Panama City, Panama

City Waste Management Profile

URBAN OCEAN

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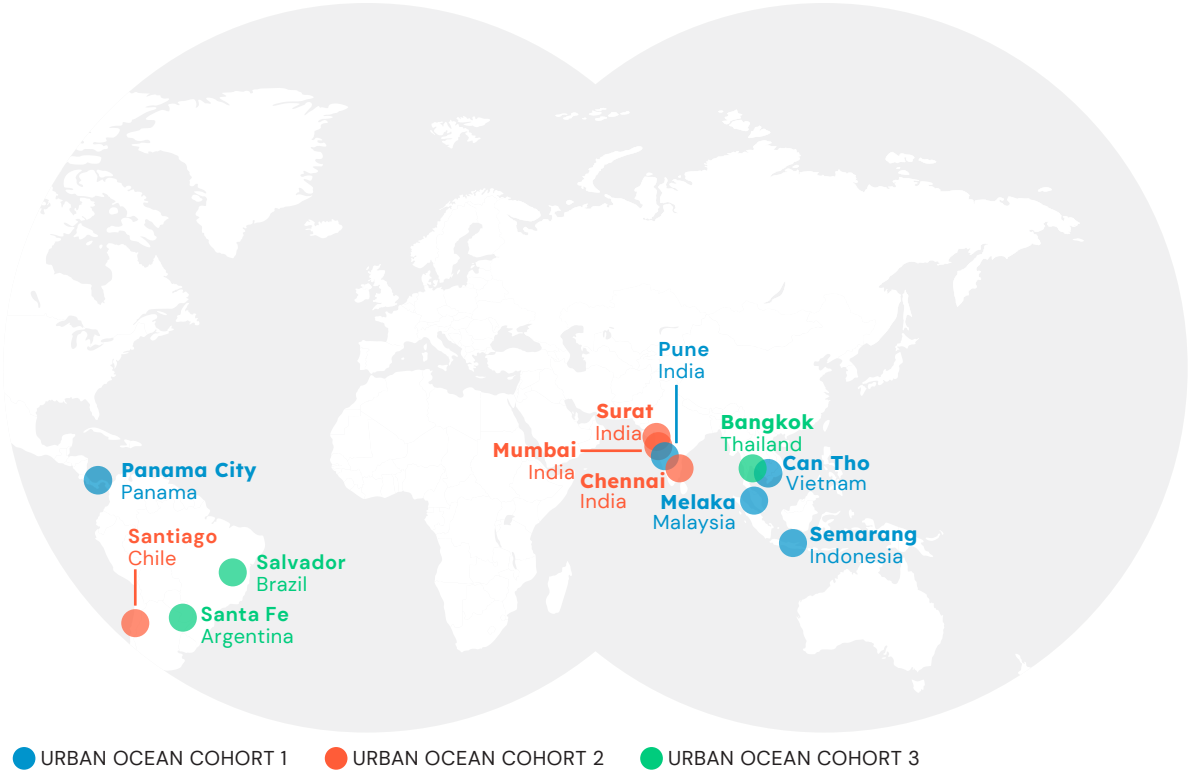
1. Introduction to Urban Ocean

Urban Ocean is a capacity-building and accelerator program for cities that champions circular economy principles, builds awareness of ocean plastic pollution, and assesses waste management systems. The program leverages city leaders to bring new ideas, partners, and resources together and solve interrelated resilience challenges related to waste management, plastic leakage, and protecting water bodies and the ocean. The program demonstrates how actions to improve waste management and recycling can provide resilient and sustainable solutions that reduce ocean plastic pollution while addressing key city priorities such as improving public health, supporting economic development, and reducing greenhouse gas emissions. Furthermore, Urban Ocean provides cities with the opportunity to demonstrate thematic leadership and share knowledge and experience across the Resilient Cities Network (R-Cities) community and beyond. The program is jointly led by R-Cities, Ocean Conservancy (OC), and The Circulate Initiative (TCI).

