CAPEX. All CAPEX would be paid to the contractor upon completion of works and delivery of initial goods, and then the full facility ownership would be transferred to Government. After commissioning, facilities need equipment regularly replaced and also need expansion of modular lines and other works at landfills, and additional sorting lines or renewal M&E of WTE at ISWMF. While these are investments, they could be considered OPEX and covered under the DBO contract agreement through tipping fees as the depreciation costs will be deducted from tax obligations of the DBO Contractor(s) regularly each year, and the fund obtained by the Contractor(s) through this method will create a separate fund for expansion of the system elements and renewal of the M&E.

CAPEX is commonly covered by a combination of grants and loans, provided by a combination of Government, Bi-lateral donors, and international development banks. To illustrate, potential CAPEX financing in Sint Maarten might come from a combination of Sint Maarten Government, the Netherlands, and the development banks of World Bank or other international financing institutions. Private sector financing is possible, and the Port Authority or a combined group of ship owners are possible contributors to CAPEX financing. If the facility appears to provide an improved base of renewable energy, possibly CAPEX financing from the electricity company is possible.

The new solid waste entity will need to rent offices and also purchase vehicles and office equipment. These are not major long-term investments. Nevertheless, there may be value in arranging that they be financed as part of a package from a bi-lateral donor or international development bank. Part of the initial setup will include computer software and systems for developing MIS on waste quantities, waste characteristics, customers, and finances. These start-up costs might also be financed as part of the package from a bi-lateral donor or international development bank.

For purposes of this study, the following categories of CAPEX at start up are considered:

- Existing MSW landfill upgrading, fire suppression, and closure of all disposal facilities for municipal waste, investment costs of ISWMF including optional WTE, investment costs of C&D waste processing facility plus conversion of suitable remaining areas for new safe sanitary landfill;
- Site preparation for proposed ISWMF;
- Initial establishment of recycling support centers for drop off and buy bank; and
- Initial establishment of office support systems and vehicles for the solid waste authority.

6.1.2 OPEX Financing

The current waste management system in Sint Maarten does not support recycling, safe disposal or treatment to recovery resources. To change this, additional facilities will be established, i.e., ISWMF with central MRF and WTE module, a separate C&D waste processing facility, upgrading the current MSW landfill with required modifications, and etc. So that system operation costs will increase, and cost recovery is needed.

It is envisioned that all services of collection, transfer, disposal and treatment for recycling and resource will be done by the private sector, either through licensing or contracting. Clearly, costs will increase significantly in order to upgrade the current collection systems to have safe disposal, full recycling and resource recovery of waste, and recycling of residuals. With no lands available for future disposal, significant new costs will be realized.

For a self-sustained SWM system, some economic instruments have considered to be in place for recovery of system operation costs, and those are mainly flat and variable user charges, tipping fees in Landfill and ISWMF, revenues from selling of recyclables sorted in ISWMF, and revenue from selling of energy from WTE to country's electricity grid.

Subsidies may also be needed for some services, rather than assuming full cost recovery. In initial 2-3 years of full system operation some costs, especially system management costs (ISWMA OPEX), cost of area cleaning, a part of collection cost such as cost of collection and transport of waste from schools would be subsidized by the government, using the fund obtained from municipal and utility fee, etc.

Unless and until the ship owners contribute waste and financing through related fees, subsidies should be anticipated.

Even though safe disposal and treatment is essential a public good, for the public protection of the environment, it is normal to link its cost recovery to waste generators through collection and tipping fees. However, such fees would normally be less for households and small commercial establishments being served by contractors, and probably higher for large commercial establishments, airports, ports and ships.

6.1.3 Cost Recovery Mechanisms

The costs of daily operations will be covered through the fee structures which would primarily would include:

- Tariffs to waste generators that receive door-to-door or curbside collection of wastes on a regular basis;

- Pick-up and haulage fees to waste generators that receive direct service to special wastes, such as construction/demolition debris, bulky waste, landscaping waste, and animal wastes;
- Tipping fees from waste collectors under contract and to licensed private haulers for wastes discharged at the official transfer, disposal, and treatment facilities;
- Special taxes or fees arranged for charging the shipping port, airport, and ships for their share of services related to the wastes of their customers; and
- Regular subsidies from Government related to the general clean-up of the streets and public areas, and for support of recycling and other activities that are related to the general public good.

Because of the unique nature of solid waste management as a largely public good, the cost recovery system is normally appropriately arranged to come from a wide range of sources. For example, some could come through property rates or other types of taxes, even environmental taxes. Some financing might come from climate change financing that is globally available or through emissions trading of carbon. Even though safe disposal and treatment is essential a public good, for the public protection of the environment, it is normal to link its cost recovery to waste generators through tipping fees. However, such fees would normally be less for households and small commercial establishments being served by contractors, and probably higher for large commercial establishments, airports, ports and ships.

A unique condition of waste collection costs, is that it costs much more to collect waste from small and poor households that it does from large and rich households. Access conditions, small quantities, less convenient containers, etc. affect the costs per tonne, making them much higher for service to the small and poor establishments. As a result, collection costs need to be graduated so that they take into consideration ability to pay, rather than estimated cost per tonne. Cross subsidies are expected to be arranged in the tariff system, so that larger and richer waste generators provide more revenue per tonne than the smaller and poorer waste generators. Subsidies may also be needed for some services, rather than assuming full cost recovery. Subsidies need to be carefully examined relative to the various costs that are public goods and also the various customers and their ability to pay. In general, in developing countries, full cost recovery is not expected. Unless and until the ship owners contribute waste and financing through related fees, subsidies should be anticipated.

Each of the recycling and resource recovery processing activities raise the costs, and are due to the lack of available land. They are due to the number of people that come to Sint Maarten and push the environment to handle waste quantities well beyond the limits of the island's natural resources. The tiny population of Sint Maarten would not have this issue of cost and cost recovery if it were not for the very large number of visitors, as it is in the COVID-19 situation. Therefore, it is reasonable and recommended that there be special dedicated revenues from the ports and airport that directly support the solid waste system, rather than simply go into the general revenues without being dedicated to support sustainable solid waste management.

If desired, tariff bundling is one way to expeditiously collect tariffs for waste collection and safe disposal. Bundling with a service that can be shut off is normally preferred, such as the water or electricity tariff. Both of these services usually have less demand from smaller and poorer establishments, so there is a built-in potential for cross-subsidy. It may be that the electricity tariff would be preferred, if the system is developed to create renewable energy from the waste.

The bundling partner would add the solid waste fee to their normal billing and collect the bundled fees. They would keep a commission, possible 2-5%, for their efforts and provide the remainder to the solid waste entity to help cover the costs.

6.2 Cost Evaluation

The evaluation covers Short, Medium, and Long Term plan period activities and sub-projects, including engineering and consultancies, works, purchasing of M&Es, and establishing of ISWMA on CAPEX and OPEX.

6.2.1 Project Management Cost

Project management cost during operation time will rest with the Government would meet the costs of establishing and operating an Integrated Solid Waste Management Agency (ISWMA), and its operating cost would be met distributing to other system components' operating costs with small percentages. See Table 6.3

CAPEX of ISWMA

ISWMA will need to have initial establishment of office and office support systems for managing the solid waste system. This cost would be covered by the Government or Donor funds or Trust Fund or short-term credit lines according to Government decision.

Table 6.1: CAPEX for Establishing ISWMA

SWMA Initial Establishment and Office Support Systems CAPEX		Total Price
		US$
1	Work Stations Furniture	***43,000***
2	Equipment (computer, printer, desk phones, etc.)	***89,500***
3	Preparation cost of office space	***40,000***
4	Vehicles	***216,000***
Total CAPEX		***348,500***

OPEX of ISWMA

The investment for the first three years of operating cost of ISWMA needs to be covered by the Government. In the following years this cost would be bundled into prospective tariffs, applying on a commission basis such as 6 or 7 percent of collection and disposal/treatment tariffs.

The detailed operating cost breakdown is given in Annex 5. The following is the indicative level of ISWMA operating cost and the commission level that may be added to the tariffs.

Table 6.2: Indicative ISWMA Operating Cost with constant prices

Operating Cost of SWMA	
Operating Cost of SWMA for first 3 Years 2023 to 2025, US$	*1,764,000*
Operating Cost of SWMA for first 15 Years - 2026 to 2040, US$	*17,010,000*
Total operating Cost - 18 Years	*18,774,000*

Per ton Operating cost for SWMA	
Total Waste to be handled from 2023 to 2040, including all special waste - tonnes	*2,896,834*
Per ton operating cost of SWMA - US$ per ton of waste received by all facilities	***6.48***

A prorate distribution of ISWMA operating cost could be possible between the system components and facilities. In such a case, the biggest part (70% of it) could be added to ISWMF operating cost, 15% for recyclables to be collected and exported by formal private recyclers, and 15% to C&D waste processing facility operating cost. See following Table.

Table 6.3: Distribution of Per ton Operating Cost of ISWMA To SWM System Components

Distribution of per ton operating cost of ISWMA to SWM System Components / Facilities	**%**	**US$ per ton**
MSW Management through ISWMF, per ton of waste received by the facility	70	4.54
Recycling Activities under oversee of SWMA (out of ISWMF), per ton of waste that is pre-processed or exported	15	0.97
C&D Waste processing Facility, per each ton C&D waste received by the facility	15	0.97

6.2.2 Existing MSW Landfill & Irma Landfill Debris Removal

MSW landfill improvement/construction, closure and after care costs, and debris removal activities in Irma Landfill are rendered as Capital Cost (CAPEX), operation costs for improvement, operation and closure of MSW landfill as Operating Cost (OPEX). The estimates provided are intended to offer a general idea of the level of cost and considerations that will need to be addressed for the improvement. While the cost of extension and operation activities of existing MSW is more expensive than the successive construction because of the general infrastructure upgrade requirements, the cost of Irma debris removal will be cheaper.

CAPEX

MSW landfill improvement/upgrade and Irma landfill debris removal costs covered all construction activities during improvement of the landfill, including re-contouring and regrading works, landfill periphery defense facilities (reinforced concrete wall and perimeter fencing), ring road, storm water and bottom drainage water collection and treatment works, re-arrangement of landfill entrance, interim capping, fire suppression activities, interim gasification, purchasing of machineries and equipment (M&E), and design & supervision costs. A 10% contingency cost is also considered for MSW landfill improvement and closure costs.

While the total construction cost of MSW landfill for upgrading/extension amounted to US$30.3 million, landfill closure cost amounted to US$7.65 million, after care activities US$2.5 million, and Irma landfill debris removal US$11.11 million respectively.

Table 6.4: Summary CAPEX for Landfill Upgrade/Extension and Irma Landfill Debris Removal

	Description of Activities	Total Costs	Phase 1 Short Term Plan Period 7 Years 2020 - 2026	Phase 2 Mid Term Plan Period 3 Years 2027 - 2029	Phase 3 Long Term Plan Period 11 Years 2030 - 2039
		US$	*US$*	*US$*	*US$*
A	**MSW Landfill Upgrade/Extension Closure and After Care**				
	Sub-total	***30,280,589***	***30,042,946***	***237,643***	
	II. MSW Landfill Closure				
	Sub-total	***7,645,950***	***-***	***7,645,950***	***-***
	III. Landfill After Care - 10 Y	***2,500,000***	***-***	***-***	***2,500,000***
	CAPEX (A) - MSW Landfill	***40,426,539***	***30,042,946***	***7,883,593***	***2,500,000***
B	**Irma Landfill Debris Removal Cost**				
	CAPEX (B) Irma Landfill	***11,111,475***	***11,111,475***	***0***	***0***
Total CAPEX (A+B)		***51,538,014***	***41,154,421***	***7,883,593***	***2,500,000***

Source: Consultant's own evaluation, see Annex 5.

OPEX

Annual operating cost included labor, equipment operating & maintenance, environmental & monitoring, miscellaneous items, landfill closure operating costs. Operating cost of MSW landfill is assumed to be realized beginning of 2022, assuming that the construction and operation tender (DBO) may be concluded to the end of 2021, and the contractor can begin operations from the beginning of 2022.

The total annual operating cost amounted to 2.14 million in US Dollars by 2022, including depreciation cost of M&E. O&M cost per ton within operation period of next 7 years would be around US$ 29 per ton in average between 2021 and 2028 as the MSW landfill will be planned to be closed in 2029. So that it can accept waste until end of 2028.

Table 6.5: Annual, Total and Per Tonne Operating Cost, by constant prices

Item	Item Description	Annual Operating Cost *US$*	Operation Time *Year*	Total O&M Cost *US$*
1	Labor	642,000	7	4,494,000
2	Equipment Operating & Maintenance	950,000	7	6,650,000
3	Environmental & Monitoring Cost	40,000	7	280,000
4	Miscellaneous Cost	432,300	7	3,026,100
Annual operating cost without depreciation cost of M&E		**2,064,300**		**14,450,100**
Depreciation cost of M&E		79,850	7	558,950
Annual operating cost with depreciation cost of M&E		**2,144,150**	7	**15,009,050**
Operating cost during closuring activities - 2 years		*65,000*	*2*	*130,000*
Operating Cost during After Care Period - 10 years		*65,000*	*10*	*650,000*

Total Operating Cost of MSW Landfill	***15,789,050***
Waste Amount to be handled - 2022 – 2028 (seven years), tonne	***540,907***
Average per tonne operating cost by 2022 – 2028 – US$	***29***

No separate OPEX calculation is conducted for Irma debris removal activities as all cost of the work is assumed construction work, and rendered as capital cost in this evaluation.

6.2.3 Integrated Solid Waste Management Facility (ISWMF)

The cost estimates provided are intended to offer a general idea of the level of cost and considerations that will need to be addressed for the implementation of ISWMF.

CAPEX

Facility capital cost included the construction costs, M&E cost, miscellaneous items (design and construction supervision), and a 10% contingency cost. As mentioned in Chapter 5 ISWMF will have two parts, the first part of it will be MRF part for waste separation and pre-processing, and second part is WTE part. The following Table is a breakdown of CAPEX for two parts.

While the total construction cost for ISWMF amounted to 96.93 million in US Dollars, only Part 1 (MRF) cost amounted to 23.93 million in US Dollars.

Table 6.6: Summary CAPEX of ISWMF with Optional Items

Description of Activities	Total Cost	Short Term Plan Period, 7 Years						
		2020	2021	2022	2023	2024	2025	2026
	US$	US$	US$	US$	US$	US$	US$	US$
I. Desing &Construction of ISWMF Part A - MRF - DBO								
Sub-total	***23,926,750***	***0***	***0***	***10,285,075***	***9,778,550***	***3,863,125***		
II. Design & Construction of ISWMF Part B - WTE - DBO - Optional								
Sub-total	***73,000,000***	***0***	***0***	***0***	***0***	***0***	***35,200,000***	***37,800,000***
Total CAPEX	***96,926,750***	***0***	***0***	***10,285,075***	***9,778,550***	***3,863,125***	***35,200,000***	***37,800,000***

OPEX

Annual operating cost has been developed only for ISWMF Part 1 (MRF) and Part 2 (WTE). Annual operating cost included labor, equipment operating & maintenance, environmental & monitoring, and miscellaneous items. While the total annual operating cost of MRF amounted to US$ 3.71 million in 16 years from 2025 to 2040, annual operating cost of WTE US$ 5.29 million in 13 years from 2028 to 2040 respectively, including depreciation costs.

Table 6.7: Summary Annual OPEX of ISWMF in Average with constant prices

Item	Item Description	Total US$
A	**MRF Part**	

	Labor	1,449,000
	Equipment Operating & Maintenance	1,811,538
	Depreciation Cost	452,030
	Total Operating Costs of MRF	**3,712,568**
B	**WTE**	
	Labor	1,530,000
	Equipment Operating & Maintenance	1,963,500
	Depreciation Cost	1,800,000
	Total Operating Cost of WTE	***5,293,500***
	Total Operating Costs of ISWMF	***9,056,068***

Per Tonne Operating Cost

The combined operating cost per tonne of ISWMF within operation period of the 16 years for MRF and 13 years for WTE would be around US$ 149 per ton with depreciation cost, excluding revenues from selling of recyclables and compost, mulch production and selling, RDF production and selling, and selling the electricity produced in WTE to the power grid of the country.

Table 6.8: **Estimated per tonne Operating cost and per tonne revenues from ISWMF Operations**

Estimated per Tonne Operating Costs		**Per tonne operating cost**
		US$
	Estimated per tonne operating cost of MRF	42
	Estimated per tonne operating cost of WTE	107
	Average per Tonne Operating Cost of ISWMF with WTE	**149**
Estimated per tonne Internal Revenues		**Per tonne revenue**
		US$
1	Estimated Revenue of ISWMF MRF - per tonne (16 years)	45.47
1	Estimated Revenue of ISWMF WTE - per tonne (13 years)	59.40
	Estimated per tonne revenue from operations of ISWMF	**104.87**
	Cash deficit	***44.56***

In case the internal revenues from selling recyclables, other recovered materials, and electricity to the power grid are included in the analysis, net per tonne operating cost of ISWMF would be around US$ 45 - 50 (see above Table) with a 10% margin for covering the contingency costs, assuming that recycling rate will be around 30% of recyclable materials in the short and mid term plan period, 35% until 2035, and 40% in the last five years of long term period, and electricity selling rate to the power grid of Sint Maarten will be US$ 0.15 per kWh.

6.2.4 Construction & Demolition (C&D) Waste Handling Facility

A central C&D waste processing facility is included into the waste management system of Sint Maarten. Estimated CAPEX and OPEX for this facility are evaluated based on consultant's previous experiences and waste market experiences worldwide, using extrapolated market capital cost and operating costs.

CAPEX

The following Table shows estimated capital cost of a basic C&D waste processing facility which has the C&D handling capacity of 61 thsd. tonnes of annual capacity.

Table 6.9: Summary of Capital Costs for C&D Processing Facility

Cost Items		Estimated Capital Cost *US$*
1	Project Development	250.000.00
2	Infrastructure	1,200,000.00
3	Workshop	1,800,000.00
4	Others	250,000.00
Total		**3,500,000.00**

Source: Consultant's own estimation based on Consultant's experiences.

OPEX

Per ton operating cost would be around US$ 19.79, assuming that the facility will process 60 ths. tonnes of C&D waste annually. If we assume that the facility will be operational by 2023, the facility would handle 1,075 ths. tonnes of C&D waste until 2040.

Table 6.10: Per tonne Operating Cost of C&D Waste Processing Facility

Item	Item Description	Total *US$*
	Labor	4.49
	Equipment Operating & Maintenance	8.20
	Utility and others	3.04
	Depreciation Cost	4.51
Total Operating Cost		**19.79**

Source: Consultant's own estimation based on Consultant's experiences.

However, the facility is capable to generate high revenue from selling recyclables for the processed mix C&D waste. Estimated per tonne revenue is given in the following Table.

Table 6.11: C&D Waste Processing Facility Average Per tonne Revenue

Indicators	Values
Waste Received (17 years) - tonne	1,075.354
Total Revenues - US$	37,058,120
Average per tonne internal revenue - US$	**34.46**

6.2.5 New Landfill

CAPEX

New landfill's construction and M&E costs are rendered as CAPEX, and cost breakdown is given in the following Table. Capital cost of New Landfill would around US$ 10.2 million. Summary Capex is below.

Table 6.12: Summary CAPEX of New Landfill

Cost Items		Estimated Capital Cost *US$*
A	Design & construction	8,235,300
B	M&E Cost	1,100,000
C	Miscellaneous	900,000
Total		**10,235,300**

Source: Consultant's own evaluation.

OPEX

Operation management cost of New Landfill includes costs of the labor, equipment operating maintenance, environmental monitoring and miscellaneous items in the long term plan period as it will begin its operation from the beginning of long term plan period by 2030. Landfill closure cost and after care costs are not included in this financial assessment as the landfill life time is at least 20 – 25 years. So that closuring and after care activities will be realized beyond this project's planning periods.

The following Table is a summary of total operating cost of New Landfill in the Long Term plan period of this project between 2030 and 2040 (11 years). While annual operating cost of the New Landfill would be US$ 1,54 million, it would be around US$ 17 million in total in the Long Term Plan Period (11 years) of this project.

Table 6.13: Summary Operating Cost of New Landfill in the Long Term Period of this Project

Item	Item Description	Annual Cost *US$*	Operation Time in Long Term Plan Period *Year*	Total Cost of Long Term Plan Period *US$*
1	Labor Cost	612,000	11	6,732,000
2	M&E operating and maintenance	466,000	11	5,126,000
3	Environmental & monitoring	28,000	11	308,000
4	Miscellaneous cost, including depreciation costs	512,150	11	5,633,650
Total Operating Cost		**1,618,150**		**17,799,650**
Waste received in project long term plan period - tonne				**615,275**
Per tonne operating Cost in Long Term Plan Period				***29***

6.2.6 Temporary Debris Storage and Reduction (TDSR)

CAPEX

The facility's construction and M&E costs are rendered as CAPEX, and cost breakdown is given in the following Table. Capital cost of TDSR would be around US$ 3.15 million, while 31% of the capital cost would be construction cost for preparation of the site, 61% of it would be M&E cost. Details of the capital cost is given in Annex 5.

Table 6.14: CAPEX of TDSR

	Activities	Estimated Capital Cost *US$*
1	Construction Cost	984,300
2	M&E Cost	2,150,300
	Total CAPEX	3,134,600

OPEX

Operation management cost of TDSR facility includes costs of the labor, equipment operating maintenance, environmental monitoring and miscellaneous items in the short term plan period. It has been planned that its operation will take only 27 months, as it will be established for volume reduction and pre-processing the accumulated scrap tire, wood and glass, and be operational in 2023 continuing its operations until when ISWMF MRF part begins operation in 2025.

Table 6.15: Summary Operating Cost of TDSR Facility

Item	Item Description	Yearly O&M Cost US$	Total O&M Cost for 27 months (2.25 years) US$
1	Labor cost	701,528	1,578,438
2	M&E O&M cost - lease costs	205,905	463,287
3	M&E O&M cost - fuel and lubricants	135,427	304,710
4	Electricity cost	85,288	191,899
5	Other Utility costs	14,400	32,400
6	Depreciation cost	205,000	461,250
	Total Operating Cost	**1,347,548**	**3,031,983**

No per tonne operating cost could be evaluated for the facility operation period as there is no data on the actual amount of scraps that will be processed in the facility.

6.2.7 Engineering & Consultancy Costs

Costs of engineering and consultancy activities are rendered as capital cost (CAPEX). They have been planned to be scheduled in the Short Term Plan period beginning from 2020 to the end of 2026. The following Table lists costs of engineering and consultancy activities.