Figure 1
Urban Ocean cities map



Overview of the Urban Ocean Challenge

Cities are home to over half of the global population and account for nearly three-quarters of global greenhouse gas (GHG) emissions (IPCC, 2021). No climate nor social target will be met without a deep transformation of urban centers towards a more inclusive, sustainable, and resilient path. Approaching urban waste management systems through a resilience lens reveals complex, interrelated ramifications for social, economic, and environmental indicators. In 2018, the International Labor Organization (ILO) estimated that the waste management sector alone has the potential to create 45 million jobs globally by 2030 while reducing GHG emissions by 15 to 20%. Additionally, circular economies offer a US$ 4.5 trillion economic opportunity by reducing waste, stimulating innovation, and creating employment by 2030 (WRI, 2021). Currently, plastic usage is growing and continues to be a threat to public and environmental health in the ocean and in cities. A huge opportunity exists for city governments to implement policies and projects that promote a more resilient and circular waste sector in their cities. Now is the time to set out on the path towards a more resilient urban–ocean relationship that highlights the importance of preventing marine plastic debris.

Program objective

The Urban Ocean program aims to collaborate with urban leaders to gather new ideas, partners, and resources to address interconnected challenges related to resilience in waste management, reduce plastic leakage and protect water bodies and the ocean. Urban Ocean provides a platform for ocean advocates and urban leaders to join forces in developing comprehensive solutions that meet the needs and priorities of governments, cities, communities, and other stakeholders to create real and lasting impacts.

Cohorts 1 and 2

Urban Ocean works closely with cities to demonstrate tangible solutions and highlight progress in addressing waste management challenges. The first cohort of Urban Ocean cities included Pune (India), Can Tho (Vietnam), Panama City (Panama), Semarang (Indonesia) and Melaka (Malaysia).

The work further expanded to four additional cities in Cohort 2 – Chennai, Surat and Mumbai (all India) and Santiago (Chile) – to expand the geographic scope of the program, expand the waste management, circular economy and resilience ecosystem, increase collaboration with local governments and establish effective waste management systems that generate environmental, social and economic co-benefits to cities.

Methodology

This report provides a summary of the information collected for the purpose of developing a resilience-oriented analysis of the urban waste management system in Panama City. The profile was created in collaboration with the Resilience Office and the Environmental Office of the Municipality of Panama, R-Cities, Ocean Conservancy and The Circulate Initiative. The analysis involved desk research, interviews and collaborative workshops with city stakeholders.

2. About the City Waste Management Profile

As part of Urban Ocean, cities create a City Waste Management Profile, in which a city's waste management systems are presented, including technical and sustainability aspects, and formal and informal actors in the system. The City Waste Management Profile ("the Profile") examines major disturbances and stresses prevalent in the city that impact the city's waste management system. It brings together preexisting data in addition to information collected in the initial phases of the program, to allow the city to assess the risks and vulnerabilities of the system, as well as support project design.

The Profile seeks to provide insight for the city to better plan and identify appropriate solutions to increase the resilience of their waste management system, reduce plastic leakage into the environment, and improve the city's ability to respond to, adapt to, or otherwise address current and future shocks and stresses. It summarizes the baseline assessment conducted in all cities in the Urban Ocean program and highlights the most relevant data and information to address urban resilience, ocean conservation, and plastic pollution.

The Profile encourages a more holistic approach to existing challenges and supports cities in the development of individual solutions suited to their specific history, economy, demographics and culture while being aligned with the city's unique institutional, environmental, and financial resources. An added benefit of being part of Urban Ocean is how cities can learn from each other by comparing common elements in their respective Profile.

3. Overview of Panama City and its Resilience Journey

Panama sits at the juncture of the North and South American continents, offering the narrowest land barrier between the Atlantic and Pacific oceans. Panama City is the capital and most populous city in Panama. The city has long been a strategic route for maritime trade and trans-isthmic transit. It is the seat of international transactions for business, banking and tourism, the trade of various goods, as well as having played a major role in the route of spices, silver, silk, porcelain and gold.

The city is located at the Pacific end of the Panama Canal, which began operations in 1914. The Panama Canal is one of the largest infrastructure projects in history and one of the most important commercial assets in the world. The construction of the canal involved a huge infrastructure investment and brought with it several environmental, social, and economic consequences for the city. The growth of Panama City is partly a result of its relationship with and changes occurring in its water ecosystems. [1]

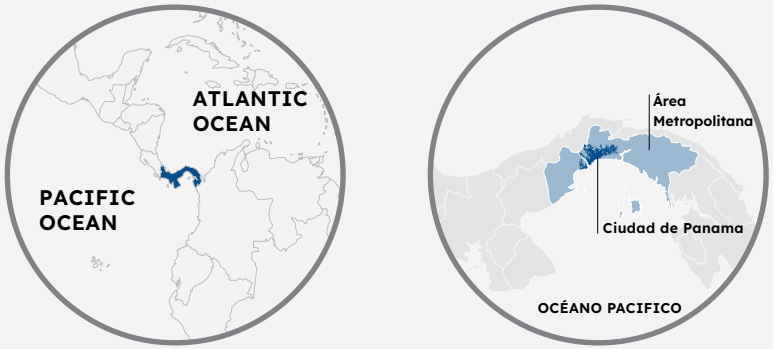


Figure 2
Socio-demographic indicators

1.1 million
Population

540 per km2
Population density

59–73 million
The annual budget of AAUD (National Urban and Household Waste Management Authority – Autoridad de Aseo Urbano y Domiciliario)

191 km²
Area

38%
Population in informal housing

1 National budget for AAUD. However, Panama City represents 25% of the country's population and 40% of AAUD own resources (municipal collection tax).

City's connection with the water bodies

The Panama Canal was built at the narrowest part of the isthmus of Panama and began operations in 1914. Leveraging the course of Chagres River, the Canal accounts for 4% of Panama's national territory. Before the construction of the Canal, the Chagres River drained only towards the Atlantic Ocean. To create access for ships and vessels towards the Pacific Ocean, the construction of the Canal involved detonating a nearby mountain chain. This process contracted the floodplain of the Chagres River, both in distance and depth, confining the river to the area near Lake Alhajuela.

The Alhajuela is an artificial lake used to regulate the flow volume of river Chagres for its regulation and later use. The lake is key for transporting vessels from the Atlantic to the Pacific and provides potable water for at least two million inhabitants - half the population of the country.

Panama's water resources are closely related to the Canal's protected areas and basins, including the basins of River Abajo, River Matasnillo, River Juan Diaz, River Matias Hernandez, River Curundu, River Tocumen, River Tapia, River Pacora, among others. These basins intertwine with a mountain range along a strip of the northern coastline containing a humid rainforest with rich biodiversity. Protected national parks form an integral part of this area, including the Metropolitan Natural Park, Soberania National Park, Camino de Cruces National Park, and Ancon Hill.

The growth of Panama's urban footprint has been partly shaped by the changes in water ecosystems. The areas closer to the coastline have been subject to urban development built on flood zones with wetland plains, a network of tributaries, and areas near hydrographic basins.

Key shocks and stresses impacting the city's waste management systems

Panama City comprises an urban zone which, by necessity, interacts with the delicate ecosystems of the surrounding rainforest and protected national parks. High waste generation and inadequate waste management have resulted in aggravated pollution, increased flooding, and poor public health outcomes. With climate change increasing the probability of natural hazards, floods are becoming even more recurrent. In this context, informal settlements and communities located in areas vulnerable to climate change are the most negatively impacted. Income inequality, high poverty levels, academic underachievement, gender inequality, racial discrimination and informal employment were some of the socio-economic challenges highlighted by the city's resilience strategy. The Panama resilience strategy identified the following key shocks and stresses in the city:

Figure 3
Key shocks and stresses in the city

Building resilience through waste management

As part of its aspirations to become a more sustainable and resilient global city, Panama City has developed a Resilience Strategy. The strategy is a result of almost two years of consistent, dedicated and collaborative efforts by local government leaders, city departments, non-government organizations, experts from institutes and universities in the city, local enterprises, and, crucially, local communities. Using a resilience lens, the strategy clearly identified the core challenges in health and wellbeing, economy and society, infrastructure and environment, and governance. The strategy also identified the immediate and long-term actions the city must take to meet these challenges.

The economic growth of Panama over the years has led to a bustling construction industry, which contributed to a high concentration of buildings on the coastline strip without any institutional coordination and with little intervention from local governments. Informal housing has poor drainage systems and unreliable water supply.

The per capita waste generation rate for the country of Panama is estimated to be around 1.2 kg/day.[2] Panama City has nine rivers that run through it to feed into the Pacific Ocean through the Panama Canal. This makes it a critical city to Panama not only from an economic perspective, but also from an environmental perspective. With a growing urban population, the city has faced challenges related to waste management in recent years and there is a need to upgrade processes and infrastructure

2 Holland Circular Hotspot 2021 - https://hollandcircularhotspot.nl/wpcontent/uploads/2021/04/Report_ Waste_Management_Panama_20210322.pdf

to handle a growing population, residents' needs, and the associated increasing amount of household waste. Panama City is also in a relatively unique position in that the municipal solid waste management system is largely controlled at the national level.[3]

Poor disposal of solid waste has been identified as one of the stresses in the city, compromising public health, blocking drainage pipes and increasing the incidence of floods. Improper disposal of waste means that heavy rain and flooding can lead to large concentrations of suspended solid waste materials, affecting the provision and quality of the potable water supply. Water courses Contamination of water sources and concentration of solid waste material increase the risk of infectious diseases such as dengue and malaria.