Table 6.16: Costs of Engineering & Consultancies for the Project

	Engineering & Consultancies to be Procured	**Cost** *US$*
1	Prepare System Feasibility Study and Roll Out Plan for Collection/Transport	400,000
2	Conduct a Comprehensive Waste Characterization Survey	120,000
3	Establish a New SWMA and build its capacity	70,000
4	Develop Waste Fee Framework and Tariff Study (Financial Framework)	120,000
5	Developing Software Packages and a Waste Data System (WIS)	60,000
6	Conduct a Legal Assignment for Developing a New Solid Waste Law	80,000
7	Develop a Guidance for Landfill Management and Closure activities	45,000
8	Develop a Short-term DBO Contract MSW Landfill Management	60,000
9	Develop a DBO Service Contract for ISWMF	60,000
10	Develop a DBO Service Contract for separately handling of C&D waste	50,000
11	Design & Implement Public Communication, Education Program & Social Inclusion Prog.	50,000
12	Conduct Training Program of SWM staff for Landfill Management	60,000
13	Conduct Training Program of staff of ISWMF and C&D Waste Management Contractors	60,000
14	Technical Advisor	140,000
15	Prepare Full ESIA for ISWMF and Landfill Upgrading	120,000
16	Supervision of Works	1,100,000
17	Prepare a Pre-feasibility Study and DBO Contract for New Landfill	280,000
	Sub Total	**2,875,000**
Optional Items		
18	Preparing a Pre-feasibility Study for WTE Part of ISWMF- Optional	200,000
19	Developing DBO Contract for WTE part of ISWMF - Optional	60,000
	Sub-total of Component 1 Optional Items	**260,000**
Total Cost of Component 1 with Optional Items		**3,135,000**

6.2.8 Other Capital Costs Included in the Cost Evaluation of the Project

The capital cost for Waste Receiving Facility for the Port in Point Blanche, procurement of works for improving the collection points and purchasing containers are also included in calculations rendering as capital costs.

6.2.9 Summary Costs (CAPEX) of the Project by Phases

Summary CAPEX of the Project

The following is the summary CAPEX evaluation for all project components. Detailed CAPEX evaluation is given in Annex 5. The total CAPEX of the system would come true around US$ 97.25 million without WTE option, and US$ 170.25 million with WTE option with the proposed actions/activities for implementing ISWMS for Sint Maarten.

Table 6.17: Summary CAPEX Evaluation

Description of Activities		Total Cost	Phase 1 Short Term Plan Period	Phase 2 Mid Term Plan Period	Phase 3 Long Term Plan Period
			2020 - 2026	*2027 - 2029*	*2030 -2040*
		US$	*US$*	*US$*	*US$*
1	**Establishing ISWMA**				
	CAPEX of ISWMA	*348,500*	*348,500*		
2	**Engineering & Consultancy**				
	CAPEX Eng. & Consultancy	*3,135,000*	*3,135,000*		
3	**MSW Landfill Upgrade/Extension, Closure and After Care**				
	CAPEX - MSW Landfill	*40,426,539*	*30,042,946*	*7,883,593*	*2,500,000*
4	**Irma Landfill Debris Removal Cost**				
	CAPEX Irma Landfill	*11,111,475*	*11,111,475*		
5	**ISWMF with WTE**				
	CAPEX - without WTE	*23,926,750*	*23,926,750*		
	CAPEX - with WTE	*96,926,750*	*96,926,750*		
6	**TDSR**				
	CAPEX - TDSR	*3,447,700*	*3,447,700*		
7	**New Landfill Construction**				
	CAPEX New Landfill	*10,235,300*	*0*	*10,235,300*	
8	**C&D Waste Processing Facility**				
	CAPEX C&D Waste F.	*3,500,000*	*3,500,000*		
9	**Port Waste Receiving F.**				
	CAPEX Port Waste RF	*500000*	*500000*		
10	**Collection System Improvement**				
	CAPEX Collection System	*620,000*	*620,000*		
Total CAPEX without WTE		***97,251,264***	***76,632,371***	***18,118,893***	***2,500,000***
Total CAPEX with WTE		***170,251,264***	***149,632,371***	***18,118,893***	***2,500,000***

Summary OPEX of the Project

The Tables below show summary OPEX evaluation for the project's seven (7) components of the improved SWM system, which are as follows:

1. ISWMA
2. MSW Landfill in Pond Island
3. ISWMF of Sint Maarten, both for two of options of:
   - 3.1 ISWMF MRF
   - 3.2 ISWMF WTE
4. TDSR Facility
5. New Landfill
6. C&D Waste processing Facility, and
7. Collection System

Summary OPEX is given in the following Table. Following analysis revealed that system total operating cost would be around US$ 202.49 million without WTE option from 2020 to 2040, and US$ 271.31 million with WTE option, respectively.

Table 6.18: Summary of OPEX for the Project Components

	Project Components	Total Cost	Phase 1 Short Term Plan Period, 7 Years	Phase 2 Mid Term Plan Period, 3 Years	Phase 3 Long Term Plan Period, 10 to 25 Years
			2020 - 2026	2027 - 2029	2030 - 2040
		US$	US$	US$	US$
1	**System Management Cost through ISWMA**				
	ISWMA Operating Cost	*18,774,000*	*2,898,000*	*3,402,000*	*12,474,000*
2	**MSW Landfill in Pond Island**				
	MSW Landfill Operating Cost	*15,789,050*	*10,720,750*	*4,353,300*	*715,000*
3	**ISWMF with WTE**				
	I. MRF Part	*59,401,088*	*7,425,136*	*11,137,704*	*40,838,248*
	II. WTE Part	*68,815,500*	*0*	*10,587,000*	*58,228,500*
	Operating Cost of ISWMF with WTE	***128,216,588***	***7,425,136***	***21,724,704***	***99,066,748***
	Operating Cost of ISWMF without WTE	***59,401,088***	***7,425,136***	***11,137,704***	***40,838,248***
4	**TDSR**				
	TDSR operating cost	*3,031,983*	*3,031,983*	*0*	*0*
5	**New Landfill Construction**				
	New Landfill operation cost	*17,799,650*	*0*	*0*	*17,799,650*
6	**C&D Waste Processing Facility**				
	C&D Facility operating cost	*21,908,407*	*4,381,681*	*3,755,727*	*13,770,999*
7	***Collection System***				
	Collection System operating cost	*65,787,632*	*17,723,288*	*9,473,341*	*38,591,003*
Total OPEX of the SWM system without WTE		***202,491,810***	***46,180,838***	***32,122,072***	***124,188,900***
Total OPEX of the SWM system with WTE		***271,307,310***	***46,180,838***	***42,709,072***	***182,417,400***

6.3 Internal Revenue Projection

As mentioned in Chapter 5, the projected SWM system would be capable to obtain internal revenue through selling of separation and pre-processing of a part of recyclables, mulch and wood briquette produced from wood waste, compost from bio-degradable waste, RDF, and selling the electricity to national power grid by producing energy from waste (EFW) during operation of ISWMF.

C&D waste processing facility would also be capable to obtain significant amount of internal revenue by selling the pre-processed or processed recoverable fractions in C&D waste during operation. The Consultant had a research on market prices of recyclables and other materials to be recovered, and the following internal revenue projection by phases has been conducted in accordance with the plans given in Chapter 5. The following analysis shows that total internal revenue of ISWMF MRF operation from 2025 to 2040 would US$ 63.81 million, whereas per tonne revenue is US$ 45.47.

Table 6.19: Internal Revenue from ISWMF MRF Operation by Phases

Material Groups	Total Revenue	Revenue in Short Term Plan Period	Revenue in Mid Term Plan Period	Revenue in Long Term Plan Period
	US$	*US$*	*US$*	*US$*
Sale of Recyclables	34,914,450	3,307,950	5,150,400	26,456,100
Sale of Mulch	2,948,200	331,300	515,800	2,101,100
Sale of Compost	6,044,900	427,500	665,600	4,951,800
Sale of wood dust and chip Briquette	4,522,950	71,550	340,050	4,111,350
Sale of RDF	15,378,675	1,351,125	2,103,675	11,923,875
Total Revenue form ISWMF MRF Operation	**63,809,175.00**	**5,489,425.00**	**8,775,525.00**	**49,544,225.00**
Average per tonne revenue from 2025 to 2040 (16 years operation) - US$	***45.47***			

Revenue analysis below revealed that 13 years WTE operation from 2028 to 2040 would generate the revenue of approximately US$ 38.15 million during project periods, whereas per tonne revenue is US$ 59.40. Calculation detail is given in Annex 5.

Table 6.20: Internal Revenue projection of ISWMF from WTE Operation from 2028 to 2040 (13 years)

Projected Revenue Source	Total	Short Term	Mid Term	Long Term
	US$	*US$*	*US$*	*US$*
Revenue from selling of electricity to national power grid	*38,164,500*	*0*	*6,207,300*	*31,957,200*
Average per tonne revenue from 2028 to 2040 (13 years operation) - US$				***59.40***

As mentioned in Chapter 2.4, C&D waste processing facility/plant can generate significant revenue from processing of C&D waste received by the plant. The following analysis revealed that the plant would generate the internal revenue of approximately US$ 37.06 million in the project period, whereas per tonne revenue is US$ 30.13.

Table 21: Internal Revenue Projection from C&D Waste Processing Facility

Revenue Source	Projected Revenues			
	Total	Short Term Plan Period	Mid Term Plan Period	Long Term Plan Period
	t	*US$*	*US$*	*US$*
From Woods in Construction Waste	*23,150,515*	*3,671,539*	*3,839,249*	*15,639,727*
Other C&D in Construction	*7,214,613*	*1,144,196*	*1,196,461*	*4,873,956*
Other Recyclables in C&D Waste	*6,692,992*	*1,061,470*	*1,109,956*	*4,521,566*
Total	***37,058,120***	***5,877,205***	***6,145,666***	***25,035,248***
Average per tonne revenue - US$	***30.13***			

6.4 Evaluation of the System Scenarios on System Operating Costs and Cash Deficit

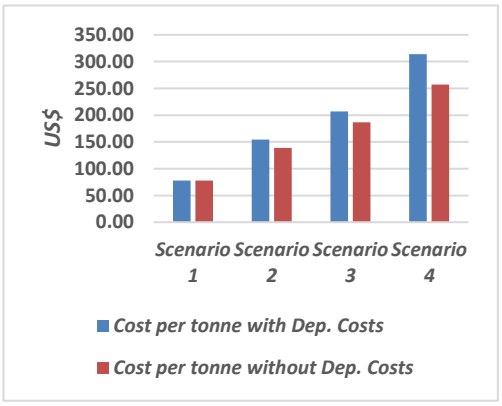
Four scenarios are evaluated on full system for forecasting of operating costs from 2021 to 2040 with evaluating cash deficit of the system, which are as follows:

1. Scenario 1: No project Option (Baseline) without no achievement;
2. Scenario 2: No ISWMF Option with little achievement on the current system, including improvement of MSW landfill, establishment of New Landfill and a separate C&D waste facility/plant, establishment of a New Waste Management Authority (ISWMA), regulating the collection system and recycling market, and starting the fee collection for both collection and disposal (tipping fee);
3. Scenario 3: With ISMWF, but No WTE Option, including improvement of MSW landfill, establishment of New Landfill and a separate C&D waste facility/plant, establishment of a New Waste Management Authority (ISWMA), regulating the collection system and recycling market, and starting the fee collection for both collection and disposal (tipping fee);
4. Scenario 4: including with ISWMF Option, including WTE with ISWMF option, improvement of MSW landfill, establishment of New Landfill and a separate C&D waste facility/plant, establishment of a New Waste Management Authority (ISWMA), regulating the collection system and recycling market, and starting the fee collection for both collection and disposal (tipping fee);

The evaluations revealed that the highest per tonne operating cost of the entire SWM system would result in Scenario 4, and the lowest in Scenario 1, see following Figure. Evaluation details are given in Annex 5.

Table 6.22: Summary Results of the Scenarios

Scenarios	Cost per tonne with Dep. Costs	Cost per tonne without Dep. Costs	Degree
Scenario 1	77.99	77.99	Lowest
Scenario 2	164.76	149.16	Low
Scenario 3	207.10	186.34	High
Scenario 4	341.20	257.03	Highest



The scenarios are also evaluated based on their intrinsic advantages and disadvantages in the following traffic light rating comparison with a set of cost, sustainability, technical and enabling system criteria.

Although the comparative assessment below suggests that Scenario 3 presents most preferrable set of options, considering the local physical conditions, local and regional market demand, size of local economy which does not strongly support the circular economy for locally recycling the total recovered waste, Scenario 4 is determined as preferred scenario by the consultant.

Table 6.23: Traffic Light Rating Comparison of the Scenarios

Traffic Light Rating Comparison of the Scenarios					
Criteria		Scenario 1	Scenario 2	Scenario 3	Scenario 4
I.	**Cost Criteria**				
	Capital Investment Cost	🟢	🟢	🟡	🔴
	Recurrent cost affordability	🟢	🟡	🟡	🟡
	Cost Recovery	🔴	🔴	🟢	🟡
	Local & Regional Market demand for by-products	🟡	🟡	🟢	🟢
II.	**Sustainablity Criteria**				
	Compliance to Project's objectives	🔴	🟡	🟢	🟢
	Compliance to ISWMS Governance Principles	🔴	🟡	🟢	🟢
	Compliance to 4R's principles	🔴	🟡	🟢	🟢
	Provide Environmental Quality protection	🔴	🟡	🟢	🟢
	Provide Public Health protection	🔴	🟡	🟢	🟢
	Consider the Socio-cultural preferences	🔴	🟡	🟢	🟢
	Response to Existing Environmental & Social Impacts	🔴	🟡	🟢	🟢
	Resource Conservation	🟡	🟡	🟢	🟢
	Climate Change effect	🔴	🟡	🟢	🟢
	Disaster Response	🔴	🟡	🟢	🟢
II.	**Technical Criteria**				
II. i)	**Generation**				
	Source Reduction (waste minimization) measures	🔴	🟡	🟢	🟢
	Encouraging the reuse and upcycling	🔴	🟡	🟢	🟢
	Use of biodegradable packaging materials	🟡	🟡	🟢	🟢
	Encourage composting of organic (food waste) at source	🔴	🟡	🟢	🟢
II. ii)	**Collection & Transport**				
	Collection system optimization & Improvement	🔴	🟢	🟢	🟢
	Separate collection of recyclables	🟡	🟢	🟢	🟢
	Regulate the collection system	🔴	🟢	🟢	🟢
II. iii)	**Recycling , Recovery & Treatment**				
	Regulate the recycling market, developing a strategy to integrate them in the waste management system of the country	🔴	🟡	🟢	🟢
	Provide a central MRF with composting facilty to support the recycling market and other waste recycling, recovery and treatment activities	🔴	🔴	🟢	🟢
	Provide a facility for energy recovery from separated waste (WTE)	🔴	🔴	🔴	🟢
	Provide a separate C&D waste processing facility	🔴	🟢	🟢	🟢
	Establish coordination between collectors and recyclers	🔴	🟢	🟢	🟢
	Develop systems for bring back, buy-back, bring banks & drop-off centers	🔴	🟡	🟢	🟢
II. iv)	**Disposal**				
	Upgrade the existing MSW landfill with necessary machineries and equipment	🔴	🟢	🟢	🟢
	Remove the debris in IDDS, separating the recyclable fractions and soil that can be used for daily cover material in MSW landfill	🔴	🟢	🟢	🟢
	Establish a new landfill site for use after 2028 - 2029	🔴	🟢	🟢	🟢
III.	**Enabling Systems Criteria**				
III. i)	**Legal & Regulatory**				
	Provide improved and adequate legal infrastructure for SWM	🔴	🟢	🟢	🟢
III. ii)	**Institutional**				
	Provide institutional reform for SWM, establishing ISWMA	🔴	🟢	🟢	🟢
	Provide training for capacity building of SWM staff	🔴	🟢	🟢	🟢
III. iii)	**Financial & Economic**				
	Set a tariff system, including for collection/transport, treatment & disposal	🔴	🟡	🟢	🟢
	Establish a reliable accounting and billing system	🔴	🟢	🟢	🟢
	Establish a waste collection database, and provide access to the public	🔴	🟡	🟢	🟢
	Develop revenue generating, revenue providing and non-revenue instruments	🔴	🔴	🟢	🟢
III. iv)	**Social Inclusion, Public Awareness and Gender Mainstreaming**				
	Develop public awareness programmes, creating a web site	🔴	🟡	🟢	🟢
	Create a system for handling and tracking complaints and suggestions (GRM)	🔴	🟡	🟢	🟢
	Support collaborative efforts of CBOs and NGOs on SWM activities	🔴	🟡	🟢	🟢
	Provide policy support for waste management programmes and strategies	🔴	🟡	🟢	🟢
III. v)	**Private Sector Involvement**				
	Support, oversee, control, and regulate the private sector participation in SWM	🔴	🟡	🟢	🟢

6.5 Cost Recovery

The basic principle for full cost recovery of the SWM operations from collection to the end point of utilization is to be able to cover all costs incurred during SWM system operations, but the system should have been optimized in all parts, including collection and transport, and waste utilization and reclamation systems.

6.5.1 Cash Out Analysis

As the most distinguished feature which shows and provides the system's sustainability is the cash flow produced by the system during the operations for sustainable management of any public utility system, and the current SWM system suffers from cash deficit continuously due to lack of adequate improvement and optimization within the operations with unregulated tariffs and generally no tariffs in Sint Maarten, cash deficit which will appear during operations within the scenarios established would be the main indicator.

The following Table and Figure show that the system operating costs will significantly increase with WTE option

Table 6.24: Cash Out of the Improved ISWM System, thsd. US$

Cash Out	Short Term	Mid Term	Long Term	Total
No WTE Option - Cash Operating Expenses	27,433	29,540	114,339	**171,312**
No WTE Option - Non-cash Operating Expenses	3,148	2,583	9,850	**15,581**
With WTE Option - Cash Operating Expenses	27,433	36,527	152,768	**216,727**
With WTE Option - Non-cash Operating Expenses	3,148	6,183	29,650	**38,981**
Total operating expenses with No WTE	**30,581**	**32,123**	**124,189**	**186,893**
Total operating expenses with WTE	**30,581**	**42,710**	**182,418**	**255,708**
Waste Received - tonne	***730,947***	***390,701***	***1,591,576***	***2,713,224***
Per tonne cash operating expenses with No WTE	*38*	*76*	*72*	*63*
Per tonne non-cash operating expenses with No WTE	*4.31*	*6.61*	*6.19*	*5.74*
Per tonne Cash operating expenses with WTE	*37.53*	*93.49*	*95.99*	*79.88*
Per tonne non-cash operating expenses with WTE	*4.31*	*15.83*	*18.63*	*14.37*

Source: Consultant's own assessment.

The following Figure also shows that cash out of the system will significantly increase within operation of WTE.

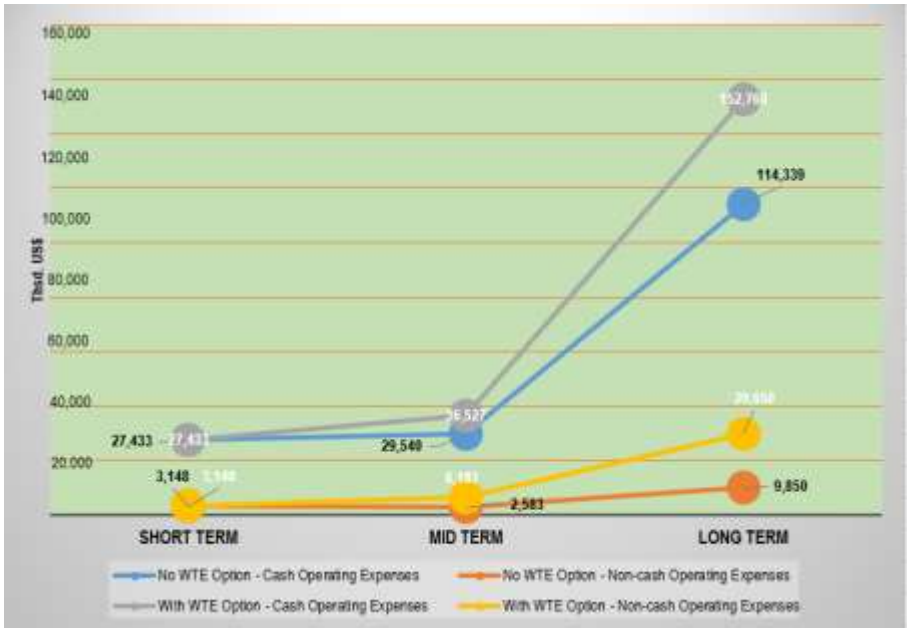


Figure 6.1: Cash Out of the Improved ISWM System, thsd. US$

6.5.2 Internal Revenues for Scenario 4 during Operations

The system would have internal revenues from the following activities of its facilities/plants, which are:

1. ISWMF MRF: through selling of recyclables to recyclers in and out of the Country;
2. WTE: through selling electricity to national power grid from electricity generation during thermal treatment (WTE) activity with the rate of US$ 0.15 per kWh;
3. C&D waste processing facility: through selling of recyclables and secondary materials locally or to local and regional recyclers;
4. TDSR: although TDSR is a temporary facility, and operational for only 2.25 years, it will generate internal revenue through selling the pre-processed recyclable materials to local and regional recyclers.

The system would generate internal revenue with the facilities and plants mentioned above approximately US$ 12.45 million in the short term period whereas average per tonne revenue would be US$ 17.00 with WTE option; approximately US$ 21.13 million in mid term period whereas average per tonne revenue would be US$ 54.00 with WTE option; and approximately US$ 107.54 million in long term period whereas average per tonne revenue would be US$ 68.00 with WTE option.

WTE part of ISWMF of Sint Maarten would generate 317,038 MWh electricity with 90% operational efficiency during all phases of the project (short, mid and long term), and would sell approximately 80% of the electricity (254,043 MWh) that remains after covering of its own need to the national power grid.

The following analysis shows the possible internal revenues during operation period by 2021 – 2040, if Scenario 4 is applied.

Table 6.25: Scenario 4 Possible Internal Revenues by 2021 – 2040

Revenue Source	Short Term	Mid Term	Long Term	Total
Sale of Recyclables, except C&D waste - US$	5,489,425	8,775,525	49,544,225	**63,809,175**
Sale of Electricy to National power grid - US$	0	6,207,300	32,957,200	**39,164,500**
C&D waste facility - US$	5,877,206	6,145,667	25,035,248	**37,058,121**
TDSR - US$	1,080,280	0	0	**0**
Total Internal Revenue with No WTE - US$	**12,446,911**	**14,921,192**	**74,579,473**	**101,947,576**
Total Internal Revenue with WTE - US$	**12,446,911**	**21,128,492**	**107,536,673**	**141,112,076**
Waste received - tonne	**730,947**	**390,701**	**1,591,576**	**2,713,224**
Av. per ton Revenue with No WTE Option - US$	17	38	47	38
Ave. per ton Revenue with WTE Option - US$	17	54	68	52

Source: Consultant's own assessment.