Panama City joined the Urban Ocean program in March 2020 to advance solutions in river waste management while prioritizing and potentiating tourism and economic activity, ultimately seeking to address the interrelated resilience challenges caused by inadequate waste management.

The Urban Ocean program in Panama City aims to define opportunity areas in the city, devise waste management solutions based on rigorous research and stakeholder engagement and conceptualize pilot projects for implementation. The program was jointly led by the Resilience Office and the Environmental Office within the Municipality of Panama, together with the Urban Ocean partners – Resilient Cities Network, Ocean Conservancy and The Circulate Initiative. For the Urban Ocean Gap Assessment, the Circularity Assessment Protocol, a baseline assessment of waste and circularity within the city conducted as part of the Urban Ocean program, was deployed. The local team also collaborated with other relevant partners on the implementation of specific projects ideas.

To maximize resilience co-benefits and to positively impact the wider social, economic and environmental context, waste management must be tackled in an integrated manner. An integrative approach will include reducing waste, managing the exiting waste efficiently to reduce waste leakage in water bodies, promoting sustainable innovations and impacting livelihoods. Actions towards improved waste management and recycling can provide resilient and sustainable solutions that reduce waste pollution and address key stresses in the city, such as improving public health, supporting unemployment and economic development, and reducing environmental degradation.

The Panama City Urban Ocean initiative is changing the relationship between the city and the waste it produces. In line with the Panama City 2037 vision in the Municipal Plan for Integrated Management of Waste in Panama City, and the resilience strategy of Panama City, the program aims to expand and consolidate the municipal role in recycling and recovering materials to reduce waste leakage into waterbodies, while generating social and economic benefits through the strengthening the recycling industry.

TIMELINE

2016–17

Resilience strategy

Panama City identified waste management as a key challenge

2020

Launch of Urban Ocean (Launch of program and Preparation forum)

Panama City joined the Urban Ocean program to address the interrelated resilience challenges related to waste

2020–21

Gap Assessment (Circularity Assessment Protocol -CAP, City Waste Management Profile, Opportunity Assessment Tool - OAT)

The city undertook assessment of risks and vulnerabilities within the waste management systems that lead to plastic leaking into the municipal environment and beyond, identification of opportunities by rethinking waste management through circular economy and resilience principles

2021-22

Design Proposal

Project Statements and Accelerator summit

The city developed specific actions to advance solutions to address plastic waste challenges

3 Circularity Informatics Lab, June 2021. Circularity Assessment: Panama City, Panama. University of Georgia, Athens, GA, USA - https://resilientcitiesnetwork.org/wp-content/uploads/2022/10/Panama-City-Report-2021-08-31-reduced.pdf

4. Legal, Policy and Governance

National, local regulations and strategies for waste management

Panama has a National Integrated Waste Management Plan for 2017–2027. The general objective of this plan, in accordance with the provisions of Executive Decree No. 34/2007 establishing the national policy on hazardous and non-hazardous solid waste management, is the integrated management of waste generated in the Republic of Panama in an environmentally sound and sustainable manner that ensures the conservation of the environment and eliminates negative effects on the health of the population.

The country also has an Action Plan for Marine Debris 2021–2026 which aims to put an end to sources and causes of marine debris.

At the national level, the following laws are in place to address waste management:

- → Law No. 1 of January 19, 2018, adopts measures to promote the use of reusable bags in commercial establishments.
- → Law No. 33 of May 30, 2018, establishes the Zero Waste Policy and its framework of action for integrated waste management.

At the local level, the city has the 'Municipal Plan for Integrated Waste Management for 2017–2023'. The objective of this plan is to achieve 100% municipal waste recovery and management by 2037, guaranteeing that all municipal waste is pre-treated before entering the landfill. Moreover, the city aims to decrease the production of waste by 20% by 2037. One of the main goals defined by the plan is to win approval for national and municipal legislation that allows for increasing implementation of Extended Producers Responsibility (EPR) policies.

The Municipality of the District of Panama has a Municipal Solid Waste Master Plan, 2016. This plan has defined the 20-year vision for waste management in line with the waste recycling and recovery objectives set forth in the Zero Waste Program.