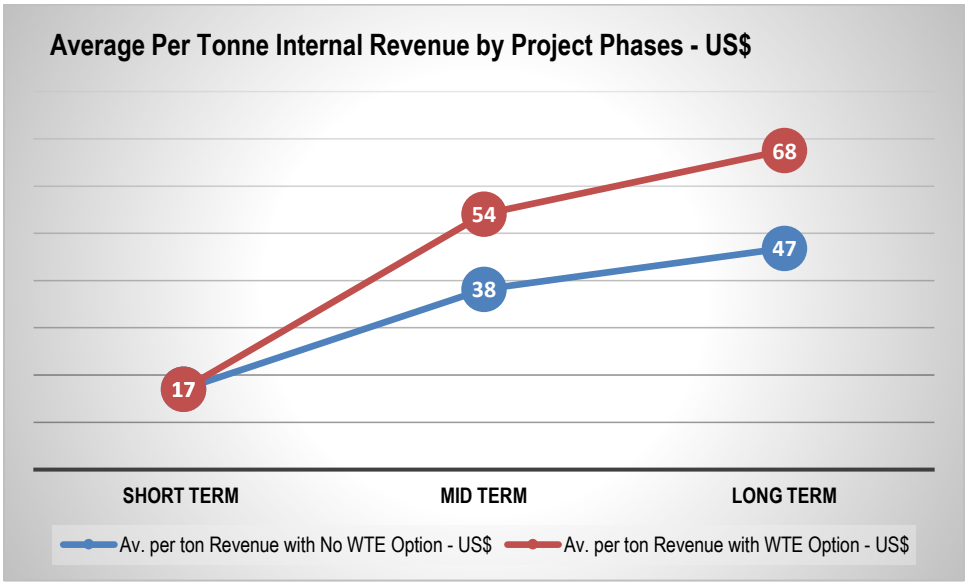


Figure 6.2: Average Per Tonne Internal Revenue with No WTE and WTE Option

6.5.3 System Full Cash Deficit without Economic Instrument

Net system cash deficit depicted in the following Table according to Scenario 4, assuming that the system would generate internal revenue approximately US$ 102 million in total by 2040 with no WTE option, and US$ 141 million with WTE option. System "Full Cash Deficit" shows the financial sustainability. The analysis also shows that per tonne average full cash deficit would come true around US$ 31 with no WTE option, and US$ 42 with WTE option.

Table 6.26: Full Cash Deficit and per tonne Deficit Analysis

	Short Term	Mid Term	Long Term	Total 20 Years
Total Cash and Non-cash Out with No WTE- ths. US$	30,581	32,123	124,189	**186,893**
Total Cash and Non-cash Out with WTE- ths. US$	30,581	42,710	182,418	**255,708**
Internal Revenues to be generated with No WTE - ths. US$	12,447	14,921	74,580	**101,948**
Internal Revenues to be generated with WTE - ths. US$	12,447	21,128	107,537	**141,112**
Full Cash Deficit with No WTE - US$	***18,134***	***17,201***	***49,610***	***84,945***
Full Cash Deficit with WTE - US$	***18,134***	***21,581***	***74,881***	***114,596***
Waste Received - tonne	***730,947***	***390,701***	***1,591,576***	***2,713,224***
Per tonne Full Cash Deficit with no WTE - US$	*25*	*44*	*31*	*31*
Per tonne Full Cash Deficit with WTE - US$	*25*	*55*	*47*	*42*
Per tonne Full Cash Deficit with mark up of 8% per tonne for No WTE Option - US$	**27**	**48**	**34**	**34**
Per tonne Full Cash Deficit with mark up of 8% per tonne for WTE Option - US$	***27***	***60***	***51***	***46***

6.5.4 Gate Fee Calculation

The cash deficit analysis above shows that cash deficit would appear approximately US$ 27.00 per tonne of waste received by the system in Phase 1 of the project with WTE option, US$ 60.00 per tonne in Phase 2, and US$ 51.00 per tonne in Phase 3, respectively. Although the deficit levels show the benchmark points for cost recovery, it will still strictly be bound with the application of the schedules recommended, and local and regional market conditions.

The above analyses also suggest that direct revenue generating instruments of US$ 65 – 75 per tonne with WTE option, and US$ 55 – 65 in average for No-WTE option would provide for full cost recovery of the system. However, the results should be correlated and modified according to results of a new comprehensive waste characterization and detailed social survey within early stage of the project.

The following analysis on gate fee for ISWMF and landfills has been conducted based on the current waste data and consultant's assumptions and projections, achieved by re-analyzing the current data. In Sint Maarten case, ISWMF gate fee will also include the landfill tipping fee.

Landfill Tipping Fee

In general, landfill tipping fee should cover the landfill operating cost and an appropriate margin for covering 8% of operating costs for contingencies and at least 8 - 10% of operating expenses for operational minor mistakes and modifications. As the current and new MSW landfill operation cost is around US$ 29 – 30 per tonne, two landfills' operating costs has been assumed to be US$ 30.00 per tonne in the calculations.

Within the planned integrated waste management system, landfills will not have any other revenue sources other than tipping fee, no internal revenue is assumed to be realized during landfills' operation. However, the tipping fee rate calculated below can be changed according to DBO contractor(s)' contracts. The following calculation results should be considered as a stand point for level of tipping fee of the landfills.

Table 6.27: Landfills (Current and new landfills) Tipping Fee Evaluation

Cost items	Tipping Fee *US$/t*
O&M Cost	30.00
Contingency - 8% of operating cost	2.40
Margin - 10% of operating cost	3.00
Tipping Fee for Landfills	**35.40**

Source: Consultant's own evaluation.

Gate Fee for ISWMF without WTE and with WTE Options

Similar approach to calculate the gate fee for ISWMF is also applied for addition of the contingency (8% of gate fee) and operational margin (10% of gate fee), and 4.54% of operating cost of ISWMA to the gate fee, as the gate fee of ISWMF will cover only cash deficit and additional margins. So that a separate cash deficit calculation has been conducted for the facility for two options of without-WTE and with-WTE.

Table 6.28: ISWMF MRF Gate Fee Evaluation (No WTE Option) by Phases

Cost items	Short Term *US$/t*	Mid Term *US$/t*	Long Term *US$/t*
Per tonne cash deficit of MRF	2.65	6.05	5.47
Contingency cost per tonne - 8% of operating cost	0.81	2.28	2.05
Operational Margin - 10% of Operational cost	1.02	2.85	2.57
ISWMA operating cost contribution - 4.54% of ISWMA operating cost	0.18	0.40	0.36
Landfill tipping fee	35.40	35.40	35.40
Gate Fee for ISWMF MRF (No WTE Option)	**40.06**	**46.98**	**45.84**

Source: Consultant's own evaluation.

ISWMF gate fee calculation result is given in the following Table with similar approach to MRF gate fee calculation. A 5% margin is also added to the calculation, considering the commission that will be paid to the electricity company (GEBE), if the solid waste fee collection is connected to electricity bill.

Table 6.29: ISWMF Gate Fee Calculation with WTE Option

Cost items	Short Term *US$/t*	Mid Term *US$/t*	Long Term *US$/t*
Per tonne cash deficit of ISWMF with WTE Plant	2.65	17.46	10.40
Contingency cost per tonne - 8% of operating cost	0.81	4.45	4.98
Operational Margin - 10% of Operational cost	1.02	5.56	6.22
ISWMA operating cost contribution - 4.54% of ISWMA operating cost	0.18	0.40	0.36
Landfill tipping fee	35.40	35.40	35.40
Gate Fee for ISWMF MRF (with WTE Option)	**40.06**	**63.26**	**57.36**

Source: Consultant's own evaluation.

6.6 Affordability Assessment

The user charges should vary for households, small and large commercial and industrial waste generators, restaurants/bars, and hotel/resorts. The distribution of user charge between the waste generators by group will require special attention because the recent statistics (2009 – 2015, see Figure 3.5) obtained from VROMI on waste disposed in MSW landfill have been re-analyzed by the consultant, and the results show that 19% of waste disposed is households waste, 25% commercial waste, 19% mixed C&D waste, 35% yard waste including area cleaning waste), and 2% other waste respectively. This issue will be addressed in detail in the consultant's ongoing Task 5 study - Financial Framework for Sint Maarten will assess the direct and indirect revenue generating instruments along with evaluation of household waste fee rates, tipping fee at the landfill, and/or gate fee at ISWMF of Sint Maarten.

The consultant's willingness-to-pay survey (WET) has been recently completed, and its results will be evaluated within Task 5 report (Financial Framework). But, a quick overview of the responses to the questions on willingness to pay of the people for SWM services in Sint Maarten gives little data which shows that almost 50% of the respondents are reluctant to give responses on fiscal issues and the SWM user rates that may be paid by system users.

6.6.1 Household Income

According to recent labor force survey report released by Department of Statistics of Sint Maarten in 2019, level of the household income is given as follows:

Table 6.30: Household income in Sint Maarten by 2018

Household Income		*% of Community*		*% of Change*
ANG	*US$*	*2017*	*2018*	
No income	No income	3%	5%	+2
1 - 1,000	0.56 - 559	11%	14%	+3
1,001 - 2,000	559 - 1115	17%	22%	+5
2,001 - 3000	1115 - 1673	16%	14%	***-2***
3,001 - 4,000	1673 - 2231	12%	13%	+1
4,001 - 5,000	2231 - 2788	9%	7%	***-2***
5,001 - 6,000	2278 - 3345	8%	6%	***-2***
6,001 - 7,000	3345 - 3903	4%	5%	+1
7,001 - 8,000	3903 - 4461	4%	3%	***-1***
8,001 - 9,000	4461 - 5019	3%	2%	***-1***
9,001 - 10,000	5019 - 5576	2%	1%	***-1***
10,0001 +	5577 +	10%	9%	***-1***

Source: Labour Force Survey Report of Department of Statistics of Government of Sint Maarten, 2019.

It is seen that most decreases in the larger income brackets and increases in the smaller income brackets. For the purposes of user charge affordability assessment, including the first three income group in the first quintile, and the last group in above table in last quintile, households in Sint Maarten could be grouped in five income groups (quintiles), which are i) low income, ii) below median, iii) median, iv) above median, and v) upper income levels.

Table 6.31: Income Quintiles of Households in Sint Maarten

Household Income		% of Community		Assumed Quintile community	Assumed Quintile % of community	Average Monthly income US$
ANG	US$	2017	2018			
No income	No income	3%	5%	Low income	41%	700
1 - 1,000	0.56 - 559	11%	14%			
1,001 - 2,000	559 - 1115	17%	22%			
2,001 - 3000	1115 - 1673	16%	14%	Below Median	27%	1,500
3,001 - 4,000	1673 - 2231	12%	13%			
4,001 - 5,000	2231 - 2788	9%	7%	Median	13%	2,750
5,001 - 6,000	2278 - 3345	8%	6%			
6,001 - 7,000	3345 - 3903	4%	5%	Above Median	8%	3,750
7,001 - 8,000	3903 - 4461	4%	3%			
8,001 - 9,000	4461 - 5019	3%	2%	Upper income level	12%	5,250
9,001 - 10,000	5019 - 5576	2%	1%			
10,0001 +	5577 +	10%	9%			
			100%		100%	

Source: Consultant's own assessment based on data of Labour Force Survey Report of Department of Statistics of Government of Sint Maarten, 2019.

As seen in above analyses, applying variable rate in accordance with electricity consumption will be more favorable than the flat rate for households in Sint Maarten, as the electricity consumption will naturally correlate with the income levels and amount of waste generated by the households due to the fact that the more income, the more waste and more electricity consumption. Conversely, applying a flat rate according to 1 or 1.5% of mean average of median group would not be appropriate as the house holds generates approximately 19 – 20% of total waste in the country.

6.6.2 Indirect Revenue Providing Instruments

Households rates cannot be directly applied to commercial, institutional, and industrial waste generators. To correlate the waste fee rate for those, as mentioned before, more specific and comprehensive waste characterization generation analysis for commercial waste generators (restaurants/bars, hotels/resorts, and small retail shops/market) should be conducted in the later stages of the project.

In addition, calculation of total revenue of the system with user charges and other economic instruments (indirect revenue generating instruments) requires more data on central government revenue from municipal/environmental, utility fee, occupancy tax for hotels/resorts, and departure tax in the airport and port/marinas for stay over and cruise arrivals.

6.7 Economic Instruments

As mentioned below, there are only two direct economic instruments used in Sint Maarten for providing solid waste management services, one of which is government budget support (subsidy) for waste collection from households, institutions and area cleaning, and disposal managing the landfill (MSW and Irma landfills), and second one is unregulated solid waste collection fee collected by private and

unregulated waste collectors. Although the other indirect economic instruments (utility fee, environmental fee, etc.) support the government budget, it is unknown how the budget obtained through indirect economic instruments is allotted for SWM services.

Therefore, the indirect economic instruments are not benchmarked here as they require the legal and institutional infrastructure arrangements that do not exist in Sint Maarten.

A comparison has been conducted with the user charge rates in 19 EU countries Vs. user charge rates proposed by the consultant with variations in phase basis. The following analysis benchmarks that the increased user charges proposed by the consultant are approximately 15% lower than EU average with No WTE option1 (Scenario 3), and almost equal to EU average with WTE option (Scenario 4). See following benchmark.

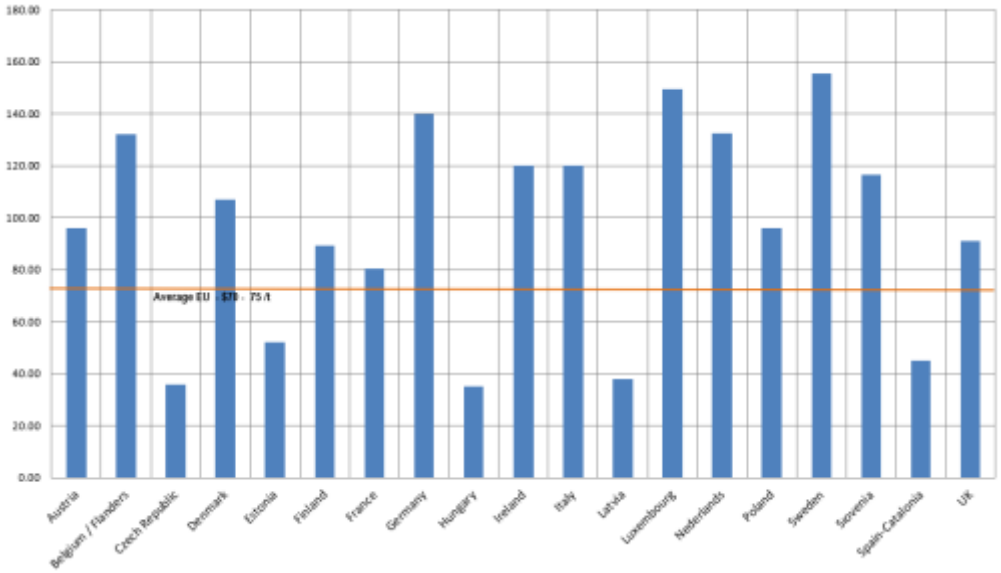


Figure 3: Benchmark Chart for user Charges

The investments are planned so that it is able to cover operating costs through the income from the following revenue resources. However, especially in the initial 2 - 3 years of operation of the system up to when the development of enabling framework infrastructure is achieved and all new regulations for smoothly managing the system are in place, use of external funds would be required through government subsidy or short and mid-term credit lines from the market or funds that will be provided by DBO contractors.

The followings would be the main economic instruments that would be applied for recovery of solid waste services in Sint Maarten.

Direct Revenue Generating Instruments:

- Flat or variable user charges
- Landfill tax or landfill gate fees
- ISWMF gate fee

1 Managing Municipal Solid Waste, EEA Report, 2013 by European Environment Agency.

- Pay as you throw schemes for user charges, and
- Government subsidy

Indirect revenue providing instruments:

- Environmental Tax
- Environmental/Municipal Fee / Tax
- Utility fee
- Occupancy tax for hotels and resorts (currently applied)
- Departure tax in the Airport and port/marinas

Non-Revenue Instruments

- Trade-off agreements
- Taxes or duties for ELVs
- Deposit refund systems
- Take back systems
- Import duties for non-recyclable packaging
- Extended Producer Responsibility Policy Instrument

After reviewing many articles and comparative studies for comparing the investment costs, recurrent costs, and accordingly, user charges / gate fees (landfill taxes, etc.) during this study, it is understood that benchmarking of waste management services with regard to waste fee structures is far from a straightforward exercise; even within a single small country with uniform regulations, level of development, culture, governance system, and climatic conditions.

The user charges levied are either on a flat rate or on volume (unit rate or flat rate) in different countries. Waste user charges based on the flat rate pricing are the fee charged for delivery of waste service, including collection, transport / transfer, disposal, and designed to cover all service cost, usually based on the ability to pay. It may be collected either separately or along with water bill, electricity bill, or property tax.

Many countries in Europe and the world have applied a mix of economic instruments to sustain their waste management systems. The following Table shows the countries that apply charges and fees as economic instruments.

Table 6.32: Countries apply Charges and Fees as Economic Instrument

Categories of Charges and Fees Applied as Economic Instruments in Solid Waste Sector	Countries where use of the economic Instruments have been reported	Sint Maarten
Waste Generation Charges - Variable rate *(based on the volume of waste generated)*	United States, Netherlands, Britain, Japan, China, Indonesia, Malaysia, Singapore, Thailand, Venezuela, Barbados, Colombia, Chile, Mexico, Ecuador, Jamaica, Bolivia, Brazil	None
Waste User Charges - Flat Rate	Belgium, Bosnia Herzegovina, Bulgaria, Croatia, Czech Republic, Latvia, Hungary, Estonia, Romania, Slovenia, USA, Korea, Ghana, Taiwan, Canada, Lithuania, Poland, Slovak Republic, New Zealand, Portugal, Vietnam, Ireland, Israel, Greece, Switzerland	None
Waste Tipping Charges	Czech Republic, Estonia, Hungary, Latvia, Romania, Ecuador, USA, Canada, Slovak Republic, Poland, New Zealand, Venezuela, Chile, Australia, France, Greece, Japan, UK,	None

	Turkey, Italy, Colombia, The Netherlands, Thailand, Switzerland	

All revenue generating instruments aforementioned would be possible to apply in Sint Maarten, however, the government subsidy is least desirable for an Integrated Waste Management System. Nevertheless, a small government subsidy would be required for low income and vulnerable households for user charges. This requirement would be re-assessed after a detail social survey to be conducted in later stages of the project.

All of the indirect revenue providing instruments are also possible to apply in Sint Maarten with proportional allocation the funds provided for solid waste management system.

All non-revenue instruments aforementioned also contribute indirectly via reducing the waste amount, which also necessitate their implementation in Sint Maarten.

6.8 Economic Analysis

The project has a high social component of providing vital infrastructure to households in the project area, tourism industry for presenting a clear environment. It is promoted by the project's basic objectives and the Government authorities as a vital component of further economic development of the country. The project will also ensure the integrity of the environment, providing less emission of GHG than the current situation.

6.8.1 Estimation of Benefits

For giving an estimate of the economic benefits related to the project, the benefits have to be identified, quantified and valuated. The benefits comprise environmental, social, health and economic development benefits.

However, it is well known that the environmental, social, health and economic development benefits are extremely difficult to quantify. Quantifying these benefits would require detailed social surveys to be undertaken which are beyond the scope of the current assignment.

6.8.2 Valuation of Project Benefits

The proposed project would ensure to comply with EU standards and best practice applications in the waste sector, which is a very important because of the fact that the country is an attractive tourism destination in Caribbean Region.

Benefits which could be evaluated in the waste sector include;

- Water: improvements in MSW landfill and removing the debris in IDDS with appropriate methods that comply the requirements of World Bank environmental and social safeguards will lower risks of contaminating ground water and surface water sources in the project corridor;

- Air: better control of LFG generated in the MSW landfill, enclosed and air-conditioned waste processing facilities (ISWMF) will remove or reduce the risk of GHG emission increase, explosions/fires, so that will have lower impact on global warming;

- Landscape: the closure of current MSW landfill after improving and adeqautly final capping will remove eyesore contamination as the project area is one the most prominent touristic destination;
- Health: improved waste disposal and treatment system and better management of SWM in the country will reduce the potential for breeding of vermin and other disease vectors,
- Efficiency: benefits arise from increased recycling and composting activities through extension in the life of the MSW Landfill in Pond Island, and potentially optimized collection/ transportation of non-recyclable waste;
- Resource cost: resource costs will be conserved through increasing the recycling rate and regulating the recycling sector in the country. These benefits would be partly offset by additional transport costs incurred; and
- Wider social and development benefits: presenting more clear and attractive environment for tourism industry, increased employment, attracting investments.

Health

Health impacts include direct risks (explosions, open and deep-seated fires and air emissions) to workers in the existing disposal facilities, and indirect risks to the wider communities arising from potential contamination of water sources from leachate seepage as well as the existing landfill being breeding grounds for vermin and other disease vectors. Little empirical data is available in Sint Maarten on the disease arising from pollution with waste. Data on disease incidences caused by vermin, and linkages to solid waste collection and landfill operation, is also not available.

It is well known that waste contains infectious and toxic materials, and attracts rodents and other vectors of disease. The reduction of disease and improved community health have economic benefits in the form of improved general work efficiency, reduced number of work or school days lost due to sickness, reduced household expenditures on medicines and medical care, reduced infant mortality and childhood disease, and improved longevity.

Resource & Eco-system Benefits

As methane is a greenhouse gas, the capture and avoidance of methane leads to a reduced level of global warming, with subsequent benefits of avoided costs of global warming. Methane resides in the atmosphere for a number of years, contributing to warming for a considerable period into the future. Any calculation of benefits therefore depends on the choice of the discount rate; the higher the discount rate, the lower the damages.

Open dumping and landfill fires result in release of fine particulates, bio-aerosols and volatilized metals and refractory organics. These pollutants cause respiratory illness and can also cause cancers. Safe disposal by sanitary landfills limits human and animal susceptibility to such emissions.

Social Benefits

Regulated and appropriately controlled waste collection and treatment will have an environmental and a public amenity value.

Economic Development Benefits

The tourism industry has great importance for Sint Maarten. An upgrade in this area would be a direct economic gain for the tourism industry.

Benefits would also be derived from the introduction and promotion of recycling and composting activities in the first phase of the proposed plan. Firstly, recycling and composting activities would extend the life of existing and future landfills by reducing the waste volumes to be landfilled. Secondly, benefit from recyclables and composting would have potential revenue value obtained through the sale/reuse of materials.

For this revenue value to be achieved, stimulating local market demand through economic instruments would be necessary.

CH – 7

IMPLEMENTATION (ACTION) PLAN

Overview

This Chapter provides a complete schedule to be implemented throughout the strategy implementation on 20 – 21 years from 2020 to 2040.

7.1 Implementation Plan & Project Phases

The Sint Maarten ISWMS topics evaluated in Short Term plan, and in Chapter 4.3 are arranged in accordance with project implementation periods that are short, mid and long-term ISWMS plan periods. It is assumed that all arrangements would be completed within the short and mid-term plan periods, including closure of existing MSW landfill, after care activities, and establishing new sanitary landfill for a projected project horizon of at least 20 years after closuring of existing MSW landfill in Pond Island. The long-term plan period would include operational activities of the system, including some fine tunings in the strategy and action plan updating them in every five (5) years in accordance with the waste capacity that may be changed in time, machinery and equipment renewals, and maintenance activities. The timeline of implementation phases is given below.

Table 7.1: Project Phases of Implementation

Phases of Implementation	Number of years covered	Expected calendar years to be covered
Short Term Plan Period - Phase 1	7	2020 - 2026
Mid Term Plan Period - Phase 2	3	2027 - 2029
Long Term Plan Period - Phase 3	11	2030 – 2040
Total Project Life	**21**	

The project activities in short, mid and long term project periods are given in Chapter 5.1, Table 5.1, 5.2 and 5.3. The project activities have been planned to be implemented under three components, which are:

1. Component 1: Engineering and Consultancy activities;
2. Component 2: Works to be procured; and
3. Component 3: Goods to be purchased.