At the local level, the following regulations are in place for waste management:

- → Municipal Agreement No. 124 September 2015 – establishes the Municipal Policy on Integrated Solid Waste Management and the Zero Waste Program 2015–2035
- → Municipal Agreement No. 231 September 25, 2018 – establishes the reduction of plastics both in facilities and activities developed by the Municipality of Panama

Existing projects for waste management

The existing programs and projects for waste management are focused on diverting waste from the landfills and promoting recycling.

- The Zero Waste Program focuses on promoting the implementation of the 3Rs (reduce, reuse, and recycle) in a prioritized order among the capital city's population. This public–private partnership has implemented actions aimed at reducing waste from the source (homes), promoting good practices such as recycling, and working with children, young people, adults, with an equitable lens.
- In coordination with members of civil society and private companies, cooperation agreements have been signed for the establishment of recycling stations and the continuous dissemination of good environmental practices and environmental education. This includes door-to-door visits in selected townships, among other initiatives.
- Plans are currently being made to divert more than two tons of vegetable waste per week from the San Felipe Neri Market and convert it into organic fertilizer. This fertilizer will be used on trees, palms, and shrubs that beautify the city, while also becoming a natural fertilizer for seedlings

germinated in the Summit Municipal Park nursery. In the future, there are plans to implement this project in other peripheral markets to take advantage of organic materials, reduce pollution, and use a circular economy model.

Governance structure

The following authorities are involved and impact the waste management systems in Panama City. Their roles and responsibilities are as below:

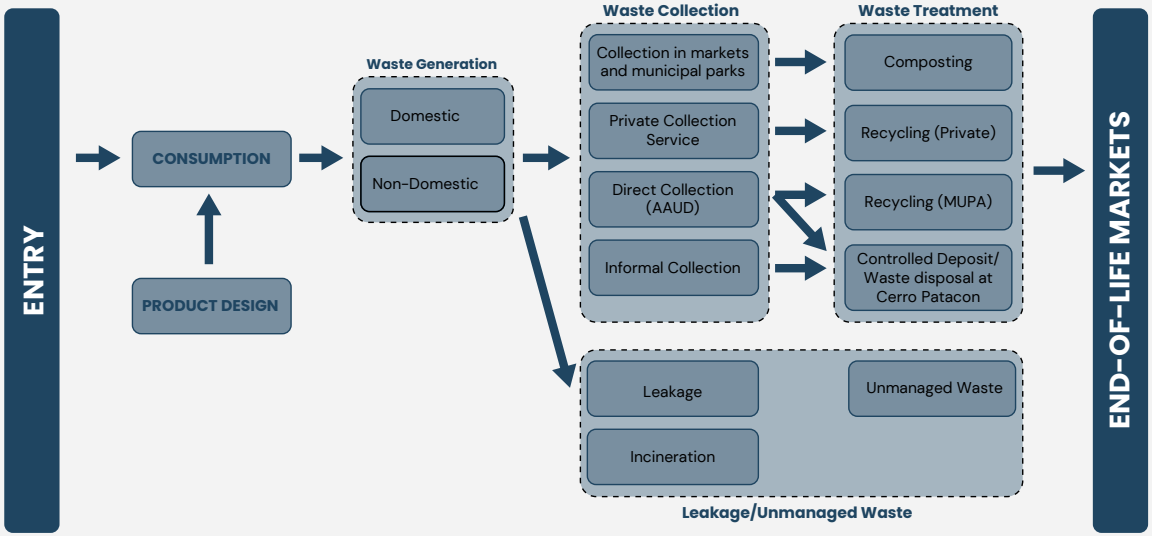
National Level	**Ministry of Environment** (Miambiente) – Miambiente oversees the formulation of environmental policy related to the protection, conservation, preservation, and restoration of the environment. It also promotes the sustainable and responsible use of natural resources through the promotion of best environmental practices and compliance and enforcement of laws. **Ministry of Health** (MINSA) – MINSA analyzes the health consequences of poor waste management, contributing to actions from a hygiene and sanitation perspective **National Urban and Household Waste Management Authority** – Autoridad de Aseo Urbano y Domiciliario (AAUD) – AAUD was established with national jurisdiction in 2010, dedicated to the provision of solid waste collection services. In Panama, waste collection and management are traditionally the responsibility of the municipalities. The District of Panama, where the national government has assumed responsibility for waste management through AAUD, is a notable exception. The institution oversees the administration, direction, planning, operation, use, investigation, inspection, and supervision of services related to commercial and domestic urban sanitation and sanitary landfills.
Local Level	**Municipality of the District of Panama** – As Panama City is comprised of two districts, Panama District and San Miguelito District, coordination and governance can be a challenge. For instance, the AAUD is not responsible for waste management in San Miguelito, as the district has its own governance structure for waste collection and treatment. Still, both districts use the Cerro Patacón landfill as their main disposal site. The Municipality of the District of Panama is directly responsible for the management of waste generated in the city's markets as well as in the more than 200 municipal parks in the Panama District. The municipality is also one of the main local implementation partners of the public–private partnership called "Zero Waste" which aims at implementing 3R actions in the city.