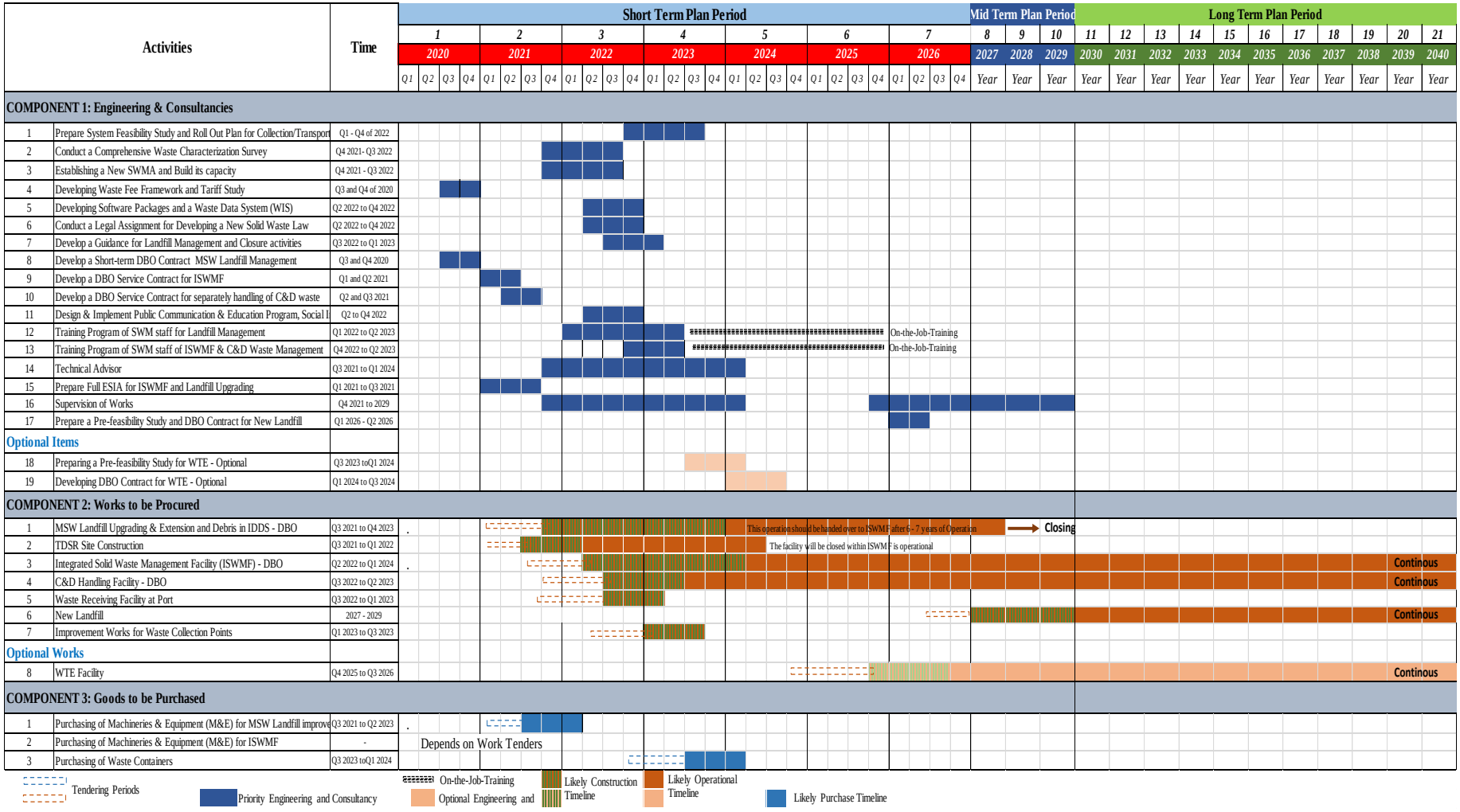
Sint Maarten should also prepare a more robust “Disaster Response and Recovery Plan (DRRP) which addresses the response and recovery phases activities in accordance with the major SWM phases of “i) Generation, ii) Collection, iii) Transportation, iv) recovery/recycling and v) disposal”. DRRP should include the principles in “Waste Management Guidelines of Joint UNEP/OCHA Environment Unit.

For the purpose of this framework, the response to and preparedness for the disaster can be divided into four phases.

1. Phase 1 - Immediate & Shor Tern Actions;
2. Phase 2 – Medium Term Actions;
3. Phase 3 – Long Term Actions; and
4. Phase 4 – Contingency Planning.

The following is a detailed implementation schedule for all phases of the project.

Table 7.2: Project Implementation Schedule



7.2 Strategy Monitoring & Review

This proposed Strategy for managing solid wastes in Sint Maarten represents only the initial stage in what is ultimately a long-term process (20 – 21 years). Needs and circumstances relating to wastes management can and almost certainly will change. It is therefore vital that the Strategy is continually monitored and periodically reviewed and updated to ensure that its objectives, actions for delivering change and underlying assumptions are still valid / appropriate, and that the timescales for achieving compliance with both European standards, and national legislation and targets, are still realistic.

7.2.1 Strategy Monitoring

In the context of Strategy implementation, the requirements for monitoring will arise in three main ways:

1. **Policy implementation**

   The extent to which the various non-technical measures and policies set out in the Strategy are implemented in practice and / or included in other policy documents at national;

2. **Development of waste management capacities**

   The extent to which the capacities of infrastructure and systems for the physical management of wastes needed to meet the objectives of the Strategy develop as planned;

3. **Results**

   The results achieved in terms of the attainment of the qualitative objectives and quantitative targets in the Strategy.

Special attention should be given to monitoring progress in:

- Limiting growth in waste generation, particularly from institutional, commercial and industrial establishments which have many opportunities to reduce waste;
- Reducing environmental hazards and risks associated with waste management activities, particularly in the storage, collection, and disposal activities of the waste cycle;
- Increasing the levels of waste recovery and recycling, particularly in the large urban areas and cities where there is access to market development for the recycled and recovered materials developed;
- Developing and operating new waste management systems and facilities that increase waste collection containment and efficiency and minimize adverse disposal environmental consequences.

Various quantitative indicators will need to be used to measure and monitor progress with Strategy implementation. These should include:

- Waste production, overall and by waste type;
- Recovery and recycling rates, overall and by waste type;
- Recycling rates, by material;

- Quantities of specific hazardous wastes produced;
- Quantities of waste transferred to ISWMF;
- Quantities and types of waste landfilled.

7.3 Strategy Review and Updating

With regard to Strategy review and updating, we propose that summary reports on the progress achieved in implementing the proposed Strategy should be prepared and published by the Government at 6-monthly intervals. The Strategy itself should be reviewed and updated biennially until 2030 in the short and mid plan periods, and thereafter quinquennially (5-year intervals) in the long term plan period.

7.4 Responsibilities for Strategy Implementation

A number of Government Departments and Agencies will be responsible and play active roles to implement and monitor the strategy performance, track and overview the initial results in order to ensure the strategy is underway in accordance with the defined targets and objectives.

The following Government departments and Agencies will directly be responsible to implement this strategy:

1. Ministry of Public Housing, Spatial Development, Environment & Infrastructure (VROMI);
2. Ministry of Public Health;
3. NRPB, and
4. ISWMA to be established.

Apart from the above Government departments and agencies, the following Government departments and agencies will be responsible in parallel to implement and achieve the objectives of this strategy.

1. Ministry of Tourism, Economic Affairs, Transport and Telecommunications;
2. Ministry of Education, Culture, Youth and Sports;
3. Ministry of Finance;
4. NGOs and CBOs

CH – 8
RISK ASSESSMENT

Overview

With any solid waste improvement plan, there are a number of potential risks that could slow or curtail the planned improvements. Some are minor risks potential and others are major. Based on the experience of many development projects by national governments and development agencies to implement solid waste improvements, the risks have occurred. Assessment of the risks is general, as it is impossible to know whether some or all of the following risks will occur.

8.1 Potential Risks that Can Arise

For purposes of risk minimization, the potential risks are listed below and discussed in the risk assessment matrix that follows.

A. Policy Level Risks

1. The Government doesn't maintain political commitment to the plan and its schedule is not maintained.
2. The Government doesn't pass all the laws and regulations for safe disposal by sanitary landfill and any recycling/resource recovery systems included as part of disposal plans.
3. The Government doesn't create capacity to monitor and enforce laws and regulations for safe disposal systems being implemented.
4. Economic instruments and private sector involvement enabling frameworks are not implemented adequately to stimulate private sector investment, market development, and competitive forces.

B. Global Level Risks

1. Global economic and market conditions adversely affect the Government's financial capacity, and financial capacity of Private Contractors that involve in solid waste management in the country.
2. Global and Regional disasters adversely affect the Government's financial capacity, and financial capacity of Private Contractors that involve in solid waste management in the country.
3. Global economic conditions adversely affect local market demand for recyclables and recovered resources.
4. Global and Regional disasters adversely affect the system capacity and local/regional market demand.

C. National Level Risks

1. The Government doesn't provide adequate funding of the plan and all required operations.
2. Local market demand for recyclables and recovered resources does not materialize as planned.
5. Costs are underestimated and thus the infrastructure and services cost more than expected, resulting in inadequate funding being programmed.
6. Cost recovery from user charges and gate fees does not materialize as planned.

D. Regional Level Risks

1. The Government doesn't comply with the formation of solid waste sector that aggregates waste quantities into amounts that achieve economies-of-scale, and therefore, supply to regional market remains over or beyond the regional market demand.

2. Supply schemes of solid waste sector to regional market is not overviewed and monitored every year, in order to be flexible for regional market demand, and therefore, waste distribution and local conditions don't enable achieving economies-of-scale in the proposed solid waste disposal facilities.

E. Local Level Risks

1. Local Government doesn't comply with requirements for safe disposal by sanitary landfill.
2. Waste Generators don't cooperate with collection system requirements of separation, storage, and container placement.

F. Social Risks

1. Public doesn't accept the process and conclusions of sanitary landfill siting activities.
2. Social inclusion issues are not adequately addressed leading to disruption and loss of livelihood for those low income people involved in waste picking and recycling.

8.2 Risk Assessment

Table 8.1: Risk Assessment of the Recommended Arrangements in the National Solid Waste Strategy

Risk that can be arisen		Assessment of the Risk	Magnitude of the Risk	Measures that should be taken during Implementation
A. POLICY LEVEL RISKS				
1	**The Government doesn't maintain political commitment to the plan and its schedule is not maintained.**	In all countries, there is potential that over the next 20 years of implementation there will be changes in economic and political conditions that could affect commitment to the plan. Sint Maarten is a comparatively stable political setting and the risk is thus minimal when compared to other countries. Also, the funding organization intends to provide financial support through a program of projects. However, international agencies have been experience cutbacks in the recent past. Perhaps the nature of the funding and the extent of buy-in from potential Trust Fund (Government of Netherlands), would influence long-term commitment. At this point, it is difficult to assess the risk potential, but it believed by the consultants to be minor.	Minor	• Maintaining timely political commitment to the nationl SWM strategic plan
2	**The Government doesn't pass all the laws and regulations for safe disposal by sanitary landfill and any recycling/resource recovery systems included as part of disposal plans.**	The Government needs clear legal/regulatory requirements coupled with specific schedules that will motivate to implement improved disposal/recycling/resource recovery changes. Ideally, this would be accompanied with articulated sanctions for non-compliance. The risk is perceived to be major as the specific schedules can be done in accordance with the clear regulations, and absense of them will cause chaos on defining the roles and responsibilities in local level	Major	• Clear regulations by Government for Implementing improved disposal/ recycling/ resource rocovery changes
3	**The Government doesn't create capacity to monitor and enforce laws and regulations for safe disposal systems being implemented.**	To implement the plan, new institutions are needed, as discussed in detail in Chapters and Annex 4 of this strategy paper. They would need to have offices with equipment and also professionally qualified staff. This will take time and effort. Capacity is an issue that already exists, and this is a significant risk for Sint Maarten. Qualified advisors from outside Sint Maarten need to be included to help build the capacity locally, and their activities would likely be needed for at least several years	Major	• Institutional reform • Regulatory reform • Estalishing National ISWMA Regulatory Authority to ovesight, policy and monitoring the SWM activties in the country
4	**Economic instruments and private sector involvement enabling frameworks are not implemented adequately to stimulate private sector investment, market development, and competitive forces.**	Enabling Framework Arrangements are expected to create the stimulus for desirable recycling and resource recovery activities without government needing to make those activities part of an investment program. If the desired economic instruments and private sector involvement enabling frameworks are not implemented, the resulting technical program will have a reduced positive impact.	Major	• Create economic instruments for cost recovery of the operations • Enable the private sector involvement in regional operations • Create incentives for desirable recycling and resource recovery activities without government involvement

Risk that can be arisen		Assessment of the Risk	Magnitude of the Risk	Measures that should be taken during Implementation
B. GLOBAL LEVEL RISKS				
1	Global economic and market conditions adversely affect the Government's financial capacity, and financial capacity of Private Contractors that involve in solid waste management in the country.	Sint Maarten's economy is totally dependent on tourism and related industries. However, tourism industry can easly affect from the global economic downturns, and along with decreased volume of waste generated in the country, the Government financial capacity can adversely be affected, which in turn can create a shortage in Government budget on SWM sector supports from the central government budget. Given the continued economic downturn globally, the risk is considered moderate.	Moderate	• Divesifying the economy to reduce economic risks. • Diversifying recycling a market and waste recovery options with necessary resiliency.
2	Global and Regional disasters adversely affect the Government's financial capacity, and financial capacity of Private Contractors that involve in solid waste management in the country.	As the counrty is located in a disaster risk zone which affects oftenly by hurricanes, stropical storms, and also global disaster like COVID – 19, the financial capacity of Government and Private contractors that involve in solid waste management activities in the country, can easily be affected, and significant financial capacity shortages can be experienced. The risk can be catgorized as major/moderate because creating a resiliency on local market demand is a long process.	Major/Moderate	• Emenrgency Preparedness Plans and programmes of the country should take into account not only arrangements of the rescue and take emergency measures right after the disasters, but should arrange the long term measures, if disaster occur.
3	Global economic conditions adversely affect local and regional market demand for recyclables and recovered resources.	For countries dependent on external markets for recyclables and recovered resources, the global and regional market demand is crucially important. Economic downturns in global and regional can create adverse effect on market demand for recovered resources. Mostly, virgin material prices decreas during the global economic downturns, and this decrease the demand to recovered resources. The risk is categoried as major/moderate for Sint Maarten, as the country has no industrial base robust enaough to support the circular economy in the country.	Major/Moderate	• Create an internal market demand with the appropriate incentives for "Green Economy" to avoid the risks of global market fluctuations. • Create policies for "Green Economy" market development. • Support the private sector investments for processing recyclables, and compost use locally, even if the local demand is small.
4	Global and Regional disasters adversely affect the system capacity and local/regional market demand.	As mentioned in risk group 2, the country is in the diaster risk zone for natural events of hurricanes and tropical storms as the hurricanes and tropical storms are regional events. This would create a major/moderate effect on solid waste generation capacity of the system, as increased capacity by Irma hurricane, and decreased capacity during COVID-19 occured.	Major/Moderate	• Create more resilient waste collection and treatment schedules, and facility capacities with primary and secondary lines of processing and treatment of waste. • Create a New Landfill space for both use of a Saniraty landfill during normal condition and a spare space for handling of waste increased in hazard condition.

Risk that can be arisen		Assessment of the Risk	Magnitude of the Risk	Measures that should be taken during Implementation
				• Take into account the disaster debris capacity during planning the separate C&D waste facility, in order to provide additional resilient to the solid waste management system.
C. NATIONAL LEVEL RISKS				
1	**Government doesn't provide adequate funding of the plan and all required operations.**	Related to the continued economic downturn and the reduced revenues being experienced by tourism relied income producing countries, government revenues are expected to be modest. The future economy is difficult to assess, but the current global situation suggests being cautious in forecasting future revenues. Thus, the risk of funding being limited is considered moderate.	Moderate	• Provide adequate funding for strategic Plan and all required operations
2	**Local market demand for recyclables and recovered resources does not materialize as planned.**	Local market demand has to be developed. It doesn't develop on its own. In part, it is dependent on global conditions. But, local stimulants are the foundation for local market demand. Most importantly, government would rewrite all of its routine procurements to include recycled content. Also, government would require all large businesses to develop plans for how they also would stimulate market demand for recyclables and recovered resources. Government would create special pricing structures for renewable energy derived from waste, including biofuels and synfuels, as well as waste-to-energy and refuse-derived solid fuels; coupled with financial incentives for investments made to enable use of waste-based renewable energy or fuel. Without market demand development, any government or private sector investment in recycling or resource recovery could fail due to lack of revenues.	Major	• Stimulate local market demand for recyclables and recovered resources, including use of converted cooking oil as bio-fuel, use of compost for garden soil amendment, on-site conversion of food wastes to compost, and charcoal briquette production locally, and so on. • Re-write the procurement policies for including the recycled content materials such as the % of recycled paper within office paper, or the % of recycled asphalt milling in the road bed material, or the use of rechargeable batteries in government offices, or the use of refillable printer cartridges, etc. • Create incentives and disincentives on imported packagingmaterials, especially for biodegradable plastics containers and bags. • Create special pricing structures for renewable energy derived from waste, Create financial incentives for investments made to enable use of waste-based renewable energy or fuel.
3	**Costs are underestimated and thus the infrastructure and services cost more**	There is a general tendency in most countries on the part of consultants, government, and funding agencies to underestimate project costs. This would be a major mistake to make, as inadequate	Minor	• Review and support for competent adequate costing

Risk that can be arisen		Assessment of the Risk	Magnitude of the Risk	Measures that should be taken during Implementation
	than expected, resulting in inadequate funding being programmed.	funding can lead to project elements being canceled or delayed. As the consultants expected to conduct the feasibility studies for investment planning, this risk needs to be minimized and client review and support for competent adequate costing is needed. Recognizing this risk now, is a step in the direction of minimizing the risk.		
4	**Cost recovery from user charges and gate fees does not materialize as planned.**	Currently, the small city setting of Sint Maarten which relied on tourism economy is not strong economically when compared to the large city settings. Ability to pay to fully cover costs is not likely in the near term. Government grants and development project financing should cover a portion of capital investment, but costs will nevertheless significantly increase over current levels. Transfer, disposal, recycling, and resource recovery have major public good characteristics and major externalities. To minimize risk, it would be useful to determine public and government views on the willingness and ability to pay of residents, institutions, commercial establishments and industries, so that a potential tariff structure and schedule of tariff changes could begin to be developed, so that risks would be minimized.	Moderate	• Government grants and development project financing should cover a portion or full of capital investment – at least costs of the Phase 1 of the investments. • Appropriate user charges should be developed gradually, and consistent with the user ability to pay. • Mode of charge collection should be developed such as the electricity bil and electricty consumption for the households, bu not commercial and industrial establishments, assuming government agreement.
D. REGIONAL LEVEL RISKS				
1	The Government doesn't comply with the formation of solid waste sector that aggregates waste quantities into amounts that achieve economies-of-scale, and therefore, supply to regional market remains over or beyond the regional market demand.	If the Government is reluctant to implement the activities and policy arrangements for formation of solid waste sector linked to regional wste market, economies-of-scale could not be provided as the planned capacity of the system could not be achieved. The pros and cons, including the cost differences, between the self-implemented solutions versus regional solutions need to be convincingly clear and detailed to secure their cooperation This would create a major risk.	Major	• Local governments should comply with the formation of solid waste sector already linked to regional waste market. • Regional solutions need to be convincingly clear and detailed to secure the local and regional recyclers and governments cooperation.
2	Supply schemes of solid waste sector to regional market is not overviewed and monitored every six month, in order to be flexible for regional market demand, and therefore, waste	Beased on strong dependency of solid waste management of the country to regional waste market demand, if overviewing and monitoring of regional market demand is not be conducted, flexibility is not provided on waste distribution between the system facilities, and thus, economies of scale in the proposed solid waste disposal/treatment facilities could not be provided. Based on global experience with the economies-of-scale for sanitary landfill, 300 tons per day are proposed. However, land scarcity and	Moderate	• Review routinely the regional waste market demand, and fluctuations on it. • Review the conditions and operation costs routinely in those areas during implementation, and update the technical divisions as required in the next phase of the project.

Risk that can be arisen		Assessment of the Risk	Magnitude of the Risk	Measures that should be taken during Implementation
	distribution and local conditions don't enable achieving economies-of-scale in the proposed solid waste disposal facilities.	limited waste generation capcity in the country, and fluctuation margin is very high according to disaster risk potential of the country, may make it very hard to to aggregate the desirable minimum waste quantities in the near term. In the study, it appeared that there were areas that could not achieve economies-of-scale. As a result, the risk in the near term is considered more than minor.		
E. LOCAL LEVEL RISKS				
1	**The Government doesn't comply with requirements for safe disposal by sanitary landfill.**	If the Government not readily cooperative with the plan, this could be a major risk.	Major/Moderate	• Early consultation and development of agreements in writing with the Government to comply with the requirements for safe disposal by sanitary landfill, coupled with a program of incentives, including incentive grants.
2	**Waste Generators don't cooperate with collection system requirements of separation, storage, and container placement.**	Ideally waste is put out for only a short time and collected soon after being put out for collection. This enables the street to look clean the majority of the time. To maintain the appearance and actuality of cleanliness requires public cooperation. This risk is perceived to be minor for Sint Maarten, but nevertheless warrants attention to public education and enforcement. It also requires that the services be provide as scheduled in a reliable and courteous manner.	Minor	• Scheduleing of the collection services in a reliable and couteous manner. • Public education. • Enforcement for collection system requirements.
F. SOCIAL RISKS				
1	**Public doesn't accept the process and conclusions of sanitary landfill siting activities.**	When the public does not accept the process of determining the site as being fair, equitable, transparent, and participatory, there could be major problems of public opposition. In some countries, this involves the public blocking the roadways of the waste transport vehicles, and in others involves legal action that significantly delays project implementation. The recommended public consultation process designed to avoid this risk involves early consultation about the process itself and the site exclusionary criteria. After areas are excluded, the process then involves agreement on actual siting criteria and finally the pros and cons of alternative sites. There will always be some, in the immediate area of preferred sites, who will oppose the siting. But, if the process is done well, this group of opposing people will not be the majority, allowing siting to be completed successfully.	Major	• Early consultation with the neighbor communities on the siting process itself and eclusionary criteria. • Consultation process should be completely open, transparent and inclusive. • Provide and program special benefits for the host community, including jobs, revenues, etc.
2			Major	

Risk that can be arisen		Assessment of the Risk	Magnitude of the Risk	Measures that should be taken during Implementation
	Social inclusion issues are not adequately addressed leading to disruption and loss of livelihood for those low income people involved in waste picking and recycling.	Informal sector waste pickers and door-to-door recyclers are involved full stream of informal buying, processing, and selling. Many of these people are poor. Relocation and full-time employment is often not an option for them. There are ways to enable inclusion of the informal sector, and they are viewed as one of the key stakeholders. They could, for example, be given a role in the pre-processing at each landfill, with support to organize and work as subcontractors to the landfill operators. Lack of social inclusion could lead to major adverse impacts to these people and to their families. To address and mitigate the impact potential, social surveys of these communities would be needed and plans developed through a consultative process with them as stakeholders.		• Adequate social surveys should be conducted for informal waste pickers and door-to-door recyclers. • Special care should be taken for income rehabilitation of the informal waste pickers and door-to-door recyclers in accordance with the relevant government policy and WB Involuntary operational policy, providing full-time employemnt in the future regional sanitary landfills and transfer stations.