5. Waste Management in the City

Overview of Panama City's waste management system

Only 2% of the city's waste is separated for recycling, and most of the waste goes to Cerro Patacón, the only landfill in the city. There is a large amount of uncollected waste left on the streets as well as litter which ends up in water bodies and drains, which often leads to flooding during periods of heavy rain. Additionally, the landfill is approaching its capacity and has become a health and environmental hazard. In June 2021, a landslide occurred at the site, causing contamination of nearby water canals. The existing flood risk in areas located in the flood plains, due to unplanned urban growth and increasing rainfall due to climate change, is further exacerbated by the inadequate disposal of waste, clogging the drainage system. The following figure summarizes the city's existing waste management value chain:

Figure 4
The city's waste management value chain



Waste generation and characterization

In 2016, an estimated 1.2 kg of waste was generated per day, per capita in Panama. In the same year, a study estimated the municipal waste generation rate per capita in Panama District to be 1.37 kg/day.[4] Both numbers are higher than the regional average for Latin America and

4 Official data used by the Municipal Plan for Integrated Waste Management in Panama City

the Caribbean, estimated at 0.93 kg /day per capita for urban solid waste generation.[5] While these numbers indicate a major waste management challenge for Panama City, the full picture can only be captured by including the city's high vulnerability to a wide range of shocks and stresses that include extreme natural events, increasing waste generation and inadequate waste management on the city's economy, lack of reliable data, and others, in addition to the governance-related limitations. A 70% waste increase in the next 30 years is expected by the city, equivalent to three million tons of waste per year.

The key sources of waste in the city are as follows:

→ Households

→ Tourism

→ Sea waste

→ Commercial activities

→ Hospitals/medical centers

As per the CAP assessment, 15% and 23% of top convenience products sampled had parent companies and manufacturers located within Panama City. This includes 90% and 70% of top yogurt and popsicle product manufacturers and parent companies, respectively. As such, there is an opportunity for partnerships with local manufacturers and parent companies to explore Extended Producers Responsibility (EPR) for packaging design and waste management for problematic items to reduce waste leakage and litter in the city.

Waste collection and transportation

Around 60–65% of solid waste is collected and transported to Cerro Patacón, the only landfill in the city. The Municipality of the District of Panama is the only local authority in the country that is not in charge of the collection and treatment of waste; this responsibility falls under the National Urban and Household Waste Management Authority.

Agencies/Stakeholders: Collectively, AAUD and some private companies sub-contracted by AAUD provide collection and transportation service in Panama City. However, contracts are generally lax in terms of collection schedules, frequency, maintenance, among other considerations.

Cost of services: The main source of revenue to defray the costs of waste management is the municipal waste fee charged for waste collection and transportation. Nationally, the AAUD has an estimated annual budget of US$ 68 million in 2017, and in subsequent years has remained somewhat constant. It is estimated in the Municipal Plan for Waste Management of Panama City that the AAUD finances 62% of its total budget through its own resources generated by the institution's normal operations. The national government transfers around 21% as the national contribution for the payment of salaries and basic services. In addition to these sources of funding, the AAUD's capital spending accounts for the final 17% of the budget, another contribution of the central government through capital transfers.

Service provision to low-income households: People living in informal housing transport their bags of waste to the nearest access road with or without waste collection services. This produces piles of unwanted garbage along roads and bridges. When a community designates an area for waste disposal, informal businesses may also dump waste in those areas; these informal dumpsites may contain domestic waste, appliances, tires, bulky objects, and commercial waste. Due to a lack of waste management services, there are also reports of low-income areas of Panama City dumping waste into rivers. Panamanians state that a lack of collection containers and space for trash bags is a major issue.[6]

Some efforts are being undertaken in the city to deal with river waste. A non-profit organization, Marea Verde, established in 2017, installed trash traps in 2019 in the Matías Hernández River. As of December of that year, more than 10,000 garbage bags had been collected, equivalent to more than 70 tons of trash – the haul included refrigerators, trolleys and suitcases. Since then, the organization has been planning to deploy

5 IADB 2010 - https://publications.iadb.org/en/regional-evaluation-urban-solid-waste-management-latin-america-and-caribbean-2010-report

6 INECO 2017

more sophisticated trash trap technology in the Juan Díaz River that could potentially collect more waste.

The role of Municipality of the District of Panama circularity[7] and waste management is limited given the current governance structure, causing inadequate waste management in the city. This results in several interrelated challenges and limits the potential benefits to holistic resilience in the city.

Treatment and disposal

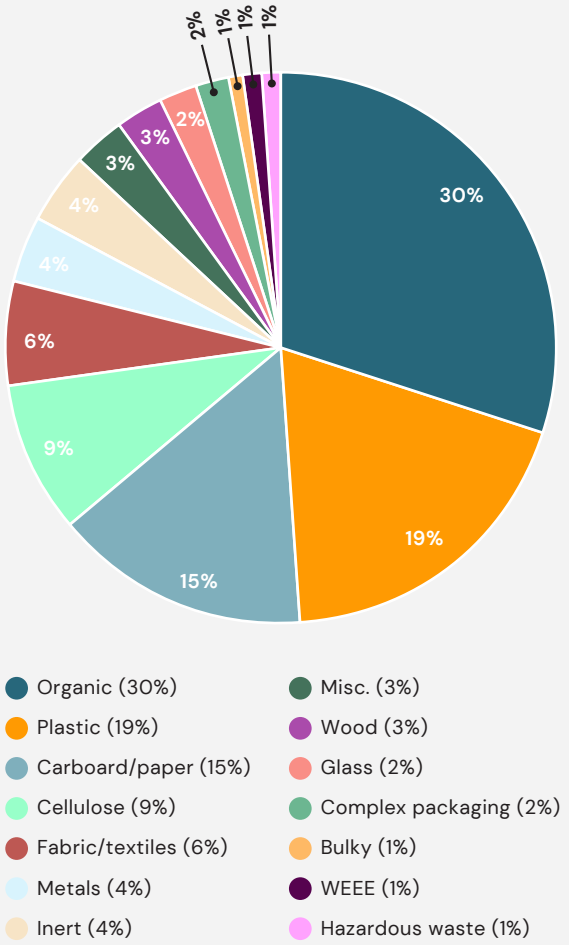
Existing treatment facilities/landfills

It is estimated that about 65% of municipal solid waste generated in the city goes to the landfill Cerro Patacón, the only landfill in the city, indicating a high incidence of waste mismanagement and leakage. Residents' general perception is that all their waste ends up in Cerro Patacón, which discourages them from improving their waste management practices, such as household segregation. Cerro Patacón has been considered an environmental and health hazard as it currently operates at nearly full capacity, without transparent nor sustainable operation monitoring practices.

Cerro Patacón processes approximately 2,300 tons of garbage per day (Hettiarachchi et al. 2018) and accepts municipal solid waste, sewage and industrial sludge, used tires, clinical waste, and construction and demolition waste.[8] Approximately 60% of waste received by the landfill is biodegradable.[9] The composition of waste received in the landfill is shown below.[10]

Since Cerro Patacón opened in 1986, waste disposal has increased by an average of 3.5% per year, largely due to high immigration rates and economic growth. Approximately 73,600 inhabitants in nearby areas are affected by low-concentration, long-term hazardous air pollutants (HAPs) generated at Cerro Patacón. Waste is not covered, leading to a high risk of open fires and pollutant leakage into water sources.[11] As recently as June 2021, heavy rains caused a landslide at Cerro Patacón in a section that had been closed for several years. This caused leachate from the landfill to overflow, inflicting damage on the leachate treatment and incineration plants, and contaminating the surrounding Guabinoso River.[12] Urgent action needs to be taken to address and mitigate the risks posed by the landfill and prevent future harm to the residents and the local environment.

Figure 5
Composition of waste received at the landfill



7 Circularity in waste management is defined as solutions which promote reduce-reuse-recycle principles, reduce waste going to landfills, incineration plants, or entering the natural environment (where no material recirculation can happen), and help cities advance circular economies.

8 Torrente-Velásquez et al. 2020

9 Torrente-Velásquez et al, 2019

10 Circularity Informatics Lab, June 2021. Circularity Assessment: Panama City, Panama. University of Georgia, Athens, GA, USA - https://resilientcitiesnetwork.org/wp-content/uploads/2022/10/Panama-City-Report-2021-08-31-reduced.pdf

11 Torrente-Velásquez et al, 2019

12 Forbes 2021

Recycling of waste

Waste collected in Panama City is not segregated at source, instead going in its entirety in plastic bags to the landfill. The recycling sector is largely informal, consisting of locals who collect and sort recyclables from the landfill to resell to private companies.[13] In CAP stakeholder interviews as well as external interviews that have been conducted in Panama City, waste collectors say that it is very difficult and unpleasant, and that they struggle to survive and make a sustainable income to support their families.[14] Recycling is limited to the most valuable materials, and plastic does not generate sufficient income for informal recyclers, nor are there deposit or return schemes readily available for plastic products. Apart from the recyclables that end up in Cerro Patacón, a significant amount of recyclable waste collected is exported to neighboring countries with stronger recycling industries. The city has a huge opportunity to address the infrastructure gap by investing in recycling, reuse, and treatment facilities for the city.

According to the Municipality of Panama, less than 5% of waste is recycled. Municipal analyses project an opportunity to recycle 70%, generating a US$ 47 million value to the economy.

13 INECO 2017

14 Agencia EFE 2018

6. Key Findings and Opportunities

	Key challenges	Potential opportunities
Urbanization and governance	→ The initial growth of Panama City was primarily due to immigrants seeking employment due to the Panama Canal construction. This infrastructure also had environmental, social, and economic impacts on the city. → Increased waste generation and inadequate waste management have resulted in pollution and flooding, impacting health and the city's environment. → The role of Municipality of the District of Panama in designing and implementing actions related to circularity and waste management has been limited by the current governance structure. There is no indication that the responsibility will be transferred to the municipality.	→ The city can explore multi-stakeholder collaborations to tackle increasing waste. It can set recycling priorities by collecting and sharing appropriate data on waste and incentivizing and supporting the recycling sector.
Resilience	→ Climate change has led to an increase in the incidence of certain natural hazards, with more frequent and severe floods. Informal settlements and communities located in environmentally vulnerable areas suffer the worst consequences. A significant percentage of waste is disposed of inadequately or dumped illegally, ultimately reaching rivers and the sea. → The tourism sector, which is important for the city's economy, suffers from inadequate disposal of waste, which makes the city less attractive for tourists.	→ Efforts to tackle river and coastal waste have been undertaken by public, private and not-for-profit organizations. The city can explore opportunities to scale these solutions and incentivize recycling to reduce waste that ends up in the landfill. → The city can explore opportunities through community engagement by focusing on clear messaging and incentives that reach a range of residents across different socioeconomic backgrounds. The CAP assessment indicates that there is willingness to practice source segregation, and there may be opportunities to promote it through public campaigns.
Existing waste Management systems	→ General household waste collection is largely handled by the local government, but the schedule can be irregular and confusing to some residents. → Collection of recyclable items is primarily done by the informal sector. The market is largest for metal items, while plastic items do not yield high returns. → According to the CAP findings, interviewees reported that age, income, and education, as well as ability and willingness to make changes, are drivers in the differing levels of awareness around plastic pollution. Many existing policies are not consistently enforced, and several interviewees do not seem to have faith in the power of policies to drive real change. → The local landfill raises a series of environmental and safety concerns and is reaching its capacity several years before it was originally due to close.	→ There is no waste segregation at the household level, and there may be an opportunity to promote segregation to maximize collection. → The city can move towards formalizing the recycling industry and provide collectors with safer working conditions and more reliable product values to make it a more profitable, safe and stable livelihood and market. → There is an opportunity to improve infrastructure around waste management, particularly in optimizing the sanitary landfill. To advance the circular economy, the city can extend and enhance its collaboration with different stakeholders including informal recyclers, private companies and manufacturers by exploring EPR policies.

7. Glossary of Terms

AAUD: National Urban and Household Waste Management Authority

CAP: Circularity Assessment Protocol. Assessment protocol developed by the University of Georgia to identify and analyze waste streams, particularly plastics.

EPR: Extended Producer Responsibility

GHG: Greenhouse gases

HAPs: Hazardous air pollutants, also known as toxic air pollutants or air toxics, are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.

IPCC: Intergovernmental Panel for Climate Change

Miambiente: Ministry of Environment

MINSA: Ministry of Health

OAT: Opportunity Assessment Tool

OC: Ocean Conservancy

R-Cities: Resilient Cities Network

TCI: The Circulate Initiative

USD: United States Dollar

WRI: World Resources Institute

8. References

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